Lexicon of Geologic Names Of the United States For 1961–1967

By GRACE C. KEROHER

GEOLOGICAL SURVEY BULLETIN 1350

A compilation of the new geologic names introduced into the literature from 1961–1967 in the United States, its possessions, the Trust Territory of the Pacific Islands, and the Panama Canal Zone

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1/ Holmes, Arthur, 1964, Principles of physical geology: 2d ed., New York, Ronald Press, p. 360-361, for the Pleistocene and Pliocene; and Obradovich, J. D., 1965, Age of marine Pleistocene of California: Am. Assoc. Petroleum Geologists, v. 49, no. 7, p. 1087, for the Pleistocene of southern California.

2/ Geological Society of London, 1964, The Phanerozoic time-scale; a symposium: Geol. Soc. London, Quart. Jour., v. 120, supp., p. 260-262, for the Miocene through the Cambrian.

3/ Stern, T. W., written commun., 1968, for the Precambrian.

4/ Includes provincial series accepted for use in U.S. Geological Survey reports.

Terms designating time are in parentheses. Informal time terms early, middle, and late may be used for the eras, and for periods where there is no formal subdivision into Early, Middle, and Late, and for epochs. Informal rock terms lower, middle, and upper may be used where there is no formal subdivision of a system or of a series.

GEOLOGIC NAMES COMMITTEE, 1969

LEXICON OF GEOLOGIC NAMES OF THE UNITED STATES FOR 1961—1967

By Grace C. Keroher

INTRODUCTION

PREVIOUS COMPILATIONS OF GEOLOGIC NAMES

The U.S. Geological Survey has published several compilations treating the names of geologic formations and stratigraphic classifications and nomenclature. The Survey publishes lexicons of geologic names as a means of keeping the geologic profession informed as to changes and current status of geologic names within the United States and its possessions.

Following is a list of the compilations published to date:

1. Weeks, Fred B., 1902, North American geologic formation names: U.S. Geol. Survey Bull. 191.
2. Wilmarth, M. Grace, 1925, The geologic time classification of the United States Geological Survey compared with other classifications, accompanied by the original definitions of era, period, and epoch terms: U.S. Geol. Survey Bull. 769.
3. Wilmarth, M. Grace, 1931, Names and definitions of the geological units of California: U.S. Geol. Survey Bull. 826.
4. Wilmarth, M. Grace, 1938, Lexicon of geologic names of the United States (including Alaska): U.S. Geol. Survey Bull. 896; reprinted 1951, 1957 (also called the Wilmarth Lexicon).
5. Wilson, Druid, Sando, W. J., and Kopf, R. W., and others, 1957, Geologic names of North America introduced in 1936—1955: U.S. Geol. Survey Bull. 1056—A.
6. Wilson, Druid, Keroher, G. C., and Hansen, B. E., 1959, Index to the Geologic names of North America: U.S. Geol. Survey Bull. 1056—B.
7. Keroher, Grace C. and others, 1966, Lexicon of geologic names of the United States for 1936—1960: U.S. Geol. Survey Bull. 1200; issued, Paris, 1967, by Centre National de la Recherche Scientifique as Volume 7 Amerique du Nord Fasc. 1 Etats-Unis, of Lexique Stratigraphique International.

PRESENT LEXICON

Those who assisted in the literature review for the present lexicon are Helen L. Nace, Marilyn L. Hubert, Carol S. Swift, and Carol Larmon.

The stratigraphic papers summarized and used in this lexicon were published between January 1, 1961, and December 31, 1967.

The geographic area covered includes the United States, its possessions, the Panama Canal Zone, and the Trust Territory of the Pacific Islands presently administered by the United States. This is the same geographic area covered in the literature review for the Keroher Lexicon (U.S. Geol. Survey Bull. 1200).

This lexicon contains 2,860 names, including cross references. Most of these names are new names introduced into the literature during the years 1961–67. However, included in this number are a few pre-1960 names which were not listed in either the Wilmarth Lexicon or the Keroher Lexicon. Included too are a few names whose type localities are in Canada and Mexico. These names were listed but not defined in the Wilmarth Lexicon. Inasmuch as these names have been recently geographically extended into the United States, they are listed in the present lexicon with appropriate annotations.

The stratigraphic code proposed by the American Commission on Stratigraphic Nomenclature (1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 5, p. 645–665) was adopted by the U.S. Geological Survey on June 6, 1961. Article 10 of this code recommends that the initial letters of all words used in forming the names of formal rock-stratigraphic units be capitalized. The Commission's recommendation on capitalization is followed in the entry listings. Within the annotations, however, the capitalization or noncapitalization of the names is that of the author being cited. Although most of the geologic names listed were formally proposed and defined, a few other names were not, but because they seemed to have potential value as formal names they are listed but not capitalized. Quotation marks are used around names if the author cited used them. Subsurface names are included if they have been defined as a part of formal stratigraphy.

Geologic names currently adopted for use by the U.S. Geological Survey are printed in boldface, as in the Wilmarth and Keroher Lexicons. These names have been used in Survey reports and they constitute a part of the official geologic nomenclature of the Survey. The Survey has had occasion to consider for acceptance or rejection considerably less than half of the names that have been applied to geologic units in the United States.

The rank, lithology, and (or) age designations of some units for which the Survey has approved the names are shown as they are currently (1969) carried in the files of the Survey, even if the reports for which such designations were adopted either were still in preparation or were published after 1967. These changes will be documented in future lexicons.

Ages of all the units are given in terms of the standard major divisions of geologic time as used by the U.S. Geological Survey (p. IV). For the sake of consistency, the designation of "early" or "late", as used by an author with the age of rock units, is changed to "lower" or "upper." The age given for a unit whose name is printed in boldface type is the age presently (1969) assigned by the U.S. Geological Survey. The age given for a unit not printed in boldface is the age given by the author of the report being cited.

ACKNOWLEDGMENTS

The cooperation and assistance of George V. Cohee and the staff of the Geologic Names Committee is gratefully acknowledged. Special thanks are due to Verda M. Dougherty, Geologic Names Committee staff, for her generous help in proofreading and invaluable assistance during the final stages of alphabetizing the manuscript. Many helpful suggestions were given by U.S. Geological Survey colleagues. Information and suggestions generously furnished by many geologists with State universities and State geological surveys are greatly appreciated.

SYMBOLS

Names printed in boldface type have been adopted for use by the U.S. Geological Survey.

Names preceded by a dagger (†) have either been abandoned by their authors or rejected for use by the U.S. Geological Survey.

Names followed by the superscript ([1]) are listed in the Wilmarth Lexicon.

Names in roman type without a dagger have not been considered by the Committee on Geologic Names of the U.S. Geological Survey for use in Survey reports.

LEXICON

Abernathy Member (of Joachim Formation)

Middle Ordovician: Southeastern Missouri, southern Illinois, and western Kentucky.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 58—59, 227. Mainly silty sandy thick-bedded dolomite containing layers of dolomitic medium-grained sandstone, and some partings of dark-red-brown shale. Thickness 25½ feet at type section; 149 feet in well near Pulaski, Ill.; 60 feet at Perryville, Mo.; 95 feet in well near Grand Tower, Ill. At type section basal 2 feet of Abernathy overlies 1 foot of Dutchtown Formation, but is on upthrown side of a fault. Basal member of Joachim; underlies Augusta Member (new).

Type section: In bluff on north side Missouri Highway 74, 1½ miles east of Dutchtown, Cape Girardeau County, Mo. Type section cut by north-trending fault with downthrow of about 55 feet on east side. Type section supplemented by Midwest Dairy Co. well at Cape Girardeau. Named for Abernathy School, 2 miles north of type section.

Abington Interstade, Silt

Wisconsin (Illinoian): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 665, 672, 681 (fig. 3, table 6). Illinoian interstadial deposit represented by calcareous organic-rich silt (Wildman Farm unit 2, Smith Farm unit 2, Darrah Farm unit 3, and Porter Farm unit 2) is herein named Abington interstadial. Follows Centerville stade (new); followed by Richmond stade (new). Abington silt overlies Centerville till; underlies Richmond till.

Type area: Wildman Farm section, which is a composite of three nearby (0.1 mile) exposures along south bank of small stream in NE¼ sec. 33, T. 16 N., R. 14 E, Wayne County. Named after village of Abington, about 3 miles south of Wildman, Smith, and Darrah Farm sections.

Abrahams Creek Member (of Pocono Formation)

Mississippian: Central Pennsylvania.

F. M. Swartz, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G—50, p. 20. A. D. Leonard (unpub. thesis) termed the upper and lower divisions of the Pocono at Jim Thorpe, Bear Mountain Member and Silkmill Run Member, respectively. These members likewise were found in ridges along the rim of the Northern Anthracite Field, where they are overlain by a body of calcareous sandstone designated Abrahams Creek Member.

Achiote Conglomerate

Achiote Member (of Cariblanco Formation)

Upper Cretaceous: Central Puerto Rico.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B5 (fig. 2), B13—B16. At type locality Achiote Conglomerate consists of massive red volcanic conglomerate with well-rounded clasts as large as 150 centimeters in diameter but generally no larger than 10 to 20 centimeters.

Clasts are red and green andesites and some chert. Interbedded with red conglomerate are green tuffaceous conglomeratic sandstones and conglomerate. Thickness 200 to 400 meters in southwestern part of Jayuya quadrangle. Thickens westward to about 1,800 meters between Cerro Maravillas and Monte Jayuya on Cordillera Central. Overlies Cotorro Tuff except east of Rio Toro Negro, where it overlies Malo Breccia. Grades upward into Maravillas Formation, and contact is defined as top of highest massive conglomerate. Late Cretaceous, probably Santonian and perhaps in part as old as Coniacian.

The U.S. Geological Survey also classifies the Achiote Conglomerate as a member of the Cariblanca Formation in some areas on the basis of a study now in progress.

Type locality: On route 149 from (144,220 m E.; 35,200 n N.) to (144,145 m E.; 34,060 m N.). Named for good exposures on west side of valley of Quebrada Achiote in southeastern part of Jayuya quadrangle.

Adam Peak Formation

Upper Pennsylvanian to Lower Permian: North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U.S. Geol. Survey Prof. Paper 431, p. 36-38, pl. 1. Predominantly clastic sequence including shale and siltstone, dolomitic sandstone, chert, and limestone. West of Adam Peak, where section is most complete, formation divisible into three unnamed members: lower, about 850 feet thick, interbedded shale, limestone, and dolomitic sandstone; middle, about 950 feet thick, chert, dolomite, and dolomitic sandstones. True thickness of upper member unknown because of cutting out by overriding Harmony formation. Exposed section about 2,100 feet thick. Overlies Battle formation on crest and west side of Osgood Mountains. Fossils indicate Late Pennsylvanian to Early Permian.

Named for Adam Peak in Osgood Mountains, Humboldt County. Occupies belt about 2½ miles long on western slope of range west of Adam Peak, from head of East Fork of Eden Creek on north to ridge east of Goughs Canyon on south. Also occurs as fault-bounded blocks along crest of range from Goughs Canyon to Perforate Canyon. Formation is on thrust plate that overrides strata of Etchart limestone at south end of northern belt and along west side of southern blocks.

Adams Argillite

Lower Cambrian: East-central Alaska.

E. E. Brabb, 1967, U.S. Geol. Survey Prof. Paper 559—A, P. A7—A9. Basal beds are light-brown quartzite. Most of quartzite massive, but along Tatonduk River it is thinly bedded and cross laminated and has interbeds of siltstone and grayish-green chloritic shale. Remainder of formation made up of variety of rocks. Argillaceous rocks include gray, green, and red argillite and shale. Isolated outcrop of greenstone occurs about 50 feet above base of Adams Argillite about 1½ miles northeast of Hillard Peak. Greenstone also occurs in Adams Argillite about 3 miles northeast of mouth of Nation River. Stratigraphic position of this greenstone uncertain, inasmuch as rocks are extensively folded and faulted. Thickness about 600 feet in Hillard Peak area. About 300 feet at east end of Limestone Hogback, but part of formation may be faulted there. Along Tatonduk River seems to be about 400 feet thick. Rests accordantly on Funnel Creek Limestone (new). Underlies Hillard Limestone (new). No complete section found. Early Cambrian fossiles.

Type section: At east end of Limestone Hogback in W½ sec. 31, T. 2 N., R. 33 E. Named for exposures in vicinity of Adams Peak.

Admiralty Island Volcanics

Eocene and Oligocene: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 79—87, pl. 1. Name proposed for thick sequence of gently dipping andesitic and basaltic flows and minor rhyolitic breccia and tuff that crops out in southwestern part of Pybus-Gambier area. Individual flows range in thickness from 10 to 50 feet and form regular layered sequence in which some flows seem to persist for miles. Thickness at least 9,500 feet west of Cannery Cove. Thins southward to less than 5,000 feet near Little Pybus Bay. Conformably overlie unnamed conglomerate and sandstone unit in Little Pybus Bay area. From Cannery Cove northwestward overlie deformed pre-Tertiary rocks with marked angular unconformity. Overlain by scattered unconsolidated deposits of Quaternary age.

E. H. Lathram and others, 1965, U.S. Geol. Survey Bull. 1181-R, p. R31—R33, pl. 1, Conformably overlies Kootznahoo Formation (new). Eocene and Oligocene.

Typically exposed west and north of Little Pybus Bay and extend beyond area. Cover about 300 square miles in southern Admiralty Island.

Adobe Flat Shale Member (of Panoche Formation)

Upper Cretaceous: Central California.

M. E. Maddock, 1964, California Div. Mines and Geology Map Sheet 3. Name given to hard, dark-gray to black silty shales occurring in down faulted syncline west of Del Puerto piercement. Shales grade upward with increasing sandstone interbeds into typical Panoche sandstone-shale lithology. Shales within 300 feet stratigraphically of base of member contain *Inoceramus labiatus* of Upper Cretaceous (lower Turonian) age. These shales rest on Knoxville(?) shales containing *Aucella piochii* of late Jurassic (middle to upper Portlandian) age.

Mapped around Adobe Flat in Stanislaus County. Well exposed west of Wilcox Ridge in sec. 23, T. 7 S., R. 6 E. and NE¼ sec. 3, T. 6 S., R. 6 E.

Agana Argillaceous Member (of Mariana Limestone)

Pliocene and Pleistocene: Guam.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A15 (table), A47—A49, pls. 1, 3. A yellowish-tan to buff or light-brown limestone with small amounts of clay. Lenticular rubbly coral conglomerate as much as 10 feet thick present at base of member. Overlying coral conglomerate is section of medium- to fine-grained yellow detrital limestone that contains mollusks, extends nearly to surface of plateau, and commonly exceeds 100 feet in thickness. Deposited upon irregular erosion surface cut on Alifan limestone.

Type locality: In cliff south of town of Agana on island of Guam.

Agate Creek Formation

Oligocene, lower: Central Colorado.

R. H. De Voto, 1964, The Mountain Geologist, v. 1, no. 3, p. 119—121. Welded trachytic, crystal, vitric tuff, consisting of a lower black lenticular zone of dense welding and an upper reddish zone of partial welding. Thickness 11 feet at type locality; 600 feet in vicinity of Mushroom

Gulch syncline. Unconformably overlies Denver(?) Formation. Underlies and is interbedded locally with Antero Formation.

C. E. Chapin and R. C. Epis, 1964, The Mountain Geologist, v. 1, no. 3, p. 149—150. Report on stratigraphic and structural features of Thirtynine Mile volcanic field. Sequence in field is as follows: pre-volcanic rocks— Precambrian granitic rocks, gneisses, and schists, Paleozoic and Mesozoic sedimentary rocks, early Tertiary granodiorite and arkose; trachytic ash-flows 1 and 2 (and perhaps others); volcanic conglomerates; andesitic laharic and flow breccias with interbedded trachytic ash-flow-3; trachytic ash-flow-4 (stratigraphic position uncertain); Antero Formation of early Oligocene (Chadronian) age; rhyolitic ash-flows-5 and -6 and trachytic ash-flow-7; volcanic conglomerates and possibly equivalent Trump and Wagontongue Formations. Ash-flow-4 is used herein for the outcrops defined as Agate Creek Formation by De Voto (1964). Believed that exposures at this locality are ambiguous as to stratigraphic position, and unit may be older than Antero. Johnson (1937) and Stark and others (1949) described outcrops of this tuff as trachyte flows and included them in Balfour Formation, which underlies the Antero.

Type exposures: On south flank of syncline near Agate Creek in NE¼SE¼ sec. 7 and NW¼SW¼ sec. 8, T. 14 S., R. 75 W., in Antero Reservoir quadrangle, southwestern South Park.

Agort Chert

Ordovician: Northeastern Nevada.

Marshall Kay, 1966, Canadian Petroleum Geology Bull., v. 14, no. 4, p. 585 (fig. 1), 587 (fig. 4). Comparison of Lower Paleozoic volcanic and nonvolcanic geosynclinal belts in Nevada and Newfoundland. Agort Chert listed in table showing distribution of the sequences with argillites, cherts, and volcanic rocks in Nevada and Idaho. Thickness of chert 800 feet. Occurs above Valder Formation (new) and below Silurian Noh Formation (new). Name credited to Riva (1966, in press).

Type locality and derivation of name not stated.

Aguajito Shale Member (of Monterey Formation)

Miocene, upper: Western California.

O. E. Bowen, 1965, *in* Symposium of papers presented at the 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Name applied to middle member of Monterey Formation in type area. Includes Galliher's (1931, Micropaleontology Bull., v. 2, no. 4) units 2 and 3. Characteristically consists of thin-bedded opaline shale or porcellanite. Beds range from fraction of an inch to several inches in thickness. On Ranchos Aguajito and Canada de la Segunda, which occupy most of the high-lands between Carmel Valley and Canyon del Rey east of state Highway 1, member reaches thickness of about 2,000 feet or two-thirds of bulk of Monterey Formation as a whole. The Aguajito grades into underlying Los Laureles Sandstone Member (new) below and Canyon del Rey Diatomite Member (new) above. Predominantly upper Miocene although lowermost beds contain Luisian Foraminifera in some localities. A few of upper beds contain Delmontian microfauna. Nowhere is Delomontian part of unit known to be more than 300 feet thick and Luisian part more than 200 feet thick.

Type section: At type section of Monterey as given by Galliher (1931) between Canyon Del Rey and San Jose Canyon along axis of Canyon

Segundo. Named for exposures on Rancho Aguajito. Shale is almost continuously exposed over 44 square miles and underlies at least 100 square miles in Monterey and Salinas quadrangles.

Aiken facies (of McAfee Adamellite)

Jurassic or Cretaceous: Eastern California and western Nevada.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 132 (fig. 2), 141. McAfee Adamellite (new) is a complex of three texturally different facies—Aiken, Central, and Garden. The Aiken is porphyritic, with large but sparsely distributed potassic feldspar megacrysts. The other two facies are equigranular. Contacts between the facies are gradational and can only be approximately located.

Underlies more than 13 square miles in Mount Barcroft quadrangle. White Mountains.

Airport Sandstone Member (of Baxter Shale)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 101-102, pl. 1. Name applied to series of sandstones and limestones in Baxter shale. Includes Hale's (1950, Wyoming Geol. Assoc. Guidebook 5th Ann. Field Conf.) "marker-bed" in which index fossil *Desmocaphites bassleri* was found. Present study shows so-called marker bed is 285 feet below actual top of Airport member as herein defined. This marks boundary between Upper Cretaceous Colorado and Montanan groups and dates member as Telegraph Creek in age. Thickness about 500 feet both in outcrop and subsurface.

Type locality: Rock Springs City Airport, sec. 30, T. 19 N., R. 103 W., Sweetwater County.

Akah Substage

Pennsylvanian (Desmoinesian): Utah, Arizona, Colorado, and New Mexico.

D. L. Baars, J. W. Parker, and John Chronic, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, p. 393—403. Proposed that the units (ascending) Barker Creek, Akah, Desert Creek, and Ismay (formerly "pay zones") be called substages and used as formal time-stratigraphic units in Four Corners Stage (new). Useful fusulinids are *Wedekindellina excentrica* and *Fusulina rockymontana.*

Interval for the four substages of the Four Corners Stage is in Shell No. 1 Hovenweep well, sec. 5, T. 40 S., R. 26 E., San Juan County, Utah.

Alacran Mountain Formation (in Hueco Group)

Lower Permian: Western Texas and eastern New Mexico.

T. E. Williams, 1963, Yale Univ. Peabody Mus. Nat. History Bull. 18, p. 13 (fig. 6) 24—30, fig. 1 (geol. map), fig. 7. Name applied to uppermost formation in group. Except for the 122-foot Deer Mountain red shale member in lower part, formation consists of light-olive-gray and olive-gray medium- and thick-bedded limestone; occasional very thick bedded units are massive cliff formers. Composite thickness about 622 feet; upper 220 feet not exposed at type section and reference section designated. Conformably overlies Cerro Alto limestone (new). Contact is one of gradual transition. Upper contact is everywhere one of disconformity, upper beds of formation having been removed by erosion.

Overlain by unconsolidated sediments of Quaternary age. Wolfcamp-Leonard boundary, marked by appearance of *Schwagerina crassitectoria-S. franklinensis* fauna, falls within formation about 80 feet above last appearance of *Pseudoschwagerina.*

Type section: Southwest side of Alacran Mountain, a small messa in central part of Hueco Mountains, Hudspeth County. Reference section: A fault-block exposure south of Menzies Ranch headquarters, also in central part of Hueco Mountains.

Alamitos Formation

Pennsylvanian (Desmoinesian-Virgilian): North-central New Mexico.

J. P. Miller, Arthur Montgomery, and P. K. Sutherland, 1963, New Mexico Bur. Mines Mineral Resources Mem. 11, p. 10—14, 22 (fig. 6), fig. 10 (facing p. 30), pl. 1. Name proposed for arkose and limestone sequence which overlies La Pasada and Flechado Formations (both new). Overlain by red shales and arkoses of Sangre de Cristo Formation. Approximately equivalent in Pecos area to what has been called arkosic limestone member of Madera Limestone by Brill (1952, Geol. Soc. America Bull. 63, no. 8). Thickness about 1,275 feet in Pecos area; about 4,000 feet in Rio Pueblo area. Contact with underlying La Pasada, well exposed in upper part of Dalton Bluff section, is placed at marked lithologic change from sequence composed primarily of limestone in upper half of La Pasada to sequence with major percentages of arkosic sandstone and conglomerate in lower part of Alamitos. In Rio Pueblo area, Alamitos retains over-all character of coarse-grained arkose. Both lower part of Alamitos and upper part of underlying Flechado are coarse-grained clastic units. Separation based on abrupt increase in feldspar from less than 3 percent in sandstones of Flechado to more than 30 percent in those of Alamitos. The 4,000 feet of Alamitos in Rio Pueblo area is believed to be equivalent only to lower 500 feet of formation in Alamitos Valley and Pecos Valley, 40 miles to south. No single section exposes entire formation. Two measured sections designated as type section. Primary type section exposes upper 1,000 feet, including contact with overlying Sangre de Cristo. Secondary type section includes lower, 1,200 feet. Formation poorly exposed at this section but locality is important because it provides contact with underlying La Pasada and lower 250 feet of formation which is not exposed in Alamitos Canyon.

Primary type section: Alamitos Canyon, San Miguel County. Base of section begins at lowest exposure in bed of Alamitos Creek 4.2 miles by road northwest of U.S. 85 and 2 miles northwest of concrete abutments at abandoned well.

Secondary type section: West of Pecos Valley on ridge between Pecos Valley and Alamitos Canyon, San Miguel County. Base of section, which begins in La Pasada Formation, is about two-thirds of way up partly timbered slope on west side of north-trending dry valley due west of triangular erosional block west of Pecos River, 1.3 miles north of State Fish Hatchery on Highway 63.

Alamo Creek Basalt Member (of Chisos Formation)

Eocene, upper: Southwestern Texas.

J. F. Evernden and others, 1964, Am. Jour. Sci. v. 262, no. 2, p. 165, 193. Potassium-argon date 42.7 m. y. Basalt dated is lowest flow in Chisos Volcanic Formation.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 23, 25, 33, road logs. Lowermost of named flows in formation in Big Bend National Park. Underlies Ash Spring Basalt Member. At all places in southwest, west, and northwest of Chisos Mountains, where Tertiary-Cretaceous contact is exposed, the Alamo Creek rests on erosion surface in Javelina Formation (new). Locally underlies Burro Mesa Riebeckite Rhyolite Member of South Rim Formation (new).

R.A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 115—116, pls. Formal proposal of name. Most of the Alamo Creek Basalt is a fine-grained hard dark lava. Locally, small phenocrysts. Base usually scoriaceous and commonly contains inclusions. Thickness 20 to 208 feet. Thickest exposures are southwest of highest Chisos Mountains peaks——Kitt Mountain-Round Mountain-Cerro Castellan area. Lava thins northwestward and southeastward from that area. Is lowest unit of western Chisos Formation facies and does not extend east of a structural barrier that is near line drawn from high part of central Chisos Mountains southeastward along crest of Cow Heaven anticline. Underlies Ash Spring Basalt Member. Overlies Javelina Formation.

Named for Alamo Creek west of Chisos Mountains where the lava is exposed almost continuously from near Dawson Creek southward to the Rio Grande, Brewster County.

Alamo Range Formation

Miocene: Southeastern Nevada.

Abraham Dolgoff, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 879 (fig. 1), 888—890, pl. 1, app. Consists of semiconsolidated pumiceous vitric tuff overlain by welded vitric tuff, locally underlain by water-laid tuff, in part one cooling unit. Thickness 400 to 1,000 feet. Overlies Hiko Tuff (new); underlies Badger Valley Basalts (new).

Type area: Alamo Range, Lincoln County. Section measured 100 yards north of Alamo Canyon road, in central part of T. 7 S., R. 61 E., about 1½ miles east of U.S. Highway 93.

Alatna Glaciation

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1938. Alatna Glaciation followed Koyukuk Glaciation (new) and preceded Siruk Glaciation (new). It was marked by a small glacier that terminated a short distance beyond mouth of Alatna Valley.

Alatna Valley originates near north flank of central Brooks Range and extends southeast through this mountain belt into Koyukuk lowlands.

Albemarle Group

Ordovician(?): Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 126, geol. map. A sequence of water-laid pyroclastics and sediments. Typically developed west and southwest of Troy anticlinorium. Comprises (ascending) Tillery Formation, McManus Formation, and Yadkin Graywacke (all new). Overlies Uwharrie Formation (new) west and southwest of Troy anticlinorium and Efland Formation (new) east and northeast of the anticlinorium. Unconformably underlies Tater Top Group (new). Early paleozoic.

The U.S. Geological Survey has redefined the Albemarle Group and currently designates the age as Ordovician(?) on the basis of a study now in progress.

Named for exposures near city of Albemarle, Stanly County, in Carolina slate belt west of Deep River-Wadesboro Triassic basin.

Albion Member (of Barwell Formation)

Eocene: Eastern Georgia.

John Sandy, R. E. Carver, and T. J. Crawford, 1966, Geol. Soc. America, Southeastern Sec., Guidebook Field Trip 3, p. 4, 16 (fig. 6), 17. Name "Albion Member" used informally to include spiculite clays and opal-cemented sandstones which occur at base of the Barnwell in eastern Georgia. Overlies Glascock Member (new) of Tuscaloosa Formation. The Albion is an excellent marker for base of Jackson Group.

Well displayed in Albion Kaolin Mine, Hephzibah, Richmond County.

Alborn Till

Pleistocene (Wisconsin): Northeastern Minnesota.

H. E. Wright, Jr., and R. V. Ruhe, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 37. Till near terminus of Alborn phase of Superior sublobe.

Alborn is in southwestern part of St. Louis County.

Alder Creek beds (in Franciscan Formation)

Upper Cretaceous: Northern California.

J. D. Berkland, 1964, California Div. Mines and Geology Mineral Inf. Service, v. 17, no. 8, p. 139—141. Cobble and boulder conglomerate. In these beds are abundant clasts of quartz, black chert, red radiolarian chert, quartz-veined sandstone, laminated argillite, silty gray limestone, and siliceous volcanic rocks, together with minor amounts of quartz diorite containing metagreenstone. Beds strike N. 15—30 W. and dip 60° NE to vertical. Top of section is upstream toward east. Structure may be simple homocline with aggregate thickness of more than 20,000 feet. Age determined on basis of microfossils. Beds belong to Coastal Belt of Franciscan Formation.

Exposed in Alder Creek area. Alder Creek is short stream that enters Pacific Ocean about 4 miles north of Point Arena, Mendocino County.

Alder Hill basalt member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Consists of several flows of which olivine basalt is most widespread. Probably oldest flows in area. Potassium-argon age 2.3 m.y. Suggested that Truckee Basin was downfaulted subsequent to extrusion of the olivine basalt. Faulting does not appear to have affected other nearby Lousetown flows (or groups of flows). At least 20 flows recognized in area. Nine are named and given informal member status in Lousetown formation.

Named for occurrence on and in vicinity of Alder Hill, Truckee area, north of Lake Tahoe.

Aldrich Mountains Group

Upper Triassic(?) and Lower Jurassic: Northeastern Oregon.

T. P. Thayer and C. E. Brown, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—438. Fields Creek Formation of Aldrich Mountains Group mapped in Aldrich Mountain quadrangle. Upper Triassic(?). Angular unconformity separates Upper Triassic Vester Formation (new) from Fields Creek.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Misc. Geol. Inv. Map I—447. Formal proposal of name. Group includes four formations (ascending): Fields Formation, Laycock Graywacke (new), Murderers Creek Graywacke (new), and Keller Creek Shale (new). Formations have maximum composite thickness of about 35,000 feet and are made up mostly of graywacke and shale, water-laid volcanic tuff, siliceous mudstone and chert, and basaltic lava. Because of lenticular nature of deposits, no type section designated for group. Intruded by rocks of Canyon Mountain Complex. Under Triassic(?), and Lower Jurassic.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548. Group mapped in Mount Vernon quadrangle, Grant County, where it has maximum composite thickness of at least 27,500 feet. Includes Fields Creek Formation, Laycock Graywacke, Murderers Creek Graywacke, and Keller Creek Shale.

Forms eastern two-thirds of Aldrich Mountains.

Alfred Complex

Triassic(?): Southwestern Maine.

A. M. Hussey, 2d, 1961, Dissert. Abs., v. 22, no. 5, p. 1581; 1962, Maine Geol. Survey Spec. Geol. Studies Ser. No. 4, p. 51–53, pls. 1, 2. Basic igneous complex. Consists of noritic gabbro, marginally altered to quartz diorite, a thin layer or layers of anorthositic gabbro associated with the noritic gabbro; a ring-shaped mass of monzodiorite; and an elliptical mass of porphyritic granodiorite in center of monzodiorite. Other complexes in area are: Tatnic, Cape Neddick, and Agamenticus. Younger than Agamenticus complex.

Underlies a series of arcuate hills on northwestern side of Lyman pluton near Alfred village, York County.

Alfred Station Coquinite Member (of Rushford Lake Formation)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 272. Recognized in field as a massively bedded coquinite about 6 feet thick or a coquinite, sandstone, mudstone, and shale sequence about 50 feet thick. Occurs about 500 feet below Cuba Formation within a thick sequence of nonfossiliferous shales, sandstones, and siltstones. At type locality occurs within a clearly defined channel about 400 feet wide and 10 feet deep and consists of crossbedded and flow-rolled coquinites and sandstones. Underlies Rush Creek Member (new). Included in McHenry Valley Substage (new) of Cassadaga Stage.

Type locality: Along Caneadea Creek in Alfred Station, Allegany County.

Alifan Limestone

Miocene, upper, and Pliocene: Guam.

W. S. Cole, 1963, U.S. Geol. Survey Prof. Paper 403—E, p. E8—E9, Ell. Report discusses Tertiary larger Foraminifera from Guam. Lower part of Alifan Limestone in which *Rotalia atjehensis* and *Miogypsinoides cupulaeformis* were found may correlate with upper part of Bonya Limestone (new) or be slightly younger. The part of Alifan that contains a *Cyclocypeus-Operculina* fauna may still be younger and may be equivalent to Barrigada Limestone of Tertiary (Miocene) age. Overlies Bonya Limestone (new).

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A31—A37, pls. Formal proposal of name. A thick fossiliferous limestone. Extensive thin basal clayey conglomerate covers large areas presumably once overlain by the Alifan. This clayey conglomerate is herein designated Talisay member. Possible that most of Alifan is upper Miocene and possibly uppermost beds are Pliocene. Type locality stated. Overlies Bonya limestone. In some areas underlies Agana member (new) of Mariana limestone.

Type locality: In Alifan quarry of the Naval Ammunition Depot above Santa Rita on the north slope of Mount Alifan. Caps the mountain ridge of central Guam from Mount Alifan to Mount Lamlam, the highest point on Guam.

Alika flow

See Mauna Loa Series.

Ali Molina Metamorphic Complex

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 119—I, p. I5—I6. Consists mostly of massive blue-gray flinty silicified sedimentary and volcanic material and to lesser extent of dark-gray to greenish-black phyllite, gray quartzite, and locally, sericitic schist. Top of section faulted and base not seen but attitude of beds and known width of outcrop suggest total thickness of several thousand feet. Considered to be Mesozoic(?) because it contains volcanic rocks which do not occur in Paleozoic rocks in southern Arizona and because it is disconformably overlain by Tertiary rocks. Part of complex may be metamorphosed equivalent of Pitoikam Formation (new).

Named for exposures along Ali Molina Canyon, Baboquivari Mountains, Papago Indian Reservation.

Alisitos Formation

Lower Cretaceous: Baja California, Mexico, and southern California.

Original reference: Manuel Santillan and Tomas Barrera, 1930, Anales del Instituto d. Geologica d. Mexico, v. 5, p. 9—10.

E. D. Melow and D. B. Ennis, 1961, Geol. Soc. America, Cordilleran Sec., 57th Ann. Mtg., Guidebook for Field Trips San Diego County, p. 24, 26. Various names have been proposed for part or all of prebatholithic rocks found on west side of Peninsular Range. Hanna's (1926) all encompassing "Black Mountain volcanics" is not appropriate. Term Alisitos formation (Santillan and Barrera, 1930) is used for Lower Cretaceous volcanics and sedimentaries (= "Santiago Peak volcanics," Larsen, 1948, "San Fernando formation," *Anon*, [C. H. Beal] 1924, Beal, 1948, Geol. Soc. America Mem. 31). In California, overlies Bedford Canyon formation and underlies Rosario formation (also extended from Mexico). Consists of three unnamed members. Thickness about 5,000 feet.

D. L. Fife, J. A. Minch, and P. J. Crampton, 1967, Geol. Soc. America Bull., v. 78, p. 299—304. Discussion of Late Jurassic age of Santiagao Peak Volcanics, California. If western San Diego County volcanic rocks are Jurassic, they are definitely older than the volcanic rocks of Cretaceous Alisitos Formation of Baja California, despite a superficial resemblance. Therefore application of name "Alisitos" to this part of the volcanic sequence, as if it were a northern extension, is not justified.

Named for occurrence in vicinity of Alisitos Ranch, in north district of Baja California, Mexico.

Allandale Formation (in Mount Eagle Group)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Tuffaceous sandstone and mudstone. Exposed thickness 2,000 feet. Underlies Cane Valley formation (new). Grades laterally into Caledonia formation (new).

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 198—199, pl. 1. Exposed only on western half of island because eastern half of island has been displaced south by normal faulting. Probably formation would be found south of eastern St. Croix beneath Judith Fancy Formation. Estimated thickness of 2,000 feet exposed over a 2½-square-mile area in core of Brooks Hill anticline but base not exposed. Grades laterally into Caledonia Formation. Underlies Hope Member of Cane Valley Formation.

Almost all accessible fresh exposures are on road leading west-northwest from Estate Allandale, western part of island.

Allan Mountain Limestone (in Madison Group)

Lower Mississippian: Northwestern Montana.

M. R. Mudge, W. J. Sando, and J. T. Dutro, Jr., 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 11, p. 2006—2008, 2009—2014. Lower formation of Madison Group in Sawtooth Range. Includes all rocks called MB_2 and MC by Sloss and Laird (1945, U.S. Geol. Survey Oil and Gas Inv. Prelim. Chart 15). Thickness about 575 feet. Composed of three unnamed members. Lower member, as much as 226 feet thick, comprises lower shaly part of MC unit of Sloss and Laird and is essentially equivalent to Saypo Limestone Member of Deiss (1933, Montana Bur. Mines Mem. 6). Middle member about 150 feet, includes medium-bedded cherty limestones formerly included in upper part of unit MC of Sloss and. Laird; probably correlative with Dean Lake Chert Member of Deiss (1933). Upper member, 200 to 350 feet, mainly medium- to thick-bedded limestone that is essentially equivalent to unit MB_2 of Sloss and Laird. Underlies Castle Reef Dolomite (new). Contains beds of Kinderhook and Osage age.

M. R. Mudge, 1965, U.S. Geol. Survey Geol. Quad. Map GQ-381. Mapped in Sawtooth Ridge quadrangle, Teton and Lewis and Clark Counties where it is about 575 feet thick and consists of three unnamed members. Underlies Castle Reef Dolomite. Unconformable above Three Forks Formation (Devonian).

Type section: Exposure along north shore of Gibson Reservoir in SE¼ sec. 36, T. 22 N., R. 10 W., Patricks Basin quadrangle, Teton County. Well exposed at Allan Mountain.

Allard Member (of Menard Limestone)

Upper Mississippian (Chesterian): Southeastern Illinois.

J.W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 5 (fig. 2), 19, pl. 1. Uppermost member of the Menard. Commonly 30 to 35 feet thick and consists predominantly of dark-gray fine-grained limestone. Overlies Scottsburg Member (new). Commonly separated from overlying Palestine Sandstone by 10 to 15 feet of shale. Name credited to Swann (ms. in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 38–40, 58, pl. 1. Name formally proposed in this report for upper of three members of Menard Formation of Elviran age. Predominantly limestone with some shale. Thickness about 36 feet at type locality. Separated from underlying Scottsburg member by an unnamed shale.

Type section: In cut at south end of tunnel on Illinois Central Railroad about one-half mile southeast of Flatwoods and 2.2 miles southeast of Allard College School, SW¼NW¼NE¼ sec. 1, T. 13 S., R. 4 E., Brownfield quadrangle, Johnson County.

Allen Quartzite Member (of Ellsworth Formation)

Silurian(?): South-central Maine.

Lester Greenwood and John Hogan, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trips E and J, p. 53. Dense gray to mauve quartzite, includes some banded to weakly banded sections, conglomeratic and biotitic in part. Separated by a transition zone, a biotite gneiss member, and a second transition zone from Pond Quartzite Member (new).

Type locality and derivation of name not given. Area of report is Blue Hill copper mine.

Allingtown Metadiabase

Allingtown Volcanics

Ordovician(?): Southwestern Connecticut.

C. E. Fritts, 1965, U.S. Geol. Survey Geol. Quad. Map GC–426, GQ–427. Mapped in Ansonia and Milford quadrangles, respectively. Mainly medium-to fine-grained dark-greenish-gray to dark-gray intrusive metadiabase in chlorite zone and equivalent medium- to fine-grained grayish-green to dark-greenish-gray amphibolite in zone or higher grade metamorphism. Near Connecticut Turnpike contains numerous inclusions of Oronoque Member (new) of Derby Hill Schist 1 to 5 feet thick interlayered with sill-like and gently inclined dikelike bodies of metadiabase 1 to 8 feet thick. Not known to intrude Wepawaug Schist.

C. E. Fritts, Dec. 1965, U.S. Geol. Survey Bull. 1224–A, p. A30–A32. Formal proposal of name. Burger (1962, unpub. thesis) made threefold division of Milford Chlorite Schist. He called a southeastern unit Savin Schist (new). This unit extends southwestward across northwest Woodmont quadrangle and into Milford quadrangle where it is interpreted as Derby Hill Schist. Burger's central unit, Allingtown Formation, consists of abundant metadiabase intruded into phyllitic metasedimentary rocks. Unit extends southwestward into southeast corner of Ansonia quadrangle [this report] and into Milford quadrangle, where the metasedimentary rocks are mapped separately as Oronoque Member of Derby Hill Schist.

Burger's northwestern unit, which includes rocks mapped by Holdway (unpub. thesis) near Maltby Lakes Reservoirs in New Haven quadrangle, consists mainly of metavolcanic rocks but contains subordinate metasedimentary rocks and minor intrusive metadiabase similar to that of Burger's Allingtown. This northwestern unit of predominantly metavolcanic rocks also extends southwestward into Ansonia and Milford quadrangles where it lies above Derby Hill Schist and unconformably below Wepawaug Schist. In present report name Maltby Lakes Volcanics is used for the metavolcanic rocks and Allingtown Metadiabase only for intrusive metadiabase or metabasalt which is probably younger than both Derby Hill Schist and Maltby Lakes Volcanics. Type locality designated. Probably Ordovician.

H. R. Burger, 3d, 1967, Connecticut Geol. and Nat. History Survey Rept. Inv. 4, p. 4 (fig. 3), 8—9. Name Allingtown Volcanics proposed for all rocks extending from Veterans Hospital to intersection of Derby Avenue and Forest Road, western part of New Haven quadrangle. Three rock types constitute main mass of this formation: a massive porphyroblastic greenstone, and a schist that is very similar to the predominant lithology of Savin Schist. Base of formation arbitrarily designated as first appearance of massive, porphyroblastic greenstone in a thick sequence of interbedded schists and greenstones. Top of formation is selected as last appearance of the porphyroblastic rock on a small hill just north of the small creek at the junction of Derby Avenue and Forest Road. Massive rocks in this formation are identified as Allingtown Metadiabase on geologic maps of Ansonia and Milford quadrangles, where Fritts (1965) considers them intrusive. Field evidence shows that the three rock types mentioned are discontinuous and widely interbedded, the schists being present throughout the unit. These facts and parallelism of contacts of the various rock types and the unit as a whole suggest an extrusive rather than an intrusive origin for the massive rock types. Allingtown Volcanics as defined in this report includes all of what Fritts mapped as Allingtown Metadiabase and those portions of this Oronoque Member of the Derby Hill Schist that are in contact with the Allingtown Metadiabase. Underlies Maltby Lakes Volcanics. Thickness a little more than 2,000 feet.

Type locality: Community of Allingtown (spelled Allington on recent topographic maps of New Haven quadrangle) just southwest of city of New Haven on U.S. Highway 1.

Allison Ranch facies (of Haymond Formation)

Pennsylvanian: Southwestern Texas.

E. F. McBride, 1966, Texas Univ. Bur. Econ. Geology Rept. Inv. 57, p. 10 22—23. Term applied to rocks exposed in cut made for county road 1 mile south of Allison Ranch headquarters. Section is an unknown distance below top of formation and is the northernmost exposure of Haymond in Marathon Basin. Sandstone beds from 2 to 14 inches thick are interbedded with shale in beds as much as 3 inches thick.

Allison Ranch is north of Clark Butte, Marathon Basin.

Allsbury Formation

Lower Silurian: Northeastern Maine.

E. B. Ekren and R. C. Frischknecht, 1967, U.S. Geol. Survey Prof. Paper 527, p. 13—15, pl. 1. Dominantly graywacke and dark-gray, black, and green slate. Thin bands of quartzite and coral-bearing limestone occur locally. Graywacke occurs in graded beds and in laminae that range in thickness from fractions of an inch to several tens of feet. Thickness cannot be accurately determined because the rocks are tightly folded. Probably minimum of 1,000 feet in northeast and at least 4,000 feet in southwest. Younger than Mattawamkeag Formation (new).

R. B. Neuman, 1967, U.S. Geol. Survey Prof. Paper 524—I, p. I 23—I 25, pl. 3. Most of southeastern half of Stacyville quadrangle and small part of Shin Pond quadrangle are underlain by slate, sandstone, and conglomerate included in Allsbury Formation (Ekren and Frischknecht, 1967). As defined in Island Falls quadrangle (Ekren and Frischknecht) the formation consists dominantly of graywacke and black, dark-gray, and green slate. Ekren and Friscknecht distinguish 10 bands of black slate across outcrop belt along the parellel that includes Allsbury Road, the type locality [Ekren and Frischknecht state type area] of the formation, where they constitute about 10 percent of the formation. The Allsbury in Shin Pond and Stacyville quadrangles is part of same outcrop belt as in type locality [type area] but here it probably includes somewhat older rocks. About one-fourth of older unit, here classed as sandstone member of Allsbury, consists of coarse-grained sandstone and conglomerate interbedded with gray and green slate. Overlying member of formation consists mostly of gray and greenish-gray slate and some red slate and greenish-gray fine-grained sandstone. These members are not recognized in Island Falls quadrangle where dark carbonaceous slate appears to be more abundant. Sandstone member crops out in faulted anticline north and west of overlying upper member. Base of sandstone member not exposed. Its top, drawn to include the thicker and more abundant sandy beds, conforms well with structural information in outlining the anticlinical outcrop. At boundary between Stacyville and Shin Pond quadrangles, exposed thickness of sandstone member is probably about 5,000 to 7,000 feet. Sandstone member is probably at least in part same age as Frenchville Formation, as both are overlain by slate member of Allsbury. However, fossils that might confirm this correlation were not found in sandstone member.

Type area: Exposures in roadbed and roadcuts of Allsbury Road, in Island Falls and Shin Brook quadrangles.

Alma Creek Leucotrondhjemite

Paleozoic(?): Northwestern Washington.

Peter Misch, 1966, *in* Tectonic History and Mineral Deposits of the Western Cordiller in British Columbia and Neighboring Parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. v. 8, p. 112. In contrast to Shuksan Suite, the Skagit Metamorphic Suite contains a variety of metamorphosed intrusives. Metamorphosed acidic intrusives comprise predominantly trondhjemitic orthogneiss, including a larger elongate stock, the Marble Creek Orthogneiss (new), small bodies of leucotrondhjemitic orthogneiss, and thin sills or dikes of usually gneissose, trondhjemitic metaporphyries. A larger elongate stock of leucotrondhjemitic gneiss, Haystack Creek Gneiss (new), was intruded in a crystalline state during a fairly late stage of metamorphism. Another larger semiconcordant leucotrondhjemite body, Alma Creek Leucotrondhjemite, was intruded near the end of the metamorphism; it is igneous but shows incipient adjustment to the facies of the surrounding schist.

Type locality and derivation of name not given.

Almirante Sur Sand Member (of Cibao Formation)

Oligocene or Miocene: Puerto Rico.

W. H. Monroe, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—334. On both sides of the Río Indio the lower tongue of the Río Indio limestone member (new) is overlain by about 30 meters of sand herein named Almirante Sur sand member of Cibao formation. Basal 5 meters is exposed at type locality where the sand is coarse grained and pebbly. About 5 meters above base is persistent layer of more indurated pebbly sandstone forming prominent ledge in hills. Higher beds of member are well exposed on Route 645 north-northeast of type locality and on ridge just east of type locality. Sand is well exposed in Manatí quadrangle [this report] in headwaters of Quebrada Arenas. West of Quebrada Arenas the sand member grades laterally into sandy, impure, marly chalk, indistinguishable from other parts of typical Cibao. East of the Río Indio the Almirante Sur member grades into Río Indio limestone member. On basis of preliminary study of fossils it is believed that the Cibao below the Quebrada Arenas limestone member is of Oligocene age.

Type locality: In Ciales quadrangle. Named for exposures in barrio Almirante Sur on Route 645 in Ciales quadrangle 450 meters south of Manatí quadrangle and 1,550 meters west of eastern edge of Ciales quadrangle.

Almond Mountain Volcanics

Pliocene, upper: Southern California.

G. I. Smith, 1964, U.S. Geol. Survey Prof. Paper 457, p. 5 (fig. 2), 23—32, pls. 1, 2. Lower part of section includes tuff breccia, tuff, lapilli tuff, sandstone, and conglomerate, which grade upward into massive rubble breccia. These stratified rocks grade laterally into their intrusive equivalents, some of which are hydrothermally altered to propylite. Thickness commonly 500 to 900 feet. Much thinner 2 or 3 miles from volcanic centers. The volcanics are intruded into, or rest with angular unconformity on, middle Pliocene Bedrock Spring Formation (new) and older rocks. Intruded or unconformably overlain by Lava Mountains Andesite (new). Type section designated, but neither this nor any other one section is representative of formation over a large area. Formation includes rocks that were divided by Hulin (1925) between "Rosamond Formation" and "Red Mountain Andesite."

Type section: Exposed about one-third mile northwest of summit of Almond Mountain. Measured column (fig. 11) extends 1,700 feet S. 700° E. from sec. E34-c [NW¼NW¼ sec. 34, T. 29 S., R. 42 E.] Named for Almond Mountain in southern part of Lava Mountains, San Bernardino County.

Alonso Formation

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 25, 27. Characterized at many localities by presence of welded tuff and fine breccia with reddish to purplish colors. In fault contact with Yunes Formation (new). Believed to be Maestrichtian. Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

A. E. Nelson and W. H. Monroe, 1966, U.S. Geol. Survey Bull. 1221—C, p. C8—C9, pl. 1. Formal proposal of name. A mixed sequence of welded tuff, nonwelded tuff, lava breccia, and volcanic breccia which contains mainly andesite lava fragments. Also contains minor amounts of lapilli tuff, lithified mudflow deposits, volcanic sandstone, and some thin beds of andesite(?) lava containing high percentage of plagioclase crystals. Weathers characteristic purplish gray. At type locality, herein designated, volcanic breccia is overlain by about 60 meters of welded tuff characterized by crude columnar jointing. Welded tuff overlain by about 7.9 meters of lapilli tuff, and upper contact faulted. Maximum exposed thickness about 500 meters. Conformably overlies Tetuán Formation. In fault contact with Yunes Formation near west edge of area. Top not exposed in area of this report [Florida quadrangle].

Type locality: Exposures extending 100 meters southeast along a dirt road from Puerto Rico Route 140 (coordinates 51,340-132,260), Florida quadrangle. Named from Barrio Don Alonso.

Alpine Stade

Pleistocene (Kansan): Southeastern Indiana and northern Kentucky.

W. J. Wayne and J. H. Zumberge, 1965, *in* The Quaternary of the United States—a review volume for the 7th Congress of the International Association for Quaternary research: Princeton, N.J., Princeton Univ. Press, p. 67 (fig. 3). Kansan glaciation divided into (ascending) Alpine Stade, Garrison Creek Interstade and Colombia [Columbia] Stade. Names credited to Gooding (in press).

A. M. Gooding, 1966, Ohio Jour. Sci., v. 66, no. 4, p. 426—433. Geologic-climate subdivisions of Kansan Stage in southeastern Indiana are named as follows (ascending): Alpine Stade, Garrison Creek Interstade, and Columbia Stade. Basal till (unit 1) at Townsend Farm, containing inclusions of bright-red noncalcareous clayey limestone-derived soil is named Alpine Stade.

Type section: Townsend Farm section located in streambank on south side of North Branch of Garrison Creek in Fayette County, Ind., in northwest corner sec. 20, T. 13 N., R. 12 E., Alpine quadrangle.

Al Rose Formation (in Mazourka Group)

Lower Ordovician: Eastern California.

D.C. Ross, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B75 (fig. 21.1), B79—B80. Consists of about 400 feet of brown-weathering, in part graptolite-bearing, siltstone and limestone. Outcrops typically have orange- to red-brown surfaces and are readily distinguisable from overlying and underlying gray-weathering carbonate unit. Siltstone, mudstone, shale, and less commonly chert, all of which are commonly hornsfelsed, have very thin irregular bedding, and are dominant in formation. Limestone commonly forms elongate lenses which weather as holes or "eyes" in the outcrop. Upper unit, which is 52 feet thick at type locality, is a much more regularly interbedded sequence of 1- to 2-inch beds of gray limestone and 1 light-brown weathering shale and siltstone. Overlies Tamarack Canyon Dolomite (new); underlies Badger Flat Limestone (new).

Type Section: On a spur along east wall of Mazourka Canyon. Top of composite section (Al Rose and Badger Flat) is 6,000 feet S. 70° E., from SE cor. sec. 36, T. 11 S., R. 35 E., Inyo County. Named for Al Rose Canyon a tributary of Mazourka Canyon. Formation crops out as a relatively continuous but faulted belt along almost entire length of Independence quadrangle. To north belt continues about 1 mile into adjacent Waucoba Mountain quadrangle, where it is cut out by Mesozoic granitic rocks and overlapped by Cenozoic deposits of Owens Valley. Southward belt of outcrop is interrupted by Mesozoic granitic plutons, but Al Rose lithology is recognized at several places along front of Inyo Mountains east of Lone Pine.

Alutom Formation

Eocene, upper, and Oligocene: Guam.

J. T. Stark and J. I. Tracey, Jr., 1963, U.S. Geol. Survey Prof. Paper 403—C, p. C1, C2, C29 (fig. 17). Dominantly tuffaceous shales and sandstones interbedded with mafic lava flows and many lenses conglomerate and breccia beds composed of cobbles and blocks of basalt and andesite. Includes Mahlac Member (new). Estimated thickness 2,000 to 3,000 feet. Unconformably underlies Umatac Formation.

W. S. Cole, 1963, U.S. Geol. Survey Prof. Paper 403 E, p. E1, E4. Report discusses Tertiary larger Foraminifera from Guam. Twenty-one species present in Alutom Formation.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A15—A22, pls. Formal proposal of name. Oldest rocks exposed on Guam. A series of waterlaid pyroclastic and flow rocks of Eocene and Oligocene age, ranging from tuffaceous shale to coarse volcanic boulder conglomerate and blocky breccia. Formation presumably includes the diorite gravels of Tayama's (1952, Coral reefs of the South Seas: Japan Hydrographic Office Bull., v. 11 [Japanese and English]) base rocks; the liparite gravel of his liparite group, the Santa Rosa beds of his andesite group, and the Fena beds and Nagas beds of his *Camerina* group. The Santa Rosa beds at Mount Santa Rosa are the only ones the authors were able to identify. Includes Mahlac member. Base of formation not exposed, but thickness above sea level is estimated to be 2,000 to 3,000 feet. Underlies Umatac formation. Type locality stated.

Type locality: Top and sides of Mount Alutom.

Alva Clay Member (of Tamiami Formation)

Miocene, upper: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 116, 213, figs. 31, 32. In Caloosahatchee area, Tamiami Formation consists of several lithologic units. Upper limestone unit is similar to exposures of Tamiami Formation in type area and is underlain by a barren fine-grained calcareous clay (Alva clay). Lowest unit consists of La Belle clay (new).

Mined in vicinity of Alva, Lee County.

Amberg Granite

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1962 [abs.], Lake Superior Geology Inst. 8th Ann. Mtg., May 10-12 (Michigan Coll. Mining and Technology), p. 5. Discussion of a Precambrian pluton near Pembine, Wis. Nine rock units mapped within some 350 square miles of the Precambrian granitic and metamorphic complex. Relative age-relationships are suggested primarily from study of xenoliths, as follows (ascending): Quinnesec Formation, biotite gneiss, Marinette Quartz Diorite (new), Twelve Foot Falls Quartz Diorite (new), metagabbro sills, Hoskin Lake Granite (new), Newingham Granite, Amberg Granite, and diabase dikes.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. In Pembine-Amberg area, eight rock units younger than Quinnesec Formation are recognized and mapped. Five of these units are named. Amberg Granite is next to the youngest unit. Younger than Newingham Granodiorite; older than unnamed diabase dikes. Tentatively correlated with High Falls Granite of Mancuso.

J. A. Cain, 1964, Michigan Acad. Sci., Arts, and Letters Papers, v. 49, p. 91—103. Described in Pembine area where northernmost exposures are present. Marginally, a medium- to fine-grained gray granite crops out; but further south, the typical medium- to coarse-grained pink Amberg Granite apparently the medium-grained gray border phase.

J. A. Cain, 1964, Ohio Jour. Sci., v. 64, no. 1, p. 57—60. Described in Athelstane area. Generally unaltered and undeformed appearance of main Amberg mass suggests that unit is younger than other granitic units to north. Relative ages of the several gray and pink varieties of Amberg Granite have not been established completely. Since outcrops of pink granite can be traced from High Falls reservoir to Amberg, it seems clear that Amberg Granite and High Falls Granite are part of the same mass.

Town of Amberg is in northeastern Marinette County.

Ambler Glaciation

Pleistocene (Wisconsin?): Northwestnern Alaska.

A. T. Fernald, 1964, U.S. Geol. Survey Bull. 1181-K, p. K12—K14, pl. 1. Lobate moraines, present along larger rivers that rise in Baird and Schwatka Mountains, were deposited by valley glaciers that, from west to east, extended progressively farther south. Glaciers were contained within mountains between Akiak and Miluet Creeks, spread out in Ambler Lowland between Redstone and Shungnak Rivers, nearly reached Kobuk River along Kogoluktuk River, and reached it along Mauneluk River. Moraines are all subdued. Glacial episode during which they were deposited is here named Ambler Glaciation. Followed Kobuk Glaciation (new). Preceded Walker Lake Glaciation (new).

Named for Amber Lowland, central Kobuk River valley.

American Creek Granite

Mesozoic(?): West-central Alsaka.

Gordon Herreid, 1966, Alaska Div. Mines and Minerals Geol. Rept. 23, p. 3—4. Two types of granite described: Asses Ears and American Creek. The American Creek is medium-grained, subhedral granular granite composed of perthitic orthoclase, oligoclase, biotite, and minor sphene. Alteration limited to minor seritization of oligoclase and chloritization of albite. Granite is surrounded by narrow contact metamorphic aureole no more than a few tens of feet wide.

Inmachik map area covers 110 square miles in northern Seward Peninsula, 10 miles north of Kotzebue Sound and 25 miles southwest of Deering, Seward Peninsula.

American Flag Formation

Cretaceous(?): South-central Arizona.

S. C. Creasey, 1967, U.S. Geol. Survey Bull. 1218, p. 41–44, pl. 1. Mostly fresh-water conglomerates and graywackes. In exposure between Peppersauce and Nugget Canyons, fine-to medium-grained graywackes characterize lower part of section, and conglomerates the upper part. Lower rocks particularly well bedded. About 200 feet above base is a 30-foot limestone conglomerate. This is approximately where conglomerate beds become conspicuous. Higher in section conglomerates increase in abundance, alternating with graywacke beds. Higher in section conglomerates become thicker, reaching maximum of 10 to 20 feet, and relative abundance of conglomerates increases until it is predominant rock type. Thickness in Nugget Canyon 2,077 feet. Unconformably overlies Escabrosa Limestone and unconformably overlain by Gila Conglomerate. Intruded by granodiorite porphyry whose Cretaceous(?) age is based on lithologic correlation with the Cretaceous(?) granodiorite porphyry in San Manuel [ore] deposit. Paleozoic section in southeastern Arizona contains no rocks remotely similar to American Flag Formation, and Triassic and Jurassic sedimentary rocks are missing in southeastern Arizona. Seems likely that American Flag Formation is Cretaceous(?).

Named for American Flag Spring, which is well-known landmark in Mammoth quadrangle, Pinal County. Formation occurs in southwest corner of quadrangle south of Mogul Fault. Largest outcrop is between Peppersauce and Nugget Canyons.

Ammonia Tanks Member (of Timber Mountain Tuff)

Pliocene, lower: Southeastern Nevada.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224–A, p. A50–A51. A composite cooling unit of rhyolitic to quartz latitic ash-flow tuff which locally reaches a thickness of almost 300 feet in vicinity of Pahute Mesa. Thickness 250 feet at type locality. Overlies Rainier Mesa Member.

E. N. Hinrichs, R. D. Krushensky, and S. J. Luft, 1967, U.S. Geol. Survey Geol. Quad. Map GQ–638. Mapped in Ammonia Tanks quadrangle, Nye County, where it is as much as 550 feet thick. Separated from underlying Rainier Mesa Member by unit referred to as Tuff of Falcon Canyon. Underlies Spearhead Member of Thirsty Canyon Tuff.

F. M. Byers, Jr., and David Cummings, 1967, U.S. Geol. Survey Geol. Quad. Map GQ–695. Mapped in Scrugham Peak quadrangle, Nye County. Thickness as much as 250 feet. Ash-flow tuff. A compound cooling unit of three ash-flow subunits with gradational contacts within a few feet. Upper subunit, quartz latitic, local and thin noncontacts within a few feet. Upper subunit, quartz latitic, local and thin nonwelded to densely welded dark-yellowish-orange to nearly black glassy tuff containing dark mafic scoria pumice, grading to flattened black glass as much as 2 feet in length, and sparse white and yellow rhyolitic pumice. Xenoliths common, including rhyolite and fragments from Rainier Mesa Member. Middle subunit rhyolitic and similar to upper except slightly fewer phenocrysts, less welded, and commonly consists of pale-purplish-gray devitrified vapor-phase zone. Lower subunit (exposed only in caldera moat) rhyolitic partly welded pale-purplish-pink devitrified zone underlain by partly welded tuff grading downward to nonwelded pink glassy tuff with white pumice as large as 1 inch. Upper member of Timber Mountain Tuff.

Type locality: About one-quarter mile north of Ammonia Tanks, Nevada Test Site. Nye County.

A Mountain basaltic andesite

Eocene-Miocene: Southeastern Arizona.

P. E. Damon and Michael Bicerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 70 (table 2). "A" Mountain basaltic andesite listed on table showing K-Ar dates for mid-Cenozoic plutonic and volcanic rocks from southeastern Arizona. Apparent age 27.0 ± 1.2 m.y.

Sentinel Peak ("A" Mountain), Pima County.

Amphitheatre Basalt

Triassic(?): Southeastern Alaska.

A. W. Rose and R. H. Saunders, 1965, Alaska Div. Mines and Minerals Geol. Rept. 13, p. 4, 5, 15, 16, fig. 1. A dark-green massive fine-grained basalt containing some plagioclase phenocrysts.

A. W. Rose, 1966, Alaska Div. Mines and Minerals Geol. Rept. 20, p. 8, fig. 1. Dark-green to gray vesicular to massive basalt underlies large area between East Maclaren and Maclaren glaciers. This basalt is similar in all respects to the Amphitheatre basalt of probable Triassic age that is widespread to the south of the Eureka Creek and Rainy Creek areas.

Forms most of Amphitheatre Mountains in northwest part of Copper River Basin.

Amphitheatre dolomite

See Watonga Dolomite Bed (in Dog Creek Shale).

Amy Dome Metadiorite, Metaperidotite, Metabasalt

Middle Devonian(?): East-central Alaska.

R. L. Foster, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2745. Rocks in study area classified into five groups: (1) Cleary Creek serpentinite and associated "rodingite" inclusions, (2) Amy Dome metadiorite, (3) Amy Dome metaperidotite, (4) Amy Dome metabasalt, and (5) flanking metasedimentary rocks. Amy Dome diorite was intruded into country rock partially composed of serpentinite and protoserpentinite (periodotite and dunite). A part of the protoserpentinite (periodotite) foundered in the invading diorite magma, and was preserved, and is herein named Amy Dome metaperidotite. Amy Dome basalt was intruded after solidification of diorite mass.

Amy Dome area, Tolovana mining district.

Anasagunticook Formation (in Woodstock Group)

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 106, figs. 1, 2, road log. Basal unit of group. Composed of coarse-grained spangled muscovite-sillimanite-feldspar-biotite-garnet schist and migmatized gneiss. Well bedded where metamorphism is less intense. Underlies Thompson Hill Formation. Lowest horizon of calc-silicate lenses seems to be continuous with Moody Brook Formation of Buckfield Group (new). Listed as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not given. Area of report is Buckfield and Dixfield quadrangles.

Anayaknaurak Stade

Anayaknaurak Substage, Till, Drift

Pleistocene: Northern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 457, 458, 459. Itkillik stage includes four substages, which for Anaktuvuk River drainage, are designated Banded Mountain, Anayaknaurak, Antler Valley, and Anivik Lake. Maximum age of Anayaknaurak readvance is 13,270 years.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N.J., Princeton Univ. Press, p. 360 (table 1). Listed as Anayaknaurak Stade in Itkillik Glaciation.

Anaktuvuk River drainage area, Brooks Range.

Anchor Bay Member (of Gualala Formation)

Upper Cretaceous: Northwestern California.

C. M. Wentworth, Jr., 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 237-238. Two synchronous members distinguished in the Gualala (herein rank reduced to formation): Anchor Bay and Stewarts Point. The Anchor Bay is characterized by greenish-gray arkose, lacking potassium feldspar. Total absence of Franciscan debris in the Anchor Bay Member suggests more than 350 miles of right slip on San Andreas fault since Late Cretaceous.

Gualala area, Northern Coast Ranges.

Anderson Creek Flow

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 122, 123, (fig. 1). Name applied to flow that issued from subdued spur 2.3 miles west of Scott Mountain and poured into valley of Anderson Creek.

Near Belknap Lava Field in Three Fingered Jack and North Sister area.

Anderson Mesa Flow, Basalt

Pliocene, middle: Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4). Listed on chart showing correlation and relationships of volcanic flows in San Francisco volcanic field.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 53. According to Damon (1965, Reports to Atomic Energy Comm. by Univ. of Arizona) Stage I Anderson Mesa lava flow has K—Ar date of 6.2 + 1.2 m.y. [Damon, 1965, referred to the basalt flows on Anderson Mesa but did not use formal term Anderson Mesa Flow].

Anderson Mesa is in Coconino County, south of Flagstaff.

Andreas Red Beds (in Keyser Formation)

Silurian or Devonian: Eastern Pennsylvania.

C. K. Swartz and F. M. Swartz, 1941, Geol. Soc. America Bull., v. 52, no. 8, p. 1142, 1143, 1144. Name provisionally proposed for red sandstone forming ledges above the quarry face at Andreas and Snyders. Thickness 17.5 feet at type locality. Age unknown but overlies beds bearing Keyser fauna and is overlain by loose fragments of chert bearing a New Scotland fauna in the road north of Snyders. Provisionally placed in Keyser formation.

Type locality: Quarry of William Loch one-half mile southeast of Andreas, on east side of small stream, and about one-fourth mile northeast of quarry of J. Rudolph, Schuylkill County (Hamburg quadrangle.)

Andrew Formation

Lower Cretaceous: Subsurface across southern Mississippi and adjoining states.

D. H. Eargle, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D45 (table), D46—D47. Generally marine rocks previously called "Pre-Dantzler rocks of Washita and Fredericksburg Groups, undifferentiated" (Nunnally and Fowler, 1954, Mississippi Geol. Survey Bull. 79). Consists, toward top, of dull- to dark-red, gray, and olive-gray shale containing beds of brownish-gray finely sandy limestone, some shell fragments, and some beds of olive-gray dolomite and light-cream limestone. Grades downward into gray and greenish-gray to dull-red micaceous shale alternating with limestone, minor beds of fine-grained sandstone containing some carbonaceous matter, and grayish-green siltstone. Much of lower part is dark-gray shale. Thickness 1,000 to 1,880 feet.

Type section: Gulf Oil Co. No. 25 J. M. Andrew well, sec. 6, T. 1 N., R. 16 W., Baxterville oil field, Lamar County, Miss. Formation extends in depth from 9,800 to 11,360 feet.

Andrews Mountain Member (of Campito Formation)

Precambrian and Lower Cambrian: East-central California and western Nevada.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 141. Lower member of Campito Formation (redefined). Consists of about 2,500 to 2,800 feet of massively bedded, locally cross-stratified, dark-gray to black quartzitic sandstone and interbedded gray siltstone and shale. Underlies Montenegro Member (new). Overlies Deep Spring Formation. Precambrian or Cambrian.

J. P. Albers and J. H. Stewart, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D24—D27. Geographically extended into Esmeralda County, Nev., where it is mainly dark-gray blocky quartzite. Thickness about 500 feet. Underlies Montenegro Member; overlies Deep Spring Formation.

P. C. Bateman, 1965, U.S. Geol. Survey Prof. Paper 470, p. 14—15, pls. 5, 6. Described in Bishop district, California, about 15 miles northwest of type area. Top and bottom of member exposed in some places but complete and unfaulted section not present. Thickest and most complete section is in south half of secs. 8 and 9, T., 8 S., R. 34 E., where about 2,700 feet of strata are exposed. Strata overlie Deep Spring formation and are truncated at top by fault. About 1,700 feet of strata crop out south of Redding Canyon in sec. 17, T. 7 S., R. 34 E., between exposures of underlying Deep Spring formation and overlying Montenegro member, but the Andrews Mountain is cut by two reverse faults that have telescoped the section. Map bracket shows Campito and members as Lower Cambrian.

Named from exposures on Andrews Mountain, Waucoba Mountain quadrangle, California.

Animas clays

Quaternary: Southwestern New Mexico.

Necip Güven and P. F. Kerr, 1965, Selected Great Basin playa clays: U.S. Air Force Cambridge Research Lab. Sci. Rept. 4, 35 p. Mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and Animas clays indicate that mica-type clay minerals, illite, vermiculite, and montmorillinite are prominent in the playa crusts.

Animas Playa represents a group of smooth gray clay surfaces, mostly smooth and hard when dry.

Animas Quartz Monzonite

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines Mineral Resources Geol. Map 17. Pink-gray quartz monzonite porphyry with various proportions of phenocrysts and aphanitic to finely phaneritic groundmass; occurs as stock. Underlies Gillespie Tuff (new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 38—43, pl. 1. Name applied to rock that makes up Animas stock. Oak Creek Tuff lies on sides and top of stock.

Occurs in Animas Mountains, Walnut Wells quadrangle, Hidalgo County. Stock is almost 4 miles long and varies from less than one-fourth of a mile wide to over 2½ miles wide. Stock is an irregularly funnel-shaped intrusion in which part of the roof of overlying rocks has been faulted.

Anivik Lake Stade

Anavik Lake Substage, Drift

Holocene: Northern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 457, 458, 459. Itkillik stage includes four substages, which for Anaktuvuk River drainage, are designated Banded Mountain, Anayaknaurak, Antler Valley, and Anivik Lake. Two radiocarbon dates from Anaktuvuk Pass indicate deglaciation from Anivik Lake readvance between 7,241 and 6,300 years ago.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J. Princeton Univ. Press, p. 360 (table 1), 361. The Recent glacial record, as recognized throughout much of central and northern Alaska, is typified by sequence recorded by Porter (1964) in Anaktuvuk Pass area. Glaciers were in an advanced position from about 8,300 years ago to about 6,300 years ago, during his Anivik Lake Stade of the Itkillik Glaciation.

Brooks Range, Anaktuvuk River drainage area.

Anklam Formation

Upper Cretaceous: Southern Arizona.

Michael Bikerman and P. E. Damon, 1966, Geol. Soc. America Bull., v. 77, no. 11, p. 1227, 1228 (fig. 2), 1231. The nonwelded top of upper flows of Cat Mountain Rhyolite grades into a tuffaceous sedimentary unit previously considered as part of the younger Safford Tuff but here in referred to as Anklam formation. The Anklam formation is composed of reworked Cat Mountain tuffs in its lower part, and in its upper part of tuffaceous arkoses and siltstones intruded conformably by a dark porphyritic andesite named Ivy May andesite by Kinnison (1958, unpub. thesis).

In Tucson Mountains, Pima County. Type locality and derivation of name not stated.

Annapolis Rhyolite (in Van East Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 32, 33. Consists of at least three facies or individual flows. Near Annapolis, is dark-gray to black porphyritic rhyolite with pinkish-gray feldspar phenocrysts. Two miles east of Annapolis, is reddish- to chocolate-brown porphyry with many feldspar and quartz phenocrysts. A dark-red to reddish-brown cryptocrystalline porphyry appears to overlie other two varieties. Name credited to Tolman and Robertson (in preparation).

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Van East Group (new).

Annapolis is in Madison County.

Antelope Granodiorite

Mesozoic: Southern California.

J. G. Evans, 1967, Dissert. Abs., v. 27, no. 11, sec. B, p. 3991. In area studied section includes (1) Mesozoic or older diorite and gneiss and Antelope Granodiorite, (2) Cretaceous or older Pelona and Portral Schists, (3) middle Pliocene Anaverde Formation, and (4) Pleistocene to Recent terrace gravels and alluvium.

Area is segment of San Andreas fault zone in Leone Valley west of Palmdale.

Antelope Flat Basalt

Pliocene (Hemphillian): Southeastern Oregon.

L. R. Kittleman, and others 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. (Fig. 4), 17. Pyroxene basalt with interbeds of altered volcanic sandstones; volcanic sandstones and conglomerates locally at base. Probably not more than four flows less than 300 feet in total thickness, but apparent stratigraphic complexity and thickness and exaggerated by faulting. Widely distributed in western part of Owyhee Reservoir district and eastern part of Crowley district, where it overlies various units of late Miocene age. Volcaniclastic rocks at base of formation contain Hemphillian (middle Pliocene) mammalian fauna.

Named for exposures near Antelope Flat in SE¼, sec. 12, T. 25 S., R. 41 E., Malheur County.

Antler Valley Stade

Antler Valley Substage, Drift

Pleistocene: Northern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 457, 458, 459. Itkillik stage includes four substages, for which Anaktuvuk River drainage, are designated Banded Mountain, Anayaknaurak, Antler Valley, and Anivik Lake. Precise age of Antler Valley readvance not known, but event is bracketed by dates on Anayaknaurak and Anivik Lake readvances. Hence it is younger than 13,270 years and older than 8,300 years.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, in The Quaternary of the United States: Princeton, N.J., Princeton Univ. Press, p. 360 (table 1). Listed as Antler Valley Stade in Itkillik Glaciation.

Anaktuvuk River drainage area, Brooks Range.

Anza Formation

Miocene: Southern California.

Richard Merriam and O. L. Bandy, 1965, Jour. Sed. Petrology, v. 35, no. 4, p. 911—913. Comprises about 1,100 feet of reddish granitic conglomerate with massive wedges of arkose. Underlies Split Mountain Formation. Overlies basement complex. Name credited to Woodard (1963, unpub. thesis).

G. D. Woodard, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2752. Reddish-brown granitic fanglomerate and arenite strata that have formerly been referred to as basal member of Split Mountain formation are defined as new formation, Anza conglomerate. In type area the formation is about 1,800 feet thick.

Type area: Split Mountain Gorge, in Vallecito area, Imperial Valley.

Apache Canyon Formation (in Bisbee Group)

Lower Cretaceous: Southeastern Arizona.

W. W. Tyrrell, Jr., Dec. 1964, Dissert. Abs., v. 25, no. 6, p. 3516. Paleozoic strata are unconformably overlain by about 9,000 feet of predominantly clastic Lower Cretaceous strata (Bisbee group) that are subdivided into following newly named units (ascending): Willow Canyon formation (with Glance conglomerate member at base), Apache Canyon formation, Shelleburg Canyon formation (Trinity), and Turney Ranch formation. No unconformities found in sequence. Strata probably represent a transition from nonmarine to marine and then back to nonmarine.

Whetstone Mountain area, Cochise and Pima Counties.

Apex Conglomerate

Eocene(?): Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 123, pl. 5. Has considerable range in composition. West-southwest of Packard Peak consists of angular to rounded fragments of quartzite with some shale and limestone in well-lithified red sandy calcareous matrix. In Eureka quadrangle, represented by prevolcanic talus deposit of angular to subrounded limestone and quartzite cobbles covered by Packard quartz latite along northern and eastern slopes of Godiva Mountain, and by conglomerate several tens of feet thick that underlies Packard quartz latite in the type locality in Apex Standard No. 2 shaft. Unconformably overlies folded, faulted, and deeply eroded Paleozoic rocks and is overlain by rocks of middle Eocene age.

Type locality: In Apex Standard No. 2 shaft in NW¼NE¼ sec. 22, T. 10 S., R. 3 W., East Tintic Mountains.

Appel Ranch Member (of Word Formation)

Lower Permian (Guadalupe Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U.S. Geol. Survey Bull. 1244—E, p. E8, pls. 1, 2. Appel [Appel] Ranch was formerly designated "Fourth Limestone" member of Word Formation (P.B. King, 1931, Texas Univ.

Bull. 3038). Type locality herein designated is King's (1931, section 24) where he measured the "Fourth Limestone" as follows: (a) fossiliferous cherty dolomite, 40 feet; (b) gray and brown limestone and dolomitic limestone, containing some chert nodules and many silicified fossils, interbedded with sandy brown limestone and some silicerous shale, 225 feet; and (c) light-gray crystalline limestone, very similar in appearance to Edwards Limestone of the Comanche and contains abundant small brown chert nodules as well as abundant fauna of brachiopods, fusulinids, and other fossils, 260 feet. Member merges into main body of the Word about a mile east of type locality, but can be traced westward nearly to site of Old Willis Ranch. Overlies Willis Ranch Member (new). Underlies Capitan Limestone.

Type locality: North of Apple [Appel] Ranch which is about half a mile northeast of site of Old Word Ranch, Hess Canyon quadrangle, Brewster County.

Apple Creek Phyllite (in Belt Supergroup)

Precambrian: East-central Idaho.

A. L. Anderson, 1961, Idaho Bur Mines and Geology Pamph. 124, p. 19—21, pl. 1. In Lemhi quadrangle, three members of Belt Series, each more than 10,000 feet thick are Apple Creek Phyllite (oldest), Lemhi and Swauger Quartzites. Phyllite is in fault contact with Cheney Volcanics (new).

S. H. Ross and C. N. Savage, 1967, Idaho Bur. Mines and Geology, Earth Sci. Ser. 1, p. 7, 22. Apple Creek Phyllite listed as formation in Belt Supergroup. In older literature rocks of the Belt Supergroup were designated "Belt Series".

Named after Apple Creek, tributary of Hayden Creek, in southwestern part of Lemhi quadrangle.

Apple Ranch Member (of Word Formation)

See **Appel Ranch Member** correct spelling.

Appleton Formation

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Formation consists primarily of dark-colored metasediments, some of which contain chiastolite of sillimanite metacrysts. Includes Round Pond facies, Ghent phyllite facies, and Vaughan Neck sillimanite gneiss facies (all new). Overlies St. George formation (new). Underlies Washington quartzite (new). Younger than East Union norite (new).

Underlies Appleton Ridge, northwestern Knox County marble belt.

Aquetuck Member (of Schoharie Formation)

Devonian: Eastern New York.

J. H. Johnsen and J.B. Southard, 1962, New York State Geol. Assoc. Guidebook 34th Ann. Mtg., p. A-12. At Leeds, member consists of interbedded calcareous mudstone and muddy limestone with abundant thin layers of small chert nodules. Muddy layers are similar to those in upper part of Carlisle Center Member to south, as is the nature of the interbedding. To the south (Kingston) the chert nodules disappear and the thin dark-weathering layers in the calcareous mudstone become inconspicuous but do not disappear. Thickness 30 to 45 feet. Gradational contact with overlying Saugerties Member. [Johnsen, 1957, Dissert. Abs., v. 17, no. 10, used term Aquetuck lithofacies of Leeds facies of Schoharie Formation.]

Type locality not stated. Town of Aquetuck is in Albany County.

Ardeola Member (of McNairy Formation)

Upper Cretaceous: Southeastern Missouri.

C. H. Johnson, ed., 1962, Missouri Geologists Assoc., 9th Ann. Field Trip, Sept. 28—29, p. 15 (fig. 15). Consists of four units: lower sand, 11 feet; "Zadoc clay", 17½ feet; clay, sand, and sandy clay, 24 feet; and sandy clay, 12 feet. Underlies Owl Creek formation. Name credited to D. R. Stewart (1942, unpub. manuscript).

Ardeola section is in NE¼SW¼NW¼, sec. 10, T. 27 N., R. 11 E., Advance quadrangle, Stoddard County.

Ardis Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.] v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Ardis sand occurs at depth of 9,156 to 9,206 feet in type well. Ardis is duplicate name for Burgess-Simmons sand, but both are popular locally and retention of the two names for same sand is favored.

Type well: Barnsdall Oil Co., No. 1 Ardis, sec. 27, T. 22 N., R. 11 W., South Sarepta field. Reference well: Sunray Oil Co., No. A-1 Bolinger, sec. 19, T. 22 N., R. 11 W., South Sarepta field, Bossier Parish.

Arlington Member (of Woodbine Formation)

[Upper Cretaceous]: North-central Texas.

C. F. Dodge, 3d, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1575. Two new member names proposed for the Woodbine. Rush Creek below and Arlington above.

Area of report is Tarrant County.

Arrow Canyon Formation

Upper Devonian: East-central Nevada.

R. L. Langenheim, Jr., and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 5, p. 596 (fig. 4), 601. Formation 1,100 feet thick at type locality, consists mostly of medium- to dark-gray limestone in thin to medium beds. Crops out in series of precipitous black cliffs which are banded by stripes of rusty brown and gray, marking the outcrops of minor interbeds of quartzite and dolomite respectively. Quartzite more prominent in upper half of formation and at least five beds appear to extend through most of quadrangle. Thin stromatoporoid-bearing beds, abundant in lower half of formation, but less numerous in upper half. Overlies Moapa Formation (new); underlies Crystal Pass Limestone; both contacts gradational.

F. G. Poole and others, 1967, *in* International symposium on the Devonian: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 1, p. 885 (fig. 2b). Age shown on correlation chart Upper Devonian.

Type locality: North of Toronto Gulch, Arrow Canyon quadrangle, Arrow Canyon Range, Clark County.

Arsenal Member (of Oneota Dolomite)

Ordovician: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 43 (fig. 15), 45. Proposed for basal cherty unit of Oneota. Thickness 100 to 150 feet. Occurs between 980 and 1,085 feet in type well. Underlies Blodgett Member (new); overlies Gunter Sandstone.

Type well: Layne-Western Kankakee No. 9, sec. 25, T. 34 N., R. 9 E., Will County. Name derived from Joliet Arsenal, western Will County.

Arsenal Sand

Pleistocene: Southeastern Minnesota.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2 (with text), p. 6 (table 2), 21. A light-gray to very pale brown to brown pebbly fine to coarse sand. Interpreted as a kame deposit. Occurs above Turtle Lake Sand (new) and below New Brighton Formation.

Type section: Arsenal gravel pit on Twin Cities Arsenal reservation in Arden Hills, SW¼NE¼ sec. 10, T. 30 N., R. 23 W., New Brighton quadrangle.

Artesia Group

Lower and Upper Permian (Guadalupe): Surface and subsurface in New Mexico and west Texas.

D. B. Tait and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 4, p. 504—517. Proposed to replace terms "Whitehorse," "Chalk Bluff," and "Bernal." Group extends from top of Tansill Formation down to base of Grayburg Formation and includes Tansill, Yates, Seven Rivers, Queen, and Grayburg Formations. It is a rock-stratigraphic unit, as are all formations of the group, and includes carbonate, evaporite, and clastic facies. Reference well is designated in subsurface in which group has thickness of 1,710 feet. Term Artesia Group (undifferentiated) can be used as a surface mapping unit where it is not possible to differentiate the component formations of the group.

P. T. Hayes, 1964, U.S. Geol. Survey Prof. Paper 446, p. 28—37. Named by Tait and others to include (ascending) Grayburg, Queen, Seven Rivers, Yates, and Tansill Formations. As defined includes a carbonate facies adjacent to the basin-margin facies and an evaporite facies farther shelfward. Group thus replaces the abandoned Carlsbad Group which was defined to include the carbonate facies only of the Seven Rivers, Yates, and Tansill Formations. Inasmuch as the constituent formations of the Artesia Group are distinguishable within the evaporite facies in the subsurface throughout southeastern New Mexico, the Chalk Bluff Formation of Lang (1937) is also abandoned. The Chalk Bluff originally included all the rocks in the evaporite facies from top of San Andres Limestone to the base of the Salado Formation.

Name Artesia is from city of that name located in Eddy County in Pecos River valley, New Mexico, a few miles northeast of extensive exposures of component formations of group, and from Artesia field in T. 18 S., R. 28 E., Eddy County, in which formations of group are extensively recognized in subsurface. Reference well: Humble Oil and Refining Company's Federal Bogle well No. 1, in sec. 30, T. 16 S., R. 30 E., Eddy County.

Asbury Park Member (of Kirkwood Formation)

Miocene, middle: New Jersey.

W. C. Isphording, 1967, Dissert. Abs., v. 27, no. 11, sec. B, p. 3992. On basis of lithology the Kirkwood is subdivided into three members, Alloway clay member, Asbury Park member, and Sand facies. The Alloway clay and Asbury Park members are basal units within the formation whereas the Sand facies interfingers with and overlies both basal members.

Coastal Plain Province, New Jersey.

Ashburn Formation

Miocene, lower: Southwestern Georgia.

N. K. Olson, 1967, (abs.) Georgia Acad. Sci. Bull. 25, no. 2, p. 88. Many exposures of indurated quartzose claystone, in part feldspathic and micaceous, occur within the part of the geologic map of Georgia shown as Miocene Hawthorn Formation. Outcrops ranging in thickness from a few feet to more than 70 feet are present in two somewhat parallel northeast-southwest alignments which are from 30 to 50 miles apart. Additional outcrops exist in a random scattering between these two alignments. More than 30 exposures have been plotted to date. These rock units are designated informally as Ashburn formation. Reference section measures more than 72 feet above the basal contact. All of Hawthorn in South Carolina is reported to be of marine origin. The Ashburn, however, and all known Hawthorn outcrops in Georgia exhibit entirely nonmarine character. Present known western limit of the Ashburn exposures overlaps and coincides with terminus of Tampa Limestone as mapped by Cooke. The Ashburn may be landward fluvial facies of the Tampa which would make its age early Miocene.

Named for exposures (reference section) on Interstate Highway 75 at bridge over West Fork of Deep Creek, 4 miles north of Ashburn, Turner County.

Ashby Creek Conglomerate Member (of Doyle Creek Formation)

Upper Triassic: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1575. Doyle Creek Formation (new) contains two members, Ashby Creek Conglomerate and Piedmont Point.

Mapped area lies between Wallowa Mountains in northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Ash Canyon Member (of Mesaverde Formation)

Upper Cretaceous: Southwestern New Mexico.

Sam Thompson, 3d, 1961, (abs.) New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 199. Mesaverde subdivided into unnamed main body and Ash Canyon member.

Southern part of Fra Cristobal Range, Sierra County.

Ashlock Formation

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D9—D16. Lower part chiefly limy and dolomitic mudstone; middle part chiefly limestone and argillaceous limestone; upper part greenish-gray unfossiliferous limy and dolomitic mudstone overlain by gray thin-bedded fossiliferous silty, granular limestone. Thickness 125 to 145 feet. Southwest of Richmond includes five members (ascending): Tate (redefined), Gilbert (redefined), and Stingy Creek, Terrill, and Reba (all new). Overlies Calloway Creek Limestone (new); underlies Drakes Formation (new).

G. C. Simmons, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—583. In Richmond North quadrangle, Madison and Fayette Counties, formation comprises (ascending) Tate, Grant Lake, Terrill, and Reba Members. Overlies Calloway Creek Limestone. Underlies Drakes Formation.

Type section: Outcrops along north bank of Dix River and in roadcuts of U.S. Highway 27 north of river. Reference section: Along north bank of Dix River beginning 0.8 mile west of U.S. Highway 27, about 4 miles north of Stanford, Lincoln County. Named for Ashlock Cemetery near U.S. Highway 27 about 0.1 mile north Dix River, northeastern Lincoln County.

Ash Spring Basalt Member (of Chisos Formation)

Eocene, upper: Western Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 23, pl. 2, road logs. Overlies Alamo Creek Basalt Member and underlies Bee Mountain Basalt Member (new). Thickness about 75 feet at Casa Grande Peak.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 116—118, pls. Formal proposal of name. Second lava above base of Chisos Formation. Conspicuously porphyritic with phenocrysts of plagioclase, some more than half an inch long at type locality. At all exposures the basal 10 feet is scoriaceous and many of these openings are filled with secondary crystals. Thickness 65 to 200 feet. At all localities studied, where it is more than 50 feet thick, it consists of two or more flows. Overlies Alamo Creek Basalt Member. Underlies Bee Mountain Basalt Member.

Type locality: On north side of Chisos Mountains where it forms massive ledge. Named for Ash Spring, Brewster County.

Aspilche Formation

Lower Cretaceous (Albian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Mudstone 5,900 feet thick. Overlies Wintun formation (new); underlies Julian Rocks formation (new).

In Elk Creek-Fruto area, Glenn County.

Asses Ears Granite

Mesozoic (?): West-central Alaska.

Gordon Herreid, 1966, Alaska Div. Mines and Minerals Geol. Rept. 23, p. 3—4. Two types of granite described: Asses Ears and American Creek. The Asses Ears is medium-grained, subhedral granular biotite granite containing perthitic orthoclase, andesine, quartz, biotite, hornblende, and mionor Apatite and pyrite. Virtually unaltered tremolite present in marble on upper Magnet Creek, but not on marble ridge just west of Asses Ears.

Inmachuk map area covers 110 square miles in northern Seward Peninsula, 10 miles north of Kotzebue Sound and 25 miles southwest of Deering, Seward Peninsula.

Atascosa Group

Lower Cretaceous: Southern Texas (subsurface).

J. A. Winter, 1961, Gulf Coast Assoc. Geol. Soc. Trans., v. 11, p. 15, 21, 23; 1962, *in* Contributions to the geology of South Texas: San Antonio, South Texas Geol. Soc. p. 86, 92. Defined as consisting of formations above the Pearsall and below the Del Rio formation, that is, Georgetown, McKnight (new), Edwards, Glen Rose, and Stuart City (new) formations and the fine-grained limestone sequence (Atascosa group undifferentiated) of the fore-reef province.

Report includes four geologic provinces: San Marcos platform, Maverick basin, Stuart City reef trend, and fore-reef province. Atascosa County is in this area.

Atco Formation (in Austin Group)

Cretaceous (Gulf Series): Central Texas.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Bros., p. 353. According to Durham (1957, unpub. thesis) the type Austin sequence (in vicinity of Austin) includes (ascending) Atco chalk, Bruceville chalk-marl, Vinson chalk, Jonah limestone, Dessau chalk, Burditt chalk marl, and Big House chalk.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121—1123. Basal formation of group. Includes Vinson chalk member and Bruceville marl member. Underlies Jonah limestone. Name credited to Durham (1957).

Keith Young, 1962, Geol. Soc. America Guidebook Houston Mtg., p. 99 (table 2), 103 (table 3). Shown on tables as formation. Listed above South Bosque formation and below Vinson formation. Gulf Series.

Occurs in type section of Austin Group at Austin, Travis County.

Augite Vent Basalt

Tertiary: Northeastern New Mexico.

Brewster Baldwin and W. R. Muehlberger, 1959, New Mexico Bur. Mines and Mineral Resources Bull. 63, p. 154. Name applied to basalts erupted from Augite Vents.

W. R. Muehlberger, Brewster Baldwin, and R. W. Foster, 1961, New Mexico Bur. Mines and Mineral Resources, Scenic Trips to the Geologic Past, No. 7, p. 37. Mentioned in discussion of geology of the Raton, Capulin Mountain, and Clayton area.

Augite Vents are a pair of deeply eroded small cinder cones about 2 miles south of Folsom, Union County.

Augusta Member (of Joachim Formation)

Middle Ordovician: Southeastern Missouri and southern Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 59—60, 227—228. Consists principally of pure to silty, thick-bedded dolomite and limestone. Thickness 29 feet at type section; 26 feet in well in Calhoun County, Ill.; 106 feet in Pulaski County, Ill. Overlies Abernathy Member (new); underlies Boles Member (new). North of Perry County, Mo., rests directly on Tonti Member (new) of St. Peter Sandstone.

Type section: In cut on Chicago, Rock Island, and Pacific Railroad, at foot of bluffs along southeast side of Missouri River, 1 mile southeast of hamlet of St. Albans, Franklin County, Mo. Named for village of Augusta, which is 5 miles west of type section. Also well exposed in Ancell type section in Cape Girardeau County, Mo.

Aura Formation

Ordovician: Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 17—18, 36 (table 1), pl. 1. Upper portion composed of thin-bedded brown to black phyllite and chert alternating with thick blue-gray limestone layers; middle member of 500 feet of buff medium-grained quartzite often missing; lower part similar to upper member with fewer and thinner limestone layers. Thickness about 3,800 feet, uncertain because of faulting and intrusive igneous stocks. Overlies Porter Peak Limestone (new); underlies Chellis Limestone (new), both contacts conformable. Tentatively assigned to Ordovician on basis of regional correlation.

Named after Aura (Columbia) mining district on east slope Bull Run Mountains, Bull Run quadrangle, Elko County. Formation exposed in undulating band trending east-west across Bull Run Mountains south of Blue Jacket Peak; continuity disrupted by intrusion of White Rock stock and by faulting which offsets part of formation.

Austerlitz Phyllite (in Cossayuna Group)

Lower Cambrian: Eastern New York.

D. W. Fisher, 1961, New York State Geol. Assoc. Guidebook 33d Ann. Mtg., p. D2 (geol. map), D5, 1962, New York State Mus. Sci. Service Geol. Survey Map and Chart Ser., no. 2. Name proposed for unfossiliferous purple and green phyllite that is widespread in eastern Rensselaer and eastern Columbia Counties. In type area unit is in fault contact on Middle Ordovician Balmville Limestone and Lower Ordovician Stockbridge Dolomite. Previously the Austerlitz has been lumped with "Berkshire" schist but it is certain that at least the black portion of the "Berkshire" is Middle Ordovician, hence it is unwise to continue to call the purple and green portion, whose age is in dispute, by same name. The Austerlitz may be eastern metamorphic equivalent of Mettawee and Nassau lithologies. In Cossayuna Group (new).

Type area: Austerlitz Township. Typical exposures occur along road to microwave tower atop hill, 1 mile west of Austerlitz, at falls on Punsit Creek, 0.8 mile south of Spencertown, and in Canaan Township along Boston and Albany Railroad, 0.25 miles southwest of main road intersection in Canaan, and extending for 0.7 mile along road to Rattlesnake Den from Queechy Lake.

Austin Stage

Upper Cretaceous (Gulfian): Atlantic and Gulf Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 348—356. Austin stage is used here as a provincial time-rock term, as a major division of the Gulf series, to include all strata in Atlantic and Gulf coastal province of North America and adjacent areas which by one means or another can be reasonably demonstrated to be equivalent to the type Austin chalk and its typical subdivisions. If future study discloses that this usage results in overlapping time-rock units, then limit or limits of the units involved should be adjusted to take care of the discrepancy. From place to place upper and lower boundaries of Austin have been mapped as unconformable. Elsewhere passage from beds of Eagle Ford age (stage) takes place without discernible break. Similar relationships are known for passage from Austinian to Tayloran strata.

Aven Formation

Ordovician: Western Virginia.

J. R. Derby, 1963, (abs.) Virginia Jour. Sci., v. 14, new ser., no. 4, p. 239. Aven formation, 600 to 800 feet thick, overlies Barron Creek limestone (new) and underlies Lenoir-Mosheim limestone. Contains *Lecanospira compacta* near top. Is equivalent to "Beekmantown" of Butts. Name credited to Tyler (unpub. thesis).

Damascus quadrangle, Washington County.

Avispa Formation (in Río Orocovis Group)

Avispa Lava Member (of Río Orocovis Formation)

Upper Cretaceous: Puerto Rico.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, pl. 1. Mainly plagioclase-rich flow rock, tuff, and breccia. Commonly 3,000 to 4,000 feet thick. Overlies Perchas Member (new); underlies Los Negros Member (new).

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 28—30, pl. 1. Formal proposal of name. A sequence of andesitic lavas which includes layers of detrital rocks and a lens of reef limestone. Thickness ranges from about 100 meters in south-central part of Ciales quadrangle to estimated thickness of 1,500 meters in the northwestward-trending belt of outcrop across central part of quadrangle where repetition of parts of formation by faulting is probable. Overlies Perchas Member in south-central part of quadrangle along a north-northeastward-trending line of contact. Base of member not exposed elsewhere in quadrangle because of faulting. Conformably underlies Manicaboa Formation (new). On south side of Cerro Cedro graben, in fault contact with Pozas Formation (new).

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C9—C10. Río Orocovis Formation redefined and raised to group status to include (ascending) Magüeyes, Perchas, Avispa, and Los Negros (new) Formations. In Corozal quadrangle [this report] the Avispa is about 1,800 m thick. Subdivided to include Cuchillas Member (new).

Named for exposures on and in vicinity of Cerro Avispa, in central part of Ciales quadrangle, between localities 13 and 14 (pl. 1). All areas of outcrop extensively faulted.

Aysees Member (of Antelope Valley Limestone)

Lower and Middle Ordovician: Southeastern Nevada.

F. M. Byers, Jr., and others, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—108. Uppermost member of Antelope Valley; overlies Ranger

Mountains member (new); underlies Eureka quartzite. Consists of lower member, 330 feet thick, of medium-gray to dark-gray thick-bedded limestone; gastropods and *Receptaculites* in upper part; upper member, 440 feet, of medium-gray to dark-gray limestone that contains thin-bedded siliceous and laminated silty limestone that weathers shades of orange and brown, two pink ledges in lower middle.

F. M. Byers, Jr., and Harley Barnes, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—577. Mapped in Nye County where it is about 950 feet thick and consists mostly of medium- to dark-gray limestone. Overlies Ranger Mountains Member. Underlies Eureka Quartzite. Forms varicolored stair-step slope.

Type locality: Aysees Peak, Lincoln County.

Aziscohos Formation

Cambro-Ordovician (?): Northwestern Maine and northern New Hampshire.

J. C. Green, 1959, [abs.] Lake Superior Geology Inst., 5th Ann. Mtg., April 13—14 (Minnesota Univ., Minneapolis), p. 24. "New Hampshire and Vermont sequences" of metamorphosed Paleozoic geosynclinal rocks are separated by a contact of uncertain significance called Monroe fault. Very few geologists have worked on both sequences, hence, correlation of the two has been a problem. Problem was increased by the establishment in 1942 of the Orfordville formation beneath the Albee formation, the lowest formation in the standard New Hampshire sequence. Many geologists believe the Orfordville is the equivalent of several formations higher in the New Hampshire sequence. This interpretation is supported by recent discovery in northern New Hampshire of a different group of rocks (Aziscohos formation) in supposed position of the Orfordville. The Aziscohos is stratigraphically beneath the Albee, as determined by graded bedding in several localities; the position of the Orfordville was determined by plunges of minor folds alone. If the Orfordville formation is thus removed from the column, correlation between the two sequences is easier, and such a correlation is now accepted by many New England geologists. Establishment of the Aziscohos formation beneath the Albee agrees better with correlation, since the Aziscohos resembles the formations of the Vermont sequence immediately below the Moretown, which is correlated with the Albee of New Hampshire.

J. C. Green, 1963, (abs.) Geol. Soc. America Spec. Paper 73, p. 162. Boundary Mountain anticlinorium, in New Hampshire, contains at its core about 7,000 feet of pelitic schist, much of which is carbonaceous, named Aziscohos Formation. This formation ends about 3 miles northeast of Errol and is believed to plunge southwest beneath Albee Formation. Correlated with Ottauquechee and Stowe of Vermont and the Masonville of Quebec.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 10—16, pl. 1. Lower part consists of black, gray, green to silvery slate, phyllite, and schist with quartz pods and lenses; lesser amounts of black, micaceous quartzite, cummingtonite, amphibolites, and plagioclase-biotite-quartz gneisses. Upper part is green to silvery slate, phyllite, and schist with quartz pods and lenses; and rare amphibolite dikes and sills. Thickness difficult to estimate because formation is highly folded and marker beds are lacking. Outcrop width on west limb of Diamond Peaks anticline is about 19,000 feet and average dip is about 40°. This would give maximum thickness of 13,500 feet if there is no repetition by folding or shearing. Estimated thickness 7,000 feet. Oldest rocks in area. Underlies Albee Formation. Not same as Orfordville Formation (Hadley, 1942), which has been mapped as underlying the Albee in Mount Cube quadrangle 75 miles to southwest.

Named for exposures along southwest shore of Aziscohos Lake, Oquossoc quadrangle, Maine. Also present in Errol quadrangle, New Hampshire.

Aztec Granodiorite

Tertiary, middle to late: Southeastern Nevada.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7; p. 2491. Four intrusive stocks of middle to late Tertiary age, but younger than the volcanic rocks, intrude foliated basement rocks and volcanics. These are named Nelson quartz monzonite, Nob Hill and Aztec granodiorites, and Keyhole leucogranite.

Eldorado mining district, Clark County.

Baboquivari Granite

Tertiary(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. I5. A reddish coarse-grained porphyritic rock containing large orthoclase phenocrysts and conspicuous clusters of chlorite. In fault contact with Mesozoic(?) rocks of area along their southern boundary (Pitoikam Formation and Mulberry Wash Volcanic Formation).

Constitutes Baboquivari Peak, Baboquivari Mountains, Papago Indian Reservation.

Bachelor Mountain Rhyolite

Oligocene: Southwestern Colorado.

J. C. Ratté and T. A. Steven, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D49, D50. Bachelor Mountain Rhyolite mentioned in discussion of magmatic differentiation in a volcanic sequence related to Creede caldera.

T. A. Steven and J. C. Ratté, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D54—D63. Formal proposal. Name given to all rhyolitic rocks included by Emmons and Larsen (1923) in their Willow Creek Rhyolite, Campbell Mountain Rhyolite, Windy Gulch Rhyolite Breccia, and intrusive rhyolite porphyry. Emmons and Larsen described Willow Creek and Campbell Mountain Rhyolites as two sequences of lava flows and flow breccias separated by irregular erosion surface, and they included both in their Alboroto Group. They believed that Windy Gulch Rhyolite Breccia was separated from Campbell Mountain Rhyolite by major unconformity, and placed it in their Piedra Group. Present study shows that Willow Creek, Campbell Mountain, and Windy Gulch are members of intragradational sequence of pumiceous pyroclastic rocks that warrants formational rank. Breaks in the sequence occur only where Bachelor Mountain rocks intertongue with other volcanic rocks at margins of the deposit. No single complete section of formation exposed in central San Juan Mountains. Campbell Mountain and Windy Gulch Members intertongue laterally with flows and breccias of Shallow Creek Quartz Latite (new) to west, and lens of typical Campbell Mountain is interlayered with Phoenix Park Member of La Garita Quartz Latite (new) to east. Eruption of Bachelor Mountain Rhyolite culminated in collapse of Bachelor Mountain cauldron near Creede, and in development of series of normal faults that extend north to northwest out from more strongly subsided area. Middle or upper Tertiary.

The U.S. Geological Survey currently designates the age of the Bachelor Mountain Rhyolite as Oligocene on the basis of a study now in progress.

Type area: On Bachelor Mountain, northwest of Creede, Mineral County.

Back Bed (in Tate Member of Ashlock Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1124—D, p. D11—D12. Fine- to coarse-grained fossiliferous limestone 4 to 8 feet thick. Present in lower part of member.

G. C. Simmons, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—583. In Richmond North quadrangle, Madison and Fayette Counties, consists of grayish-green limestone; weathers grayish-yellow green. At some places occurs in one relatively thick ledge; at others in resistant layers less than 0.3 foot thick separated by shaly partings. Fossiliferous. Occurs between a lower and an upper limestone unit.

Named for representative outcrops along Back Creek in central part of Garrard County.

Backbone Ridge Siltstone Member (of Mahantango Formation)

Middle Devonian: South-central Pennsylvania.

R. L. Ellison, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Middle sequence of formation includes Backbone Ridge, Crooked Creek, and Donation members in Huntingdon County.

R. L. Ellison, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G 48, p. 29—30. Formal proposal of name. A medium- to dark-grayish-red siltstone of micaceous-calcareous composition. Contact with underlying Gander Run Member and overlying Crooked Creek Member gradational. Upper contact placed at top of a relatively well defined 1-foot bed of argillaceous siltstone that is somewhat more competent than overlying rocks and, consequently, exhibits better developed jointing than the overlying rocks. Thickness 45 feet at type section; about 60 feet at Martins Gap.

Type section: Along U.S. Route 22 opposite Huntingdon. Named from occurrence on Backbone Ridge, a discontinuous ridge along western limb of Broadtop synclinorium.

Bacons Castle Formation

Pliocene and (or) Pleistocene, lower (?): Southeastern Virginia.

N. K. Coch, 1965, U.S. Office Naval Research, Geography Branch Tech. Rept. 6, p. 35—45, geol. map. Proposed for clayey sand, pebble gravel, coble gravel, and silty sand that overlies Sedley Formation and is overlain by Elberon Formation (new). Subdivided into two facies: coarse-grained Kilby and fine-grained Cross Creek. Thickness 15 to 28 feet. Where Sedley Formation is absent, the Bacons Castle overlies Yorktown Formation.

Name derived from town in Isle of Wight County.

Badger Flat Limestone (in Mazourka Group)

Middle Ordovician: Eastern California.

D. C. Ross, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B75 (fig. 21.1), B80—B81. About 600 feet of fossiliferous silty blue-gray limestone, siltstone, and chert. Dark- to medium-gray limestone is dominant rock type. Overlies Al Rose Formation (new); underlies Barrel Spring Formation of Phegler (1933, Southern California Acad. Sci. Bull., v. 32, pt. 1).

Type section: On a spur along east wall of Mazourka Canyon. Top of composite section (Al Rose and Badger Flat) is 6,000 feet S. 70° E., from SE cor. sec. 36, T. 11 S., R. 35 E., Inyo County. Named for exposures in and near Badger Flat. Formation crops out in faulted belt parallel to Al Rose Formation.

Badger Valley Basalts

Pliocene (?): Southeastern Nevada.

Abraham Dolgoff, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 879 (fig. 1), 890, app. Total thickness of all flows probably not over 200 feet. Unconformable upon all formations from the Paleozoic rocks through Alamo Range Formation (new). Present only in two small areas as thin cappings over the pyroclastic rocks.

Type area: Badger Valley, Pahranagat area, Lincoln County.

†Badin Greenstone (in Tater Top Group)

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 130—132, geol. map. Predominantly basaltic, lithic-crystal tuffs with interbedded crystal tuffs and flows. Maximum thickness 200 feet. Basal formation in group. Unconformably overlies Uwharrie Formation (new) and Tillery Formation (new) of Albemarle Group (new).

The U.S. Geological Survey has abandoned the Tater Top Group and its formations the Badin Greenstone and Morrow Mountain Rhyolite on the basis of a study now in progress.

Type locality: Represented by continuous exposures along service road to Badin Dam from eastern limits of Badin to base of the dam on western bank of the river. Named for town of Badin, Stanly County. Crops out over wide area in northern Stanly County, western Montgomery County, and southwestern Randolph County. Reference locality: In western Randolph County, 1.7 miles south of U.S. Highway 64 at and near High Park Baptist Church.

Bagby Ranch Formation (in Patagonia Group)

Lower Cretaceous: Southeastern Arizona.

R. C. Baker, 1962, Dissert. Abs., v. 23, no. 1, p. 201. Patagonia group divided into four formations. Corral Canyon red beds (new), Duquesne volcanics (new), and Bagby Ranch formation, tentatively correlated with Bisbee group (Lower Cretaceous); the Molly Gibson formation is younger than Bisbee group.

Area of report is southeastern part of Patagonia Mountains, Santa Cruz County.

Bahia Fosforescente Member (of Parguera Limestone)

Upper Cretaceous: Southwestern Puerto Rico.

C. C. Almy, Jr., 1965, (abs.) Houston Geol. Soc., v. 8, no. 3, p. 16. Composed of basal tuffaceous calcarenites grading upward into glauconitic, bioclastic limestone. Grades upward into Punta Papayo Member (new). Santonian-Early Campanian.

Punta Melones-Ensenada area.

Bailey Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 601, pl. 1. Consists predominantly of limestone, black secondary chert, and calcareous quartzose siltstone. Some bedded (primary) cherts also present. Total thickness not over 1,100 feet. Overlies Frost Creek Member (new); underlies upper unnamed member of formation.

Well exposed on hilltop (elevation 7,904 feet) south of head of Bailey Creek, Bull Run quadrangle, Elko County.

Baird Group

Middle and Upper Devonian and older(?): Northwestern Alaska.

I. L. Tailleur, W. P. Brosgé, and H. N. Reiser, 1967, International Symposium on the Devonian System, Calgary, 1967: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1345—1361. Name applied to thick succession of carbonate rocks typically exposed in western Baird Mountains. Consists of Kugururok Formation and Eli Limestone (new) in western Brooks Range, and of Skajit Limestone. Over much of Brooks Range the subthrust Baird Group consists only of Skajit Limestone, underlies Endicott Group (new), and is no younger than Frasnian. Its lower part is generally unfossiliferous and the base is not exposed; at one place it includes rocks of probable Silurian age. In places underlies Lisburne Group. Middle(?) and Upper Devonian.

The U.S. Geological Survey currently considers the age of the Baird Group to be Middle and Upper Devonian and older(?) on the basis of a study now in progress.

Typically exposed in the western Baird Mountains in Brooks Range.

Baker Brook Volcanics

Middle Ordovician: Southwestern Vermont.

J. B. Thompson, Jr., 1967, Vermont Geol. Survey Bull. 30, pt. 2, p. 80—81, pl. 1. Principal rock types are quartz-muscovite-biotite schist with feldspar augen, mainly plagioclase, and a greenstone schist containing epidote, albite, chlorite, ankerite, and a green actinolite amphibole. Maximum thickness about 200 feet. Rest upon carbonates assigned either to Bascom Formation, Shelburne Marble, or Clarendon Springs Formation, indicating an unconformity at base. In north part of Danby, below the volcanics, but too thin to show on map, are thin-bedded limestones with minor beds of dolomite. These limestones resemble, in part, Middlebury Limestone of early Middle Ordovician age, but contain no fossils and the outcrops are many miles distant from nearest dateable Middlebury. Underlies Ira Formation.

Well exposed at a falls in Baker Brook in north part of Danby and neighboring hills, eastern part of Pawlet quadrangle.

Bakersfield Greenstone (in Underhill Formation)

Cambrian: Northern Vermont.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 24, 25, pl. 1. Two main bands of greenstone present in Underhill Formation of Richford syncline; a westerly one herein named Bakersfield Greenstone and a more easterly one named Peaked Mountain Greenstone. Bakersfield Greenstone lies consistently between White Brook Member and Sweetsburg Formation but never in contact with either.

Named for village of Bakersfield, Enosburg area.

Bald Mountain Basalt

Pliocene(?): Southern California.

C. W. Chesterman, 1956, California Div. Mines Bull. 174, p. 15 (fig. 7). Named on map legend of geologic map of Mono Craters pumice area.

Mapped on and in vicinity of Bald Mountain, Mono County.

Bald Mountain Formation

Upper Triassic and (or) Lower Jurassic: Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy Spec. vol. 8, p. 103, 117. Mesozoic eugeosynclinal deposition prior to the Late Cretaceous is represented by following units on western flank of Northern Cascades: Late Triassic and Early Jurassic Cultus Formation, and the questionably correlative Bald Mountain Formation; the Middle Jurassic Wells Creek Volcanics (new); the Upper Jurassic and Lower Cretaceous Nooksack Group, separated from the Wells Creek Volcanics by a disconformity.

Type locality and derivation of name not stated.

Bald Mountain olivine latite member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Age of Bald Mountain olivine latite relative to Big Chief basalt (new) difficult to ascertain. The two flows are presently considered close in age with Bald Mountain slightly younger. Potassium-argon age of Bald Mountain 1.2 m.y. Older than Hirschdale olivine basalt (new) on stratigraphical and structural evidence. At least 20 flows (or groups of flows) recognized in Truckee area, north of Lake Tahoe. Nine flows (or groups of flows) named and given informal member status in Lousetown Formation.

Mapped in vicinity of Bald Mountain.

Baldwin Conglomerate

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), 5, 8. A thin band of conglomerate that can be traced for several miles in an east-west direction southwest of Thunder Mountain. Mancuso (unpub. thesis) correlated the conglomerate with quartzites of the area and concluded essential structure was broad syncline pitching westward. Baldwin conglomerate is flanked on southeast by Waupee volcanics. Immediately north of Baldwin conglomerate and south of McCaslin Mountain is distinctive rhyolite named Hager by Mancuso.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 11. A review of some problems of Precambrian geology of northeastern Wisconsin. Mancuso (1957, 1960, unpub. theses) established following sequence in McCaslin syncline: Waupee Volcanics (oldest), Macauley Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite and High Falls Granite.

Probably named for Baldwin Creek, McCaslin district.

Balluco Gravel

Quaternary: Southwestern Texas.

C. C. Albritton, Jr., and J. F. Smith, 1965, U.S. Geol. Survey Prof. Paper 479, p. 99—100, pl. 1. Gravels on surfaces of erosion in Sierra Blanca area are named (ascending): Miser, Madden, Gills, Ramey, Balluco. The Balluco consists of limestone, sandstone, quartzite, conglomerate, and extrusive and intrusive igneous rocks. Thickness 6 inches to 20 feet.

Type locality: Along Arroyo Balluco south of U.S. Highway 80, Hudspeth County.

Banco Bonito Flows

[Pleistocene]: Northwestern New Mexico.

V. C. Kelley, E. H. Baltz, Jr., and A. R. Bailey, 1961, New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 53, 54. Black vitrophyre, a post-Bandelier rhyolite. Fills canyons that were cut in Battleship Rock welded tuff (new).

Flows appear to have come from low crater called El Cajete at southern base of Redondo Mountain, Jemez Mountains, Sandoval County. Flows are near Banco Bonito picnic ground.

Bancroft Springs Basalt (in Snake River Group)

Pleistocene, upper: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1216, pl. 1. At type locality consists of columnar lava, at least 300 feet thick, that lies in a former canyon about as deep as present Snake River Canyon. Basalt extends eastward from Bancroft Springs, forming upland plain cropping out as rimrock of columnar lava on northern canyon rim as far upstream as Malad Canyon where it overlies Madson and Thousand Springs basalts. Columnar lava of the Bancroft Springs was considered by Stearns, Crandall, and Steward (1938, U.S. Geol. Survey Water-Supply Paper 744) as part of recognizably younger McKinney Basalt which is herein restricted to the Recent lava flow from McKinney Butte. From Malad Canyon to 7 miles downstream the columnar rimrock lies on pillow lava that is in the Bancroft Springs. This pillow lava is as much as 500 feet thick and lies in canyon as deep as the present. The base of the basalt is lower than grade of Crowsnest Gravel (new). Pillow lava was termed Bliss Basalt by Stearns, Crandall, and Steward (1938) but name is herein abandoned. Stratigraphic relation to Sand Springs Basalt is indefinite; the two are nowhere in contact. Underlies Melon Gravel (new).

Type locality: Bancroft Springs which issue from talus slope near base of basalt in northeastern wall of Snake River Canyon, 7 miles east of Glenns Ferry, Elmore County.

Bandana dolomite marble

Age not stated: Northwestern North Carolina.

S. G. Conrad, 1960, North Carolina Dept. Conserv. and Devel. Bull. 74, p. 30, 31 (fig. 9). White uniformly coarse-grained dolomite marble.

On east side of North Toe River, 1.3 miles northwest of Bandana, Mitchell County.

Banded Mountain Member (of Bonanza King Formation)

Middle and Upper Cambrian: Southeastern Nevada.

Harley Barnes and A. R. Palmer, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—101 (fig. 187.2), C—103. Upper member of Bonanza King. Overlies Papoose Lake Member (new). Thickness about 2,450 feet. A brown-weathering siliceous carbonate sequence about 40 feet thick occurs at base of member.

Harley Barnes, R. L. Christiansen, and F. M. Byers, Jr., 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D27—D31. Has three local subunits. Lowest, 1,765 feet, is banded sequence of laminated to thin tabular beds of light-gray dolomite and dark-gray limestone. Color bands range in width from several inches to 15 feet. Dolomite predominates over limestone. Lowest 40- to 230-foot sequence is the "brown-weathering siliceous carbonate" referred to by Barnes and Palmer (1961). Middle and upper subunits form two broadly contrasting light and dark outcrop bands. Light middle subunit contains about 375 feet of thick to very thin tabular beds of light- to yellowish-gray limestone. Its upper contact is conformable but sharp, its lower contact gradational. Upper subunit contains 300 feet of dark- to light-gray limestone in tabular to somewhat irregular thin beds. Upper 10 feet of subunit is composed of dark-yellowish-brown and medium-gray thin to laminated irregular beds of limestone that contain much bituminous material and weather brownish gray. Middle and upper subunits are equivalent to units C and D of upper part of Johnson and Hibbard's Yucca Flat Formation.

Named for exposures on Banded Mountain, Nye County.

Banded Mountain Stade

Banded Mountain Substage, Drift

Pleistocene: Northern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 457, 458, 459. Itkillik stage includes four substages, which for the Anaktuvuk River drainage, are designated, Banded Mountain, Anayakaurak, Antler Valley, and Anivik Lake. Banded Mountain is regarded as earliest advance of Itkillik glaciation. Age of Banded Mountain advance may be between 18,000 and 20,000 years B.P.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N.J., Princeton Univ. Press, p. 360 (table 1). Listed as Banded Mountain Stade in Itkillik Glaciation.

Anaktuvuk River drainage area, Brooks Range.

Barber Member (of Quarry Mountain Formation)

Upper(?) Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 43—47, 95, pls. A, B. Proposed for lower dolomitic member of Quarry Mountain Formation (new). Characteristically dolomitic limestone with numerous beds of calcitic dolomite. Weathers light to medium gray. Thickness 52 feet at type locality (based upon surface exposures plus data from core hole). Underlies Marble City Member (new); overlies Tenkiller Formation (new).

Type locality: Along a small tributary of Dry Creek in Cherokee County about 3 miles southeast of Barber, SE¼NW¼NE¼ sec. 2, T. 14 N., R. 23 E.

Barclay Creek Formation

Permian(?): Northwestern Washington.

R. S. Yeats, 1964, Geol. Soc. America Bull., v. 75, no. 6, p. 554, 556, pl. 1. Consists of laminated gray, green, tan, and black argillite, with lesser amounts of greenstone, quartzite, and graywacke. Apparent thickness 3,700 feet. Overlies Gunn Peak Formation (restricted). Contact apparently conformable. Lithologies of both units interbedded near contact, which is placed at top of highest massive quartzite bed. At type locality top is in fault contact with migmatite. Underlies Swauk Formation along South Fork of Front Creek.

Type locality: North wall Barclay Creek Canyon, Index district, Cascade Range.

Barcroft Granodiorite

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 137. Characterized by medium-gray color due to high mafic content and to bluish-gray quartz and feldspar. In contact with younger sedimentary rocks and younger McAfee Adamellite (new). Eastern part of unit has been called quartz diorite by Anderson (1937, Geol. Soc. America Bull., v. 48, no. 1) and larger western part of unit is part of Anderson's (1937) Pellisier Granite.

R. G. Strand, 1967, Geologic map of California, Mariposa sheet (1:250,000): California Div. Mines and Geology. Barcroft Granodiorite mapped with Mesozoic granitic rocks.

Mapped in Mount Barcroft quadrangle, in White Mountains. Part of Inyo batholith.

Barker Creek Substage

Pennsylvania (Desmoinesian): Utah, Arizona, Colorado, and New Mexico.

D. L. Baars, J. W. Parker, and John Chronic, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, p. 393—403. Proposed that the units (ascending) Barker Creek, Akah, Desert Creek, and Ismay (formerly "pay zones") be called substages and used as formal time-stratigraphic units in Four Corners Stage (new). *Fusulina insolita* is useful fusulinid.

Interval for the four substages of the Four Corners Stage is in Shell No. 1 Hovenweep well sec. 5, T. 40 S., R. 26 E., San Juan County, Utah.

Barnes Creek Gravel

Pliocene: Central western Montana.

V. E. Gwinn, 1961, Dissert. Abs., v. 21, no. 8, p. 2247; 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4). Gravel with pink sandy matrix. Overlies upper part of Flint Creek beds. Thickness 0 to about 250 feet. Contains Pliocene vertebrate fragments in upper part.

Named for occurrence near mouth of Barnes Creek, Granite County.

Barneveld Stage

Ordovician (Mohawkian): New York.

D. W. Fisher, 1962, New York State Mus. and Sci. Service Geol. Survey, Map and Chart Ser. No. 3. On this chart, the Ordovician is divided into 12 stages (including three unnamed Canadian stages). Medial Ordovician is that of Cooper (1956, Smithsonian Misc. Colln., v. 127, pt. 1), but with name Trenton used as rock-stratigraphic name. A new name, Barneveld, is substituted in the chronostratigraphic sense. Follows Wilderness Stage and precedes Eden Stage. Mohawkian.

Barneveld is post office designation of Trenton, N.Y.; the type section remains as Trenton Falls Gorge section along West Canada Creek, beginning at base of the Shoreham and terminating at top of the Cobourg. About 260 feet of rock are exposed.

Barranquitas Tuff Member (of Robles Formation)

Upper Cretaceous (Cenomanian): East-central Puerto Rico.

Guillermo Otalora, 1961, Dissert. Abs., v. 22, no. 5, p. 1583. Lowermost member of Robles formation. Underlies Lapa andesite member; overlies Río Loco formation.

G. Otalora, 1964, Am. Jour. Sci., v. 262, no. 6, p. 726, 727, 728 (fig. 2), 730. Discussion of zeolites and related minerals in Cretaceous rocks of east-central Puerto Rico. Robles formation subdivided into three members: Helechal and Barranquitas tuff members at top and base of formation and Lapa andesite member between them. The two tuff members commonly consist of well-bedded, laminated rocks with a mineral suite similar to underlying Rio Rico rocks but with addition of a variable amount of clay and organic material.

In Barranquitas quadrangle.

Barron Creek Limestone

Ordovician: Western Virginia.

J. R. Derby, 1963, (abs.) Virginia Jour. Sci., v. 14, new ser., no. 4, p. 239. Barron Creek limestone, 350 to 850 feet thick, overlies Conococheague formation and underlies Aven formation (new). Contains *Finkelburgia bellatula* near top. Equivalent to "Chepultepec" of Butts. Name credited to Tyler (unpub. thesis).

Damascus quadrangle, Washington County.

Bartlett Point Amphibolite

Age not stated: Southwestern Maine.

M. W. Bodine, Jr., 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., Trip F, p. 58. Coarse hornblende-plagioclase (bytownite at Bartlett Point)-diopside rock. Thickness about 200 feet. Associated with Pejepscot Formation. This may be unit mapped as Androscoggin Formation by Fisher (1941, Geol. Soc. America Bull., v. 52, no. 1) in Lewiston area. An informal name used in advance of formal definition.

Exposed at Bartlett Point, Sturdivant Island, Wolf Neck, and along coast near Bunganuc Landing, southwestern Casco Bay area.

Basin Creek Tuff

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 36—38, pl. 1. Consists of tuff, tuff breccia, and tuff agglomerate of quartz latite composition. Ranges in thickness from 700 feet, north of Gillespie Mountain, to 150 feet, south of Bennett Creek, and pinches out south of Cedar Hill. Rests with apparent conformity upon Oak Creek Tuff north of Gillespie Mountain, unconformably upon Cretaceous rocks on northwestern flank of Winkler anticline, disconformably upon Bennett Creek Breccia (new) south of Bennett Creek, and conformably upon Timberlake Fanglomerate (new) on south side of Cedar Hill. Underlies Cedar Hill Andesite (new).

Named for exposures at headwaters of Basin Creek, mostly in S½, sec. 9 and N½, sec. 16, T. 30 S., R. 18 W., Hidalgo County.

Basin Mountain Substage

[Recent?]: East-central California.

D. A. Rahm, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 221. Listed as medial of three substages of Neoglacial stage. Preceded by Wonder Lakes substage and followed by Gilbert substage.

Bishop area, Sierra Nevada.

Bastille Limestone Member (of Masket Shale)

Silurian: Central Nevada.

Marshall Kay and J. P. Crawford, 1964, Geol. Soc. America Bull., v. 75, no. 5, p. 437, 439, 445 (fig. 5), pls. 1. 6. Basal part of formation. Thickness about 220 feet. Lowest 30 feet are thick-bedded somewhat shaly dolomite. Next 30 feet, exposed twice because of faulting, are heavy-ledged calcarenite. Upper 160 feet consist of 1- or 2-foot ledges of calcisilite with interbedded thinner and shaly beds, a few with contortion and cross stratification. Overlies Gatecliff Formation.

Type section: Slope above Gatecliff, Toquima Range. Named from Bastille Ridge between July and August Canyons. [Map shows Bastille Ridge south of August Canyon and between August Canyon and North Mill Canyon.]

Batesland Formation

Miocene, middle: Southwestern South Dakota.

J. C. Harksen and J. R. Macdonald, 1967, South Dakota Geol. Survey Rept. Inv. 96, 10 p. In type section area Batesland Formation is composed of about 50 feet of bedded and crossbedded sands along with silts, clays, and marls that unconformably overlies middle Miocene Rosebud Formation and is overlain unconformably by Ogallala Formation. Distinguished from underlying Rosebud by (1) its light-greenish versus pink color, (2) its abundance of sand and marl versus silt and clay, (3) its lack of concretionary ledges, (4) its overall appearance in gross observation in the field, (5) its occurrence in the stratigraphic column as now known, and (6) its contained fossils. The Batesland at its type section and throughout the area of outcrop has no known overlying rocks in natural exposures. In normal stratigraphic sequence, the Ogallala would overlie the Batesland. Distinguished from Ogallala Formation by (1) its greenish versus grayish to brownish color, (2) its finer sand grains, (3) the color of the fossils; a diagnostic gray in the Batesland and mostly white and blue in the Rosebud and Ogallala Formations, (4) its overall appearance in the field, and (5) its contained fossils. The Batesland is a paleo-valley fill.

Type section: In SE¼ sec. 36, T. 37 N., R. 39 W., Bennett County, and about 10 miles east of town of Batesland, Shannon County.

Bates Pond Lentil (in Putnam Gneiss)

Pre-Pennsylvanian: Southeastern Connecticut.

G. L. Snyder, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—144. A uniform unlayered gray gneiss that is uniformly granular and contains large porphyroblasts of black hornblende and flesh-colored soda-orthoclase as much as several centimeters in length.

Named for exposures near Bates Pond, Norwich quadrangle. Exposed in several lenticular bodies in southeastern corner of quadrangle.

Battleship Rock Welded Tuff, Flow

Pleistocene: Northwestern New Mexico.

V. C. Kelley, E. H. Baltz, Jr., and A. R. Bailey, 1961, New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 52, 53, 54. Rhyolite welded tuff and breccia. A post-Bandelier rhyolite. Banco Bonito flow (new) fills canyons cut in Battleship Rock welded tuff.

Named for Battleship Rock, Jemez Mountains, Sandoval County. Rhyolite poured down San Diego Canyon from El Cajete center to the northeast near southern base of Redondo Mountain.

Battleship Wash Formation (in Bird Spring Group)

Mississippian (Chesterian): Southeastern Nevada.

V. A. M. Langenheim and R. L. Langenheim, Jr., 1965, Illinois Acad. Sci. Trans., v. 58, no. 4, p. 225--240. Name applied to basal formation of Bird Spring Group. This unit termed BSa of Bird Spring Group by Langenheim and others (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 5). At type section consists of three unnamed members. Basal sandstone member is 4½-foot interval of interbedded sandy limestone and calcareous sandstone in beds about 4 inches to 1 foot thick. At Arrow Canyon contains abundant specimens of *Faberophyllum* sp. Middle member about 65 feet thick at type locality consists of medium-grained thick-bedded limestone characterized by strikingly parallel bedding. Rocks are spar cemented. Fossils notably absent. Uppermost member consists of about 8 feet of medium-grained limestone which weathers purplish gray and is more thinly bedded than middle member. Bedding plane surfaces bear association of *Stigmaria* sp., shark teeth, solitary rugose corals and spiriferid brachiopods. Total thickness 80 feet. Overlies Yellowpine Limestone of Monte Cristo Group. Underlies unnamed unit (BSB) of Bird Spring Group.

G. D. Webster and N. G. Lane, 1967, *in* Essays in Paleontology and Stratigraphy, R. C. Moore Commemorative Volume, Kansas Univ. Dept. Geology Spec. Pub. 2, p. 507. Battleship Wash Formation has not been recognized to south or southeast in Spring or Muddy Mountains in Clark County, although it is included in Bird Spring Group by Langenheim and Langenheim (1965). Because the lithology is distinctive, the fauna is different, and age is Late Mississippian, Battleship Wash is herein considered a separate formation not included in, or related to, rocks of Bird Spring or Indian Springs formations at their type localities.

Type section: In north wall of Arrow Canyon at lower entrance to the deep and narrow upper gorge, Arrow Canyon Range, Clark County.

Bautista Complex

Pre-Middle Cretaceous: Southern California.

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, p. 722 (table 1), pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features on which correlations are based. Bautista complex is one of six complexes used in correlation.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Baylis Formation

Cretaceous: Western Illinois.

J. C. Frye, H. B. Willman, and H. D. Glass, 1964, Illinois Geol. Survey Circ. 364, p. 3 (fig. 1), 4—10, 17—18, 26—28 (geol. sections). Consists of two members: Hadley Gravel Member (new) at base and Kiser Creek Member (new), consisting of sand and clay. Thickness 25 feet at type section where both members are present. Overlies Abbott Formation. Underlies Pleistocene deposits (Roxanna Silt in some areas).

Type section: Aberdeen School geologic section measured in creek bank, NW¼SW¼SE¼ sec. 31, T. 4 S., R. 4 W., Pike County. Named for town of Baylis, 4 miles north of type section. Makes prominent ridge that forms the divide between Illinois River and Mississippi River drainage. Extends northwestward from point northwest of Pittsfield nearly 10 miles into Adams County.

Bay of Pillars Formation

Upper Silurian: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C6—C11, pls. Name applied to thick sequence of complexly folded calcareous sandstone and argillite that underlies most of northwestern part of Kuiu Island. Primarily medium-grained medium-light gray calcareous lithic sandstone. Owing to complex deformation, thickness of formation unknown but probably several thousand feet. Underlies Kuiu Formation (new). In northwesternmost part of island, intruded by gabbro and adamellite plutons of Cretaceous(?) age. At least in part Late Silurian.

Type locality: North of shoreline of the Bay of Pillars, Kuiu Island.

Bays-of-Maine Complex

Middle Paleozoic: Maine and Canada.

C. A. Chapman, 1962, Geol. Soc. America Bull., v. 73, no. 7, p. 883—887. Name applied to belt of igneous rocks that underlies northeastern half of Maine coastal area. The complex, of Middle Paleozoic, is bimodal and is composed of predominantly layered gabbroic rocks and granites. Trends roughly parallel to regional structure for at least 175 miles, and total length probably exceeds 300 miles. Flanking complex on northwest is belt of low- to medium-grade metamorphic rocks of pre-Middle Silurian age and composed of Ellsworth Schist and Charlotte Group (type area in New Brunswick). Toward southeast flank and in part covering the complex is sequence of Middle and Upper Silurian volcanic and associated sedimentary rocks. Near Maine-New Brunswick border, the Silurian rocks and some of the granitic rocks are unconformably overlain by Upper Devonian Perry Formation.

Extends from Maine-New Brunswick border southwest at least as far as Penobscot Bay.

Beacon Till

Pleistocene: Northwestern Washington.

J. H. Mackin, D. R. Mullineaux, and W. J. Stark, 1950, Washington Univ. (Seattle), Trend in Engineering, v. 2, no. 4, p. 19–21. Oldest glacial deposit in area. Consists of stones of all sizes embedded in compact clayey matrix. Deposited directly by ice at base (rather than in front of) an actively moving glacier. Underlies Duwamish formation (new).

Exposed in brick pit on west side of Beacon Hill, just south of Spokane Street in Seattle.

Beacon Peak Tuffs

Oligocene, upper or Miocene, lower: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 20 (table 2), 22, 37, 38, fig. 1, 2. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age of upper welded tuff 26.0 ± .5 m.y., lower welded tuff 33.2 ± 7 m.y.

Beacon Peak is in SE cor. sec. 17, T. 17 N., R. 15 E., Donner Pass quadrangle.

Bear Hill Formation

[Devonian]: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., p. 108. North from Dixfield quadrangle, Saddleback Mountain Formation (new) is traced across a fault and a granodiorite pluton into the Bear Hill Formation of Moench (1963, U.S. Geol. Survey Map MF—259). [Compiler checked Map MF 259. Moench did not use term Bear Hill Formation on this map.]

Bear Lake Formation

Miocene, middle and upper: Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. Mem. 99, pt. 1, p. 89—92, 97, 100, pt. 2, maps. A thick sequence of interbedded sandstones, conglomerates, and a few siltstones is exposed along eastern shores of Port Moller and in mountains to northeast, well beyond Bear Lake. Locally beds carry abundant marine fauna of middle and late Miocene age. Sequence is here named Bear Lake Formation. Thickness at least 5,000 feet, may possibly be twice this much. In type area includes Unga Conglomerate Member at base. Unconformably overlies Stepovak Formation, but in many exposures exact contact is problematical; overlain by several hundred feet of coarse volcanic breccias and thick volcanic flows.

Type locality: In mountains above and eastward from Bear Lake, Port Moller-Unga area, Alaska Peninsula.

Bear Mountain Member (of Pocono Formation)

Mississippian: Central Pennsylvania.

F. M. Swartz, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G-50, p. 20, 21. A. D. Leonard (unpub. thesis) termed the upper and lower divisions of the Pocono at Jim Thorpe, Bear Mountain Member and Silkmill Run Member, respectively. These members likewise were found in ridges along the rim of the Northern Anthracite Field, where they are overlain by body of calcareous sandstone designated Abrahams Creek Member. Thickness of Bear Mountain 599 feet. Composed of cycles tending to grade upward from conglomerate into sandstone and in some instances into thin interval of shale, generally thin with some truncation by scour below base of next higher beds. "Bear Mountain" of Lehigh Gap appears to be correlative with both Beckville and Mount Carbon Members at Westwood Gap.

Bear Valley facies (of San Benito Gravels)

Pliocene-Pleistocene: West-central California.

W. L. Griffin, 1967, Soc. Econ. Paleontologists and Mineralogists Pacific Sec., Guidebook, Oct. 20-21, p. 61. Discussion of origin and deformation of San Benito Gravels. Two facies distinguished on bases of color and sedimentary structures: brown sand facies and white sand facies and compositionally and texturally distinct unit in the south, named Bear Valley facies. Origin of the Bear Valley facies is obscure. Sands of the Bear Valley are light tan and poorly bedded and the gravels occur as scattered lenses and sheets. May not even be lateral equivalent of the white sand facies.

Entire outcrop of Bear Valley facies is a fault slice between Bear Valley and San Andreas faults in Coast Ranges south of Hollister.

Bear Valley Formation

Miocene(?): Southwestern Utah.

J. J. Anderson, 1966, (abs.) Houston Geol. Soc. Bull., v. 8, no. 10, p. 21; 1966, Dissert. Abs., v. 26, no. 12, pt. 1, p. 7256. Geology of northern Markagunt Plateau, Utah. Bear Valley consists of up to 1,000 feet of wind-deposited volcanic arenite with minor interbeds of tuff, lava flows, and mudflow-breccias. Unit blanketed most of the plateau. Deposition of Bear Valley Formation was ended by inundation of at least 2,000 feet of volcanic flows and mudflow-breccias of Cottonwood Canyon Formation (new).

Type locality and derivation of name not stated.

Beaver Bay Group

Paleocene, Eocene, and Oligocene: Southern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 88—89, 95—97, pt. 2, maps. Name proposed for 20,000 to 25,000 feet of volcanic sandstones, conglomerates, breccias, and black siltstones exposed along west and north shores of Beaver Bay and in mountains bordering lower part of Beaver Valley. Includes Tolstoi (new) and Stepovak Formations. Unconformably overlies Hoodoo (new) and Chignik Formations. Underlies Bear Lake Formation (new).

Type locality: Port Moller-Unga Island area, Alaska Peninsula.

Beaver Creek Formation or Loess

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 40, 60–61, 64. Clayey silt and sand much of which is slightly silty. Thickness 19-1/3 feet at type locality. Overlies Grafton Formation (new); underlies Loveland Formation. Upland eolian equivalent is Beaver Creek Loess. Santee Till (new) believed to be periglacial fluviatile equivalent of the Beaver Creek Formation.

Type locality: In cut banks on northeast side of Beaver Creek valley in NE¼SE¼NE¼ sec. 25, T. 10 N., R. 1 W., York County.

Beaverdam Formation (in Idavada Volcanics)

Miocene, middle (Hemingfordian-Barstovian): Southern Idaho.

D. I. Axelrod, 1964, California Univ. Pubs. Geol. Sci., v. 51, p. 6 (table 1), 9–10, 13, 15, 28, 75, 76 (table 2). Since the Payette is not represented in Goose Creek basin, Idaho, name Beaverdam formation is proposed to supplant it for lowest part of Idavada volcanics. Composed chiefly of slabby well-bedded light-green and yellowish-gray shale that makes up about half of formation. Only about 200 feet of upper part of formation crops out in valley of Trapper Creek; 900 feet exposed in drainage of Beaverdam Creek. Underlies Jenny Creek formation; overlies Jarbidge rhyolite. Trapper Creek flora collected from upper 30 feet of formation. Flora is middle Miocene. Beaverdam most probably is early Barstovian.

Named for exposures in upper drainage of Beaverdam Creek, Cassia County, just north of Utah line.

Beaverdam Run Member (of Catskill Formation)

Upper Devonian: East-central Pennsylvania.

Harry Klemic, J. C. Warman, and A. R. Taylor, 1963, U.S. Geol. Survey Bull. 1138, p. 27–28, pl. 1. Gray or greenish-gray very fine grained to medium-fine silty sandstone and siltstone that weathers to brownish gray or olive tan. Thickness as much as 900 feet in Walcksville area; between 800 and 900 feet along Lehigh River. Overlies Walcksville sandstone member (new); underlies Damascus redbed member.

Named for rocks exposed along U.S. Route 309 on west side of Lehigh Run just south of Beaverdam Run, Lehighton quadrangle. Member is at surface in narrow zone about 1,000 to 3,000 feet wide along north limb of Lehighton syncline.

Beaverhead Granitic Complex

Eocene: Eastern Idaho and southwestern Montana.

L. D. Ramspott, 1963, Dissert. Abs., v. 23, no. 7, p. 2492. Two mappable units occur in Beaverhead pluton: Beaverhead granitic complex and Willow Creek leucosyenite. Beaverhead granitic complex consists of medium- to coarse-grained seriate, one- or two-feldspar granite with considerable textural variation and widespread muscovitic alterations.

Crops out over about 17 square miles in Eighteenmile Peak area, in Lemhi County, Idaho, and Beaverhead County, Mont.

Beaver Hill Tuff (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 219–220, pl. 1. Massive light-gray tuff more than 50 feet thick. Exposed near base of Gray Hills rhyolite (new).

Occurs in vicinity of Beaver Hill, Tushar uranium area, near Marysvale, Piute County.

Beavers Bend Illite (in Blaylock Formation)

Silurian: Southeastern Oklahoma.

C. J. Mankin and C. G. Dodd, 1963, *in* 10th Natl. Conf. on Clays and Clay Minerals Proc., p. 373, 378. An exceptionally pure illitic clay present in outcrops of Blaylock Formation.

Occurs in Beavers Bend State Park in Ouachita Mountains.

Beckers Butte Member (of Martin Formation)

Lower and Middle Devonian: Central Arizona.

Curt Teichert, 1965, U.S. Geol. Survey Prof. Paper 464, p. 21- 27, 89, pls. 1—13. A channel fill that ranges in thickness from a few feet to 200 feet. Typically consists of medium- to coarse-grained crossbedded poorly sorted sandstones. Conformably underlies Jerome Member. Rests on irregular surface of Precambrian rocks. Replaces term Sycamore Creek Sandstone of earlier authors.

Named for Beckers Butte, a prominent peak, about 4,800 feet high, capped by Redwall Limestone, in triangle formed between Salt River and Flying V Canyon, Gila County.

Beckville Member (of Pocono Formation)

Lower Mississippian: Eastern Pennsylvania.

J. P. Trexler, G. H. Wood, Jr., and H. H. Arndt, 1962, U.S. Geol. Survey Prof. Paper 450-C, p. C36—C39. Basal member of formation. Underlies Mount Carbon Member (new). Thickness 544 feet at type section; 800 feet in vicinity of Lykens. Consists of fine to coarse quartz-pebble conglomerate that is overlain by intercalated beds of fine pebble conglomerate, conglomeratic sandstone, quartzose sandstone, subgraywacke, siltstone, shale, and a few thin lenses of anthracite. Basal unit of member is 18 feet thick and consists of very light gray to light-olive-gray quartz-pebble conglomerate that rests upon a 30-foot unit of light-olive-gray dark-brown-weathering shale and siltstone of Spechty Kopf Member of Catskill Formation.

Type section: On east side of water gap cut in Second Mountain by West Branch of Schuylkill River in Pottsville quadrangle, Schuylkill County. Named for village of Beckville. Base of member lies a few feet north of paved road junction 1 mile north of Beckville. Rocks of type section slightly overturned to north.

Bedrock Spring Formation

Pliocene, middle: Southern California.

G. I. Smith, 1964, U.S. Geol. Survey Prof. Paper 457, p. 5 (fig. 2), 10, 15—23, pls. 1, 2. Consists chiefly of coarse arkosic conglomerate, sandstone, siltstone, and claystone, with smaller amounts of limestone, evaporites, tuff, tuff breccias, rubble breccia, and lapilli breccia. Thickness more than 5,000 feet at type section. In some areas unconformably underlies conglomerate facies of Christmas Canyon Formation (new). Unconformably underlies Almond Mountain Volcanics (new). Unconformably overlies pre-middle Pliocene arkosic sandstones, conglomerates, altered volcanics, and unaltered volcanics. Assigned to middle Pliocene.

Vertebrate fossils indicate it to be of this age or possibly late early Pliocene. Rocks assigned to the Bedrock Spring were included in Rosamond Formation of Hulin (1925). That name not used in present report because Rosamond as mapped by Hulin included Bedrock Spring plus part of Almond Mountain Volcanics.

Type section (fig. 6, p. 16): Base located in sec. E5-f; from there extends N. 35° W. for 2,500 feet to base of unit 4; then is offset northeast to sec. B31-a, and from there extends N. 35° W. for 3,000 feet and then S. 80° W. for 6,500 feet [SE¼NW¼ sec. 5, T. 29 S., R. 42 E.] Named after Bedrock Spring, 2 miles north of Dome Mountain and about 1 mile west of type section, in Lava Mountains, San Bernardino County.

Bee Cave Member (of Walnut Formation)

Lower Cretaceous: South-central Texas.

C. H. Moore, Jr., 1961, Texas Jour. Sci., v. 13, no. 1, p. 17, 21, 26--30. Upper member of Walnut formation. Overlies Bull Creek member (new). The Bee Cave is a wedge of marl and clay that intertongues with Comanche Peak to the southwest and south. Thickness 10.8 feet at type section.

C. H. Moore, Jr., 1962, (abs.) *in* Contributions to geology of south Texas: San Antonio, South Texas Geol. Soc., p. 116; 1964, Texas Univ. Bur. Econ. Geology Rept. Inv. 52, p. 1—48. Discussion of stratigraphy of Fredericksburg Division. Walnut Formation includes six members (ascending): Bull Creek, Bee Cave, Cedar Park, Whitestone (new), Keys Valley Marl (new) and unnamed upper marl.

Type section: Just west of Austin, Travis County. Section measured in roadcut on east side of Bee Cave Road, 0.34 miles northwest of intersection of Bee Cave Road and St. Stephens School Road. Section starts at top of Bull Creek member, exposed in ditch, and ends in Edwards at top of roadcut.

Bee Mountain Basalt Member (of Chisos Formation)

Eocene, upper: Southwestern Texas and northern Mexico.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 23, 26, pl. 2, road logs. Overlies Ash Spring Basalt Member (new) and underlies Mule Ear Spring Tuff Member (new) in Chisos Mountains. Overlies Alamo Creek Basalt Member in Lajitas Mesa. Thickness about 100 feet at Casa Grande Peak.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 118--119, pls. Formal proposal of name. Most extensive basalt member of the Chisos. Mostly fine to medium grained, consisting of several flows that are conspicuously scoriaceous or vuggy along contacts. Thickness about 25 to 80 feet in the higher Chisos Mountains, but thickness increases southwestward to 527 feet at Cerro Castellan. Lies on erosion surface in Chisos Formation. Occurs above Ash Spring Basalt Member. Occurs below Mule Ear Spring Tuff Member. Present at many places west and southwest of Chisos Mountains, and is traceable from lowlands eastward into Chisos Mountains. Extends southward from Big Bend National Park into Mexico, northwestward into southeastern foothills of Bofecillos Mountains, and is present in Black Gap east of the Sierra del Carmen.

Type locality: Bee Mountain in southwestern part of Big Bend National Park, Brewster County, Tex.

Beersheba Formation

Mississippian (Chesterian): Central Tennessee.

M. N. A. Peterson, 1962, Jour. Geology, v. 70, no. 1, p. 2, 3 (chart). Overlies Big Clifty sandstone; underlies Calfkiller formation (new). Name credited to Vail (1959, unpub. thesis).

R. G. Stearns, 1963, Tennessee Div. Geology Inf. Circ. 11, p. 17. Now called Bangor Limestone.

Type locality and derivation of name not given.

Beers Hill Member (of Rhinestreet Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Thickness about 300 feet at type locality. Overlies Dunn Hill Member and underlies Roricks Glen Member (both new).

Type section: A southeastward flowing stream in Catlin Township. Beers Hill, Chemung County, is 1 mile south of type section.

Belchertown Intrusive Complex

Devonian(?): West-central Massachusetts.

Peter Robinson, 1967, Massachusetts Univ. Conf. on Econ. Geology in Massachusetts, Proc., p. 33, 34. Progress report on bedrock geologic mapping. Complex consists of massive biotite and (or) hornblende quartz diorite, biotite-hornblende-diopside granodiorite, marginal zones and inclusions of hornblendite and diopside hornblendite. Evidence indicates emplacement before end of deformation associated with metamorphism. Development of coarse sillimanite in an included septum of Partridge Formation in a regional kyanite zone indicates major thermal effect of intrusion. Younger than Prescott Intrusive Complex (new).

Present in Bronson Hill anticline, a complex zone of gneiss domes and recumbent folds, that lies near center of Appalachian tectonic belt of New England. Generalized axis of anticline in Massachusetts runs 3 to 5 miles east of Triassic border fault. Anticline consists of an en echelon series of gneiss domes interrupted by the cross-cutting Belchertown Intrusive Complex.

Belfield Member (of Spearfish Formation)

Permian: Western North Dakota (subsurface).

W. G. Dow, 1967, North Dakota Geol. Survey Bull. 52, p. 5 (fig. 2), 6–8, 9, (fig. 4), pls. Name proposed for lower siltstone and shale unit of the Spearfish. Lies between depths of 7,228 and 7,431 feet in type well. Thickness ranges from erosional edge to 232 feet in northwestern Dunn County. Underlies Pine Salt Member. Overlies Minnekahta Formation.

Type section: Interval between 7,228 and 7,431 feet, mechanical log depth, in Amerada Petroleum Corp., R. E. Newton No. 1 well, NW¼SW¼ sec. 31, T. 140 N., R. 99 W., Stark County. Name derived from nearby town of Belfield, N. Dak.

Bell Brook Formation

Silurian(?) and Devonian(?): Northern Maine.

Louis Pavlides, 1965, U.S. Geol. Survey Bull. 1206, p. 28—33, pl. 1. Consists of an older conglomerate member about 5,000 feet thick and a younger member about 6,000 feet thick that consists of olive-green siltstone and slate. May overlie Meduxnekeag Formation.

Named after Bell Brook in central part of T. C., R. 2, Bridgewater quadrangle.

Bell City Quartzite

Cretaceous: Southeastern Missouri.

C. H. Johnson, 1962, Missouri Geologists Assoc. Guidebook 9th Ann. Field Trip Sept. 28—29, p. 7. Marbut (1902, Missouri Univ. Studies, v. 1, no. 3) used name "Bell City quartzite" for exposure at Bell City and "Commerce" quartzite for equivalent exposures near town of Commerce in Scott County. "Commerce" has been preferred name in most references to the quartzite. The quartzite is result of localized silicification of upper sand in lower part of McNairy. [Compiler unable to locate Marbut reference.]

Crops out on east front of Crowley Ridge at Bell City, Stoddard County.

Bellefontaine Till

Pleistocene (Wisconsin): West-central Ohio.

J. L. Forsyth, 1967, Ohio Div. Geol. Survey Rept. Inv. 66 (map only). Three tills recognized in area (ascending): Pickrelltown, Bellefontaine, and Marysville. The Bellefontaine has pebbly loam texture like that of Pickrelltown but has developed in it Miami 6 A soils. Till is present as both ground moraine and end moraine.

Named for town of Bellefontaine, 7 miles west of East Liberty quadrangle.

Bellingham Glaciomarine Drift

Pleistocene, upper: Northwestern Washington.

J. D. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1475, pl. 3. Consists of blue-gray to brown unsorted and unstratified pebbly, sandy clay and pebbly clay. Thickness 10 to 70 feet. Overlies Deming sand (new). Older than Sumas till; contact not observed. In many places resembles true till, but elsewhere grades into clay with only a few pebbles.

Named for occurrence in vicinity of Bellingham and Bellingham Bay, Puget Lowland.

Bellingham Granite

Precambrian: Southwestern Minnesota.

S. S. Goldich and others, 1961, Minnesota Geol. Survey Bull. 41, p. 144, 146—147. Red to dark-reddish brown. Commonly porphyritic.

Occurs near Bellingham, Lac qui Parle County.

S. S. Goldich and C. E. Hedge, 1962, (abs.) Jour Geophys. Research, v. 67, no. 4, p. 1638. Rb-Sr age on whole rock of Bellingham Granite 2,260 m.y.

Bells Sandstone Member (of Eagle Ford Formation)

Cretaceous: Northeastern Texas.

C. L. McNulty, Jr., 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 375—379. Name proposed for sandstone unit that occurs in uppermost 50 to 100 feet of Eagle Ford Formation outcrop in northern Collin, Grayson, and Fannin Counties. The Bells is a gray, brown-weathering quartz sandstone. Overlain by Maribel Shale Member (new). Because of incompleteness of well-exposed sections and the considerable variation in properties along the outcrop, multiple sections are presented for typic definition. Thickness 46.6 feet at section 1; 23.5 feet at section 2; 1 and 15.8 feet at section 4. Name replaces Lake Crockett shale member of Lake Crockett Formation (McNulty, 1954). Name Lake Crockett Formation abandoned.

Name taken from town of Bells in east-central Grayson County. Bells is near center of the well-known outcrop area of the sandstone member, on a topographic bench underlain by it and near several good but incomplete exposures of the member.

Belongia Granite

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1961, Dissert. Abs., v. 21, no. 11, p. 3421. Youngest rocks in McCaslin district are the intrusive High Falls (new) and Belongia Granites. Dominant structure in district is McCaslin syncline which trends approximately east-west. Trough opens to west and appears to close to east but is disrupted by intrusive High Falls granite.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology in northeastern Wisconsin. Mancuso (1957, 1960, unpub. theses) established following succession: Waupee Volcanics (oldest), Macauley Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry. Belongia Granite and High Falls Granite. Major structure recognized by Mancuso is syncline (outlined by quartzite) plunging to west, which was intruded to north and northeast by High Falls Granite and to south by Belongia Granite.

Belted Range Tuff

Miocene: Southwestern Nevada.

K. A. Sargent, D. C. Noble, and E. B. Ekren, 1965, U.S. Geol. Survey Bull. 1224—A, p. A33—A34. Included Tub Spring Member in lower part and Grouse Canyon Member in upper part. Also includes some local informal units. At most places unconformably overlies local informal units of tuff and lava. Unconformably overlain by tuff, lava, Paintbrush Tuff, Timber Mountain Tuff or Thirsty Canyon Tuff. Miocene or Pliocene.

K. A. Sargent, and others, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—496. Mapped in Quartet Dome quadrangle, Nye County, where it is as much as 410 feet thick and comprises both Tub Spring and Grouse Canyon Members. Unconformably overlies unnamed rhyolites and ash-fall units. Overlain by unnamed rhyolite and ash-flow tuffs. Miocene and Pliocene(?).

D. C. Noble and others, 1967, U.S. Geol. Survey Geol. Quad Map GQ—614. Mapped in Dead Horse Flat quadrangle, Nye County, where it is as much as 270 feet thick and includes both Tub Spring and Grouse Canyon Members. Miocene and Pliocene(?).

R. B. Colton and D. C. Noble, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—719. Mapped in Groom Mine SW quadrangle, Nye County, where it is 150 to about 350 feet thick and contains only Tub Spring Member. Miocene.

Type area: In southern part of Belted Range, in northeastern part of Nevada Test Site, Nye County.

Bemis Drift

Pleistocene: Eastern South Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 16, 20. Notes on Pleistocene stratigraphy of North Dakota. Named drifts are ecostratigraphic units (Krumbein and Sloss, 1965, Stratigraphy and sedimentation: San Francisco, W. H. Freeman and Co.) a variety of which has been called morphostratigraphic units by Frye and Willman (1965, Illinois Geol. Survey Circ. 285). Named surface drifts are lithologically indistinguishable on regional scale and belong to a single lithostratigraphic unit to be defined in later report. Drift C in North Dakota may be equivalent to "Cary Drift" of Flint (1955, U.S. Geol. Survey Prof. Paper 262) in western South Dakota, which Flint correlated with Bemis Drift in eastern South Dakota, which has been dated 14,000 B.P. in Des Moines lobe.

Term Bemis has been used in earlier reports for a moraine (Flint, 1955).

Ben Lomond Quartz Diorite

Cretaceous: West-central California.

A. D. Baldwin, Jr., 1967, Dissert. Abs., v. 28, no. 3, sec. B, p. 937. Ben Lomond quartz diorite and Montara quartz diorite mentioned in discussion on geologic and geographic controls upon rate of solute erosion from coastal river basins between Half Moon Bay and Davenport. Water draining from the above quartz diorites are less mineralized than those draining from basins underlain by Tertiary sedimentary and igneous rocks.

Coastal River basins between Half Moon Bay and Davenport.

Ben Lomond Mountain granite

Probably lapsus for Ben Lomond Quartz Diorite

Bennett Creek Breccia

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 21—23, pl. 1. Angular fragments of volcanic and sedimentary rocks embedded in tuff of quartz latite composition. Thickness 0 to 100 feet. Overlies Mojado Formation with angular unconformity in some places and in others rests with erosional unconformity upon Timberlake Fanglomerate (new). Disconformably overlain by Basin Creek Tuff (new). At one locality near head of Bennett Creek, formation overlies U-Bar Formation.

Named for exposures south of Bennett Creek, in central part of Walnut Wells quadrangle, Hidalgo County.

Bennion Creek Formation

Upper Cretaceous: Central Utah.

M. T. Moussa, 1965, Dissert. Abs., v. 26, no. 4, p. 2136. A thick conglomerate that overlies Price River Formation (restricted by removal of Castlegate Sandstone) and underlies North Horn Formation.

In Soldier Summit quadrangle.

Benns Church Formation

Pleistocene, lower: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Beach and dune sand. Maximum thickness 40 feet. Overlies Kilby Formation.

Benns Church is in Isle of Wight County.

Benton Falls Limestone

Silurian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 22, 25. Interbedded limestone and shale, and marble. May have possible correlation with Berry Ledge formation (new). Name credited to Osberg (in preparation).

Waterville area.

Benton Range basalt

[Pleistocene]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 34 fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 3.2 ± 0.1 m.y. Figure 12 mentions basalt at Benton Range.

Mount Morrison quadrangle.

Berg Creek Amphibolite (in Riggins Group)

Paleozoic or Mesozoic: Western Idaho.

C. P. Ross, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 63, 65. Structurally highest formation in Riggins Group (new). Name credited to Warren Hamilton (in press).

Warren Hamilton, 1963, U.S. Geol. Survey Prof. Paper 436, p. 17, 27, pl. 1. Formal proposal of name. Schistose amphibolite and hornblende-rich schist. Lies between Lightning Creek Schist and Squaw Creek Schist (both new). Thickness 1,000 to 2,000 feet.

Type section: Exposures along north side of Salmon River, 3½ miles east of Riggins, Idaho County. Named for Berg Creek, tributary to Salmon River just east of type section.

Bergland Rhyolite

Precambrian: Northern Michigan.

Sambhudas Chaudhuri, 1967, Dissert. Abs., v. 27, no. 9, sec. B, p. 3146. Bergland rhyolite yielded radiometric age of 1042 ± 6 m.y.

Study of Keweenawan rocks and copper deposits of northern Michigan.

Bergstrom Formation

Upper Cretaceous: Central Texas.

Keith Young, 1965, Texas Univ. Bur. Econ. Geology Circ. 65—3, p. 4—6. Name proposed for claystone unit usually referred to as "Upper Taylor

Marl." A greenish-gray to brownish-gray, unctuous, montmorillonitic claystone, more calcareous toward base, where it is transitional with underlying Pecan Gap Formation. Thickness about 400 feet. Underlies Corsicana Formation.

Type locality: Roadcuts along Farm Road 973, east of Moore and Berry's Crossing (mistakenly shortened to Moore's Crossing on Texas Highway Department's Travis County highway map and U.S. Geol. Survey Montopolis quadrangle, topographic) of Onion Creek, just east of Bergstrom Field, Travis County.

Berkey Member (of Silica Formation)

Middle Devonian: Northwestern Ohio.

S. W. Mitchell, 1967, Michigan Acad. Sci., Arts and Letters, Papers, v. 52, p. 182—196. Silica formation divided into two members, based on a faunal break: Brint Road below and Berkey. Thickness about 13 feet. Underlies Ten Mile Creek dolomite.

Type locality: North Quarry of Medusa Portland Cement Co., SE¼ sec. 7, T. 9 S., R. 6 E., Sylvania Township, Lucas County. Named for town of Berkey, about 5 miles west of North Quarry.

Berkshire Valley Formation

Silurian-Devonian: New York and New Jersey.

S. G. Barnett, 3d, 1967, Dissert. Abs., v. 27, no. 9, sec. B, p. 3145. Two new units named—Berkshire Valley Formation and Orrs Mills Member of Decker Ferry Formation—in this study of Late Cayugan and Helderbergian stratigraphy.

Area of study is Green Pond-Schunemunk Mountain outlier and along main Silurian-Devonian outcrop belt 25 miles to northwest in southeastern New York and northern New Jersey.

Bernard Formation

Upper Cretaceous: East-central Oregon.

L. W. Vigrass, 1961, Dissert. Abs., v. 22, no. 5, p. 1588. Pebbly sandstone and sandy "roundstone" conglomerate. Thickness 1,500 feet. Overlies Shaw formation (new), angular unconformity; underlies Columbia River basalt, angular unconformity.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 68—70, pls. 1, 3. Formal proposal of name. Dominantly yellowish-brown calcareous and limonitic pebbly sandstone that grades locally into sandy "roundstone" conglomerate. The pebbly or cobbly sandstone occurs in massive units as much as 200 feet thick. Estimated thickness 1,500 feet. Rests with angular unconformity on Paleozoic, Upper Triassic, and Middle Jurassic strata and is overlain, with angular unconformity, by Tertiary lavas and tuffs. Cenomanian.

Typical strata exposed near Andrew Bernard ranch house, in Smith Basin, and north of Camp Creek near Soda Spring. Name taken from Andrew Bernard Ranch on South Fork of Beaver Creek in SE¼ sec. 11, T. 17 S., R. 25 E.

Berry Ledge Formation (in Buckfield Group)

Silurian: Western and northwestern Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table 1), 20—22, pls. 1, 2. A distinctive thin calcite-rich calc-silicate unit. Predominant lithology is dark-green quartz-calcite-plagioclase-diopside granulite with interbedded impure marble. Thickness 150 to 250 feet. Conformably overlies Noyes Mountain formation (new) and conformably underlies Moody Brook formation (new). May have a possible correlation with Benton Falls limestone as described by Osberg (in preparation).

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf. 57th Ann. Mt., Trip K, p. 104 (table 1), 105, figs. 1, 2, road log. Included in Buckfield Group (new). Overlies Noyes Mountain Formation.

Type locality: Berry Ledge, which is 1 mile northeast of village of West Paris, Bryant Pond quadrangle. Also well exposed along west side of Stearns Hill, in the West Paris quarry, and on the hills on either side of Rock Dundee.

Beverly Granite Gneiss

Early Paleozoic: South Carolina.

C. J. Cazeau and C. Q. Brown, 1963, Geologic Notes, (South Carolina State Devel. Board, Div. Geology), v. 7, no. 5, p. 34, fig. 1. Generally light gray with medium to coarse equigranular texture. Probably equivalent to Westminster pluton.

Mapped in Pickens County.

Beverly Member (of Ellensburg Formation)

Miocene, upper and Pliocene, lower: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 26—29, 31, 33. Term "Beverly" originally used by Twiss (1933, unpub. thesis) for a pumicite bed in sedimentary rocks beneath Saddle Mountain Basalt (new) in Sentinel Gap section is here redefined to include all sedimentary rock and intercalated basalt between top of Yakima Basalt and base of Saddle Mountains Basalt in that section. A tongue of basalt here designated Huntzinger flow fills a valley cut in upper part of Yakima Basalt during Beverly time.

J. W. Bingham and M. J. Grolier, 1966, U.S. Geol. Survey Bull. 1244—G, p. G13—G14. Beverly Member at type locality consists of beds of quartzite-bearing conglomerate pumicite, and tuffaceous sand, silt, and clay. At Sentinel Gap the quartzitebearing conglomerate and pumicite compose about 160 feet of the total 300 feet. In scattered outcrops, member may include basaltic fanglomerate, as well as conglomerate, pumicite, tuffaceous sand, silt, and clay. Member may be considered a lithosome consisting of mutually intertonguing lithostratigraphic units, any one of which may predominate or be present to the exclusion of the others at one locality. The 200± feet of sedimentary deposits underlying the Saddle Mountains Member in Yakima area was named Selah Tuff Member of Ellensburg by Mackin (1947, Northwest Sci., v. 21, no. 1). In 1961 Mackin (Washington Div. Mines and Geology Rept. Inv. 19) named the 300± feet of sedimentary deposits and basalt flows under the Saddle Mountains Member at Sentinel Gap the Beverly Member of Ellensburg. Name Beverly Member is here given to the sedimentary deposits below top of uppermost Saddle Mountains flow and above Priest Rapids Member. Name Selah Tuff Member is abandoned. Type locality noted.

The U.S. Geological Survey currently designates the age of the Beverly Member as upper Miocene and lower Pliocene on basis of study now in progress.

Saddle Mountains-Priest Rapids area. Excavations below bed of Columbia River. Beverly is in Grant County.

Bevos Group

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 8 (strat. column), 81, 82, 83. Includes Breadtray [Bread Tray] granite (new), Brown Mountain rhyolite porphyry (new), Butler Hill granite (new), Graniteville granite, Knoblick [Knob Lick] granite, and Silvermine granite. Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Bevos Mountain is in Madison County.

Bickmore Canyon Arkose or Diatomite

Miocene, upper: West-central California.

E. A. Gribi, Jr., 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 19. At least 6,000 feet of upper Miocene shales with some interbedded sands were deposited in trough portion of Bitterwater Basin. This entire section becomes sandy to northwest where its equivalent in outcrop is the Bickmore Canyon arkose east of the Pinnacles. The Bickmore Canyon consists of a poorly sorted variety of rock types that suggest nonmarine deposition. To east of Bitterwater Basin, a narrow fault block has about 2,000 feet of Bickmore Canyon arkose resting on older rocks. The arkose here includes the O'Connor producing sand of the Bitterwater field.

W. W. Worndart, Jr., 1967, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Field Trip Oct. 20—21, p. 48—53. Referred to as Bickmore Canyon diatomite. Check list of siliceous microfossils gibe. Delmontian.

Bickmore Canyon is in San Benito County, north of Pinnacles National Monument.

Bidwell Tongue (of Sanhedrin Formation)

Lower Cretaceous (Valanginian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Sandstone-conglomerate 1,200 feet thick. Uppermost tongue of formation. Overlies Briscoe tongue (new).

In Elk Creek-Fruto area, Glenn County.

Bieber Formation

Plio-Pleistocene: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 61—62, 115—119; v. 2 pls. Lake deposits of interbedded gravel, white sand, black sand, clay, silt, and diatomite. At least 1,000 feet thick. Probably underlain by similar materials belonging to Turner Creek formation (new).

Underlies all of Big Valley and Round Valley.

Bieroth Andesite

Eocene (?): Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 22, pl. 1. Consists of tuffs and andesites, welded tuffs, and flows. Rocks are light-brownish gray to yellowish gray and pinkish gray on fresh surface, darker on weathered surface. Total thickness of flows and pyroclastics about 200 to 400 feet. On Sunflower Flat the Bieroth is nearly horizontal and grades conformably upward into Jarbridge Rhyolite. In northern part of quadrangle dips about 20° north and is overlain unconformably by Idavada Volcanics.

Named for exposures around Bieroth Spring in sec. 14, T. 45 N., R. 55 E., Rowland quadrangle, Elko County.

Big A Butte Member (of Supai Formation)

Permian: Eastern Arizona.

S. S. Winters, 1962, New Mexico Geol. Soc. Guidebook 13th Field Conf., p. 87- 88, 1963, Geol. Soc. America Mem. 89, p. 10, measured sections. Thickness about 475 feet. Contains numerous stringers and beds of gypsum, as well as thin limestone and calcareous claystone units, interbedded with dominant reddish-brown mudstones and siltstones which form ledge and slope topography. Overlies Amos Wash Member; underlies Fort Apache Limestone Member.

Named for good exposures on Big A Butte about 1 mile southeast of town of Whiteriver, Navajo County.

Big Ben Quartz Porphyry

Tertiary: Central Montana.

A. C. Johnson, 1964, Dissert. Abs., v. 25, no. 6, p. 3514. Tertiary intrusives consist of series of porphyritic rocks that are granitic to leuco-granitic. They are as follows: aplite (oldest), Big Ben quartz porphyry, Silver Dyke granite porphyry, Snow Creek quartz porphyry, and Carpenter Creek granite porphyry.

Big Ben area is in Neihart mining district, Cascade County, about 2½ miles northeast of Neihart.

Big Bend Park Group

Eocene, middle to Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pls., tables, road logs. Consists of (ascending) Canoe Formation (new), Chisos Formation, and South Rim Formation (new). Overlies Tornillo Group.

R. A. Maxwell, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 107—151, pls. Formal proposal of name. Includes the Tertiary volcanic rocks exposed in Big Bend National Park. Comprises (ascending) Canoe Formation, Chisos Formation, and South Rim Formation. These are formed of massive coarse conglomerate, sandstone, clay, fresh-water limestone, tuff, tuffaceous sandstone and clay, flow breccia, and lava. Complete uninterrupted section not preserved. Only basal unit, Canoe Formation, has been precisely dated.

Named for Big Bend National Park, Brewster County.

Big Chief basalt member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Older than Tahoe City flow (new). Age of Bald Mountain olivine latite (new) relative to Big Chief basalt difficult to ascertain, but Bald Mountain may be slightly younger. Big Chief basalt flow blocked Upper Truckee Canyon drainage and brought about deposition of Fir Crags gravel. At least 20 flows (or groups of flows) recognized in Truckee area, north of Lake Tahoe. Nine flows (or groups of flows) are named and given informal member status in Lousetown formation.

Mapped in vicinity of settlement of Big Chief, Placer County.

Big Claw Red-Bed Member (of Lobster Lake Formation)

Silurian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 159, 178—180, pl. 34. Consists of red quartzite, red sandstone, red slate, and red conglomerate, with small amount of gray sandstone. Thickness 200 feet. Comprises lower part of formation. Overlies phyllite of Cambrian or Ordovician age.

Type locality: On east side of Big Claw arm west of northern part of Big Island. Named for Big Claw arm of Lobster Lake, southwest quarter of Ragged Lake quadrangle and south-east quarter of North East Carry quadrangle.

Big Hatchet Formation (in El Paso Group)

Canadian (Demingian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Term used for thick massive dolomites with interbeds of shale and overlying limestones or dolomites with round chert nodules containing *Leiostegium* and *Kainella*. Younger than Sierrite limestone. Older than Cooks formation (new). Canadian treated as system in this report.

Well developed only in Big Hatchet Mountains.

Big Hole Basalt (in Snake River Group)

Pleistocene, middle or upper: Southeastern Idaho.

W. J. Carr and D. E. Trimble, 1963, U.S. Geol. Survey Bull. 1121—G, p. G25—G26, pl. 1. Includes flows from different eruptive centers. Characteristically dense, blue gray to blue black; commonly contains a few megascopic olivine crystals. Contact with underlying sediments (Raft formation) in water well about 7 miles north of American Falls is at altitude of about 4,320 feet; lower contact about 5½ miles west of American Falls is about 4,350 feet. Basalt at latter well is 150 feet thick, but thinner to east ranging from 56 to about 20 feet thick beneath Aberdeen terrace. Overlain by loess, sand dunes, American Falls lake beds, and terrace deposits. Stearns and others (1938, U.S. Geol. Survey Water-Supply Paper 774) thought this basalt was intercalated with American Falls lake beds; herein believed that underlying beds are Raft formation.

The U.S. Geological Survey currently classifies the Big Hole Basalt as a formation in the Snake River Group on the basis of a study now in progress.

Type locality: Big Hole, a basalt-rimmed inlet on west side of American Falls Reservoir, about 3 miles south of Abderdeen, Bingham County. Crops out over most of northwest quarter of American Falls quadrangle.

Big House Chalk Member (of Dessau Formation)

Big House Formation (in Austin division)

Cretaceous (Gulf Series): Central Texas.

G. E. Murray, 1961, Geology of the Atlantic and Coastal Province of North America: New York, Harper and Bros., p. 353. According to Durham (1957, unpub. thesis) the type Austin sequence (in vicinity of Austin) includes (ascending) Atco chalk, Bruceville chalk-marl, Vinson chalk, Jonah limestone, Dessau chalk, Burditt chalk marl, and Big House chalk.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121—1123. Uppermost member of Dessau formation of Austin group. Overlies Burditt chalk-marl member. Name credited to Durham (1957).

Keith Young, 1962, Geol. Soc. America Guidebook Houston Mtg., p. 99 (table 2), 103 (table 3). Listed on tables as Big House Formation, Austin division, Gulf Series.

Keith Young, 1965, Texas Univ. Bur. Econ. Geology Circ. 65—3, p. 2—4. Gradational contact with overlying Sprinkle Formation (new). The Sprinkle, a clay lithosome of the Austin Chalk, thickens basinward both by the increasing thickness of each bed and also through lateral replacement by Big House Chalk, Burditt Marl, and Dessau Limestone in deeper parts of basins.

Present in type section of Austin Group at Austin, Travis County.

Big Kettle cordierite trondhjemite

Lower Cretaceous(?): Southeastern Oregon.

W. H. Taubeneck, 1964, Geol. Soc. America Bull., v. 75, no. 11, p. 1096, 1097 (fig. 2), 1102—1103. Cornucopia stock contains at least five distinct tonalites and trondhjemites; each is separate injection. Oldest and largest is Cornucopia tonalite. Next oldest is Tramway trondhjemite. Following unit, first in series of three cordierite trondhjemites, is the Big Kettle, and the two subsequent units are Pine Lakes and Crater Lake.

Kettle Creek is in Baker County.

Big Obsidian Flow

Recent: Central Oregon.

N. V. Peterson, 1965, Oregon Dept. Geology and Mineral Industries Bull. 57, p. 11, 14 (photo), 17 (fig. 10). Study of history of Newberry Volcano. "Big Obsidian Flow" is one of four separate, steep-sided flows of glistening, black obsidian. The "Big Obsidian Flow" covers a square mile and has its own plug dome of pumiceous obsidian. Occurred late in history of the volcano.

A. C. Waters, 1967, Moon Craters and Oregon Volcanoes: Oregon State System of Higher Education, Condon Lectures, p. 33, 34. Radiocarbon dating shows that building of Pumice Cone of Newberry Volcano occurred roughly 2,000 years ago. Younger than Pumice Cone are several black obsidian flows. The largest, Big Obsidian flow, overtopped a circular vent about one-fourth mile north of a curving reentrant in south wall of caldera. From this relatively high ground the lava crept north for nearly 2 miles as a lobate mass festooned with broken and angular blocks disposed into long ridges and swales by combined flow and shear in the semisolid mass. It pushed to south side of Litte Crater and came to rest with steep flow front over 60 feet high.

Newberry Volcano is about 25 miles south of Bend and some 35 miles east of crest of the High Cascades, Deschutes County.

Big Pole Formation (in Pony Trail Group)

Mesozoic: North-central Nevada.

L. J. P. Muffler, 1964, U.S. Geol. Survey Bull. 1179, p. 22—26, pl. 1. Consists of volcanic wackes and subordinate altered flows. Thickness 700 feet at type locality where only upper part of formation is exposed. Maximum thickness may be as much as 6,000 feet. Basal formation of group. Underlies Sod House Tuff (new); locally unconformable. Cut by Lower Cretaceous(?) plutons.

Type locality: Pony Trail Canyon, in Frenchie Creek and Pine Valley quadrangles. Type section truncated to west by Crescent fault. Named for Big Pole Creek which drains area of most extensive outcrop of formation.

Big Sand Draw Sandstone Lentil (in White River Formation)

Oligocene, lower: Central Wyoming.

F. B. Van Houten, 1964, U.S. Geol. Survey Bull. 1164, p. 56—57, pls. 1, 3. A distinctive sandstone 75 to 80 feet thick in basal part of White River. Fills a former broad shallow valley. Grades upward into Beaver Divide Conglomerate Member. Oligocene. Has been referred to as Sand Draw Sandstone Lentil.

J. D. Love, 1964, U.S. Geol. Survey Prof. Paper 474-E, p. E41, E43 (table 10). Pale-greenish-yellow to yellowish-gray soft tuffaceous sandstone; lenticular conglomerates of small rounded pebbles of Tertiary volcanic rocks and Precambrian crystalline rocks. Thickness as much as 70 feet. In lower part of formation. Underlies Beaver Divide Conglomerate Lentil. Overlies Tepee Trail equivalent. Mammalian fossils of earliest Oligocene (early Chadronian) age.

Type section: North of Wagon Bed Spring, in SE¼ T. 32 N., R. 95 W. Name taken from Sand Draw Drainage area, Fremont County.

Big Skunk Formation (in Montana Group)

Upper Cretaceous: Western Montana.

G. W. Viele and F. G. Harris, 3d, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 4, p. 379—417. Consists of 2,100 feet of volcanic-rich arkosic sedimentary rock that disconformably overlies Eagle equivalents of Two Medicine Formation and fills upper two-thirds of Two Medicine stratigraphic interval along western margin of Disturbed Belt. Includes (ascending) members A through E, which are respectively: basal sequence of grayish-red volcanic-rich, sedimentary breccia and mudstone; an ash-flow tuff 121 feet thick; variegated volcanic-rich mudstones, shales, and sandstones; gray to black mudstones and conglomeratic sandstones; and gray-green mudstones and sandstones interstratified with tuffs. Northeastward, formation thins to tongue of volcanic-rich strata underlain by 1,125 feet and overlain by 125 feet of flood-plain deposited Two Medicine shale and mudstone. These overlying Two Medicine strata pinch out southeastward. Formation is generally restricted to sector of Disturbed Belt which lies south of Sun River and west of Adel Mountain volcanic field. Eastward, along line marked approximately by eastern edge of Disturbed Belt, the Big Skunk intertongues with Two Medicine formation; westward area of outcrop is bounded by overthrust sheets of Paleozoic and Precambrian strata, which form Lewis and Clark Range; southward it extends at least as far as northern end of Big Belt Mountains. In area northeast of Dearborn River zone, lower members of formation intertongue with Two Medicine formation, and upper members form DE tongue of Big Skunk. Active period of vulcanism represented by Big Skunk Formation is time-correlated with Elkhorn Mountains vulcanism of central Montana, and should be distinguished from nearby Adel Mountain vulcanism, which is post-Horsethief and pre-Eocene thrust faulting in age. Name Big Skunk replaces term Hogan Formation (Viele, 1960).

Type section: In roadcuts along Montana State Highway 20, in sec. 21, T. 17 N., R. 5 W., Lewis and Clark County. Named for Big Skunk Creek, the major tributary of Middle Fork of Dearborn River.

Big Spring Member (of Nittany Dolomite)

Ordovican: Central Pennsylvania.

A. R. Spelman, 1965, Dissert. Abs., v. 26, no. 4, p. 2139. Lowermost member of the Nittany. Underlies Shoenberger Member (new). The Big Spring and upper member, the Etna Furnace (new), have many dolomite beds containing quartz grains whereas few if any dolomite beds in Shoenberger Member contain quartz grains.

In vicinity of Bellefonte, Centre County.

Bigtank Gravel

Quaternary: Western Texas.

J. P. Brand and R. K. DeFord, 1962, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 24. Composed of volcanic materials. Overlies caliche horizon. Thickness only a few feet. Within map area [Kent quadrangle] overlies truncated Gulfian marl. East of area overlies truncated Gatuna. Name credited to DeFord (in preparation).

Big Timber Igneous Complex

Tertiary, middle: South-central Montana.

John Tappe, 1967, Dissert. Abs., v. 27, no. 9, sec. B, p. 3154. Big Timber igneous complex, consisting of six discrete igneous intrusions, was intruded into Livingston-Fort Union sediments during mid-Tertiary time.

Present in Crazy Mountains.

Big Valley Formation

Middle Ordovician: West-central Virginia.

K. F. Beck, 1962, Virginia Div. Mineral Resources Rept. Inv. 2, p. 11—12, 13—14, 17 (fig. 3), pl. 1. Name introduced to include Ward Cove, Peery, and Benbolt formations of Kay (1956). In Williamsville quadrangle [this report] Peery formation is not mappable unit and seldom outcrops. Ward Cove and Benbolt contain wide covered areas and are variable in lithology. Hence formations as defined by Kay are difficult to use as mapping units. However, base of Ward Cove and top of Benbolt are at distinctive and easily traced lithologic changes. Thickness 232 feet at Big Valley section; 187 feet at Hightown Valley section; 204 feet at Warm

Springs Valley section. Conformably overlies Lincolnshire limestone and conformably underlies McGlone. Lower contact is at change from thick-bedded coarse-grained chert-bearing limestone to thin-bedded fine-grained cherty limestone. Upper contact at base of aphanitic limestone resembling Five Oaks member of Lurich formation. Three type sections designated.

Type section: Big Valley, 1.6 miles north of Bolar, east of Bolar Run. Same section, with minor variations, exposed 2.1 miles north of Bolar on west side of Bolar Run.

Type section: Hightown Valley, one-fourth mile north of Bluegrass along highway and on hill immediately east of highway.

Type section: Warm Springs Valley, Hollowrock farm, three-fourths mile south of Sinking Springs Church on east side of U.S. Highway 220, Alleghany County. Starting in field one-fourth mile east of farmhouse and measuring west through farmyard and to top of small hill 200 yards south of farmhouse. Section also well exposed for three-fourths mile along west side of U.S. Highway 220, starting one-half mile south of Hollowrock farm.

Big Valley Mountains Volcanic Series

Miocene to Pliocene: Northeastern California.

California Department of Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 52—53; v. 2, pls. Series of basalt flows and minor beds of sand, tuff, and diatomite. Thickness as much as 4,000 feet. May be correlative in part with Turner Creek formation. Upper part is composed of about 400 feet of basalt which has uniform easterly dip suggesting it may extend beneath floor of Big Valley where its depth would be several thousand feet.

Big Valley constitutes broad plain about 13 miles long from north to south, and 15 miles wide from east to west with northern part in Modoc County and southern part in Lassen County. Big Valley Mountains are on west and Barber Ridge on east.

Big Yellow Sandstone Member (of Canoe Formation)

Eocene, middle: Southwestern Texas.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 107, pl. 2. Massive yellow sandstone, 30 to 50 feet thick. Basal unit of formation. Has irregular base and occupies channels in Hannold Hill Formation. Underlies unnamed upper part of formation.

Named from Big Yellow arroyo in southern Tornillo Flat, Big Bend National Park, Brewster County.

Billiard Ball Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies Step limestone member and underlies Fern limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. Welsh's local names such as Billiard Ball and Step should be used with caution.

Bingham mining district, Oquirrh Mountains.

Billings Hill Formation (in Woodstock Group)

Silurian to Lower Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table 1), 33—36, pls. 1, 2. Coarse-grained rusty weathering migmatitic gneiss and some biotite granulite. Light fraction consists of pegmatitic quartz and plagioclase. Dark fraction consists mainly of coarse two-mica-sillimanite schist. Thickness 2,000 feet. Overlies Shagg Pond formation (new). Is top of Siluro-Devonian sequence immediately below the Devonian Littleton formation.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., p. 112 (fig. 2). Included in Woodstock Group (new).

Type locality: Along brook that parallels Billings Hill Road on westside of Billings Hill, Bryant Pond quadrangle. Unit is present in broad belt that covers much of Spruce Mountain and Billings Hill.

Billman Creek Formation (in Livingston Group)

Upper Cretaceous: South-central Montana.

A. E. Roberts, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B86—B92. Mostly claystone with lesser amounts sandstone, siltstone, and conglomerate. Thickness 2,590 feet at type section. Conformably overlies Miner Creek Formation (new); conformably underlies Hoppers Formation (new).

A. E. Roberts, 1964, U.S. Geol. Survey Geol. Quad. Map GQ-258. Mapped in Hoppers quadrangle where it overlies Miner Creek Formation and underlies Hoppers Formation. Consists of olive-gray, brownish-gray, and grayish-red claystone with interbedded sandstone, siltstone, and conglomerate; contains fresh-water mollusks and dinosaur bones. Livingston Group.

Type section: Near Billman Creek in S½ sec. 13, T. 2 S., R. 8 E., and W½ sec. 18, T. 2 S., R. 9 E., Park County.

Bingham Mine Formation (in Oquirrh Group)

Pennsylvanian (Missourian-Virgilian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 8—9, pls. 2, 5. Name applied to upper 6,500 feet of Oquirrh group. Subdivided into (ascending) Jordan, Lark, Commercial, Parnell, Petro, Maybe, and Mostest limestone members (all new). Overlies Butterfield formation (new); underlies Curry formation (new). The limestones and quartzitic sandstones of formation are intruded by Bingham stock. Sandstones of formation are rocks known as "Bingham quartzites" in mining district. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. Name has local value only, presumably for purposes of economic convenience in Bingham mining district.

Type section: On South Mountain between Oquirrh and Stansbury Ranges, secs. 20, 21, and 22, T. 4 S., R. 5 W., Bingham mining district. Reference section: North of Middle Canyon in sec. 6, T. 4 S., R. 3 W., and secs. 30 and 31, T. 3 S., R. 3 W., Salt Lake County.

Bishop Point volcanic mudflow

Recent: Alaska.

Harald Drewes and others, 1961, U.S. Geol. Survey Bull. 1028—S, p. 643—644. Valley south of Bishop Point contains terrace about 100 feet above the dissecting streams, the surface of which slopes seaward unscarred by streams. Agglomerate forming this terrace is massive and internally structureless, contains abundant cinders, and overlies basalt and andesite flows of Makushim volcanics (new). It is probably a volcanic mudflow formed at relatively recent time.

Vicinity of Bishop Point, Unalaska Island, Aleutian Islands.

Bison Silt and Sandstone (in Ludlow Formation)

Bison Beds or Bison silt and sandstone zone (in Ludlow-Cannonball Member of Lance Formation)

Paleocene: Northwestern South Dakota.

W. V. Searight, 1934, South Dakota Geol. Survey Rept. Inv. 21, p. 32, 33. Overlies Scotch Cap sandstone (new). Uppermost beds in Ludlow-Cannonball member of the Lance in Perkins County. Thickness 100 feet or more. Greater part of succession is composed of alternating beds of buff and gray shale, silt, and fine sandstone.

A. F. Agnew and P. C. Tyschen, 1965, South Dakota Geol. Survey Bull. 14, p. 45—46. Referred to as Bison silt and sandstone in Ludlow Formation. Paleocene. Term Bison silt and sandstone not used in official nomenclature of South Dakota Geological Survey.

Beds underlie town of Bison and form bedrock of divide between South Fork of Grand River and Thunder Butte Creek, Perkins County.

Bitterwater Creek Shale

Miocene(?) and Pliocene(?): Central California.

T. W. Dibblee, Jr., 1962, San Joaquin Geol. Soc., Am. Assoc. Petroleum Geologists Pacific Sec., and Soc. Econ. Paleontologists and Mineralogists Guidebook, Geology of Carrizo Plains and San Andreas fault, p. 8, 10 (fig. 5), 11 (fig. 6), pl. 1. Coarse upper Miocene breccias of southwest flank of Temblor Range are overlain unconformably(?) by sequence of Pliocene(?) age. In south end of range, from Elkhorn Hills southeastward across upper Bitterwater Creek, this unit is indistinctly bedded brown semisiliceous shale commonly referred to as "Santa Margarita" shale. It is herein named Bitterwater Creek shale. Thickness about 2,000 feet at type locality. Overlies Santa Margarita conglomerate and sandstone. Unconformably underlies Paso Robles formation. Grades laterally into Panorama Hills formation (new).

A. R. Smith, 1965, Geologic map of California, Bakersfield sheet (1:250,000): California Div. Mines and Geology. Indistinctly bedded brown semisiliceous shale grading northwesterly through marine sandstone into nonmarine gravels of Panorama Hills Formation. Mapped with middle and (or) lower Pliocene marine sedimentary rocks. Formerly mapped as Santa Margarita.

J. G. Vedder and C. A. Repenning, 1965, U.S. Geol. Survey Oil and Gas Inv. Map OM-217. Miocene(?) and Pliocene(?).

Type locality: Secs. 32 and 33, T. 11 N., R. 24 W., Kern County. Named after Bitterwater Creek.

Blacho Tuff Member (of Pozas Formation)

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip in Puerto Rico Nov. 22—24, p. 9. Formation includes La Reves Sandstone, Blacho Tuff, and "Rio Bauta" Members (all new).

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 51—52, pl. 1. A sequence of ash-flow deposits and interbedded lapillistone, reworked tuff, and volcanic breccia. Aggregate thickness about 500 meters in type area. Overlies Minguillo Lava Member (new) south to vicinity of Quebrada Manicaboa and Manicaboa Formation (new) south of the Quebrada Manicaboa to Quebrada El Gato fault. Base of member not exposed within Cerro Cedro graben.

Named for outcrops about 100 meters west of mouth of Quebrada Blacho in cliff adjacent to Río Torro Negro between localities 19 and 20 (pl. 1). Crops out within Cerro Cedro graben and in arcuate belt north of graben from Quebrada El Gato fault northwestward to west-central edge of Ciales quadrangle. Structure of member in Cerro Cedro graben is synclinal.

Black Lava Flow

Recent: Northern California.

G. A. Macdonald, 1966, California Div. Mines and Geology Bull. 190, p. 89. Callahan flow (Peacock, 1931, Geog. Review, v. 21, no. 2) is also known as Black Lava flow.

Occurs in Modoc Lava field.

Black Butte metabasalt

Age not stated: Northern California.

E. D. Ghent, 1964, Dissert. Abs., v. 25, no. 4, p. 2443. Black Butte metabasalt and Plaskett schist (new) have been metamorphosed more intensely than Franciscan Formation.

Present in Black Butte area, Hull Mountain and Anthony Peak quadrangles.

Black Cap Limestone

Middle Devonian: Southeastern Alaska.

D. L. Rossman, 1963, U.S. Geol. Survey Bull. 1121—K, p. K10 (fig. 2), K21—23, pls. 1, 2. At base is thin-bedded black limestone which becomes progressively lighter colored and thicker bedded upward. Where metamorphosed the black limestone generally retains its black color, some of its internal structure, and recognizable fragments of fossils. Upon metamorphism rocks in upper part generally become more massive and show virtually no evidence of bedding. Where possible, lower and upper parts are differentiated on map (plate 1). Section of formation incomplete; upper contact not recognized; all exposed sections structurally complex. Estimated thickness 4,500 feet; upper part may be as much as 3,800 feet; dark-colored basal part about 700 feet. Overlies Rendu formation (new). Contains abundant invertebrate fauna.

Named from exposures on Black Cap Mountain, Mount Fairweather quadrangle, Glacier Bay. Crops out on peninsula between Rendu and Queen

Inlets, in area of Hugh Miller Inlet, and along east edge of mapped area east of Muir Inlet, and western and southwestern ends of Adams Inlet. Makes up Mount Merriam and the 4,277-foot peak 1½ miles east of it.

Black Cliff limestone (in Chaffee Formation)

Upper Devonian: Central Colorado.

A. C. McFarlan, 1961, Rocky Mountain Geol. Assoc. Geologists Guidebook 12th Field Conf. p. 126 (fig. 4), 130. "Black Cliff limestone," 15 to 25 feet thick, consists of a dark-gray to black cliff-forming limestone in upper part of the Chaffee. Occurs 35 to 45 feet above "Walrod sandstone."

Present in Cement Creek area, Gunnison County.

Black Creek Member (of De Chelly Sandstone)

Permian: Northeastern Arizona.

H. W. Peirce, 1964, Mus. Northern Arizona Bull. 40, p. 15—32. Characterized by very light colored sandstones that contain quartz cement. Horizontally stratified sandstones alternate vertically with cross-stratified units and constitute as much as 50 percent of member. Overlies White House Member (new); underlies Fort Defiance Member (new). Baars' (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 2) Glorieta Sandstone of eastern Defiance Plateau is unit herein called Black Creek Member. It is not split by Yeso Formation of Baars but directly overlies White House Member wherever both members are present.

H. W. Peirce, 1967, New Mexico Geol. Soc. Guidebook 18th Field Conf., p. 57—62. Discussion of Permian stratigraphy of Defiance Plateau, Ariz. In sections on east flank (excluding Buell Park) White House Member is but a lower part of "Upper Member" of De Chelly Sandstone. Peirce (1958, New Mexico Geol. Soc. 9th Ann. Field Conf.) called attention to fact that sandstones constituting upper part of De Chelly Sandstone on east flank are not a replica of those exposed in Canyon De Chelly. At Bonito Canyon, near Fort Defiance, several workers have noted these contrasts. Baars (1962) considered that these sandstones are to be assigned to Glorieta Sandstone. These different-appearing strata are herein referred to Black Creek Member. Most fundamental aspect of this unit that contrasts with White House Member is nature of its stratification. Throughout its extent in outcrop, horizontally stratified sandstones alternate with those that are cross-stratified on a large to medium scale. These horizontally stratified sandstones average from 5 to 12 feet in thickness, depending upon the section, and form 20 to 35 percent of thickness of member. They are water-deposited sandstones, although the particular aqueous environment is perhaps speculative. Because of this fact the question of origin of the cross-stratified sandstones arises. Read (1951, Guidebook of the south and west sides of the San Juan Basin, New Mexico and Arizona, 2d field Conf.) speaks of "migrating beaches and bars". Present writer believes that eolian representatives are significant such that Black Creek Member represents a transgressive transition phase between a dominantly eolian environment to north (White House Member) and a dominantly marine environment to the south (Kaibab-San Andres related sandstones and carbonates). Black Creek Member does not have recognized sharp boundary with underlying White House Member. Fact that the Black Creek Member gradationally overlies White House Member to south of Canyon De Chelly is important in evaluating Baars' correlations on Defiance Plateau. It is his concept that Yeso Formation (restricted) occupies stratigraphic position between his Glorieta (Black Creek Member) and De Chelly (White House Member—in part) sandstones but that at Bonito Canyon and Canyon De Chelly the Yeso Formation (restricted) has been removed by erosion prior to deposition of the Glorieta. Relationships at Oak Springs Cliff section (not included by Baars) prove conclusively that position of his Yeso Formation (restricted) is stratigraphically below White House Member, not above it. He used this nonexistent unconformity to conclude that the Coconino-Glorieta sandstones are significantly younger than the De Chelly Sandstone of type area. This concept aided Baars in linking entire De Chelly Sandstone with the Meseta Blanca Sandstone which forms lower part of Yeso Formation in New Mexico. This led to his suggestion that name "Meseta Blanca" be changed to "De Chelly".

Named for Black Creek, Defiance Plateau, Apache County.

Black-Grand Falls Flow, Basalt

Pleistocene, upper(?) to early Recent: Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4). Discussion of geomorphology and age of volcanic rocks in northeastern Arizona. Black-Grand Falls flow listed on chart showing correlation of volcanic flows in San Francisco volcanic field.

Black Falls-Grand Falls area is in Coconino County.

Blackgum Formation

Lower Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 20—31, 93—94, pls. A, B. Name proposed for strata formerly referred to basal part of "St. Clair Formation" of northeastern Oklahoma (Huffman, 1958, Oklahoma Geol. Survey Bull. 77). Comprises thin sequence of Lower Silurian carbonate strata which overlie Sylvan Shale and underlie Tenkiller Formation (new). Contains a tan dolomite member and upper limestone member. At base is locally developed oolitic bed herein named Pettit Oolite Member. Thickness 13 feet at type locality; 10 to 15 feet in core holes.

Type locality: At Blackgum Landing on southeast shore of Lake Tenkiller, Cherokee County, SW¼SE¼ sec. 32, T. 14 N., R. 22 E.

Black Hill Member (of Quinebaug Formation)

Middle Ordovician(?) or older: Eastern Connecticut.

H. R. Dixon, 1964, U.S. Geol. Survey Bull. 1194—C, p. C9, C10—C11. Composed of series of metasedimentary rocks, most of them calcareous. In general a poorly exposed nonresistant unit. Across Black Hill, unit has maximum thickness of about 2,500 feet, but rocks are strongly folded, and true thickness is probably less than figure given. Rock types are different on east and west sides of the hill. On west side of Black Hill, rocks are well-bedded medium-gray fine- to medium-grained (garnet)-muscovite-biotite-quartz schist and minor yellow muscovite-quartz schist interlayered or interfolded with dark-gray fine-grained (muscovite)-calcite-hornblende-quartz-biotite-oligoclase schist. On east side of hill, rock is primarily light-greenish-gray fine- to medium-grained calcite-muscovite-plagioclase-quartz granulite but has interlayered rocks containing scapolite, diopside, hornblende, and biotite. Overlain and underlain by unnamed members of formation.

Robert Zartman and others, 1965, U.S. Geol. Survey Prof. Paper 525—D, p. D1—D10. Implications of new radiometric ages in eastern Connecticut and Massachusetts. Tatnic Hill Formation (as well as equivalents and underlying rocks including Quinebaug Formation) is probably Middle Ordovician or older.

Named for exposures on southern end of Black Hill, which is east of Quinebaug River and just north of State Route 14A, Plainfield quadrangle.

Black Hills Glaciation

Pleistocene (Illinoian): East-central Alaska.

A. T. Fernald, 1965, U.S. Geological Survey Prof. Paper 525—C, p. C120—C123. Morainal deposits define two major glaciations—the Black Hills of Illinoian age and the Jatahmund Lake of Wisconsin age—in upper Tanana River valley. During Black Hills Glaciation, the Nebesna glacier advanced northeastward across the piedmont to the Black Hills and there deposited drift up to maximum altitude of about 3,000 feet above sea level. Ice reached most northerly advance along present course of Nabesna River. Gray till, consisting of cobble- to boulder-sized fragments in a matrix of sandy silt, is exposed at type section for the deposits of the glaciation.

Type section for deposits: Eastern part of Black Hills, Nabesna River area, upper Tanana River valley.

Black Mesa Gravel (in Idaho Group)

Pleistocene, middle: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1212, pl. 1.

Beds of Bruneau and Glenns Ferry Formations (both new) south of Snake River near Glenns Ferry are beveled by erosion surface that terminates 550 feet above river level. This surface is veneered with about 25 feet of sand and gravel, herein named Black Mesa Gravel. Capped by hard caliche several feet thick. Black Mesa Gravel is older than present Snake River Canyon and is regarded as middle Pleistocene.

Named for Black Mesa, an upland area 5 miles southeast Glenns Ferry where gravel is typically exposed.

Black Mountain Formation

Lower Permian: Northwestern Washington.

J. W. Mills and James R. Davis, 1962, Cushman Found. Foram. Research Contr., v. 13, pt. 2, p. 43. Black Mountain Formation contains fusulinid *Pseudofusulinella occidentalis.* Name credited to W. R. Danner (1957, unpub. thesis).

Occurs at northern end of Black Mountain, northern Whatcom County.

Black Mountain Formation (in Missoula Group)

Precambrian (Belt Series): Southwestern Montana.

E. E. Bierwagen, 1965, Dissert. Abs., v. 25, no. 7, p. 4078. Uppermost unit of group. Equivalent to red bed McNamara Argillite in Missoula Group.

Type section: Along Continental Divide north and south of Black Mountain.

Black Panther marker bed (in Bluebell Dolomite)

Ordovician, Silurian, and Devonian: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 66. Local name given dusky-gray to grayish-black dolomite, prominently banded with thin and thick layers that range in color from medium-dark gray to creamy white. Thickness about 45 feet. Occurs about 130 feet above base of formation.

In East Tintic Mountains area.

Black Peaks Formation (in Tornillo Group)

Paleocene: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, tables, plates, road logs. Varicolored clay interbedded with ledge-forming crossbedded yellow, buff, and gray sandstone and lenses of conglomerate. Thickness more than 850 feet. Overlies Javelina Formation (new); underlies Hannold Hill Formation (new). Where Hannold Hill is absent, the Black Peaks underlies Canoe Formation (new).

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 98—102, pls. Formal proposal of name. Oldest Tertiary rocks in west Texas. Formation is approximately middle part of Udden's (1907) Tornillo Clay herein redefined and rank raised to group. Formation is an alternation of sandstone and clay. Most of the sandstones are gray or gray white. Clay is mottled gray and maroon. Thickness 284 to 866 feet. Thickest part is in north-central part of Tornillo Flat. Overlies Javelina Formation. Underlies Hannold Hill Formation. Paleocene.

Named for three small black peaks on Tornillo Flat, northwest of McKinney Hills, Big Bend National Park, Brewster County.

Black Point Lava Flow

Pliocene, upper(?): Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 7, 15. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Black Point Lava flow is an example of stage I lava flow in which the edge of the flow has been eroded back so far that the original extension of the flow is obliterated. At one time the flow must have dammed the Little Colorado so that the river flowed over the lava flow before it cut a canyon around the end.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4), 108. Stage I basalts, stages IA and IB as defined in this paper, are lava flows that flowed out on the Black Point surfaces. Stage IB basalts overlie early

Black Point erosion surface that formed broad valleys of low relief. These valleys sloped gently northeast to Little Colorado River from a few miles north of Flagstaff to Black Point and they include Black Point and related flows. Black Point flow extends across Black Point segments of East Kaibab monocline without changing gradient. Probably upper Pliocene.

H. S. Colton, 1967, The Basaltic Cinder Cones and Lava Flows of the San Francisco Volcanic Field: Flagstaff, Mus. Northern Arizona, p. 15, 53. K-Ar date of Black Point lava flow 2.39 + 0.32 m.y.

Flow can be traced from Cameron Road (U.S. Highway 89) to little Colorado River. Source of flow is unknown but may have been from fissure near Spider-Web Ranch, or its vent lies buried under later deposits to the west.

Black Rapids Drift

Recent: Alaska.

T. N. V. Karlstrom, 1964, U.S. Geol. Survey Misc. Geol. Inv. Map I—157. Listed with named glacial drifts included in moraine units.

Big Delta area.

Blind Spring Formation

Oligocene: East-central Nevada.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). Discussion of variations within ignimbrite cooling units. Generalized Cenozoic section of Grant Range lists following Oligocene formations (ascending): Railroad Valley Rhyolite; Blind Spring Formation, 0 to 700 feet; Calloway Well Formation; Saddle Mountain Formation (new); Stone Cabin Formation; local andesite flows; Currant Tuff; Windous Butte Formation; Forest Home Ignimbrite (new); Needles Range Formation; and Shingle Pass Formation.

Grant Range is in Nye County.

Blodgett Member (of Oneota Dolomite)

Ordovician: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 43 (fig. 15), 45. Name proposed for noncherty or only slightly cherty dolomitic unit overlying Arsenal Member (new) of Oneota. Thickness 90 to 100 feet. Occurs between 885 and 980 feet in type well. Underlies New Richmond Sandstone.

Type well: Layne-Western Kankakee No. 9, sec. 25, T. 34 N., R. 9 E., Will County. Named for town of Blodgett in western Will County, 3 miles southwest of type well.

Blomeyer Member (of Mifflin Formation)

Middle Ordovician (Champlainian): Eastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 80—81, 231. Unit is limestone or dolomite, argillaceous, lithographic to chalky, blue-gray to brown-gray, and weathers gray to buff. Thickness 12 feet at type section; 20 feet in Midwest Dairy well at Cape Girardeau; 3 feet in type section of Medusa Member of Pecatonica Formation in Lee County, Ill. Basal member of formation; underlies Brickeys Member.

Type section: In quarry on north side of Missouri Highway 74, one-fourth mile east of highway junction at Rock Levee, Cape Girardeau County, Mo., in NW cor. NE NW 24, 30N—13E, Cape Girardeau quadrangle. Named for village of Blomeyer, 6 miles north of type section.

Bloody Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 34. Bloody flow listed with flows that are thick and have steep fronts. In general stage I and stage II flows are quite thin. Stage III and IV show considerable variation in thickness. Some are 10 to 20 feet thick and others as much as 75 to 100 feet thick.

Bloody flow issued from Bloody Crater numbered 100 but not shown on any of the maps.

Bloody Mountain Formation

Permian(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 26—27, pls. 1, 3. Dense dark-gray pyritic siliceous hornfels. Scour and fill and intraformational conglomerate near base. Thickness about 3,000 feet near type locality but intrusive granodiorite has cut out upper part of formation. Overlies Lake Dorothy hornfels (new); disconformably underlies metavolcanic rocks of Mesozoic age.

Type locality: Northeast slope of Bloody Mountain, Mount Morrison quadrangle, Sierra Nevada. Crops out in nearly continuous layer from north end of ridge separating Laurel and Sherwin Creeks, southeastward 8½ miles to east slope of Red and White Mountain, 1½ miles south of quadrangle boundary in Mount Abbot quadrangle.

Bloomfield Lithofacies (of Mansfield Formation)

Lower Pennsylvania: Southwestern Indiana.

H. H. Gray, 1962, Indiana Geol. Survey Prog. Rept. 26, p. 29—33, 37, 38. Three lithofacies recognized in the Mansfield: Shoals, Bloomfield, and Cannelton. These three diagnostic rocks make up a little more than half of formation. Bloomfield Lithofacies characterized by gray shales. Thickness about 45½ feet in Parke County; about 80½ feet in Greene County.

Named for town of Bloomfield, Greene County.

Bloomington Lake Member (of Fish Haven Dolomite)

Ordovician: Southeastern Idaho.

A. S. Keller, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2746. Fish Haven Dolomite divided into Paris Peak, Deep Lakes, and Bloomington Lake Members (all new).

Area is behind Bannock thrust in parts of Preston and Montpelier quadrangles.

Blue Hill facies (in Normanskill Group)

Ordovician: New York.

D. W. Fisher, 1962, New York State Mus. Sci. Service Geol. Survey Map and Chart Ser., no. 3. Name applied to local facies of Normanskill Group. At type locality consists of about 400 feet of interbedded siliceous argillite and green chert, with rare, thin, black shale seams, and some red shale at base of section; lower contact unexposed. Top transitional into Mount Merino black shale.

Type locality: Along east side of Blue Hill, 4½ miles south-southwest of Hudson in Catskill quadrangle.

Blue Mountain Drift

Pleistocene: North Dakota.

W. A. Pettyjohn, 1967, North Dakota Geol. Survey Misc. Ser. 30 (Guidebook 18th Ann. Conf. Friends of the Pleistocene), p. 125. This drift sheet consists predominantly of gravelly and very sandy clay till. Lignite chips abundant. Extends largely under younger drift over a wide area. Buried oxidized zone has been traced in test holes for nearly 40 miles north and more than 30 miles east of Blue Mountain end moraine in Ward County. Older that Makoti drift sheet.

Blue Mountain is in Ward County. Aerial photograph shows Blue Mountain ground moraine in central part of T. 151 N., R. 87 W., in Ward County.

Blue Mountain Member (of Judith Fancy Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Siliceous siltstone 3,700 feet thick.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 201, pl. 1. Distinguished by its hard, resistant olive-green siliceous siltstone interbedded with fine-grained tuffaceous sedimentary rocks. Base of member about 2,700 feet above bottom of Judith Fancy Formation. Maximum thickness about 3,700 feet.

Highest peaks on St. Croix, including Blue Mountain, are composed predominantly of this member.

Blue Point Member (of Wiggins Formation)

Oligocene: Northwestern Wyoming.

W. H. Wilson, 1963, Wyoming Univ. Contr. to Geology, v. 2, no. 1, p. 17. Name proposed for lower member of formation. Composed of two green andesitic cobble conglomerates separated by light-greenish-gray clay bed. Locally, upper part of clay bed is white trachytic ash. Either directly overlies or lies within 100 feet above top of Early Basalt flows (Hague, 1899, U.S. Geol. Survey Geol. Atlas, Folio 52) in Carter

Mountain-Greybull River area. Underlies sequence of dominantly grayish to brownish fairly well-bedded andesitic volcanic material—conglomerates, sandstones, lapilli tuffs, tuff breccias, and an occasional flow. These beds underlie Crosby breccia (new).

Named from exposures at Blue Point on Wood River, Park County.

Bluerock Creek Formation (in Maxville Group)

Middle and Upper Mississippian: East-central Ohio.

J. W. Scatterday, 1964, Dissert. Abs., v. 24, no. 11, p. 4635. Youngest formation in group. Overlies Jonathan Creek Formation (new). Disconformity may separate the two formations.

Bluff Creek Formation

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 49—50, pl. 1. Quartz-latitic pyroclastic rocks interbedded with lenticular beds of tuffaceous sandstone and shale. Maximum thickness 1,000 feet. Unconformably overlies Timberlake Fanglomerate (new); underlies Gillespie Tuff.

Named for exposure near Bluff Creek in southeastern part of Walnut Wells quadrangle, Hidalgo County.

Boca Ridge flow member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Boca Ridge flows are probably some of oldest flows in area. Topographic position of flow on Boca Ridge high above streams suggests that it is older than adjacent Hirschdale flow (new). At least 20 flows recognized in area. Nine flows (or groups of flows) are named and given informal member status in Lousetown Formation.

Named for occurrence on and in vicinity of Boca Ridge, Truckee area, north of Lake Tahoe. Flow on Boca Ridge projects eastward across Lower Truckee Canyon to a flow along west flank of Carson Range.

Bocas Breccia

Eocene: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 24, 25. Volcanic breccia. Overlies Yunes Formation (new). Footnote 2 (p. 6) states that stratigraphic names quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

Occurs in vicinity of large reservoir, Lago Dos Bocas.

Bodcaw Tongue (of Terryville Sandstone)

Bodcaw Sand (in Schuler Formation)

Upper Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Name Bodcaw was originally applied to sand lens in Glen Rose Formation, but use of that name was discontinued prior to introduction of same name for a Cotton Valley sand in 1938 (Sloan, 1958, Louisiana Geol. Survey Bull. 33). Sloan's recommendation to retain name Bodcaw for persistent Cotton Valley sandstone is justified despite duplication and antecedent use of name, because its use in Cotton Valley Group is well established. Occurs at depth of 8,170 to 8,188 feet in type welll.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 148, 150. The second, descending, tongue of the Terryville. Underlies Cadeville Tongue (new); overlies Vaughn Tongue (new). Occurs at depth of 8,170 to 8,188 feet in type well.

Type well: Ohio Oil Co., Bodcaw Lumber Co. No. 1, SW¼SE¼ sec. 28, T. 21 N., R. 10 W., Cotton Valley field, Webster Parish.

Bofecillos Group

Eocene to Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 17, 25—26. Comprises (ascending) Chisos Formation, Mitchell Mesa Ash-flow Tuff, Fresno Formation, Santana Ash-flow Tuff, and Rawls Basalt.

Bofecillos Mountains.

Bolaldo Park Formation

Paleocene-Eocene: Central California.

F. R. Sullivan, 1965, California Univ. Pub. Geol. Sci., v. 53, p. 20—21, fig. 2, table 3. In type area consists of 290 feet of mudstone, the upper and lower units of which are poorly exposed. Underlies Tres Pinos sandstone which in turn underlies Los Muertos Creek formation. Contains fossil nannoplankton. Name credited to Kaar (1962, unpub. thesis).

Tres Pinos area, southeast of Hollister.

Boles Member (of Joachim Formation)

Middle Ordovician: Eastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 60, 228. Principally thin to medium beds of silty dense dolomite alternating with similar layers of pure vuggy dolomites; in Cape Girardeau section, member is limestone. Contains at least seven discontinuous bands of nodular white to black chert. In Jefferson and St. Louis Counties, Mo., a chert band within this member has been designated as boundary between Rock Levee and Joachim Formations (Grohskopf, 1948), but in well in Jackson County, Ill., boundary was placed at chert band that appears to be near base of Augusta member (new). Thickness about 20 feet in most outcrops; 30 feet in Ancell type section. Overlies Augusta Member; underlies Defiance Member (new).

Type section: Quarry in bluffs on north side of Missouri River 1 mile southwest of Matson, St. Charles County, Mo., NE cor. SE¼NE¼SW¼ sec. 4, T. 44 N., R. 2 E., Augusta quadrangle. Named for hamlet of Boles which is on Missouri Pacific Railroad on south side of Missouri River and 6 miles southwest of type section.

Bolinger Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Bolinger sand occurs at depth of 9,150 to 9,169 feet in type well.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Bolinger blanket sandstone included in McFearin Tongue (new) of Terryville Sandstone (new).

Type well: Sunray Oil Co., No. A-1 Bolinger, sec. 19, T. 22 N., R. 11 W., South Sarepta field, Bossier Parish.

Bonanza Orthogneiss

Age not stated: North-central Washington.

J. B. Adams, 1964, Am. Jour. Sci., v. 262, no. 3, p. 292 (footnote). Skagit Gneiss has been restricted by Misch (ms.). All the gneisses that can be shown to be derived from plutonic rocks are now separated from Skagit Gneiss (restricted). They include: Eldorado Orthogneiss, Gabriel Peak Orthogneiss, and Bonanza Orthogneiss.

Bonanza Peak is in northern Chelan County.

Boney Member (of Conejo Volcanics)

Tertiary: Southern California.

B. A. Blackerby, 1965, Dissert. Abs., v. 25, no. 12, pt. 1, p. 7199. Corresponds to Malibu Junction member in Malibu Lake area. Name credited to Sonnemann (1956). [Compiler unable to locate Sonnemann reference.]

In Boney Mountains area, Santa Monica Mountains, Los Angeles County.

Bonham Reservoir Formation

Bonham Reservoir Glaciation

Recent: Western Colorado.

W. E. Yeend, 1966, Dissert. Abs., v. 26, no. 9, p. 5375—5376. Quaternary geology of Grand Mesa area. Most dominant effects upon the topography have been made by three glaciations. Glacial, alluvial, and colluvial deposits associated with the three separate glaciations have been included in three newly named formations: Lands End, Grand Mesa, and Bonham Reservoir. A very restricted, local ice buildup termed Bonham Reservoir glaciation (Temple Lake? stade, Recent) left crevasse-fill deposits and fresh morainal topography on the landslide bench below Grand Mesa. Ice of this recent glaciation did not erode top of Grand Mesa.

Grand Mesa is a basalt-capped plateau rising above 10,000 feet elevation. The mesa is about 20 miles east of the junction of the Gunnison and Colorado Rivers in the arid to semiarid lands of western Colorado.

Bonito Lava Flow

Recent: East-central Arizona.

H. H. Robinson, 1913, U.S. Geol. Survey Prof. Paper 76, p. 90, 94, pl. 12. Discussion of San Francisco volcanic field, Arizona. No cone associated with Bonito flow. Lava escaped from vent opened through older basalt flow and filled an elongated depression between older flows and cones. Lies west of Sunset Peak. Very recent lavas.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 10, 33, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Bonito flow is an example of stage V in which the true edge is visible.

C. A. Hodges, 1962, Plateau, v. 35, no. 1, p. 15—36. Associated with Sunset Crater are two lava flows—Bonito and Kana-a. Bonito flow consists of two phases designated primary and secondary. These are distinguished by position and by mantle of ash covering the primary but entirely lacking on secondary. Primary flow consists of sequence of superposed flow units of varying thickness and extent. The secondary flow filled the periphery of basin about the primary flow, partially filling drainage channel opening into Bonito Park on west, and flowing into basin formed south of semicircular crater remnant at southwest of Sunset cinder cone. Secondary exhibits variety of flow structures. Aa type lava. Partially concurrent with Kana-a flow. Younger than S. P. flow (new). Birth of Sunset Crater about A.D. 1064.

D. A. Breternitz, 1967, Plateau, v. 40, no. 2, p. 72—75. Suggested date of eruption of Sunset Crater A.D. 1066—1067.

Sunset Crater is in east-central part of San Francisco volcanic field, 16 miles north of Flagstaff and 4 miles east of U.S. Highway 89, Coconino County.

Bonneville-Graniteville Substage

Pleistocene (Sehoo-Toyeh Stage): Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. [For explanation see Sehoo-Toyeh Stage.] Sehoo-Toyeh Stage divided into two substages, Bonneville-Graniteville (younger) and Draper-Midvale.

Type area: Large gravel pits on southern Promontory Point, Salt Lake, Utah.

Bonsecours facies (of Underhill Formation)

Cambrian: Northwestern Vermont.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 23, pl. 1. Eastern (Richford syncline) belt of Underhill rocks is similar in appearance to Fairfield Pond rocks of the west. However, instead of repeating the green phyllite with quartz lenses, rocks in Richford syncline have in addition a number of bands of contrasting lithology. The eastern facies is herein named Bonsecours facies. On west flank of syncline base is well established by White Brook Dolomite. Peaked Hill [Mountain] Greenstone forms questionable base on east flank. Top is beneath Bridgeman Hill or Sweetsburg Formation, wherever they occur.

In Enosburg area. Name taken from Bonsecours, Quebec, type locality for Osberg's Bonsecours Formation, which correlates broadly with Bonsecours facies of Underhill Formation.

Bonya Limestone

Miocene, lower: Guam.

W. S. Cole, 1963, U.S. Geol. Survey Prof. Paper 403—E, p. E7—E8, E11 (table 8). Report discusses Tertiary larger Formanifera of Guam. Overlies Umatac Formation; underlies Alifan Limestone (new).

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A29—A31, pls. Formal proposal of name. Commonly well-bedded limestone with beds 2 inches to 2 feet thick. Part of rock is buff-white to pink compact detrital limestone made up of poorly to moderately well sorted foraminiferal and algal debris set in fine-grained well-lithified matrix of calcareous "mud". Remainder of rock is yellow, tan, or brown porous calcarenite made up of sandy debris with less matrix. Maximum thickness 120 feet in Togcha gorge and over much of karst area of Fena basin. In karst area northeast of Fena dam, the Bonya in most places overlies Bolanos member of Umatac formation. Northern edge of the Bonya overlies Alutom formation, and westernmost outcrop of Bonya, 3,000 feet northwest of Fena Valley Reservoir, laps onto lava flows assigned to Dandan flow member of Umatac. No rocks are known to overlie Bonya in Fena basin except along the northeast edge of formation where it is overlain by Alifan limestone. In some areas immediately underlies the Janum. Type locality stated.

Type locality: Exposures in small quarry 800 feet northeast of north end of Fena River dam and in another small quarry 1,600 feet east of dam. Also forms steep-sided gorge of Togcha River north of village of Talofofo and parts of the north and south banks of Talofofo River near mouth of Ugum River.

Boreal Ridge basalt

[Pliocene]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci v. 47, p. 4 (table 1), 36. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 7.4 ± .2 m.y.

Boreal Ridge is in southeastern part of Donner Pass quadrangle.

Boriana granodiorite

Precambrian: Northwestern Arizona.

G. W. Putman and C. W. Burnham, 1963, Geochim. et Cosmochim. Acta, v. 27, no. 1, p. 60, 73—74. Name used to distinguish a rock unit in trace elements study. Granite in Boriana pluton. Pluton not observed in contact with Hualpai granite but believed to bear intrusive relationship to what is here called Wikieup granodiorite. Part of Cerbat complex. Name as used herein has no claim to priority. Entire Hualpai Range has been mapped by Schrader (1909, U.S. Geol. Survey Bull. 397) as Precambrian complex, but lack of sedimentary rocks and intrusive nature of Boriana pluton make age designation difficult. Entirely possible Boriana granodiorite is much younger, possibly Mesozoic in age.

Boriana pluton underlies major part of Hualpai Range.

Bosque Alluvium

Bosque River Alluvium

Recent: Central Texas.

J. M. Burket, 1965, Baylor Univ. Geol. Studies Bull. 8, p. 20—21. Bosque alluvium and Bosque River alluvium are terms applied to alluvial deposits that occupy Bosque River terraces and floodplain. Alluvial valleys are narrow where they transect Main Street Member of Georgetown Formation and moderately wide where they cross Del Rio Clay outcrop. Alluvium consists of thick clay-rich floodplain soils, bank load clay and sand deposits, and thin bed load limestone gravel deposits.

Present in vicinity of Waco, McLennan County.

Bottle Lake Quartz Monzonite

Devonian: Eastern Maine.

D. M. Larrabee, 1964, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—282. Gray and pink porphyritic quartz monzonite. Northeastern tip of pluton, extending into Waite quadrangle, is referred to as Topsfield granitic facies. This facies is chiefly leucocratic pink aggregate of microcline, quartz, plagioclase, with little muscovite, and less biotite or hornblende. A gradational change from normal quartz monzonite to the pink Topsfield facies may be in vicinity of Vickery Brook, Scraggly Lake quadrangle. On map legend the Bottle Lake is placed above Wabassus Quartz Monzonite (new) but relationship to the Wabassus not discussed. Potassium-argon age of sample from Bottle Lake locality is about 342 m.y. Age of sample from road from West Musquash Lake to Upper Oxbrook Lake, Scraggly Lake quadrangle, about 370 m.y. by potassium-argon method or 380 m.y. by lead-alpha method.

Type locality: One mile northwest of Bottle lake, along road from Springfield southerly to that lake, Springfield quadrangle. Pluton extends from Waite quadrangle southwestward and westward into Scraggly Lake, Springfield, Winn, Wabassus Lake, Nicatous Lake, and Saponac quadrangles, Washington County.

Boulder Creek Quartz Monzonite, Granodiorite

Mesozoic: Alaska.

A. W. Rose, 1967, Alaska Div. Mines and Minerals Geol. Rept. 28, p. 10, 11 (table 4) 12, figs. 1, 2. Gray medium- to coarse-grained hornblende-biotite quartz monzonite, in part with large potash feldspar phenocrysts. The granodiorite occurs as a pluton a little over a mile in diameter, with a "stem" extending off to the east. It intrudes argillite on the southside and is interpreted to intrude pyroxenite on the north. Most of the quartz monzonite is quite fresh and unaltered.

In peaks north of Boulder Creek, upper Chistochina River area, Mount Hayes quadrangle.

Boundary Ridge Member (of Twin Creek Limestone)

Middle(?) Jurassicc: Southeastern Idaho, northeastern Utah, and southwestern Wyoming.

W. R. Imlay, 1967, U.S. Geol. Survey Prof. Paper 540, p. 36—41, pls. Consists of interbedded soft red, green, or yellow siltstone, silty to finely sandy limestone, oolitic limestone, and greenish-gray silty claystone. Thickness 30 to 285 feet (285 feet at type section). Grades downward within 1 to 2 feet into the shaly limestone of Rich Member (new) and at most places overlain sharply by cliff-forming limestone of Watton Canyon Member (new). Has been called member D by Imlay (1950, Wyoming Geol. Assoc. Guidebook 5th Ann. Field Conf.).

Type section: Exposures at and immediately north of railroad cut about 1 mile southwest of Pegram in NW¼ sec. 12, T. 15 S., R. 45 E., Bear Lake County, Idaho. Named after Boundary Ridge which lies east and southeast of type locality.

Bow Island lithofacies or sandstone member (of Dynneson unit of Mowry Shale)

Lower Cretaceous: Subsurface in north-central Montana and Alberta, Canada.

G. R. Wulf, 1962, Am. Assoc. Petroleum Geologists Bull, v. 46, no. 8, p. 1396—1402. Dynneson unit comprises lower part of formal Mowry Shale. Essentially it is a shale body with two prominent sandstone lithofacies, the Dynneson and Bow Island. Bow Island sandstone is term applied informally to a sandstone well developed in Bow Island gas field, Alberta. No type section has been described but term is used widely in petroleum industry and is retained in this study for sandstones near base of Dynneson unit in north-central Montana. Bow Island lithofacies is typically developed in north-central Montana where it attains thickness of about 100 feet. Lies near base of Dynneson unit and is overlain by and grades into lower Mowry lithofacies. Typically it is a gray to white, very fine to fine-grained sandstone.

First used in Bow Island gas field, Alberta, Canada.

Bowler Granite

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 14, 16 (map), 18, 19. A group of granitic rocks that intruded Tigerton anorthosite (new). Relation of Bowler granite to other granites in state not determined.

McCaslin district. Bowler is in Shawano County.

Boxford Formation

Silurian(?) or older: Northeastern Massachusetts.

R. O. Castle, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C81—C86. Name introduced for group of conspicuously foliated rocks cropping out abundantly in east-central section of South Groveland quadrangle. Divided into lower and upper members. Lower member chiefly conspicuously foliated, although generally obscurely layered, fine- to medium-grained mica schists and quartzofeldspathic gneisses, with subordinate amounts of amphibolite. Upper, which crops out more conspicuously than the lower, is composed entirely of conspicuously foliated, generally thinly layered, very fine grained hypidoblastic rocks. Thickness probably exceeds 5,000 feet. The Boxford Formation and Fish Brook Gneiss (new) together comprise the metamorphic rocks in South Groveland quadrangle exclusive of Merrimack Group. Most of rocks included in the formation originally were mapped with Salem Gabbro-Diorite by Emerson (1917, U.S. Geol. Survey Bull. 597) and a small part was mapped with Marlboro Formation and undifferentiated gneisses and schists. May be correlative with Rye Formation of southeastern New Hampshire.

Type locality: Exposures in northwest half of town of Boxford, South Groveland quadrangle, Essex County. Main belt of outcrop is about 4 miles wide.

Box Springs Quartz Diorite

Age not stated: Southern California.

M. S. Joshi, and F. W. Dickson, 1965, (abs.) Geol. Soc. America Spec. Paper 82, p. 258. Coarse-grained well-foliated crudely layered quartz diorite that contains abundant oriented pancake-shaped mafic inclusions. Transected by numerous small concordant aplites and discordant pegmatites.

Occurs in Box Springs Mountains, Riverside County.

Boyd Tavern Formation

Precambrian and Lower Cambrian to Lower Ordovician: Northern Virginia.

H. R. Hopkins, 1961, Dissert. Abs., v. 21, no. 7, p. 1911. Five units in mapped area are (ascending) Lynchburg formation, Catoctin greenstone, Rivanna formation (new), Keswick formation (new), and Boyd Tavern formation. The sedimentary rocks were deposited in eugeosynclinal environment. Sequence of deposition broken by Precambrian-Cambrian unconformity and Middle Cambrian unconformity.

Western Louisa County.

Bradley Creek Limestone Member (of Nolichucky Formation)

Cambrian: Eastern Tennessee.

W. L. Helton, 1967, Dissert. Abs., v. 28, no. 3, sec. B, p. 941. An algal limestone near middle of Nolichucky Formation.

Report area covers approximately 80 square miles and includes much of the northeast part of Hawkins County, Tenn., and a small part of south-central Scott County, Va.

Brady Butte Granodiorite

Precambrian: Central Arizona.

P. M. Blacet, 1966, U.S. Geol. Survey Prof. Paper 550—B, p. B1—B5. Granodiorite older than isoclinally folded schists of Yavapai Series is exposed in core of upfaulted anticline at Brady Butte southeast of Prescott. A folded unconformity at base of Alder Group of Yavapai Series is exposed in area of about 3 square miles, providing only known exposure of depositional contact between older Yavapai Series and a still older basement. The herein named Brady Butte Granodiorite predates Mazatzal revolution, during which the overlying Alder Group was metamorphosed, and represents a plutonic event older than any previously recognized in Arizona. Occurrence of the granodiorite unconformably beneath older Precambrian schists of Yavapai Series has two principal implications: (1) that a crust of continental character has underlain central Arizona for more than 1,700 m.y.; (2) that direct evidence now exists in Arizona for a plutonic, and probably orogenic event, predating the Mazatzal revolution. The existence of large volumes of quartzofeldspathic sedimentary and silicic igneous rocks with the older Precambrian of Arizona has long suggested the presence of older granitoid rocks but the granodiorite at Brady Butte constitutes the first known exposure of this ancient basement.

Type locality: A continuous section through the granodiorite in canyon of Wolf Creek immediately northeast of Brady Butte, Bradshaw Mountains, Yavapai County. The granodiorite is exposed along a high ridge approximately 15 air-line miles southeast of Prescott and 6 miles south-west of Mayer. Named for exposures at Brady Butte.

Brady Canyon Member (of Toroweap Formation)

Permian (Leonardian): Northwestern Arizona.

J. E. Sorauf, 1963, Dissert. Abs., v. 24, no. 2, p. 702. Middle member of Toroweap. Overlies Seligman Member and underlies Woods Ranch Member (both new). The three members represent transgression, maximum extension, and regression of Toroweap sea, respectively.

Whitmore area, Mohave County.

Brahma Schist

Precambrian (Archean): Northwestern Arizona.

J. H. Maxson, 1961, Geologic history of Bright Angel quadrangle (with geologic map): Grand Canyon Nat. History Assoc. Consists of bluish-green hornblende with small amounts of quartz, albite, calcite, and pyrite. Interbeds of quartzite and quartz mica schist. Thickness over 15,000 feet. Overlies Vishnu Schist. Stands nearly vertical everywhere.

P. E. Damon, D. E. Livingston, and R. C. Erickson, 1962, New Mexico Geol. Soc. Guidebook 13th Field Conf., p. 56. Potassium-argon dating gives apparent age of Brahma schist (Vishnu series) muscovite 1,410 m.y. and biotite 1,240 m.y.

In Inner Gorge of Grand Canyon.

Brainerd Till, Drift

Pleistocene: Central Minnesota.

A. F. Schneider, 1961, Minn. Geol. Survey Bull. 40, p. 40—42. Dark-brown till very similar to Pierz till. May be that Pierz and Brainerd lobes actually represent protrusions of one ice mass, which gave birth to two sublobes that deposited lithologically similar drift.

Occurs in vicinity of Brainerd, Crow Wing County.

Brandon Bridge Formation

Silurian (Niagaran Series): Northeastern Illinois.

R. M. Liebe, 1962, Dissert. Abs., v. 23, no. 1, p. 202. Discussion of conodonts from Alexandrian and Niagaran Series of Illinois basin. *Amorphognathus-Bryantodus* zone, characteristic of Brandon Bridge Formation in northeast Illinois, is also present in west-central Illinois.

Faunal units can be recognized within Bainbridge Group, some of which are probably Cayugan in age.

Type locality and derivation of name not stated.

Brazos Alluvium

Brazos River Alluvium

Recent: Central Texas.

J. M. Burket, 1965, Baylor Univ. Geol. Studies Bull. 8, p. 19—20, 21. Brazos alluvium and Brazos River alluvium are terms applied to alluvial deposits that occupy Brazos River terraces or floodplain. Brazos River alluvium occupies more extensive area than alluvium of Bosque River. Brazos alluvial belt is narrow where it transects resistant Austin Chalk outcrop in northern part of Waco area. Belt widens on less resistant Taylor Marl.

Present along Brazos River, Waco area McLennan County.

Breadtray Granite (in Bevos Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 8 (strat. column), 81, 83. Included in Bevos group (new). Name credited to Tolman and Robertson (in preparation). Also spelled Bread Tray.

Occurs in St. Francois Mountain area. Bread Tray Mountain is in St. Francois County.

Breakfast Hill Granite

Devonian(?): Southeastern New Hampshire.

R. F. Novotny, 1964, Dissert Abs., v. 24, no. 7, p. 2871. Igneous rocks of Devonian(?) Hillsboro plutonic series range in composition from gabbro to granite and granite pegmatite and in structure from foliated to massive. Indicated relative ages (oldest to youngest): Breakfast Hill granite and pegmatite, Newburyport quartz diorite, porphyritic quartz monzonite of Seabrook, Exeter diorite, and quartz monzonite of Barrington and Rochester.

Dover-Exeter-Portsmouth region.

Breezy Hill Member (of Satans Kingdom Formation)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 36, 39—41, pl. 1. Nonrusty-weathering medium-grained plagioclase-mica-quartz schist containing garnet, staurolite, and small plagioclase porphyroblasts. Overlies Ratlum Mountain Member (new); underlies Slashers Ledges Formation (new).

Type locality: On top of Breezy Hill east and west of Breezy Hill Road, Collinsville quadrangle. Reference localities: In Satans Kingdom and along transmission line crossing Bee Mountain, south of Route 4, near Nepaug.

Briceburg Formation (in Mariposa Group)

Upper Jurassic(?): Central California.

O. E. Bowen, 1963, Sacramento Geol. Soc. Guidebook Ann. Field Trip, May 18—19, p. 27, road log map 4. Black silty slate. In apparently conformable depositional contact with Penon Blanco Formation (greenstone) [of Amador Group]. In fault contact with Paleozoic Hite Cove Formation (new). Age uncertain; may be Upper Jurassic and may be equivalent to Mariposa Slate. Formerly the slates were considered to be part of Paleozoic Calaveras Formation.

Briceburg is in Mariposa County.

Bridal Veil Limestone Member (of Oquirrh Formation)

Pennsylvanian: Northern Utah.

A. A. Baker and M. D. Crittenden, Jr., 1961, U.S. Geol. Survey Geol. Quad. Map GQ—132. Medium- to dark-gray limestone about 1,200 feet thick at base of formation. Contains fossils of Early Pennsylvanian age. Appears to be equivalent to West Canyon limestone member (Nygreen, 1958).

A. A. Baker, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—241 (with text). Mapped in Orem quadrangle. Crops out in cliff extending across northeast corner of quadrangle along side of range but is partially obscured by allochthonous mass of quartzite that extends from south of Provo River to north edge of quadrangle. Contains abundant fossils including *Millerella* sp. Bissell (1959) applied name Hall Canyon Member to the unit in Oquirrh Mountains. Note on type locality.

Type locality: Bridal Veil Falls, on south side of Provo Canyon in sec. 34, T. 5 S., R. 3 E., about 2 3/4 miles southeast of southeast corner of Timpanogos Cave quadrangle.

Bridal Veil Falls Member (of Oquirrh Formation)

Probably lapsus for **Bridal Veil Limestone Member** (of Oquirrh Formation).

Bridgeman Hill Formation

Lower Cambrian: Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Undifferentiated dolomite, slate, and conglomerate on east limb of St. Albans synclinorium. About equivalent to Dunham, Parker, Rugg Brook, and Saxe Brook formations.

J. G. Dennis, 1961, New England Intercollegiate Geol. Conf. Guidebook 53d Ann. Mtg., sec. 6 (table 1). Listed below Sweetsburg Formation on table showing sequence of geologic events in northern Vermont east of Champlain thrust.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 28—30, pl. 1. Bridgeman Hill Formation of this report [Enosburg area] includes as members, Dunham Dolomite, Oak Hill Slate, and Scottsmore Quartzite and Conglomerate of Clark (1936, Royal Canadian Inst. Trans., v. 21, pt. 1). Formation forms narrow outcrop band on east side of St. Albans synclinorium, stratigraphically equivalent to Dunham Dolomite, Parker Slate, and Rugg Brook Dolomite of west limb of St. Albans synclinorium. Following Clark (1934, Geol. Soc. America Bull. 45, no. 1) succession on east limb of synclinorium is called "Oak Hill sequence" and west limb "Rosenberg sequence". Clark believed each to be in separate but stratigraphically partially equivalent thrust slices. Present study found no valid evidence for thrusting between the sequences (other than purely local Hinesburg thrust, which only affects pre-Dunham rocks, and Dunham Dolomite in part). Hence only structure involved in the two sequences is St. Albans synclinorium. In present report Bridgeman Hill rocks have been grouped as one formation, because they are not separably mappable in area covered. This condition persists to some extent north of international boundary. Formation includes (ascending) Dunham Dolomite, Rice Hill (new) Oak Hill Slate (Parker Slate), and Rugg Brook Dolomite (Scottsmore Quartzite) Members.

Name taken from Bridgeman Hill, near Franklin, Enosburg area.

Bright Dot Formation

Pennsylvanian(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 23—24, pls. 1, 2. Consists of lower massive unit 1,000 to 1,500 feet thick, which grades into an upper well-layered unit 500 to 1,000 feet thick. Lower unit consists of microgranular gray to dark-gray pyritic muscovite, siliceous hornfels, and metachert. Upper unit well-layered sequence of siliceous calc-hornfels and siliceous hornfels in alternate layers. Thickness about 2,500 feet at type locality. Underlies Mount Baldwin formation (new). Base not exposed; in fault contact with underlying metasedimentary rocks along entire exposed length.

Type locality: Immediately east of Bright Dot Lake, easternmost lake in Convict Creek drainage, Mount Morrison quadrangle, Sierra Nevada. Exposed almost continuously from northernmost exposure in east wall of canyon of Laurel Creek, southeast to its termination against granodiorite near Mount Baldwin, a distance of 6 miles.

Brint Road Member (of Silica Formation)

Middle Devonian: Northwestern Ohio.

S. W. Mitchell, 1967, Michigan Acad. Sci., Arts and Letters, Papers, v. 52, p. 182—196. Silica formation divided into two members, based on a faunal break: Brint Road below and Berkey. Thickness about 24 feet. Overlies Dundee limestone.

Type locality: North Quarry of Medusa Portland Cement Co., SE¼ sec. 7, T. 9 S., R. 6E., Sylvania Township, Lucas County. Named for Brint Road just south of the quarry.

Briscoe Tongue (of Sanhedrin Formation)

Upper Jurassic (Portlandian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Sandstone-conglomerate 3,400 feet thick. Overlies Gillaspy tongue and underlies Bidwell tongue (both new).

In Elk Creek-Fruto area, Glenn County.

Brock Canyon Formation

Upper Pennsylvanian or Permian: North-central Nevada.

L. J. P. Muffler, 1964, U.S. Geol. Survey Bull. 1179, p. 6—14, pl. 1. Consists of about 5,000 feet of near-shore marine and nonmarine sedimentary rocks, which was deposited unconformably on deformed eugeosynclinal rocks of Ordovician Valmy Formation, part of allochthonous upper plate of Roberts thrust (Late Devonian to Early Pennsylvanian). Comprises four informal members (ascending): conglomerate member, dolomite member, claystone member, and arkose member. The two upper members are unfossiliferous and may be of early Mesozoic age. Formation named by Gilluly in Crescent Valley quadrangle

(Gilluly and Roberts, in press). Only lower few hundred feet of formation exposed in that quadrangle. Type locality and supplementary sections designated in area of present report.

James Gilluly and Olcott Gates, 1965, U.S. Geol. Survey Prof. Paper 465, p. 44, pl. 1. Formal proposal of name. Consists of dolomite, conglomerate, sandstone, and limestone. In fault contact with Valmy Formation. Total thickness in Crescent Valley quadrangle, 1,200 to 1,500 feet. Late Pennsylvanian or Early Permian. Derivation of name.

Type section: In upper part of Cottonwood Canyon in Frenchie Creek and Horse Creek Valley quadrangles. Section measured from E. 277,859, N. 2,006,900 to E. 271,850, N. 2,002,550. Supplementary section 1: East side of Brock Canyon near the mouth from E. 245,700, N. 2,015,200 to E. 247,450, N. 2,014,450. Supplementary section 2: West side of Brock Canyon near the mouth from E. 245,450, N. 2,012,800 to E. 244,500, N. 2,012,250. Named for its exposures in Brock Canyon on northwest face of Cortez Mountains, in and east of southeast corner of Crescent Valley quadrangle.

Brockport lentil (in Lockport Formation)

Silurian: New York.

D. H. Zenger, 1962, Dissert. Abs., v. 23, no. 6, p. 2097. In Bergen quadrangle, the stratigraphic position of Gasport Member of the Lockport is occupied by fine-grained fossiliferous (brachipods, trilobites) limestone informally named Brockport lentil.

Derivation of name not stated.

Broken Back flow

Pleistocene: Central New Mexico.

H. R. Weber, 1963, New Mexico Geol. Soc. Guidebook 14th Field Conf., p. 142. Exposed parts consist of fluidal olivine basalt of fine grain showing similarity to basalt of younger overlapping Carrizozo flow.

Located in extreme southeastern Socorro County and northwestern Lincoln County at southeastern toe of Chupadera Mesa. Flow extends southward about 10 miles in floor of modern valley and eastward about 7 miles into upper Tularosa Valley.

Broken Rib Member (of Dyer Formation)

Upper Devonian: West-central Colorado.

J. A. Campbell, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1573. Dyer Formation divided into two carbonate members. The lower, Broken Rib, consists of dark-gray dolomitic fossiliferous limestone. Member reflects deposition in a shallow sublittoral environment. Underlies Coffee Pot Member (new).

Type locality and derivation of name not given.

Broncks Lake Member (of Kalkberg Formation)

Lower Devonian (Helderbergian): Eastern New York.

J. R. Dunn and L. V. Rickard, 1961, New York State Geol. Assoc. Guidebook 33d Ann. Mtg., p. C2, C4—C5, C9, C11. Name applied to upper member of formation. Lower part of member, 14 to 16 feet thick, consists of fine-grained blue-gray limestone beds, 1 to 3 inches thick, interbedded with calcareous shale layers, about 1 to 2 inches thick; at base is black euxinic shale, 2 to 3½ feet thick, which contains small calcareous fossils. Upper part is fine-grained blue-gray limestone 23 to 30 feet thick. Overlies Hannacroix Member (new); underlies New Scotland Formation.

Named for occurrence at Broncks Lake, Greene County.

Brookesmith Formation (in Canyon Group)

Pennsylvanian: North central Texas.

F. B. Conselman, 1961, Abilene Geol. Soc. Guidebook Sept. 15—16, p. 7 (fig. 2), 14. Name proposed for the beds between top of Brownwood formation and base of Winchell formation. Includes Adams Branch limestone member below and Cedarton shale member above.

Type locality: Immediate vicinity of village of Brookesmith, Brown County.

Brooks Sandstone or Tongue (in Rock Springs Formation)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 104, pl. 1. Fine- to medium-grained massive buff to brown sandstone. Thickness about 120 feet in type area. Underlies Coulson shale tongue (new) and overlies Black Butte tongue.

Type locality: Secs. 30 and 31, T. 18 N., R. 101 W., and sec. 1, T. 17 N., R. 102 W., Sweetwater County. Named for Brooks Ranch.

Brooks Range Glaciation

Age not stated: Northern Alaska.

D. A. Livingstone, 1955, Ecology, v. 36, no. 4, p. 596. Name applied to glaciation in Brooks Range.

Brothers Volcanics (in Stephens Passage Group)

Upper Jurassic and Lower Cretaceous: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 55—69, pl. 1. A sequence of andesitic volcanic flows, breccias, and associated volcanic sedimentary rocks at least 2,000 feet thick. Seems to lie conformably on Seymour Canal Formation (new) as shown by contact exposed on West Brother Island and by general structural conformity of the two formations. May be either partly or wholly within uppermost part of Seymour Canal Formation, as suggested by location of their outcrops within eastern and younger part of outcrop belt of the Seymour Canal, or they may lie wholly above the Seymour Canal. Underlie unnamed conglomerate sna sandstone unit with angular unconformity.

E. H. Lathram, and others, 1965, U.S. Geol. Survey Bull. 1181—R, p. R23, R28, pl. 1. Uppermost formation in Stephens Passage Group (new). May prove to be either lens in Seymour Canal Formation or equivalent to Douglas Island Volcanics as southern continuation of its outcrop belt. Mapped with Douglas Island Volcanics in this report.

Occur on The Brothers Islands in southeastern part of Pybus-Gambier area, Admiralty Island.

Brower Creek Volcanic Member (of Mariposa Formation)

Upper Jurassic: East-central California.

L. D. Clark, A. A. Stromquist, and D. B. Tatlock, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—222. Very coarse heterogeneous volcanic breccia in vicinity of Fowler Lookout; elsewhere ranges from very fine tuff to coarse breccia; contains pillow lava near Bear Creek.

L. D. Clark, 1964, U.S. Geol. Survey Prof. Paper 410, p. 12, 19, 23—24, 25, pls. 1—11. Name applied to sequence of volcanic rocks, chiefly volcanic breccia, that forms upper part of Mariposa formation north of Stanislaus River. Member is thickest near Fowler Lookout, where it apparently represents an accumulation in vicinity of a vent. Northwest of the lookout, member divides into two tongues that are interlayered with epiclastic rocks of formation. Member is surrounded on three sides by epiclastic rocks continuous on surface with type area of Mariposa. Exposures are on western flank of syncline, and beds dip steeply. Near Mokelumne River, Mariposa formation is about 4,000 feet thick of which nearly all is Brower Creek. Overlaps Logtown Ridge formation between Drytown and Mokelumne River. Brower Creek was mapped as diabase and porphyrite by Turner (1894, U.S. Geol. Survey Geol. Atlas, Folio 11) and was included in Logtown Ridge formation by Eric and others (1955).

Named for Brower Creek, whose headwaters are near Fowler Lookout on lower western slopes of the Sierra Nevada, Calaveras County. Extends northwestward beyond Mokelumne River but probably not as far northwestward as Cosumnes River.

Brown rhyolite member (of South Rim Formation)

Oligocene or younger: Southwestern Texas.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 138 (fig. 89), 139. Informal name applied to sequence of lava units at base of South Rim Formation. Lavas range in composition from dark plagioclase-rich rock with glassy base to a light felsite. Thickness less than 10 feet to 800 feet.

Exposed only in area of highest Chisos Mountains peaks.

Brown Creek Formation

Pilocene, middle: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Consists of lacustrine deposits and locally basalts (the Sinker Creek basalt member, new). Underlies Oreana Formation (new). Was included in Idaho Formation by Cope (1884), Term Idaho herein abandoned.

Oreana quadrangle in foothill country of Owyhee Mountains and southern margin of western Snake River Plain.

Brownell Mountain Phyllite Member (of Bascom Formation)

Lower Ordovician: Western Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Calcareous phyllite in upper part of formation. Occurs on east limb of Hinesburg sincylinorium.

Brown Mountain Granite

Precambrian: Northwestern North Carolina

J. C. Reed, Jr., 1964, U.S. Geol. Survey Bull. 1161—B, p. B8—B9, pl. 2. Medium- to coarse-grained light-colored homogeneous granite. Poorly foliated and nonlayered, but commonly has distinct cataclastic lineation. Faulted against Wilson Creek Gneiss and upper Precambrian sedimentary and volcanic rocks on west and northeast; on southeast, bounded by Linville Falls fault, which marks southeastern boundary of Grandfather Mountain window.

J. C. Reed, Jr., 1964, U.S. Geol. Survey Geol. Quad. Map GQ—242. Mapped in Lenoir quadrangle.

Named for exposures in northeastern part of Linville Falls 15-minute quadrangle.

Brown Mountain Granodiorite

Oligocene: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 73,75. Intruded Wiggins formation. Intermittant exposures indicate approximate thickness of 1,200 feet.

Occurs in crescent-shaped body and occupies an area about two-thirds mile long and one-third mile wide on Brown Mountain.

Brown Mountain Rhyolite Porphyry (in Bevos Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 8 (strat. column), 81, 83. Included in Bevos group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Brown Mountain is in St. Francois County.

Browns Pass Quartz Monzonite

Precambrian: Central Colorado.

Fred Barker and M. R. Brock, 1965, U.S. Geol. Survey Bull. 1224—A, p. A25—A26. Consists of three rock types, oldest to youngest, buff medium- to coarse-grained foliated homogeneous biotite-quartz monzonite northeast of Browns Pass; pink to buff coarse-grained massive to foliated quartz monzonite and granite southeast of Browns Pass and in small stock north of Cottonwood Pass; buff fine- to medium-grained massive alaskite in dikes southeast of Browns Pass. Discordantly intrudes Denny Creek Granodiorite Gneiss (new). Older than Kroenke Granodiorite (new).

Type area: Browns Pass, Mount Harvard quadrangle, Chaffee County.

Bruceville Marl Member (of Atco Formation)

Cretaceous: Central Texas.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Bros., p. 353. According to Durham (1957, unpub. thesis) the type Austin sequence (in vicinity of Austin) includes (ascending) Atco chalk, Bruceville chalk-marl, Vinson chalk, Jonah limestone, Dessau chalk, Burditt chalk marl, and Big House chalk.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121—1123. Bruceville marl member, north of Austin is equivalent to Vinson chalk member south of Austin. Name credited to Durham (1957).

E. A. Pessagno, Jr., 1967, Palaeontographica Americana, v. 5, no. 37, text-figure 2. Bruceville shown on correlation chart above the Atco and below the "Hutchins" (new) in Dallas area. Austinian Stage.

Occurs in type section of Austin Group.

Bruneau Formation (in Idaho Group)

Pleistocene, middle: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1210—1212, pl. 1. Characterized by lake and stream deposits and basaltic lava flows. Thickest sections lie close to present course of Snake River and outline ancient canyon fill about 800 feet thick. Sedimentary deposits of canyon fill are exposed from type area upstream to Hagerman and downstream to vicinity of Murphy. Basaltic material of the Bruneau forms canyon fill more than 1,000 feet thick near mouth of Sinker Creek east of Murphy and a fill 500 feet at Crane Falls on Snake River north of Bruneau. Basaltic flows also mantle plateau from Nampa to Glenns Ferry north of Snake River. In canyon walls west of Hagerman the Bruneau lies against steep former canyon wall eroded in Glenns Ferry Formation (new) and in overlying Tuana Gravel (new). At Bruneau, the formation similarly lies against steep slope eroded in the Glenns Ferry and in overlying pediment gravel. Not in actual contact with Tuana Gravel but relations show that the Bruneau is stratigraphically younger. Beds of Bruneau and Glenns Ferry Formations south of Snake River near Glenns Ferry are beveled by erosion surface that terminates 550 feet above river level. This surface is covered by gravel herein named Black Mesa.

Type locality: Typical exposures begin east of mouth of Bruneau River about 9 miles northwest of Bruneau and extend southeastward to pediment gravel 6 miles southeast of Bruneau. Named for exposures near town of Bruneau, Owyhee County.

Brushy Canyon Formation (in Mariposa Group)

Brushy Canyon Member (of Mariposa Formation)

Upper Jurassic: Central California.

O. E. Bowen, 1963, Sacramento Geol. Soc. Guidebook Ann. Field Trip, May 18—19, p. 24, 25, road log map 4. Referred to as Brushy Canyon Member of Mariposa Formation and as Brushy Canyon Formation. Member consists chiefly of light-green, light-brown, and pinkish tuffaceous sandstone and conglomerate with some muscovite schist derived from rhyolite tuff. In contact with metavolcanics of Agua Fria Formation [of underlying Amador Group]. Member also in contact with slates of [overlying] Mariposa Slate Member of Mariposa Formation.

Brushy Canyon is in Mariposa County.

Brushy Knob Formation (in Jackfork Group)

Mississippian: Southwestern Arkansas.

B. H. Walthall, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 4, p. 508, 509 (table 1). Morris (1964, unpub. thesis) divided Jackfork Group in frontal Ouachitas, Ark., into (ascending) Irons Fork Mountain and Brushy Knob Formations (both new). Brushy Knob includes all of

Jackfork Group younger than Prairie Hollow Shale Member of Wildhorse Mountain Formation. Underlies Johns Valley Formation.

Type locality and derivation of name not given.

Buck and Doe Conglomerate

Tertiary-Quaternary: Northwestern Arizona.

Robert Gray, 1964, Arizona Acad. Sci. Jour., v. 3, no. 1, p. 39—42. Predominantly white, and consists of angular to subrounded limestone and chert fragments. Rests unconformably on upper member of Hindu Canyon Formation (new). Sediments show cross stratification toward southwest.

Type section: In Hindu Canyon, secs. 20—25, T. 27 N., R. 12 W., Gila River and Salt River Principal Meridian, Mohave County.

Buck Creek Felsite Tuff (in Trowbridge Formation)

Upper Jurassic: East-central Oregon.

W. R. Dickinson, 1962, Am. Jour. Sci., v. 260, no. 4, p. 249—266. Informal name applied to quartz keratophyre in Trowbridge formation in Izee area.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 61. Basal resistant sequence in Officer Member (new) of Trowbridge Formation is ledge-forming felsite tuff unit informally named Buck Creek felsite tuff (Dickinson, 1962). Maintains thickness of 60 to 70 feet throughout area of Sheep Creek, but thins rapidly to feather edge to west.

Buck creek is in Grant County.

Buckfield Group

Silurian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., Trip K, p. 103, 104 (table 1), 105, figs. 1, 2, road log. Composed of sillimanite-biotite rich schists and calc-silicate granulites. Comprises (ascending) Turner (new), Patch Mountain, Noyes Mountain, Berry Ledge, and Moody Brook Formations. Underlies Woodstock Group (new). Noted as unpublished and unofficial stratigraphic name. Group has been traced northeast [from Buckfield quadrangle] into large pluton in Farmington and Norridgewock quadrangles. Traced through Bryant Pond, Poland, and Lewiston quadrangles into Sebago pluton. Correlated with Waterville Formation of Osberg (in press).

Type locality and derivation of name not stated. Area of report is Buckfield and Dixfield quadrangles.

Buckhorn Sand (in Tuscaloosa Group)

Upper Cretaceous: East-central Louisiana (subsurface).

H. V. Spooner, Jr., 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 1, p. 1—21. Study in type area of Tuscaloosa Group revealed that although numerous lower Tuscaloosa sands produce hydrocarbons, only one, herein named Buckhorn sand, constains significant reserves. Defined as that sand which occurs below upper 110 feet of lower Tuscaloosa and above pre-Tuscaloosa unconformity.

Type log: A composite electric log of Lower Tuscaloosa and Washita-Fredericksburg stage, in Buckhorn oil field, Tensas Parish.

Buckindy Intrusive Complex

[Tertiary, middle]: Northwestern Washington.

A. R. Grant, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1982. Buckindy Intrusive Complex mentioned in comparison of textures and structures between pre-Cascade metamorphism Marblemount and Sulphur Mountain plutons and Tertiary Cloudy Pass batholith.

In Dome Park area, located on western flank of Northern Cascades in Chelan, Skagit, and Snohomish Counties.

Buck Ridge Complex

Pre-Middle and Middle Cretaceous: Southern California

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, p. 722 (table 1), pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features on which correlations are based. Buck Ridge complex is one of six complexes used in these correlations. Several plutons and sills also listed and mapped.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Budden Canyon Formation

Lower and Upper Cretaceous: Northern California.

M. A. Murphy, G. L. Peterson, and P. U. Rodda, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 4, p. 496—502. Proposed to include those rocks of Ono quadrangle and Chanchelulla Peak quadrangle that lie above igneous and metamorphic rocks of Klamath Mountains complex and are unconformably overlain by Tehama (Pliocene) or Red Bluff (Pleistocene) Formations. Consists of thick succession of medium- to dark-gray sandstones, siltstones and mudstones, and minor amounts of conglomerate. Total thickness exposed along type section difficult to estimate because of faulting, but probably at least 22,000 feet. Divided into seven members: Rector Conglomerate, Ogo (new), Roaring River, Chicabally (new), Huling Sandstone, Bald Hills, and Gas Point (new). Hauterivian to Turonian. Name Ono Formation abandoned in this report.

Type section: Exposed along State Route 36 (Dry Creek-Budden Canyon) from secs. 35 and 36, T. 29 N., R. 9 W., to sec. 18, T. 28 N., R. 6 W., Ono quadrangle.

Buddys Run Member (of Catskill Formation)

Upper Devonian: Eastern Pennsylvania.

H. H. Arndt, G. H. Wood, Jr., and J. P. Trexler, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C32—C35. Name applied to a dominantly red continental facies beneath Spechty Kopf Member (new) and above Irish Valley Member (new). Thickness 4,400 feet at type section. Consists of about 75 percent red beds, chiefly grayish-red to pale-brown and brownish gray sandstone, siltstone, and shale, and 25 percent gray to light-olive-gray and dusky-yellow sandstone, siltstone, and shale. Top of Buddys Run is arbitrarily placed at horizon where gray and greenish-gray beds characteristic of Spechty Kopf Member predominate over red beds characteristic of main body of Catskill.

J. L. Dyson, 1963, Pennsylvania Geol. Survey, 4th ser., Atlas A 137ab, 25—26, 43—48, pl. 1. Described in New Bloomfield quadrangle where Newport section exposes 3,921 feet of member. At this locality, member is divisible into two subdivisions. Lower submember is 2,715 feet thick and consists of about 90 percent of red beds; cyclic bedding. Upper submember is about 1,200 feet thick. About 50 percent of this submember consists of thin-bedded platy olive-gray to reddish-gray cross-bedded medium- to coarse-grained sandstones which are cyclically bedded with grayish red shales and siltstones. Direct lithologic correlation between submember units of Buddys Run Member in Newport section and units in type section of member probably not possible. Overlies Irish Valley Member.

Type section: At mouth of Irish Valley on west side of Shamokin Creek along Reading Railroad north of Shamokin, Northumberland County. Top of Buddys Run along these tracks is in water gap in Little Mountain about 1½ miles northwest of Shamokin City limits. Named for small stream which flows east through Irish Valley to Shamokin Creek. Member crops out in continuous belt that surrounds western end of Western Middle anthracite field and northern prong or "fishtail" of Southern anthracite field.

Buelter Member (of Ironton Sandstone)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 26 (fig. 9), 36—37. Name applied to basal sandstone member of Ironton Sandstone. Consists largely of medium-grained sandstone that is moderately sorted and rarely dolomitic. Thickness 20 to 80 feet. Occurs between 1,180 and 1,230 feet in type well. Underlies Fox Valley Member (new); overlies Galesville Sandstone.

Type well: Miller-Batavia No. 3, sec. 22, T. 39 N., R. 8 E., Kane County. Named for Buelter School, NE¼ sec. 24, T. 39 N., R. 8 E., Kane County, 2 miles east of type well.

Buffaloville Limestone

Lower Pennsylvanian: Southwestern Indiana.

M. T. Thompson and R. H. Shaver, 1964, Illinois Acad. Sci. Trans., v. 57, p. 17, fig. 2. A limestone that caps the Buffaloville coal.

Occurs in Spencer County.

Buffington Formation

Upper Cambrian(?): Southeastern Nevada.

C. R. Longwell and M. C. Mound, 1967, Geol. Soc. America Bull., v. 78, no. 3, p. 407 (fig. 2). Shown on section across Monocline Valley Formation (new) at type locality of Monocline Valley Formation. Underlies Monocline Valley. Overlies Dunderberg Formation.

In Clark County north of Las Vegas.

Buford Granite Porphyry (in Musco Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Musco group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Buford Mountain is in Iron County.

Buford Canyon Formation

Mesozoic and Cenozoic: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 41–44, pl. 1. A sequence of sedimentary and volcanic rocks. On basis of lithology divided into lower conglomerate member and upper volcanic member. Conglomerate member is at least 700 feet thick in Buford Canyon and 200 to 600 feet thick in Klondyke Wash. Volcanic member at least 1,500 feet thick in Buford Canyon and Klondyke Wash. Top of volcanic member not exposed, and member everywhere overlain with pronounced angular unconformity by older alluvium. Formation trends northwest, and beds dip from 30° to 65° SW in region northeast of Silver Coin mine to 40° to 80° SW in Buford Canyon. Age not known with even accuracy of a geologic era. Formation rests on early Precambrian Pinal Schist, is faulted against Horse Mountain Volcanics (new) at one place, and is overlain by older alluvium of Pliocene or Pleistocene age. Appears to be unfossiliferous. Presumably of Mesozoic and Cenozoic age, since no similar rocks are found in Paleozoic sequence anywhere in southeastern Arizona.

Named for exposures in Buford Canyon, Klondyke quadrangle. Crops out in three places in northeast part of T. 7 S., R. 20 E. Occupies an area of about a square mile, or about 4 percent of the quadrangle.

Bugtown Formation

Precambrian: Southwestern South Dakota.

J. A. Redden, 1963, U.S. Geol. Survey Prof. Paper 297–D, p. 203, 204–207, pl. 21. Oldest of metamorphic rocks in Fourmile quadrangle, Custer County. Consists predominantly of quartz-mica schist, derived from graywacke and impure sandstone. Exposed thickness about 1,500 feet; estimated thickness 4,000 feet. Lower contact not exposed within limits of quadrangle; contact tentatively placed between massive quartz-mica schist typical of the Bugtown and an unnamed garnetiferous schist that lies to northeast. Underlies Crow formation (new).

Named for Bugtown Gulch in Berne quadrangle, which adjoins Fourmile quadrangle on north. Bugtown Gulch crosses well-exposed section of formation.

Bulgarmarsh Granite

Devonian(?) or older: Rhode Island and Massachusetts.

S. J. Pollock, 1964, U.S. Geol. Survey Bull. 1158–D, p. D4–D5, pl. 1. Pink to gray, coarse-grained, and foliated in most places. Albite (An_{3-7}) is principal plagioclase. Younger than mica-chlorite schist of Blackstone(?) Series. Bulgarmarsh Granite was included with Dedham Granodiorite by Emerson (1917, U.S. Geol. Survey Bull. 597). Bulgarmarsh not correlated with typical Dedham Granodiorite, which is more than 20 miles from

Tiverton area because published descriptions show andesine to be principal plagioclase feldspar in the Dedham. Pre-Pennsylvanian age shown by unconformable relation between the granite and Pennsylvanian sedimentary rocks.

Named for exposures along Bulgarmarsh Road, about 2,300 to 3,400 feet northeast of intersection with Main Road, Tiverton quadrangle, Rhode Island—Massachusetts. Well exposed south of Bulgarmarsh Road to Tiverton Four Corners.

Bull Creek Formation or Beds

Oligocene or Miocene: Western Oregon.

Don Campbell, 1962, Oregon County Geol. Soc. News Letter, v. 28, no. 8, p. 52. Bull Creek Formation mentioned in discussion of trip up Clackamas River. Noted at Ripple Creek Junction. Unusual because of occurrence in region of completely igneous rock. Beds tipped at angle of forty-five degrees.

D. L. Peck and others, 1964, U.S. Geol. Survey Prof. Paper 449, p. 11, 25. Volcanic conglomerate and water-laid tuff in upper Clackamas River valley south and west of Oak Grove Ranger Station were named Bull Creek Beds by Barnes and Butler (1930, unpub. thesis) and questionably correlated with Umpqua Formation by Hodge (1932, Oregon Univ., Pub. Geology Ser., v. 1, no. 5; 1938, Oregon Country Geol. Soc. News Letter, v. 4, no. 1). Bull Creek Beds were separated from overlying flows, breccia, and tuff of Eagle Creek Formation (part of Little Butte Volcanic Series of present report) because Bull Creek Beds dip steeply in contrast to almost flatlying strata of Eagle Creek Formation. Bull Creek Beds assigned to Little Butte Volcanic Series in present report because the steep dips and variable strikes are not result of tectonic deformation but of slumping which is widespread in upper Clackamas River valley where Columbia River Basalt overlies soft tuff.

Bull Creek Member (of Walnut Formation)

Lower Cretaceous: South-central Texas.

C. H. Moore, Jr., 1961, Texas Jour. Sci., v. 13, no. 1, p. 17, 22—27, 32 (fig. 6). Basal member of formation. Underlies Bee Cave member (new). A clastic limestone that onlaps the Glen Rose to north and west. Thickness 32.6 feet at type section.

Type section: Just west of Austin, Travis County, in drainage of Bull Creek. Section measured in roadcut on City Park road, 0.4 miles west of Ranch Road 2222 (Bull Creek Road). Lower clay member forms bench at top of steep road cut. Section starts 37.8 feet below this bench and ends at Bee Cave-Bull Creek contact.

Bull Fork Formation

Upper Ordovician: Northeastern Kentucky.

J. H. Peck, 1966, U.S. Geol. Survey Bull. 1244—B, p. B16—B22. Composed of alternating shale and limestone; the shale content gradually increasing from about 20 percent of the formation near base to about 80 percent near top. Shale is gray to greenish gray, calcareous, and locally fossiliferous. Thickness 200 feet in type area. Thins southward. Transitional with overlying Preachersville Member of Drakes Formation. Upper contact placed at top of highest persistent fossiliferous limestone. Overlies Grant Lake Formation (new).

Type section: Measured in roadcuts along Kentucky Route 1443 beginning about 0.9 mile north of junction with Kentucky Route 984, Mason County. Base of section at E. 2,176,500; N. 408,859 (10,000-foot grid based on Kentucky coordinate system, north zone). Named for Bull Fork Creek, a tributary of Ohio River heading near Plumbille, Mason County.

Bull Run Quartzite (in Prospect Mountain Quartzite)

Lower Cambrian: Eastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 13—14. Local name applied to Prospect Mountain Quartzite in Bull Run quadrangle.

Bully Creek Formation

Pliocene (Clarendonian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 25, 43—44. Volcanic sandstones and diatomites. Thickness about 440 feet. Widely exposed in northern part of Harper Basin district, where it unconformably overlies Littlefield Rhyolite (new) and Drip Spring Formation (new). Underlies Grassy Mountain Formation. In western and northern margins of basin rests on faulted Littlefield Rhyolite and Hunter Creek Basalt (new).

Type sections: (1) SW¼ sec. 7, T. 19 S., R. 41 E.; (2) NW¼ sec. 11, T. 19 S., R. 41 E., Malheur County.

Bunejug Formation

Pliocene-Pleistocene: Southwestern Nevada.

R. B. Morrison, 1964, U.S. Geol. Survey Prof. Paper 401, p. 9 (table 3), 12—14, pl. 3. A series of basalts and andesites. Maximum thickness 650 feet. Unconformably overlies Truckee formation and in some areas interfingers with it. Underlies pre-Lake Lahontan lacustrine deposits (Paiute formation).

Type locality: West face of the 4,866-foot mountain in south-central Bunejug Mountains, secs. 33 and 34, T. 17 N., R. 30 E., Churchill County.

Burgess-Simmons Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Burgess-Simmons, unlike McFearin-Davis, is not combination of two independently applied names but is single name applied initially to the sand (Shreveport Geol. Soc., v. 2, 1945). Expanded definition (Louisiana Dept. Conserv. Orders, v. 4, 1956-59) is favored in present report because it is correlative with a regionally extensive sand. Ardis sand is duplicate name for the Burgess-Simmons. Both are popular locally and retention of the two names for the sand is favored. Occurs at depths of 8,766 to 8,806 feet in Caruthers No. 1 Simmons Unit (original) and at 8,758 to 8,821 feet in Drilling and Exploration Co., No. 2 Burgess-Simmons (expanded).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Included in Justiss Tongue of Terryville Sandstone (new).

Type well (original): Caruthers No. 1 Simmons Unit, Lisbon field, sec. 2, T. 20 N., R. 5 W. Expanded: Drilling and Exploration Co., No. 2 Burgess-Simmons, sec. 2, T. 20 N., R. 5 W., Lisbon field, Claiborne Parish.

Burlington Till

Pleistocene: Northern Vermont.

D. P. Stewart, 1961, New England Intercollegiate Geol. Conf. Guidebook 53d Ann. Mtg., sec. 5, p. i. Name applied to till deposited by Burlington lobe. Younger than Shelburne till (new). Believed to be same age as Fort Covington till in St. Lawrence Valley.

Present in Burlington quadrangle.

Burney Basalt

Pleistocene, lower: Northern California.

G. A. Macdonald, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—345. Dark-gray to black, moderately to highly vesicular, generally diktytaxitic, locally dense basalt flows generally porphyritic, with olivine phenocrysts generally less than 2 mm across but in places as much as 8 mm. Most flows are pahoehoe, a few are aa.

G. A. Macdonald, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—443. Burney Basalt mapped in Harvey Mountain quadrangle.

G. A. Macdonald, 1966, California Div. Mines and Geology Bull. 190, p. 91. Discussion of Warner Basalt. Has been recognized that it may not be possible to group all of the "plateau" basalt of area into a single stratigraphic unit [Warner Basalt]. Considerable variation both in degree of weathering and thickness of the ashy soil cover on the basalt in different places, as well as other differences in geological relationships, indicate that there is considerable difference in the age of the basalt from one place to another, and it is preferable to use local formation names until the correlation of the basalts throughout the region can be firmly established. Names Burney Basalt and Gardens Basalt [Devils Garden Basalt] have been used in this way. For purposes of this report Russell's name Warner Basalt is retained as a collective term for the petrographically and structurally similar lavas throughout the region, without any specific implication as to contemporaneity.

Type locality: Roadcut on U.S. Highway 299, 4 miles northeast of Burney, Shasta County. Town of Burney is 11 miles northeast of Prospect Peak quadrangle [GQ—345].

Burnside Lake Adamellite

Jurassic-Cretaceous: Eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 12, pl. 1 facing p. 1789. Named on map legend.

J. B. Koenig, 1963, Geologic map of California, Walker Lake Sheet (1:250,000): California Div. Mines. Jurassic-Cretaceous.

Burnside Lake is in Markleeville quadrangle, Alpine County.

Burnstad Drift

Pleistocene (late Wisconsin): South-central North Dakota.

Lee Clayton, 1961, North Dakota Acad. Sci. Proc., v. 15, p. 11, 12—14. Fauna described from Burnstad drift. Older than Napoleon drift.

Lee Clayton, 1962, North Dakota Geol. Survey Bull. 37, p. 62—69. Formal proposal of name. Defined as morpho-stratigraphic unit consisting of till of Burnstad end moraine and other associated drift that was deposited from same glacial ice, including till of Venturia, Fresh Lake, and Streeter end moraines, dead-ice moraine, and ground moraine, and associated outwash and lake sediment. "Burnstad drift" and "Streeter drift" of Clayton (1961) and "Burnstad Drift" and "Streeter Drift" of Rau and others have been included in a single morphostratigraphic unit, the Burnstad Drift. Younger than Long Lake Drift.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44 (Ground Water Studies 5), pt. 1, p. 56. After deposition of Napoleon drift, the ice margin probably receded to Missouri Coteau and remained there until about 12,000 years ago when the Long Lake and Burnstad drifts were deposited.

Type area: In eastern part of secs. 9 and 16 and secs. 10, 11,14, and 15, T. 134 N., R. 71 W., northwest of Burnstad, Logan County. Covers entire Missouri Coteau parts of Logan and McIntosh Counties and some adjacent parts of Coteau Slope.

Burnt Brook Formation (in Meduxnekeag Group)

Silurian(?): Northeastern Maine.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, p. A54 (table 1), A55. Chiefly green noncalcareous slate and gray calcareous slate. Locally has sparse thin blue-gray limestone beds. At least 5,000 feet thick. Conformably overlies Carys Mills Formation (new), but not overlain by younger rocks in its type area. May be equivalent to lower part of Smyrna Mills Formation as well as to part of Perham Formation. Believed to be Silurian(?).

Type locality: Along Burnt Brook, Aroostook County.

Burnt Island Conglomerate (in Hyd Group)

Upper Triassic: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C29—C33, pl. 1. Basal marine conglomerate in Hyd Group. At type locality is a rudely bedded poorly sorted pebble conglomerate consisting almost entirely of clasts of blue-green and black argillite, graywacke, and chert derived from Cannery Formation. Matrix of the conglomerate is gray calcite. Thickness at least 100 feet at type locality but thins to a few tens of feet at northwest tip of Hamilton Island and is absent on much of northeast shore of Hamilton Island. Where the Burnt Island overlies the Pybus Formation, the detritus is primarily chert and limestone from the Pybus.

Type locality: Reefs between Burnt Island and Grave Island, west of Kake, Keku Islets. Supplementary sections are on north shore of Hamilton Bay 2,000 feet northwest of Little Hamilton Island, and on the northeast shore of the islet 0.6 mile west-southwest of triangulation station Isle in northern Keku Islets.

Burnt Mountain Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 9, 37. Overlies Quartz Mountain Basalt Member and underlies Sourdough Basin Basalt Member (both new). Thickness 56 feet.

Type locality: N½, sec. 23, T. 22 S., R. 43 E., Malheur County. Named for Burnt Mountain, 2 miles southeast of type locality.

Burnt Valley Complex

Pre-Middle Cretaceous: Southern California.

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, p. 722 (table 1), pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with the configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features in these correlations. Several plutons and sills also listed and mapped.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Burroughs Mountain Stade

Holocene: Central Washington.

D. R. Crandell and R. D. Miller, 1964, U.S. Geol. Survey Prof. Paper 501—D, p. D110—D114. Older of two stades in Winthrop Creek Glaciation (new). Based on limiting dates of ash layers, Burroughs Mountain Stade occurred between 3,500 and 2,000 years ago.

Type section: Northwestern slope of Burroughs Mountain, where it is represented by lateral moraine, at Mount Rainier.

Bushkill Member (of Martinsburg Formation)

Middle and Upper Ordovician: Northeastern Pennsylvania and western New Jersey.

A. A. Drake, Jr., and J. B. Epstein, 1967, U.S. Geol. Survey Bull. 1244—H, p. H6—H9. Consists of thin-bedded dark- to dark-medium-gray claystone slate that weathers medium gray to very light gray to yellowish brown. Thickness about 4,000 feet. Estimate may be high because of repetition by unrecognized folds and thrust faults. Transitional contact with overlying Rameysburg Member (new). Member is in conformable and gradational contact with underlying Jacksonburg Limestone.

Named for representative outcrops along Bushkill and Little Bushkill Creeks in the Wind Gap quadrangle, Northampton County, Pa.

Butler Till

Pleistocene (Illinoian): Northeastern Ohio.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. A deposit of Scioto glacial lobe.

Report discusses glacial geology of Richland County.

Butler Hill Granite (in Bevos Group)

Precambrian: Southeastern Missouri.

F. G. Snyder and R. E. Wagner, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 14, 15, 16, 17. Borders Skrainka diabase on north. In contact with Stouts Creek rhyolite on west slope of Knoblick Mountain.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 81, 83. Included in Bevos group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Butler Hill is in T. 34 N., R. 6 E., St. Francois County.

Butlerville Till Member (of Jessup Formation)

Pleistocene: Western Indiana.

W. J. Wayne, 1963, Indiana Geol. Survey Bull. 25, p. 51 (fig. 7), 53—54, 70. Dominantly conglomeratic mudstone with lenses of gravel, sand, silt and clay, and a few lenses of peat and marl. Consists of at least two and possibly three units of till that are separated by fossiliferous silt beds. Distinctive weathered zone, buried where member is overlain by younger sediments, caps Butlerville and serves as key bed for recognizing top of Jessup. Thickness about 27 feet at type section. Overlies Cloverdale Till Member (new).

Type section: Road- and spillway-cut exposure at Brush Creek Reservoir, 2 miles northwest of Butlerville, Jennings County, in NE¼NE¼ sec. 16, T. 7 N., R. 9 E., Butlerville quadrangle.

Butte Creek Volcanic Sandstone

Micocene (Barstovian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 15—16, 35. Volcanic sandstones and volcanic-pebble conglomerates. Thickness probably not more than 100 feet. Overlies Littlefield Rhyolite (new). Underlies Wildcat Creek Ash-Flow Tuff (new) in Crowley district. Underlies Tims Peak Basalt (new) in Monument Peak district. No complete exposed section known. Contains Barstovian (late Miocene) mammalian fossils.

Type locality: SW¼SW¼, sec. 23, T. 24 S., R. 40 E., Willamette Meridian, Malheur County. Named for exposures along Butte Creek.

Butterfield Formation (in Oquirrh Group)

Middle Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 9—10, pls. 2, 5. Underlies Bingham Mine formation (new); overlies "White Pine" formation. Nine mappable limestone members recognized (ascending): Ribbon, Step, Billiard Ball, Fern, G. J., G. C., Highland, St. Joe, and Sub Jordan. Thickness about 4,000 feet. Within Butterfield area, formation is intruded by sills, dikes, and small plutons. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissel, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. Has local value only, and presumably for purposes of economic convenience in Bingham mining district.

Type section: In secs. 10 and 15, T. 4 S., R. 3 W. Traverse begins at Butterfield Peak 9,360, and proceeds up section north along ridge into section 10, just above Tie Fork, Salt Lake County.

Butterfield Peaks Limestone Members (of White Pine Formation)

Pennsylvanian: Central Utah.

J. E. Welsh and A. J. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1). Butterfield Peaks limestone members of White Pine formation listed on table of Pennsylvanian and Permian units within Oquirrh Mountains. Present at base of the White Pine formation above Maple formation.

"White Pine" formation crops out on south slopes of Butterfield Peaks and is well exposed around the Long Ridge anticline in the southern Oquirrh Mountains and also along the North Oquirrh thrust block in northern Oquirrh Mountains.

Buttress Diabase

Upper Triassic or younger: Southwestern Connecticut.

C. E. Fritts, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D33 (fig. 128.1), D34. Intrudes West Rock Diabase (new) of Newark Group.

C. E. Fritts, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—199. Medium- to fine-grained porphyritic diabase; dark- to dark-greenish-gray groundmass. Intrudes New Haven Arkose and West Rock Diabase of Newark Group. Mapped in Mount Carmel quadrangle.

C. E. Fritts, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—200. Mapped in Southington quadrangle. Forms system of widely spaced, nearly vertical dikes as much as 100 feet thick.

C. E. Fritts, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—426. Mapped in Ansonia quadrangle. Upper Triassic or younger.

Type locality: About 800 feet northwest of Wilbur Cross Parkway tunnel, New Haven quadrangle. Named for topographic feature known locally as The Buttress, which protrudes from west side of West Rock Ridge, in New Haven quadrangle.

Buzztail Spring Formation

Ordovician(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 19—20, pls. 1, 2. Composed of interlayered generally dark-colored pelitic hornfels and slate, siliceous hornfels, metachert, calcareous quartz sandstone, and marble in beds typically ranging from a few inches to a few feet thick. Includes light-colored quartz sandstone member about 350 feet thick near top. This member interpreted as a formerly continuous stratigraphic unit that has been deformed by faulting and tight folding. Thickness about 2,500 feet. In fault contact with older rocks on east. Upper contact with Mount Aggie formation (new) depositional. Discontinuously exposed over strike length of about 4 miles.

Type locality: North of McGee Creek, Mount Morrison quadrangle, Sierra Nevada. Named for spring on north side of McGee Creek.

Cabbage Patch Formation or Beds

Oligocene, upper, or Miocene, lower: Central western Montana.

R. L. Konizeski and J. C. Dono[a]hoe, 1958, Soc. Vertebrate Paleontology, Guidebook 8th Ann. Field Conf., p. 45—49. Name applied to beds containing Cabbage Patch local fauna. Consist of fine-bedded to massive gray silts with buff-colored areas and secondary iron 16½ feet; buff-colored silts 6 feet; gray silts with buff patches 12 feet; well-bedded gray ash 3 inches; fine-bedded to massive gray silts 130 feet. This is believed to be locality referred to by Douglass (1901, Am. Philos. Soc. Trans, new ser., v. 20) a few miles to the northeast of the New Chicago-Flint Creek beds.

V. E. Gwinn, 1961, Dissert. Abs., v. 21, no. 8, p. 2247, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4). Tuffaceous mudstones and siltstones, crystal and vitreous tuffs, argillaceous limestones, and micaceous conglomerates overlying older rocks north of Clark Fork River and east of Dunkleberg Ridge. Comprises mappable sequence and persists eastward into Gold Creek basin along east margin of Drummond area. Thickness 400 to 650 feet in Clark Fork Valley. Distinguished from overlying Flint Creek beds by predominance of massive bedding and by presence of feldspathic-micaceous conglomerate and sandstone. Unconformable above early Tertiary clays and rhyolitic tuffs. Middle part of beds yielded Miocene (Arikareean) vertebrates.

Occur north of U.S. Highway 10, T. 10 N., R. 12 W., in secs. 1, 2, 3, 10, 11, 12, 13, 14, Granite County. Probable Douglass locality in sec. 10.

Cabin Granodiorite

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 137—139. Bordered by sedimentary rocks on the east and west, Leidy Adamellite (new) on north and McAfee Adamellite (new) on south. Medium gray in color. Similar to Barcroft Granodiorite (new). Contact relationships show Cabin Granodiorite to be intrusive into the sedimentary rocks and older than the adamellites.

R. G. Strand, 1967, Geologic Map of California, Mariposa sheet (1:250,000) California Div. Mines and Geology. Mapped with Mesozoic granitic rocks.

Underlies about 6 square miles in northwestern part of Mt. Barcroft quadrangle.

Cadeville Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Cadeville occurs at depth of 9,730 to 9,750 feet in type well.

Type well: Atlantic Refining Co. No. A—1 Golson, in sec. 19, T. 17 N., R. 2., Ouachita Parish.

Cadeville Tongue (of Terryville Sandstone)

Upper Jurassic: Northern Louisiana (subsurface).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 148, 150. Uppermost of five tongues in the Terryville (new). Occurs at depth of 10,300 to 10,540 feet in type well. Includes blanket sandstones Kavanaugh, Cadeville, "B", "C", and "D". Overlies Bodcaw Tongue (new).

Type section: Arkansas-Louisiana Gas Co., Kavanaugh No. 1, SW¼SE¼ sec. 22, T. 17 N., R. 3 W., clay field, Jackson Parish.

Caetano Tuff

Oligocene(?): North-central Nevada.

James Gilluly and Harold Masursky, 1965, U.S. Geol. Survey Bull. 1174, p. 73—78, pl. 1. Name applied to body of welded and water-laid tuff and associated conglomerate and sandstone. Thickness about 8,000 feet on aasumption that formation is almost completely duplicated by normal faulting. Only exposure of base of formation is southwest of Francis Cabin, 2 miles north of Caetano ranchhouse. Here a normal fault has brought up a mass of quartzite of the Valmy Formation about half a mile long.

Crops out over most of the northern Toiyabe Range north of Wenban fault and south of Cortez Canyon, Cortez quadrangle. Name derived from Caetano Ranch, which is situated on and surrounded by the formation.

Calcutta Silt

Pleistocene, lower: Northeastern Ohio.

H. D. Lessig, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 129—139. Unconsolidated, laminated, silty material which contains sandy layers, small flat pebbles, and layers of gravel and rubble in lower part. Thickness 2 to 10 feet.

Type location: Along north side of County Road 428, about 1 mile northwest of Calcutta, St. Clair Township, Columbiana County, at center of SW¼SE¼ sec. 6, about 600 feet north of a farmhouse.

Caldwell Gulch Formation

Pliocene: South-central Colorado.

R. D. MacNish, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2414. Cenozoic history of Wet Mountain Valley. A new phase of tectonic activity began in Pliocene time. The Sangre de Cristo Range and Wet Mountains rose along normal faults, disrupting the relatively smooth surface of the pediment. Sediments of the rising mountains covered the floor of Wet Mountain Valley as coalescing alluvial fans forming Caldwell Gulch Formation. This sedimentation continued into the Pleistocene.

Wet Mountain Valley is an intermontaine trough in south-central Colorado.

Caledonia Formation (in Mount Eagle Group)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Consists of 10,000- to 20,000-foot turbidite sequence of volcanic sedimentary rocks. Includes East End member about 3,500 feet below top of formation. In western part of island the Caledonia grades laterally to south into Allandale formation (new). Both Allandale and Caledonia are overlain by Cane Valley formation (new). Underlies Judith Fancy formation (new). Campanian or older.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 186, 187—197, pl. 1. Composed of a variety of rock types, including, in order of abundance, mudstones, sandstones, limestones, cherts, and conglomerates. Thickness of any particular lithology generally on scale of inches, and most rock types are repeated, giving a homogeneous aspect to entire formation. Thickness unknown as base is not exposed. Maximum 4,200 feet calculated in northwest part of island, but formation shows no sign of ending at seacoast and may be thicker. Estimated stratigraphic thickness exposed in Prosperity thrust sheet 7,500 feet. On eastern half of island formation is at least 9,000 feet, and is 18,000 feet thick if measured from Buck Island to south coast of St. Croix, assuming no significant faulting between Buck Island and St. Croix. Includes East End Member in upper part in eastern half of island. Grades laterally into Allandale Formation. Overlain by Cane Valley Formation and Judith Fancy Formation.

Named for Caledonia Valley in northwestern part of St. Croix. Formation present in several areas: in northwest part of island in vicinity of Punch, Mount Washington, Frenchman Hill, Hams Bluff, and Maroon Ridge; in a narrow outcrop near LaVallee; and on eastern half of island from Christiansted eastward, including Buck Island and Green Cay.

Calfkiller Formation

Mississippian (Chesterian): Central Tennessee.

M. N. A. Peterson, 1962, Jour. Geology, v. 70, no. 1, p. 2, 3 (chart). Overlies Beersheba formation (new); underlies Cowan formation (new). Name credited to Vail (1959, unpub. thesis).

Cumberland Plateau.

Callahan Chert Member (of Duzel Formation)

Ordovician(?): Northwestern California.

G. A. Davis and others, 1965, Geol. Soc. America Bull., v. 76, no. 8, p. 948, 949, pl. 1. Massive chert that forms highest part of formation in Etna quadrangle, topographically, structurally, and perhaps stratigraphically. Typical cherts range from white to more dominant black or reddish brown and have flinty luster and conchoidal fracture. Overlies wacke-mudstone member.

Occurs near Callahan, Siskiyou County, in south-central Klamath Mountains.

Callaway lithofacies (of Cedar City Formation)

Callaway limestone facies (of Callaway Formation)

Middle Devonian: Central and northeastern Missouri.

A. G. Unklesbay, 1952, Missouri Geol. Survey and Water Resources, 2d ser., v. 33, p. 32—37. Facies in Callaway formation. Dominant lithology relatively pure, light-gray to dark-blue fine-grained to sublithographic limestone which is fossiliferous in some places.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Middle Devonian strata formerly assigned to Callaway formation, which embraced Callaway and Cooper limestone facies, are herein named Cedar City formation. Names Callaway and Cooper retained to designate lithofacies of the Cedar City. Callaway lithofaces divided into four physiofacies, Lupus sandstone, Mineola crinoidal or arenaceous limestone, Sandy Hook dolomitic limestone or dolomite and Calwood limestone.

G. H. Fraunfelter, 1967, Illinois Acad Sci., Trans., v. 60, no. 1, p. 30—35, measured sections. Callaway Limestone Lithofacies is best developed in Callaway County. Thickest observed and measured section, about 63.5 feet, occurs at junction of a west-flowing tributary to Auxvasse Creek and Auxvasse Creek (NW¼SE¼SE¼ sec. 8, T. 48N., R. 8 W., Callaway County), overlying the Little Shaver Creek Facies of the Cooper and covered above. Thickness about 54 feet at type section where the Calwood, Sandy Hook, Mineola, Smithton, and Lupus Physiofacies are exposed. The Callaway is overlain, underlain, and interfingers with various physiofacies of Cooper Lithofacies. Where not directly associated with the Cooper, in Saline County, north of Saline City, it is underlain by Kimmswick Formation. Underlain by Jefferson City and St. Peter Formation in Moniteau, Cole, Boone and most of Callaway County. Along Clarks Branch north of Williamsburg is underlain by the Plattin, and southeast of Readsville, underlain by Joachim. Underlain by Kimmswick in St. Charles County. In Lincoln County, underlain by Maquoketa. Where not associated with the Cooper or is not covered, the Callaway is overlain in Saline, Pettis, Cooper, Moniteau, and Cole Counties by *Siphonodella* Beds of Bachelor Formation. In Callaway County overlain by *Siphonodella* Beds, Pennsylvanian sands or shales, or by Upper Devonian Snyder Creek or Holts Summit Formation. In Pike County overlain by Grassy Creek and Turnpin Sandstone. Gregor (1936, St. Louis Acad. Sci. Trans., v. 29, no. 2) mentioned Bellama Spring, Callaway County, as type section of the Callaway Formation; no further information was found. This outcrop is about 0.75 mile north and slightly east of Hams Prairie locality (type section for Callaway Lithofacies). Name Bellama Springs no longer in use and not found on any available maps. According to M. G. Mehl, the section referred to as Bellama Springs by Gregor is same section referred to herein as Crown Fork section (SW¼NW¼NW¼NE¼ sec. 1, T. 46 N., R. 9 W., Callaway County.)

Type section: W½ NE¼SW¼SW¼SE¼ sec. 1, T. 46 N., R. 9 W., about 2.3 miles northeast of Hams Prairie, Callaway County, along west side of dirt road about 0.1 mile southeast of Stinson Bridge (Fulton quadrangle.)

Calloway Creek Limestone

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D6—D8. Chiefly gray thin-bedded fossiliferous fine- to medium-grained limestone having partings and seams of greenish-gray shale; lower part of formation includes greenish-gray thin-bedded limy siltstone. Thickness 80 to 130 feet; 125 feet at type locality. Transitional with underlying Garrard Siltstone and overlying Ashlock Formation (new). Lower contact placed so that all relatively persistent beds of limestone are included in the Calloway Creek. Contact generally lies above all siltstone beds more than 0.5 feet thick. Upper contact placed so as to separate muddy limestone of Calloway Creek from limy mudstone of the

Ashlock. Previous workers have correlated beds here included in Calloway Creek with Fairmount Limestone Member of Fairview Formation of Cincinnati area.

Type section: Roadcuts of Interstate Highway 72, beginning about 0.4 mile north of Kentucky River and extending southward to point 0.6 mile north of Kentucky Highway 388. Named for Calloway Creek in north-central Madison County.

Calloway Well Formation

Oligocene: East-central Nevada.

R. B. Scott, 1965, (abs.) Houston Geol. Soc. Bull., v. 8, no. 4, p. 23. Tertiary rocks in Grant Range consist of 5,000 to 15,000 feet of rhyolitic ignimbrite sheets, nonmarine sediments, and siliceous flows. Major named units are (ascending): Sheep Pass Formation, middle to upper Eocene; Railroad Valley Rhyolite (new), 36 m. y.; Calloway Well Formation, ignimbrites; Stone Cabin Formation, ignimbrites; Windous Butte Formation, ignimbrites, 33 m. y.; Currant Tuff; Needles Range Formation, ignimbrites; Horse Camp Formation, Mio-Pliocene.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). As shown on generalized section of Grant Range, Calloway Well Formation, 0 to 600 feet thick, overlies Blind Spring Formation and underlies Saddle Mountain andesite (both new). Oligocene.

Grant Range, eastern Great Basin.

Calwood Limestone physiofacies (of Callaway lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Callaway lithofacies of Cedar City formation (new) divided into four physiofacies· Lupus sandstone, Mineola crinoidal or argnaceous limestone, Sandy Hook dolomitic limestone or dolomite, and Calwood limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 41—43. Maximum thickness of Calwood Limestone physiofacies about 30 feet. Overlies, underlies, and interfingers with Smithton Facies of Cooper Lithofacies; overlies, underlies, and interfingers with Sandy Hook and Mineola Facies of Callaway lithofacies. Overlies Ordovician formations—Jefferson City, Joachim, and Plattin. Underlies Snyder Creek Formation (Upper Devonian). Underlies *Siphonodella* Beds of Bachelor Formation (basal Mississippian). Underlies Pennsylvanian sandstone.

Type area: NW¼SE¼SE¼ sec. 8, T. 48 N., R. 8 W., at junction of Auxvasse Creek and a west-flowing tributary of Auxvasse Creek about one-half mile north of U.S. Highway 70, east and south of Old Auxvasse Church (Fulton quadrangle). Best developed in Callaway and Montgomery Counties. Also crops out in Pettis, Moniteau, Boone, Warren, Lincoln, Pike, and Marion Counties.

Camera Hill Greenstone Member (of Seboomook Formation)

Lower Devonian: West-Central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 169—171, pl. 34. Volcanic unit in upper part of Seboomook. Consists of felsite with scattered feldspar phenocrysts and some vesicles near base. Dark green where fresh, weathers gray to rusty brown. Thickness 0 to 400 feet. Oriskany age.

Type section: Camera Hill, southwest quarter of Spencer quadrangle, Somerset County.

Cameron Pass Volcanics Group

Eocene(?): North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Consists of basalt-andesite-trachyandesite units divided into three formations: Skeleton Gulch Andesite, Zimmerman Andesite, and Michigan Basalt. Stratigraphic relationships not entirely clear. Underlies Specimen Mountain Volcanic Group.

Mount Richthofen-Iron Mountain area, about 40 miles south of Wyoming border. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Camille Lava Flow

Pleistocene(?): Alaska.

D. M. Hopkins, 1963, U.S. Geol. Survey Bull. 1141—C, p. C35, C47—C48, C64—C68, pl. 1. Name proposed for large pahoehoe lava flow, only slightly distrubed by frost riving, that is exposed discontinuously from Camille Cone 24 miles westward to junction Goose Creek and Noxapaga River. The Camille overlies flows of Gosling and Imuruk volcanics (both new) and is overlain between Lava Lake and Camille Cone by Lost Jim lava flow. The part of Camille flow that invaded valleys of Andesite Creek and Noxapaga River is confined to meandering channel in surface of stream terrace and stands about 4 feet above present flood plain of Noxapaga River. A lava about 100 feet high and 1 mile in diameter has accumulated over source vent at Camille Cone; elsewhere, Camille flow is generally less than 25 feet thick. Probably late Wisconsin.

Type locality: Camille Cone, an agglomerate cone at source vent, in Imuruk Lake area, Seward Peninsula.

Camp Canyon Member (of Chainman Formation)

Carboniferous: Eastern Nevada and western Utah.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978, Chainman, about 2,000 feet thick along Utah-Nevada boundary, is herein subdivided into six lithostratigraphic members which intertongue with each other. They are (ascending): Needle Siltstone; Skunk Spring Limestone; Camp Canyon Member composed of dark fondotherm shales 500 to 1,800 feet thick, and containing an upper deltaic meiorogenic facies; Donner; Willow Gap Limestone; and Jensen.

Type locality and derivation of name not stated.

Camper Flat granodiorite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Camper Flat granodiorite mentioned and shown on map in report on contact metamorphic reactions and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle, just south of Lake Tahoe.

Camp Rice Formation

Pleistocene: Southwestern Texas and northern Mexico.

W. S. Strain, 1965, Dissert. Abs., v. 25, no. 9, p. 5216. Characterized by sand, silt, clay, and volcanic ash. Unconformably overlies Fort Hancock Formation (new). Pearlette volcanic ash dates middle part of formation as late Kansan. Fossils indicate lower part is probably Aftonian.

W. S. Strain, 1966, Texas Mem. Mus. Bull. 10, p. 19—21, 51, 52, 53, 54. Formal proposal of name. Formation is collection of gravel, sand, silt, volcanic ash, and caliche. Range of color very light gray through shades of pink and orange to light brown. Thickness 88.3 at type section, herein designated. Strata horizontal and rest disconformably on Fort Hancock Formation. Camp Rice is unevenly bedded, has coarser grain size, and is lighter color than Fort Hancock. Pearlette volcanic ash occurs in discontinuous lenses and crops out in and near railroad cut west of Finlay and in Camp Grande Arroyo. Typical Camp Rice outcrops form steep slopes and, where unprotected by caliche, form badlands-type topography. Age of lower part of formation probably Aftonian, middle part late Kansan, and upper part undetermined. Pearlette Ash determines age of middle part of formation as late Kansan. Three reference sections established.

Type section: In Camp Grande Arroyo in NE¼NE¼ sec. 46, T. 6, Blk. 74, Hudspeth County. At a point 5 miles north of McNary on the county road, the type section is on the east side of the arroyo. Reference sections: (1) East side of Campo Grande Arroyo, 5 miles north of McNary, NE¼NW¼ sec. 3, T. 7, Blk. 74; (2) Campo Grande Arroyo, 3.7 miles north of McNary, SE¼NE¼ sec. 9, T. 7, Blk. 74; (3) In U-shaped arroyo one-fourth mile south of west end of Finlay railroad cut in NW¼NE¼ sec. 20, T. 7, Blk. 73, Madden Arroyo. Named for Camp Rice Arroyo, an intermittent tributary of Rio Grande in western Hudspeth County. Typically exposed in Rio Grande Valley in El Paso and Hudspeth Counties, and along escarpment southwest of river in Chihuahua, Mexico.

Camp Run Member (of New Albany Shale)

Upper Devonian and Lower Mississippian: Southeastern Indiana.

J. A. Lineback, 1965, Dissert. Abs., v. 25, no. 11, p. 6538. Interbedded carbon-rich silty or dolomitic pyritic shale. Overlies Clegg Creek Member (new) and underlies Morgan Trail Member (new).

Type locality and derivation of name not stated.

Campus Andesite

Post-Cretaceous: Western Texas.

J. M. Hoffer, 1967, El Paso Geol. Soc. and Soc. Econ. Paleontologists and Mineralogists, Permian Basin Sec., Joint Field Trip Guidebook (Feb. 25), p. 15. An intrusive body called locally "Campus Andesite". Rock is porphyritic with phenocrysts of plagioclase and biotite in a microcrystalline groundmass of feldspar, biotite, and quartz.

"Campus Andesite" is largest of several intrusive bodies of igneous rock that occur in Rio Grande Valley southwest of Franklin Mountains in El Paso. "Campus Andesite" occupies an area of about 1 square mile on and near campus of the University of Texas at El Paso.

Camuy Formation or Limestone

Miocene: Puerto Rico.

W. H. Monroe, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—197. A sequence of limestone, marl, sandy chalk, and sandstone. In Camuy quadrangle divided into three members, but these are not readily traceable beyond borders of quadrangle. Estimated thickness about 200 meters. Disconformably overlies Aymamon Limestone; underlies Pleistocene deposits.

Type locality: Exposures on Highway 119 between town of Camuy and foot of ridge, 1 kilometer west-southwest of La Pica, Camuy quadrangle. Formation traced discontinuously from town of Isabela, 16 kilometers west of Camuy quadrangle, to town of Dorado, 52 kilometers east of quadrangle, a distance of about 80 kilometers.

Cañabón Lava Member (of Robles Formation)

Upper Cretaceous: Puerto Rico.

R. P. Briggs and P. A. Gelabert, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—336. Consists principally of augite phenocrysts set in aphanitic or finely crystalline groundmass. In barrio Cañabón the Cañabón member is about 200 meters below top of Robles formation and may be about 650 meters stratigraphically above Lapa lava member. Thickness 10 meters (33 ft) to 60 meters (200 ft). May be equivalent to Las Tetas lava member.

Named for barrio Cañabón of Municipio of Barranquitas northwest of Barranquitas.

Canal Run Formation

Pliocene or Pleistocene, lower: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Fluvial sand, silt, and clay. Maximum thickness 15 feet. Overlies Sedley Formation; underlies Kilby Formation.

Canal Run is in Isle of Wight County.

Canaseraga Formation

Pleistocene: South-central New York.

G. G. Connally, 1965, Dissert. Abs., v. 25, no. 11, p. 6533. Younger of two formations in Almond moraine area. Shows predominance of purple garnet, suggesting provenance north of Montreal and Ottawa in contrast to older Olean Formation which contains red garnet indicating a provenance in central Adirondacks. Includes Goff Creek Member (new). Binghamton is magnafacies of the Canaseraga and Olean Formations. Deposited during Woodfordian time.

In western Finger Lakes area. Appears to have Almond moraine as southern boundary. Also spelled Canaserago.

Canelo Hills Volcanics

Triassic or Jurassic: Southeastern Arizona.

P. T. Hayes, F. S. Simons, and R. B. Raup, 1965, U.S. Geol. Survey Bull. 1194—M, p. M1—M9. Formation subdivided into three thick units: basal interbedded volcanic and sedimentary rocks, rhyolitic lavas, and an upper welded tuff. All units not everywhere present. Basal unit present at many places in northern Canelo Hills, where it rests with marked unconformity on Paleozoic carbonate rocks and is as much as 2,000 feet thick. Rhyolitic lava unit crops out extensively along northeast side of southern Canelo Hills. Smaller outcrop areas are along crest of Canelo Hills, on Lone Mountain, and in southeastern Huachuca Mountains. Maximum exposed thickness 1,000 feet about 5 miles east-southeast of Canelo Pass. Where base is exposed the lava flows rest on Paleozoic limestone. Upper unit makes up most of southern Canelo Hills. Also crops out at north end of Canelo Hills, on and near Lone Mountain, and in southern Huachuca Mountains. Greatest apparent thickness, about 6,000 feet, is along southwest-trending section on southwest side of Canelo Hills, 4 miles southeast of Canelo Pass. Neither base nor top exposed. Conformably overlies rhyolitic lavas where they are present. Elsewhere, as in Huachuca Mountains and northern Canelo Hills, tuff lies unconformably on volcanic rocks of basal unit or on Paleozoic formations. Unconformably overlain by various younger formations oldest of which is conglomerate at base of Lower Cretaceous Bisbee Group. Potassium-agron dating on biotite of welded tuff gives 173 ± 7 million years. Hence welded tuff unit is Late Triassic or Early Jurassic in age.

Type area: Canelo Hills, Santa Cruz and Cochise Counties.

Cane Run Bed (in Grier Limestone Member of Lexington Limestone)

Middle Ordovician: Central Kentucky.

D. F. B. Black, E. R. Cressman, and W. C. MacQuown,Jr., 1965, U.S. Geol. Survey Bull. 1224—C, p. C20. A bed of argillaceous micrograined limestone as much as 5 feet thick at or near top of the Grier. Base of bed is from 15 to 25 feet below base of Brannon Member.

Type section: In Pemberton Quarry on east side of U.S. Highway 25, 0.9 mile north of Linlee School, Lexington West quadrangle, Fayette County. Bed extends past pinchout edge of the Brannon into northern Fayette and southern Scott and Bourbon Counties. Named for Cane Run in north-central Fayette County.

Cane Valley Formation (in Mount Eagle Group)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Both Allandale (new) and Caledonia (new) formations are overlain by Cane Valley formation. Composed of Hope member (mudstone, 700 feet thick), Robe Hill member (tuff, 400 feet thick), and Springfield member (mudstone, 600 feet). Cane Valley formation (in the west), and Caledonia formation (in the east) are overlain by Judith Fancy formation (new).

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 199—200, pl. 1. Consists of mudstones and interbedded tuffaceous sandstones. Maximum thickness 1,700 feet. Divisible into Hope, Robe Hill, and Springfield Members. Overlies Allendale Formation. Northward the Caledonia Formation stratigraphically replaces the Allandale so that remaining Cane Valley is indistinguishable from the Caledonia and cannot be separated in mapping. Underlies Judith Fancy Formation.

Present in western part of island.

Cannelton Lithofacies (of Mansfield Formation)

Lower Pennsylvanian: Southwestern Indiana.

H. H. Gray, 1962, Indiana Geol. Survey Prog. Rept. 26, p. 29—33, 39—40. Three lithofacies recognized in the Mansfield: Shoals, Bloomfield, and Cannelton. These three diagnostic rocks make up a little more than half of formation. Cannelton Lithofacies characterized by siltstones and mudstones. Thickness 63 feet in Dubois County; about 47 feet in Perry County.

Well developed in vicinity of Cannelton, Perry County.

Cannery Formation

Lower Permian: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 26—35, pl. 1. Thinly interbedded chert, argillite, and graywacke, and local intercalations of thick-bedded calcareous volcanic graywacke and altered pillow lavas and breccias. Formation tightly folded. Total stratigraphic thickness probably no more than a few thousand feet. Overlies Hood Bay Formation (new) to southwest and Gambier Bay Formation (new) to north. Underlies Pybus Dolomite (new). Southwest of Pybus Bay, formation is buried unconformably beneath nonmarine sedimentary rocks of Tertiary age. Near Gambier Bay, Hyd Formation (new) unconformably overlies the Cannery.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C23—C25. Described in Keku Islets and parts of Kuiu and Kupreanof Islands. On Kupreanof Island, Cannery Formation is intensely deformed, and contact with Middle(?) Devonian Gambier Bay Formation is a fault. Along Hamilton Bay and on prominent mountain on northwestern Kupreanof Island, formation is overlain by Pybus Formation. On islets opposite Kake, the Cannery is overlain by Burnt Island Conglomerate (new) of Late Triassic age. Probably lateral equivalent of Halleck Formation (new).

Typically exposed in and around mouth of Cannery Cove on southwest shore of Pybus Bay, Admiralty Island. Crops out almost continuously from point 3½ miles southeast of Cannery Cove northwestward to north shore of Donkey Bay.

Canoe Formation (in Big Bend Park Group)

Eocene, middle: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pls., tables, figs., road logs. Base is massive yellow crossbedded sandstone overlain by tuff, mudstone, tuffaceous sandstone, indurated tuff, and lavas. Thickness as much as 1,170 feet. Basal formation in group. Underlies Chisos Formation; overlies Hannold Hill Formation (new) of Tornillo Group. Middle Eocene on basis of mammalian remains.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 107—112, pls. Formal proposal of name. Includes massive sandstone, conglomeratic sandstone, cross-bedded sandstone, red, purple, gray, and maroon clay and mudstone, gray and gray-white calcareous tuff, indurated vitric tuff, and basaltic lava. Includes Big Yellow Sandstone Member (new) at base. Local lavas within formation are basalt. Individual flows are 17 to 61 feet thick, near type locality where they are deformed by McKinney Hills intrusion, and are 250 and 575 feet, respectively, above base of formation. Underlies Chisos Formation. Overlies Hannold Hills Formation of Tornillo Group. Thickness 1,161 feet at type section.

Type section (locality): Northeast of abandoned rock crusher on southern edge of Tornillo Flat, Big Bend National Park, Brewster County. Named for Canoe Valley, where its basal unit is folded into a canoe-shaped syncline.

Canyon Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 405—406, pl. 1. Flow has textures and structures which suggest that it may have been emplaced in type of eruption transitional between a lava flow and a pyroclastic flow. Has well-developed, steeply dipping flow banding on both a coarse and fine scale. Thickness more than 1,000 feet near head of Yellowstone Canyon.

Crops out at head of Yellowstone Canyon and east of the canyon in area bounded approximately by Sour and Broad Creeks, Yellowstone National Park.

Canyon Creek Member (of Ericson Formation)

Upper Cretaceous: Northwestern Colorado (subsurface).

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 18. Name suggested for upper part of Ericson (Iles) Formation. Overlies "Rusty Zone" of Ericson (Iles) Formation. Name has been in common use by oil company geologists and others that have interests in Vermilion Basin.

Occurs in Mountain Fuel Supply Co.'s Canyon Creek Field, Moffat County.

Canyon del Rey Diatomite Member (of Monterey Formation)

Miocene, upper: Western California.

O. E. Brown, 1965, *in* Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Name applied to uppermost member of Monterey Formation in type area. Typically a white-weathering, white to cream-colored, very light-weight, punky rock consisting mostly of tests of diatoms, radiolaria, silicoflagellates and foraminifera. Some beds have been altered to porcellanite and opalite indistinguisable from underlying Aguajito Shale Member (new). Bedding is massive in some areas and thinbedded in others. Thickness 800 feet. Corresponds to Galliher's (1931, Micropaleontology Bull., v. 2, no. 4) unit 1. Unit thins substantially east of Los Laureles Grade road and ultimately lenses out into Santa Margarita Formation or else is cut out by faulting. Upper Miocene. Contains foraminiferal assemblage described by Kleinpell (1938, Miocene stratigraphy of California: Tulsa, Okla., Am. Assoc. Petroleum Geologists) as typical of his Delmontian stage.

Named from extensive exposures in Canyon del Rey. Best exposures of stratigraphic section are in road cuts along old Los Laureles Grade road in secs, 9, 10, 15, and 16, T. 16 S., R. 1 W. Unit exposed more or less continuously in long, narrow strip over 8 square miles and is known to underlie about 12 square miles in Monterey and Salinas quadrangles.

Canyon Mountain Complex

Lower to Middle Triassic: Northeastern Oregon.

T. P. Thayer, 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C82—C85. Consists of olivine-rich peridotite, pyroxene-rich peridotite and pyroxenite, serpentine, quartz diorite, and albite granite. Intrudes volcanic and sedimentary rocks of which at least part are Late Permian in age, faulted off at east end and along half of north side. On west, Upper Triassic pillow lava, conglomerate, and graywacke lie unconformably on serpentine that forms part of present border of complex.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548 (with (text). Mapped in Mount Vernon quadrangle, Grant County. Paleozoic rocks have been intruded, and in places completely disrupted, by serpentinite of Canyon Mountain Complex and by associated gabbro and quartz diorite. Most of serpentinite is highly sheared and was moved plastically, mainly before deposition of Upper Triassic(?) rocks. By late Triassic time the Canyon Mountain Complex had been exposed to erosion, for its debris is found in sedimentary rocks of that age.

Named for Canyon Mountain which occupies area about 12 miles long by 15 miles wide across John Day quadrangle, Grant County.

Cape Disappointment Volcanics

Eocene, lower and middle: Southwestern Washington.

See Fort Columbia Volcanic Series.

Capens Formation

Silurian or Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 177, pl. 34. Interbedded red slate, green slate, and conglomerate. Thickness 200 to 400 feet on east side of Deer Island. Underlies Whiskey quartzite (new). Appears to be conformable on undifferentiated strata of Silurian and Devonian age, a transition zone a few feet thick between them.

Type section: Between Capens and Lambert Island in northeastern part of Deer Island on the north limb of an anticline. Exposed on Sugar Island, Deer Island, and adjacent mainland in Moosehead Lake area (Moosehead Lake quadrangle).

Cape Thompson Member (Nasorak Formation)

Lower Mississippian: Northwestern Alaska.

R. H. Campbell, 1967, U.S. Geol. Survey Prof. Paper 395, p. 7—14, pl. 1. A massively outcropping very thick bedded light-gray to light-olive-gray limestone. Thickness about 225 feet. Limestone is chiefly a crinoid biosparite, consisting almost exclusively of coarse sand- to fine pebble-sized crinoid stem fragments and columnals. Locally contains minor amount of very fine quartz silt that has been partly dolomitized and partly silicified. Overlies unnamed shale unit at base of formation. Succeeded by about 50 feet of very thick bedded grayish-black calcareous mudstone containing pyrite concretions and a few pyritized fossils. Lower Mississippian.

Type locality: The promontory of Cape Thompson, vicinity of Chariot Site, Lisburne Peninsula.

Capitol Reef Bed (in Petrified Forest Member of Chinle Formation)

Upper Triassic: Southern Utah.

J. H. Stewart, 1957, Am. Assoc. Petroleum Geologists Bull., v. 41, no. 3, p. 457. A persistent ledge-forming unit at top of reddish-orange facies of Petrified Forest member.

In Capitol Reef area and northern part of Circle Cliffs area, Wayne and Garfield Counties.

Cap Rock quartz monzonite facies

Precambrian: Colorado-Wyoming.

D. H. Eggler, 1967, Mountain Geologist, v. 4, no. 3, p. 109. Informal name applied to outer and inner core of Sherman batholith.

Livermore-Tie siding area, in northern Front Range-southern Laramie Range.

Caps Creek Beds

Lower Jurassic: East-central Oregon.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 30, pls. 1, 3. Along Poison and Caps Creeks and in headwaters of Rosebud Creek (contingous ground in northeastern part of area), about 5 square miles are underlain by poorly exposed strata whose stratigraphic relations are uncertain. These "Caps Creek beds" are in contact with Begg and Brisbois Formations along fault which pre-dates Lower Jurassic Mowich Group. Strata underlie Suplee Formation of late Early Jurassic age with apparent angular unconformity. Rocks are dominantly thin-bedded calcareous sandstone, siltstone, and mudstone. Discontinuous calcirudite beds composed principally of reworked Upper Triassic and Paleozoic detritus. Although beds are mapped separately in this report name "Caps Creek beds" is considered to be informal.

In Suplee—Izee area.

Cap Winn Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 600, pl. 1. Consists of distinctive red jasperoid chert and other types. Thickness about 350 feet. Overlies Harrington Creek Member (new); underlies Ott Creek Member (new).

Named for Cap Winn Creek in Bull Run quadrangle, Elko County.

Capybara Limestone

See 111 Ranch Beds.

Carbide Member (of Shady Formation)

Lower Cambrian: Southwestern Virginia.

E. L. Weinberg, 1963, Geol. Soc. America Guidebook Southwestern Sec. Mtg., p. 6b, 7, (also Virginia Polytech. Inst. Eng. Ext. Ser., Geol. Guidebook 2). Local name for uppermost member of Shady. Predominantly pure calcilutite with local shale beds. Overlies Austinville member. Grades transitionally into superjacent Rome formation.

Occurs in Austinville-Ivanhoe mine area about 70 miles southwest of Roanoke.

Card Member (of Water Canyon Formation)

Lower Devonian: Northeastern Utah.

J. S. Williams and M. E. Taylor, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 38—53. Lower member of formation. Underlies Grassy Flat Member (new); overlies Laketown formation. Composed of thin-bedded white-weathering argillaceous dolostone. Beds of intraformational conglomerate common. Thickness 93 to 334 feet; 221 feet in Logan Canyon East.

Well exposed on ridge behind Card Ranger Station in Logan Canyon. Section measured 6.8 miles east of mouth of Logan Canyon in NE¼ sec. 24, T. 12 N., R. 2 E., Salt Lake Base and Meridian.

Carmelo Formation

Paleocene: Western California.

O. E. Bowen, 1965, *in* Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Oldest unmetamorphosed sedimentary unit in area [Monterey and Salinas quadrangles], is Carmelo Formation first described by Lawson (1893, California Univ. Dept. Geol. Sci. Bull., v. 1). [Lawson used term Carmelo Series.] Unit was given formation status by Bramkamp (1934) in a private report made for Point Lobos State Park. Lawson did not formally name a type locality or measure a type section which might conform to current stratigraphic codes. It is clear he intended Point Lobos (then called Carmelo Point) to be type locality. He measured stratigraphic thickness from exposed base to eroded surface at 800 feet. Only thick section of Carmelo Formation not complicated by complex folding is exposed along sea cliffs across Pebble Beach and Stillwater Cove between Pescadero and Arrowhead Points. This 725-foot section consists of three units: lower, 0 to 100 feet, is interbedded buff arkosic sandstone and dark conglomerate, commonly crossbedded, containing scattered pelecypod and gastropod casts, macerated seaweed and carbonized wood with sparse Foraminifera; contains well-rounded pebbles of red, green, purple and black volcanic rocks; middle, 100 to 625 feet, is massively bedded, yellowish brown, arkosic sandstone made up chiefly of granitic debris; upper, 625 to 725 feet, massive boulder and cobble conglomerate made up almost exclusively of porphyritic granodiorite; contains a few colored volcanic rock cobbles and an occasional gneiss boulder from Sur Series. Overlies granitic rocks and Sur Series. Underlies Chamisal Formation (new). Paleocene on basis of fossils.

Lawson's probable type locality was Carmel Point (now called Point Lobos). Formation crops out in five patches, all adjacent to Carmel Bay, and underlies 3 to 3½ square miles.

Carrara Formation

Lower and Middle Cambrian: Western Nevada and southern California.

H. R. Cornwall and F. J. Kleinhampl, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—157. Interstratified shale and limestone with minor amounts of quartzite, sandstone, and siltstone. Thickness 1,785 feet at typical section. Clastic rocks dominate lower half and limestones the upper half. Lower half commonly has three major subdivisions and upper half, two. Overlies Stirling(?) quartzite; underlies Bonanza King formation; appears to be transitional through zone of irregularly dolomitized limestone with dolomitization increasing upwards into overlying formation.

Harley Barnes, R. L. Christiansen, and F. M. Byers, Jr., 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D27—D30. Described east of Yucca Flat, Nye County, Nev., where it is 1,960 feet thick and is divided into 7 subunits. Subunits 1, 2, 3, were correlated by Johnson and Hibbard (1957, U.S. Geol. Survey Bull. 1021—K) with Poiche Shale of Groom district, subunit 4 with Lyndon Limestone of Groom district, and subunit 5 with Chisholm Shale of Groom district. Jangle Limestone of Johnson and Hibbard is here recognized as member of the Carrara. Subunit 7 is equivalent to lower part of Johnson and Hibbard's Yucca Flat Formation. Gradational with underlying Zabriskie Quartzite Member of Wood Canyon Formation. Transitional with overlying Bonanza King Formation. All but lower 50 feet of subunit 7 was included by Barnes and Palmer (1961) in Bonanza King Formation. Name Carrara seems more appropriate in this area than names Latham Shale, Chambless Limestone, and Cadiz Formation as used by Barnes and Palmer.

B. C. Burchfiel, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 1, p. 46 (fig. 3c), 47—48. Described in Specter Range quadrangle, Nevada, where it crops out in two areas forming slopes below overlying Bonanza King Formation. Total thickness about 1,500 feet. Overlies Wood Canyon Formation. Lower part is Lower Cambrian. Upper part probably lower Middle Cambrian.

H. R. Cornwall and F. J. Kleinhampl, 1964, U.S. Geol. Survey Prof. Paper 454—J, p. J34, pls. 1, 2. Crops out only in west and northeast corners of Bullfrog quadrangle, Nevada and California, where it conformably overlies Corkscrew Quartzite (new). Upper contact not exposed and complex faulting precludes measurement of reliable section.

J. H. Stewart, 1964, U.S. Geol. Survey Bull. 1224—A, p. A61, A67 (fig. 14), A70. Described in southern part of Last Chance Range area, Inyo County, Calif. Consists of gray limestone containing *Girvanella*, greenish-gray phyllitic siltstone, and yellowish-brown silty limestone. Thickness 1,640 feet. Overlies Zabriskie Quartzite; underlies Bonanza King Formation.

Harley Barnes, R. L. Christiansen, and F. M. Byers, Jr., 1965, U.S. Geol. Survey Geol. Quad. Map GQ—363. Described in Jangle Ridge quadrangle, Nye and Lincoln Counties, Nev. Thickness 2,000 feet. A transitional lithologic sequence, upper half limestone with interbedded shale, lower half shale with interbedded limestone. Gradational contacts with underlying Zabriskie Quartzite and overlying Bonanza King Formation.

Harley Barnes and R. L. Christiansen, 1967, U.S. Geol. Survey Bull. 1224—G, p. G10—G11, G16 (table 1). Described in Groom Range, Nev., where it contains 1,870 feet of interbedded limestone, siltstone, shale, and quartzite. Divided into one formal (Jangle) and six informal members which correspond to the seven members described in Halfpint Range by Barnes and others (1962). Overlies Zabriskie Quartzite. Underlies Bonanza King Formation.

Named for Carrara, an abandoned mining camp, 8 miles east-southeast of Beatty, on Nevada Highway 95. Formation well exposed in and near Carrara Canyon, 2 miles northeast of the camp. Typical section measured in canyon one-half mile north-west of Carrara Canyon, Bare Mountain quadrangle, Nye County, Nev.

Carreras Siltstone

Upper Cretaceous or Tertiary, lower: Puerto Rico.

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 63—65, pl. Consists of very fine grained debris in thin to medium beds of light-colored bands or laminae. Seems to be part of thick heterogenous sequence of sedimentary rocks that crops out in northwestern part of adjacent Corozal quadrangle, but because of faulting, stratigraphic continuity within sequence is not known with certainty. This sequence, which has thick reef limestone at base, rests on rocks that may be equivalent to upper part of Pozas Formation (new). Thickness several hundred meters in Ciales quadrangle. The Carreras is in synclinal block that has been tilted southward; siltstone has been strongly folded and locally beds are vertical. Unconformably underlies San Sebastian Formation of middle Tertiary (Oligocene) age. Overlies Pozas Formation (new). Age problematical. Meager fossil evidence suggests Late Cretaceous age. Age designated as either Late Cretaceous (Maestrichtian) or early Tertiary (Paleocene or younger). Rocks of Carreras Formation were referred to Unibon Shale by Semmes (1919) but as he did not describe stratigraphic or areal limits for formation, a new name is necessary.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C14. Exposed in west-central part of Corozal quadrangle where it consists of thin-bedded dark-gray to olive-black locally calcareous volcanic siltstone and some thin beds of volcanic sandstone and tuff. Maximum thickness about 600 m. Contact with underlying Cubuco Formation (new) placed at top of uppermost conglomerate bed. Because of lithologic similarities and stratigraphic position, the Palmarejo Formation (new) may be equivalent to Carreras Siltstone in western part of quadrangle.

Named for outcrops along the Río Las Carreras, east-central Ciales quadrangle.

Carrie Creek Formation

Upper Cretaceous: Southern California.

C. A. Hall, Jr., and C. E. Corbató, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 562 (fig. 2), 565—566, pl. 1. Name provisionally proposed for group of Upper Cretaceous rocks that may be equivalent in age and lithology to Atascadero Formation of Fairbanks (1904, U.S. Geol. Survey Geol. Atlas, Folio 101). However, the U.S. Geological Survey has abandoned the name Atascadero. For purposes of discussion and clarity, name Carrie Creek is herein considered appropriate. Consists of more than 5,000 feet of greenish-brown siltstone, brown to gray or greenish-gray fine to coarse-grained arkosic sandstone, and resistant to nonresistant conglomerate. Overlies Jollo Formation. Underlies unnamed Paleocene [Upper(?) Cretaceous] rocks. Top not exposed in type area.

Type area: Carrie Creek area in eastern part of Nipomo quadrangle, San Luis Obispo County. Crops out west of Nacimento fault and east of East Huasna fault where it lies unconformably upon Lower Cretaceous and Jurassic rocks.

Carson Sand Member (of Gallup Sandstone)

Upper Cretaceous: Northwestern New Mexico (subsurface).

F. F. Sabins, Jr., 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 2, p. 198, 199 (fig. 5). Bisti stratigraphic trap consists of three individual bar sands called Marye, Huerfano, and Carson sands. Earlier writers have designated these sands by numerical or alphabetical "zones," but these systems do not conform with normal stratigraphic procedure nor with industry practice at Bisti. The Marye, Huerfano, and Carson sands are herein defined as individual members of Gallup Sandstone. The three bar sands are referred to collectively as "Bisti bar complex." The Carson Sand Member is the interval 4,870 to 4,900 feet in the type well. The Carson is the least extensive of the three bar sands and is known only from the central part of the Bisti field where it is less than one mile wide. The Carson bar lies southwest of, and parallel with, Huerfano bar. The two bars occupy the same stratigraphic interval above the main Gallup Sandstone and below the Marye bar sand.

Type well: Shell No. 21—13 Carson (NE¼SE¼ sec. 23, T. 25 N., R. 12 W.), Bisti field, San Juan County.

Carson Pass Tonalite

Jurassic-Cretaceous: Central eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend of Markleeville quadrangle.

J. B. Koenig, 1963, Geologic map of California, Walker Lake sheet (1:250,000): California Div. Mines. Quartz diorite and diorite. Name credited to R. B. Parker, 1961, unpub. thesis).

Carson Pass is in Alpine County.

Carson Range flows

See Lousetown flows.

Carter Creek Formation (in Colorado Group)

Upper Cretaceous: Central western Montana.

V. E. Gwinn, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4). Consists of 4,500 to 6,000 feet of intercalated marine, brackish, and fresh-water deposits between Jens formation (new) and overlying unconformable Golden Spike conglomerate or facies of Elkhorn Mountain volcanics. No type section designated.

V. E. Gwinn, 1965, Billings Geol. Soc. Guidebook 15th Ann. Field Conf. p. 48—49. Type area noted. Poorly known because of inadequate exposure. Occurs only in deeper parts of Carter Creek and Gold Creek synclines between Jens and Garrison.

Type area: Between Brock and Carter Creeks. Named from Carter Creek, a south-flowing tributary of Clark Fork, 13 miles southeast of Drummond, Granite County. Partial section (lower 778 feet) measured in NE¼ sec. 20, T. 10 N., R. 11 W., east of Jens.

Cartersburg Till Member (of Trafalgar Formation)

Pleistocene: Indiana.

W. J. Wayne, 1963, Indiana Geol. Survey Bull. 25, p. 48—49, 77. Primarily conglomeratic sandy mudstone, but includes all sediments from surficial soil downward to top of thin fossiliferous silt bed that caps underlying member (Center Till, new). Where fossiliferous silt bed is absent it is difficult to separate the two members. Thickness 30½ feet at type section.

W. J. Wayne, 1965, Indiana Geol. Survey Prog. Rept. 28, p. 7. Radiocarbon dates indicate that Cartersburg till was deposited when ice reached its maximum extent about 20,000 years B. P.

Type section: Cutbank exposed along southwest side of West Fork of White Lick Creek, 2 miles northwest of Cartersburg and 2 miles northeast of Clayton, Hendricks County, in SW¼SE¼SW¼ sec. 23, T. 15 N., R. 1 W., Plainfield quadrangle.

Carter Spring Member (of Chainman Shale)

Upper Mississippian: East-central Nevada.

P. E. Playford, 1962, Dissert. Abs., v. 22, no. 12, pt. 1, p. 4332. Upper part of Chainman Shale includes two members, of interbedded sandstone and shale, which workers in adjacent areas have mapped as either Scotty Wash Quartzite or Diamond Peak Quartzite. Name Carter Spring is proposed for lower of these two members; other not formally named.

Area mapped includes about 200 square miles of Egan Range, near Lund Township, east-central Nevada.

Carver Creek Granite Porphyry (in Musco Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 39, 40. Carver Creek granite porphyry is sill-like mass which has been intruded into Stouts Creek rhyolite. Consists of fine-grained granite porphyry with green and purple mottled groundmass.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Musco group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Carver Creek is in T. 33 N., R. 3 E., Iron County.

Carys Mills Formation (in Meduxnekeag Group)

Middle Ordovician to Lower Silurian: Northeastern Maine.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244–A, p. A54 (table 1), A55. Typically consists of gray-blue limestone and calcareous siltstone interbedded with buff-weathered ankeritic limestone and with gray and green slate. Slate and graywacke lenses present at different stratigraphic levels within the formation in Bridgewater quadrangle, where formation is estimated to be as much as 12,000 feet thick and locally overlies Chandler Ridge Formation (new). Underlies Burnt Brook Formation (new) in Aroostook County. Also underlies Spragueville Formation (new). Conformably underlies and grades into Smyrna Mills Formation of Silurian age in Houlton and Smyrna Mills quadrangles. Now dated as Middle Ordovician (Caradoc) to Early Silurian (A4–B1 of the Llandovery) in age. Has been described as ribbon rock member of Meduxnekeag Formation.

Named after community of Carys Mills, Aroostook County.

Casamero Member (of Morrison Formation)

Jurassic: Northwestern New Mexico.

C. T. Smith, 1967, New Mexico Geol. Soc. Guidebook 18th Field Conf., p. 135. Name proposed for uppermost member of Morrison along north flank of Zuni Mountains. It is only unit that closely resembles type Morrison of Colorado. Member exhibits rapid alternations between very fine-grained sandstone and mudstone and gritty to conglomeratic sandstone and conglomerate. Typically lower part of unit is variegated chocolate- to reddish-brown to green to gray mudstone interbedded with fine sandstone and siltstone. Upper part is massive cliff-forming medium- to coarse-grained poorly sorted quartz sandstone. Average thickness about 80 feet. Overlies Prewitt Member. Underlies Dakota Formation.

Type locality: SW¼NW¼ sec. 4, T. 14 N., R. 12 W., New Mexico base meridian, north flank of Zuni Mountains.

Cascade andesite

A general term for the andesites extruded along crest and margins of Cascade Range during quiet period that followed the explosive phase of volcanism. Hodge (1938) called these flows "Cascan."

Cascade Creek Andesite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 69, 70–71. Intrudes Wiggins formation. Is an east-west-striking plug that dips 55 degrees to the south. Exposed along strike for more than three-fourths mile over a difference of elevation of about 1,000 feet and tapers from about 250 feet wide near east end to about 150 feet on west contact where it has been cross cut by a southwest-striking biotite-hornblende andesite porphyry dike near top of Mount Sniffel Ridge. Mineral composition and texture vary across width of outcrop. In southern and northern parts of plug are hornblende-biotite andesite and hornblende-pyroxene andesite, respectively, while core is dacitic andesite.

Crops out on east side of Mount Sniffel, southern Absaroka Mountains. Name derived from nearby Cascade Creek.

Cascade Pass Quartz Diorite

Miocene: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Three intrusive quartz diorite plutons of probable Tertiary age crop out south of Cascade Pass. The largest, Cascade Pass quartz diorite, is a discordant dike-shape body which has been strongly hornfelsed near Cascade River schist (new) and Eldorado gneiss (new).

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera and in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 103. Age given as Miocene.

Present in area south of Cascade Pass, northern Cascade Mountains.

Cascade River Schist

Age not stated: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Consists of chlorite schist, two-mica schist, biotite paragneiss, calcic-mica schist, and minor meta-conglomerate and marble. Underlies Magic Mountain gneiss (new). Eldorado gneiss (new) appears to have been thoroughly tectonically mixed with Cascade River schist during metamorphism.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 103, 105, 109, 113, 114–115. Skagit Metamorphic Suite, which underlies most of the metamorphic core of the Northern Cascades, comprises the isochemically metamorphosed, predominantly metasedimentary Cascade River Schist and the migmatic Skagit Gneiss thought to be largely derived from the former. Cascade River Schist and Skagit Gneiss were traced southeast from map area [Northern Cascades of Washington] for 30 miles by theses mapping. Thus, the "Martin Ridge Schist" [Youngberg and Wilson, 1952, Econ. Geology, v. 47, no. 1] of Holden quadrangle is now known to be Cascade River Schist. Stratigraphic age of Cascade River Schist is not known. Cascade River Schist sequence may contain Chilliwack strata, but it could be older. Age of Skagit metamorphism is not known either, beyond its being older than mid-Cretaceous orogeny and, presumably, than latest Triassic-Jurassic-early Cretaceous deposition.

Present in area south of Cascade Pass, northern Cascade Mountains.

Cascade Station Member (of Leakesville Formation)

Triassic: South-central Virginia.

C. T. Meyertons, 1963, Virginia Div. Mineral Resources Rept. Inv. 6, p. 12—17, 51—52, 53, 54, pl. 1. Consists of maroon, red, and brown claystones, shales, siltstones, fine- to coarse-grained sandstones, and a few conglomerates. No complete section of all tongues exposed in area, but partial sections of as much as 2,360 feet have been measured. Intertongues with Cow Branch member (new).

Type section: Part of Leakesville type section on State Road 622 and 0.2 mile north of Virginia state line, Pittsylvania County. Named from small station on Carolina and Northwestern Railway about 2 miles northwest of Leakesville Junction.

Casselman Formation (in Conemaugh Group)

Pennsylvanian: Southwestern Pennsylvania and western Maryland.

N. K. Flint, 1965, Pennsylvania Geol. Survey, 4th ser., County Rept. C56A, p. 85—91, pl. 1. Name given to upper formation of Conemaugh Group. Overlies Glenshaw Formation (new) and includes about 500 feet of beds up to base of Pittsburgh coal bed. Base of Pittsburgh coal bed is well-established boundary between Conemaugh and overlying Monongahela strata. Beds of formation are variable and difficult to trace and correlate. Contains as many as 15 thin nonpersistent coals and eight fresh-water limestones or calcareous zones. Coal beds and limestone beds tentatively correlated with beds in western Maryland and West Virginia sections. Many type localities of strata in this unit are in Georges Creek-Wellersburg syncline of western Maryland and Pennsylvania. For descriptive purposes formation divided into three stratigraphic units or intervals. In lower Grafton sandstone-Wellersburg coal interval, 160 feet thick, following stratigraphic units recognized (ascending): lower Grafton sandstone, Federal Hill coal, upper Grafton sandstone, Birmingham red bed, Barton limestone, Barton coal, and Wellersburg limestone. Wellersburg coal-Lonaconing coal interval is poorly known. Seven named stratigraphic units recognized (ascending): Wellersburg coal, Morgantown sandstone, lower Clarysville coal, Niverton shale, upper Clarksburg limestone, and upper Clarysville coal. Shale beds lying between these units not named. Lonaconing coal-Pittsburgh coal interval contains Lonaconing coal, Franklin coal, unnamed coal bed between the two, unnamed fresh-water limestone above Franklin coal, Franklin "rider" coal, unnamed coal above it, lower Pittsburgh limestone, Little Pittsburgh coal, and Morgantown coal.

Named for good exposures along Casselman River valley in Berlin syncline, both in Somerset County, Penn., and in Garrett County, Md.

Castalia Marl

Pleistocene (Wisconsin): Northeastern Ohio.

V. Sterki, 1920, Ohio Jour. Sci., v. 20, no. 6, p. 177—184. Named applied to fossiliferous marl present in vicinity of Castalia. Most of marl is soft, but at places with hard concretions, and here and there blocks and even rocklike masses of travertine. There is hardly a doubt that the Castalia marl is of comparatively recent origin, possibly still in the process of formation in eastern marshy part of area.

Aurele La Rocque, 1967, Ohio Geol. Survey Bull. 62, pt. 2, p. 349. Castalia marl mentioned in report on Pleistocene mollusca of Ohio.

In Erie County, west of Castalia and east of Sandusky Bay, deposit extends over several miles with surface about 30 feet above level of Lake Erie, about 10 feet deep where opened, and underlain by clay. Marl has been used for manufacturing of Portland cement.

Castle Gardens sandstone

Upper Cretaceous: Central Wyoming.

W. R. Keefer, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 182. A local name applied to the alternation of white-weathering massive lenticular sandstone beds of bluish-gray and brown weathering carbonaceous shale that is characteristic of the Lance.

Well displayed in vicinity of Castle Gardens, Fremont County.

Castle Reef Dolomite (in Madison Group)

Lower and Upper Mississippian: Northwestern Montana.

M. R. Mudge, W. J. Sando, and J. T. Dutro, Jr., 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 11, p. 2005—2006, 2014—2018. Upper formation of Madison Group in Sawtooth Range. Thickness 640 to 810 feet. Subdivided into Sun River Member and a lower unnamed member that makes up lower one-half to two-thirds of formation. Lower member is essentially same as MB unit of Sloss and Laird (1945, U.S. Geol. Survey Oil and Gas Inv. Prelim. Chart 15). Overlies Allan Mountain Limestone (new). Osage and Meramec.

M. R. Mudge, 1965, U.S. Geol. Survey Geol. Quad. Map GQ-381. Mapped in Sawtooth Ridge quadrangle, Teton and Lewis and Clark Counties where it is 730 to 815 feet thick and includes Sun River Member at top. Overlies Allan Mountain Limestone. Unconformable below Sawtooth Formation of Ellis Group.

Type section: East face of ridge just north of west end of Diversion Reservoir, Teton County.

Castlewood Member (of Spechts Ferry Formation)

Middle Ordovician (Champlainian): Eastern Missouri, western Illinois, northeastern Iowa, and Minnesota.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 107—110, 235—236. Consists of dark-brown shale, bentonite, and argillaceous limestone. Chert at base in type area. Thickness about 7 feet at Caledonia, Minn. Underlies Glencoe Member (new); overlies Quimbys Mill Formation of Platteville Group. Castlewood of this report is equivalent only to basal Carimona Limestone in type area, but where upper unit is absent, which is common south of Decorah, Iowa, the Carimona is equivalent to the Castlewood.

Type section: Exposure in south bluff of Meramec River along St. Louis-San Francisco Railroad, a quarter of a mile east of Mincke Siding, St. Louis County, Mo., near center E½SESE 21, 44N—4E, Manchester quadrangle. Named for village of Castlewood, St. Louis County, 1½ miles northeast of type section.

Cataract Creek Gravels

Age not stated: Northwestern Arizona.

Donaldson Koons, 1964, Arizona Geol. Soc. Digest, v. 7, p. 108—112. Cataract Creek Gravel is reworked Frazier Well Gravel. Both gravel units consist of bedded but poorly sorted pebbles, cobbles, and small boulders as much as 20 inches in long diameter composed of red and white quartzite, vein quartz, granitic and gneissic rocks, chert, and sandstone. Age not stated. Frazier Well Gravel may have been deposited any time during Miocene or Pliocene but is probably no younger than early Pleistocene. Older than Robbers Roost Gravel.

Crops out near Rose Well, Cataract Creek, and in isolated places north of Rose Well, eastern Hualpai Indian Reservation.

Cathedral Cliffs Formation

Eocene, lower: Northwestern Wyoming and southwestern Montana.

W. G. Pierce, 1963, Geol. Soc. America Bull., v. 74, no. 1, p. 9—22. Name proposed for rocks in Clarks Fork area that have long been known by informal name "early and breccia." Composed of tuffs, with lesser amounts of volcanic sedimentary rocks and breccias. Thickness ranges from less than 100 feet to about 1,500 feet but more commonly 500 to 900 feet. At type locality overlies Madison Limestone. Underlain by rocks ranging from Precambrian to late early Eocene or early middle Eocene and unconformably overlain by early basic breccia of middle Eocene age.

Type locality: At west end of north face of Cathedral Cliffs, a prominent feature on south side of valley of Clarks Fork of Yellowstone River in southeastern part of Beartooth Butte quadrangle.

Cathedral Mountain Formation

Lower Permian (Leonard): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1584 (fig. 2), 1586. Name proposed for yellow-weathering limestones and small pebble conglomerates which overlie Sullivan Peak Member of Skinner Ranch Formation (both new) and which formerly constituted most of Leonard Formation of King (1931, Texas Univ. Bull. 3038). Thickness 1,145 feet at type section; 1,600 feet on north side of Lenox Hills. Underlies Road Canyon Member (new) of Word Formation.

G. A. Cooper and R. E. Grant, 1966, U.S. Geol. Survey Bull. 1244—E, p. E5—E6, pls. 1, 2. In western part of outcrop area includes Wedin Member (new).

Type section: On west side of Sullivan (Yates) Ranch road from north slope of Lenox Hills to base of "First limestone member" of Word Formation. King's (1931) section 12, Leonard Formation, beds 19 through 38, is designated as type section. Beds are exposed in front of and along base and lower slopes of Cathedral Mountain, Brewster County.

Catskin Formation

Upper Cretaceous (Cenomanian-Coniacian): West-central California.

E. V. Tamesis, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 237. Eight stratigraphic units ranging from Early to Late Cretaceous are recognized in area. In descending [ascending?] order these are: Badger Shale, Risco Formation, Johnson Peak Formation, Catskin Formation (new), Lovel Shale (new), Redman Sandstone, Willow Spring Mudstone (new), and Moreno Formation. Unconformities exist between Campanian Redman and Maastrichtian Willow Spring Mudstone, Redman and Santonian Lovel Shale, and the Lovel and Cenomanian-Coniacian Catskin Formation.

Area of report is Avenal Ridge-Reef Ridge area of Southern Diablo Range, 200 miles southeast of San Francisco, in Fresno and King Counties.

Cave Creek quartz monzonite

Precambrian: Central Arizona.

G. W. Putman and C. W. Burnham, 1963, Geochim. et Cosmochim. Acta, v. 27, no. 1, p. 61, 73—74. Name used for a rock unit in trace elements study. A coarse-grained biotite quartz monzonite porphyry. Name as used herein has no claim to priority.

Makes up Cave Creek batholith that extends from point just south of Cave Creek, where it is intrusive into Pinal(?) schist, westward to Verde River; and for an undetermined distance to south where it is covered by alluvium. To southeast it disappears under metasedimentary rocks and volcanics of Mazatzal Range.

Cave Hill Member (of Kinkaid Formation)

Upper Mississippian (Chesterian): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 6 (fig. 2). Named on rock classification chart where it is middle member of formation. Overlies Negli Creek Member; underlies Goreville Member (new).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 42, 43, 44, 45, 62—63, pl. 1. Name formally proposed in this report for middle member of Kinkaid Formation of Elviran age. Consists of shale and limestone with shale beds at its boundaries. Unit is 85 to 90 feet thick near its type but is thickened to 108 feet by tectonic squeezing in its type section, which is in synclinal axis of drag of large fault. Overlies Negli Creek Member; underlies Goreville Member.

Type section: In roadside ditch and in stripping above an abandoned quarry on west slope of Cave Hill about 4 miles northeast of Rudemont, SE¼SW¼NW¼ sec. 3, T. 10 S., R. 7 E., Rudemont quadrangle, Saline County.

Cave Valley Formation

Pliocene-Pleistocene: East-central Nevada.

H. E. Kellogg, 1964, Geol. Soc. America Bull., v. 75, no. 10, p. 958—959, pl. 1. Basal unit in north is conglomerate of pebbles, cobbles, boulders, and blocks up to 30 feet long of bluish-gray, light-gray, or medium-gray limestone and dolomite. Most of formation above basal cliff is fine- to coarse-grained silt, sandstone, and conglomerate. At one contact (sec. 10, T. 10 N., R. 63 E.), Cave Valley Formation appears to overlap the younger volcanic flows, and both units rest with marked angular unconformity upon beds as young as Upper Tertiary sedimentary rocks (medial Miocene-Pliocene?). Seems unlikely that the two formations are much older than Pleistocene or latest Pliocene, since some time must be allowed for tilting and erosion of underlying rocks. On other hand, Cave Valley Formation has been tilted eastward as much as 24°. From structural considerations an earliest Pleistocene age seems reasonable for flows and at least lower part of Cave Valley.

Extensively exposed in Cave Valley, from north border of southern White Pine County to Single Pass area, central Lincoln County.

Cedar Bluff Group (in Mammoth Cave Megagroup)

Mississippian (Valmeyeran-Chesterian): Western Kentucky and southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 5 (table 1), 6 (fig. 2) 10—13, pl. 1. Predominantly limestone and consists of (ascending) Renault Limestone, Yankeetown Shale, and Downeys Bluff Limestone. Thickness 70 to 130 feet. Overlies Aux Vases Sandstone; underlies West Baden Group.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 46, 63, pl. 1. Name formally proposed in this report for Downeys Bluff, Yankeetown, and Renault (including both Shetlerville and Levias Members) Formations in areas where these formations are dominantly limestone. Name is exact objective synonym of Ohara. Reinstatement of Ohara in its original meaning would cause confusion because Ohara now has widespread informal use in subsurface of deeper part of basin for an earlier unit, the Karnak Member of Ste. Genevieve. Lies between Aux Vases and Bethel Sandstones.

Type section: Cedar Bluff (formerly Ohara) quarry near Princeton, Caldwell County, Ky.

Cedar Bluffs Till

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 32, 54—55. Thickness about 17½ feet at type locality where it occurs above Fontanelle Soil developed at top of Nickerson Till (new). Fluviatile equivalent of the Cedar Bluffs in periglacial region is Walnut Creek Formation (new).

Type locality: In bluffs on southwest side of Platte River valley below Boy Scout Camp Cedars, about 3 miles northeast of town of Cedar Bluffs, in SW¼NE¼ sec. 24, T. 17 N., R. 7 E., Saunders County. Well represented in prominent drainage divide between Big Blue River and Missouri River drainages in southeastern Nebraska where it forms prominent lateral moraine.

Cedar Breaks Formation

Paleocene(?): Southern Utah.

M. C. Schneider, 1967, Brigham Young Univ, Geology Studies, v. 14, p. 143—194. Cedar Breaks strata form the "Pink Cliff Series" in southern Utah. These "Pink Cliffs" were first described by Dutton (1880, U.S. Geol. and Geog. Survey Rocky Mountain Region). They form uppermost of four great platforms of plateau-cliff step sequences that develop downward to Grand Canyon on south. Lithology variable. Major lithologic categories are, calcisilite, calcilutite, argillaceous calcilutite and small amounts of sandstone and conglomerate. In Pavant Range, north of Richfield, total thickness, traced and measured as continuous section from North Horn Formation below to Green River Formation above is 1,907 feet. Thickness decreases southward to 1,434 feet at Cedar Breaks (type section), then eastward decreases to 605 feet at Bryce Canyon. Within Pavant Mountains the orange and red colors of the dominantly clastic Cedar Breaks Formation north of Richfield grade rapidly north and east into the light-brown colors of the less clastic Flagstaff in Valley Mountains. Hence Cedar Breaks Formation is southern and western equivalent of Flagstaff but is deemed sufficiently different in color, topographic expression, and lithologic content to merit separate designation. In south-central Utah, Cedar Breaks strata have heretofore been designated as either lower part of Wasatch Formation, when Brian Head Formation was not separately designated, or as entire Wasatch Formation, excluding the Brian Head. Cedar Breaks Formation is older than type Wasatch Formation of Wyoming and is so separated from type Wasatch and is so different in lithology that continued designation of southern Utah sequence as Wasatch is inappropriate and term Wasatch is herein abandoned. At type section the Cedar Breaks underlies Brian Head Formation and overlies Kaiparowits Formation. Since the Flagstaff is eastern equivalent of the Cedar Breaks Formation in Pavant Range, the Cedar Breaks is considered in this report Paleocene(?) after the age of the Flagstaff rather than Eocene after the type Wasatch.

Type section: At Cedar Breaks National Monument. Section is located primarily along the topographic nose called "Adams Barrier" in NW½ sec. 27, T. 36 S., R. 9 W., Iron County. Top of "Adams Barrier" is forested and faulted and major white cliff-forming units are readily traced laterally, top portion of type section was measured along second nose to east. This top portion is located along upper part of topographic nose between Labyrinth and Highleap Canyons in sec. 23, T. 36 S., R. 9 W.

Cedar City Formation

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Middle Devonian strata of central and northeastern Missouri were formerly assigned to Callaway formation, which embraced Callaway and Cooper limestone facies. These strata are herein designated Cedar City formation. Names Cooper and Callaway retained to designate lithofacies of the formation. The Cooper lithofacies is divided into seven physiofacies and the Callaway lithofacies is divided into four physiofacies.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 9—44. Formal proposal of name. Unklesbay (1952, Missouri Geol. Survey and Water Resources, 2d ser., v. 33, p. 30—39) revised usage of terminology applied to Middle Devonian of central Missouri. In describing Middle Devonian in Boone County he used Callaway as a formational designation embracing the Callaway, Cooper, and Asland Limestone facies. The latter three limestones had previously been recognized as formations. The Mineola (Branson, 1920) was not recognized in Boone County at that time. As fieldwork on the Middle Devonian of central and northwestern Missouri progressed, it became evident that the Cooper, Callaway, Mineola, and Ashland Formations were actually facies of a single formation as had been suggested by Unklesbay. To avoid confusion resulting from usage of name Callaway as both a formation name and as a name for a facies of the same formation, name Cedar City Formation is herein proposed to embrace all middle Devonian of central and northeastern Missouri. Decision to replace name Callaway as a formational designation rather than a facies designation was prompted by fact that the Middle Devonian of central and northeastern Missouri can be readily divided, grossly, into two distinct limestone facies, the Cooper and the Callaway, which interfinger with one another. The Cooper is a nearly dense limestone, lacking clastic deposits in most places, except basally, and containing few megafossils. The Callaway is a fine- to coarse-grained limestone containing many clastic deposits and many megafossils. The Ashland and Mineola Formations of E. B. Branson are here regarded as a biofacies (*Rensselandia* Beds) and a physiofacies, respectively, of the Callaway Lithofacies. The Cooper Lithofacies is subdivided into seven physiofacies: Lamine River Conglomerate, Shiel Clay, Ralls Oolitic Limestone Conglomerate, Little Shaver Creek Laminated Limestone, Smithton Limestone, and Clifton City Sparritic Limestone. Calaway Lithofacies is divided into four physiofacies: Lupus Sandstone, Mineola Crinoidal or arenaceous Limestone, Sandy Hook Dolomitic Limestone or Dolomite and Calwood Limestone. The various physiofacies of the Cooper and Callaway Lithofacies interfinger with one another. Thickness 15 to 70 feet.

Type area: Along northwest and southeast sides of U.S. Highway 54 in N½SW sec. 36, T. 45, N., R. 11 W., Callaway County. Name derived from town of Cedar City, which is 0.5 mile directly north of Missouri River Bridge at Jefferson City and about 3.75 miles southwest of type area.

Cedar Cove Formation

Middle and Upper(?) Devonian: Southeastern Alaska.

R. L. Loney, W. H. Condon, and J. T. Dutro, Jr., 1963, U.S. Geol. Survey Bull. 1108—C, p. C8 (table 1), C17—C23, pl. 1. A sequence of clastic and carbonate rocks overlying Kennel Creek limestone (new) and overlying Freshwater Bay formation (new). At type section divided into two members: a lower dominantly thin-bedded argillite and an upper dominantly limestone. Maximum exposed thickness at type section about 2,660 feet.

Type section: Extends from point on west shore of Cedar Cove, about due west of Cedar Island, northwest along shore for distance of about 3 miles, Freshwater Bay area, northeastern part of Chichagof Island.

Cedar Forest Formation

Triassic: South-central Virginia.

C. T. Meyertons, 1963, Virginia Div. Mineral Resources Rept. Inv. 6, p. 27—30, 62, pl. 1. Red shale and conglomerate sequence that lies disconformably above Leakesville and Dry Fork formations (both new). Thickness 87 feet at type section.

Type locality: Along Virginian Railway about one-half mile northwest of Long Island Station in Campbell County. Name taken from small community at junction of State Roads 761 and 639 in northern Pittsylvania County, about 2 miles south of type locality. Total outcrop about 7 square miles.

Cedar Fork Member (of Burlington Limestone)

Mississippian (Osage Series): Southeastern Iowa.

S. E. Harris, Jr., and M. C. Parker, 1964, Iowa Geol. Survey Rept. Inv. 1, p. 6 (fig. 3), 10 (fig. 6), 11 (fig. 7), 16, 18 (fig. 11), 22 (fig. 4). Coarsely to very coarsely crystalline crinoidal limestone. Scattered glauconite present throughout. Thickness about 18 feet. Overlies Haight Creek Member (new); underlies Keokuk Limestone. Subsurface data.

Type section: Leonhard quarry, SE cor. sec. 1, T. 71 N., R. 4 W., Des Moines County. Quarry is near east bank of Cedar Fork Creek. Forms massive cliffs and overhangs.

Cedar Hill Andesite

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 46—47, pl. 1. Andesite flow rocks. Typically green or red and commonly has green and red color bands. Sequence thins northeastward from thickness of more than 300 feet in vicinity of Henry's Cabin to 200 feet on west flank of Gillespie Mountain, and to about 100 feet north of Gillespie Mountain. Thins southeastward from Henry's Cabin along Cowboy Rim where it pinches out. Overlies Basin Creek Tuff (new). Locally near Gillespie Mountain a 10-foot sandstone unit lies between the andesite and the underlying tuff. Underlies Young Ranch Tuff (new) with disconformable contact. Gillespie Tuff appears to lie conformably on the Cedar Hill in most places.

Named for exposures on Cedar Hill, Walnut Wells quadrangle, Hidalgo County. Crops out from Cedar Hill along western part of Animas Mountains near mouths of Thigpen and Cottonwood Creeks.

Cedar Ridge Glaciation, Till

Pleistocene: Northwestern Wyoming.

G. M. Richmond, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D132—D136. Name Cedar Ridge Till applied to oldest of three pre-Bull Lake tills. Disconformably underlies Sacagawea Ridge Till (new). Thickness 40 to 50 feet at type locality where it overlies conglomerate of Tertiary age. Cedar Ridge, Sacagawea Ridge, and Dinwoody Lake (new) Tills may be equivalent to Rocky Flats Alluvium (oldest), Verdos Alluvium, and Slocum Alluvium of Denver Basin, which in turn are correlated with Nebraskan, Kansan, and Illinoian Glaciations. For purposes of correlation in Rocky Mountain region, terms Cedar Ridge, Sacagawea Ridge, and Dinwoody Lake Glaciations are proposed from type localities of their respective tills.

G. M. Richmond, 1964, U.S. Geol. Survey Prof. Paper 501—D, p. D104—D109. Younger than Washakie Point Glaciation and Till (both new). Dinwoody Lake Glaciation and Till abandoned.

Type locality: Cedar Ridge on north side of Bull Lake, center sec. 31, T. 3 N., R. 3 W., Fremont County.

Cedar Springs Dolomite Bed (in Blaine Formation)

Permian (Guadalupean): West-central Oklahoma.

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, p. 32 (fig. 7), 33 (fig. 8), 34, 205, pl. 1. Name given to dolomite at base of Blaine Formation, conformably overlying Flowerpot Shale and grading upward into Medicine Lodge Gypsum. Thickness about 9 inches at type area where it is light gray, fine grained, oolitic, and massive, and has a few compact portions that are nonoolitic. In central Major County, unit is almost 3 feet thick, the lower 1½ feet being argillaceous, with a 3-foot thick impure massive gypsum beneath it included in Flowerpot Shale.

R. O. Fay, 1964, Oklahoma Geol. Survey Bull. 98, p. 30—32. In Blaine County, the Cedar Springs is same as in type area except that it is 1 or 2 inches thick. Southward into Canadian County, grades laterally into Chickasha Formation.

Type section: Exposed in high bluff along east bank of Sand Creek in NW¼ sec. 20, T. 20 N., R. 12 W., southern Major County. Named from town of Cedar Springs in north-central part of Major County.

Cedartop Dolomite Bed (in Blaine Formation)

Permian: North-central Texas.

Robert Roth, 1945, Geol. Soc. America Bull., v. 56, no. 10, p. 901. Consists of dense blocky buff dolomite, light-gray-buff dolomite, and light-buff dense dolomite. Thickness about 10½ feet. McCaulley dolomite at type locality is probably Cedartop in age.

E. C. Pendery, 3d, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 10, p. 1836, 1837. Investigations have revealed that definitions of Blaine of Texas are not equivalent to original definition of Blaine in Oklahoma. Suggestions made to correct nomenclature regarding the "Blaine of Texas." Van Vacter Gypsum Member of Blaine was named for exposures on Van Vacter Ranch, Oklahoma. Van Vacter consists of alternating gypsums, shales, and dolomites with gypsum predominating in Oklahoma, and dolomite in north-central Texas. Several persistent dolomites occur within the Van Vacter stratigraphic interval, some of which have member status. The "Cedartop", Acme, and Shimer Dolomites have been named from localities in Texas. These units should be referred to "Beds" because they occur in Van Vacter Gypsum Member. The "Cedartop" Dolomite Bed (Roth, 1945) is used as informal name in present report due to conflict with Cedartop Gypsum Member. The McCaulley Dolomite Beds are considered equivalent to the Acme.

Named from exposures in southeast part of sec. 104, John B. Rector Survey, Block A, King County, Tex.

Celta Formation

Tertiary: Western Nevada.

E. R. Larson and L. H. Beal, 1966, Geol. Soc. America, Cordilleran Sec., Guidebook for Field Trips April 6-11, p. B24. As shown on map legend volcanic rocks include flows, breccias, agglomerates, and tuff; dikes and plugs. Formations in area include Hartford Hill Rhyolite, Celta Formation, Chloropagus Formation, and Kate Peak Formation.

Area of field trip is from Fernley, Lyon County, through Storey County to Reno, Washoe County.

Cenotaph Volcanics

Tertiary: Southern Alaska.

George Plafker, 1967, U.S. Geol. Survey Misc. Geol. Inv. Map I-484. Name applied to an unfossiliferous unit about 1,250 feet thick characterized by green, red, and purple andesitic volcanic breccia, tuff, and flows interbedded with tuffaceous siltstone, glauconitic sandstone, pebble conflomerate, and minor coal. Intertongues with and is in part unconformably overlain by a sparsely fossiliferous marine unit herein named Topsy Formation. Unconformably overlies pre-Tertiary rocks. Unconformable below Yakataga Formation.

Type section: Along south shore of Cenotaph Island in Lituya Bay.

Centerburg Till

Pleistocene: Northeastern Ohio.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. A deposit of Scioto glacial lobe. Correlates with Haynesville till, a-deposit of Killbuck glacial lobe.

Report discusses glacial geology of Richland County.

Center Creek Flow (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 30, fig. 18. Member of "Upper" Basalt of Columbia River Basalt [Group]. Thickness about 170 feet. Separated from underlying Grave Creek Flow (new) by two unnamed flows totalling about 150 feet in thickness. Separated from overlying Johns Creek Flow (new) by two unnamed flows about 180 feet thick.

Named from exposure in Center Creek Canyon about 1,200 feet below surface of Doumecq Plateau. Well exposed in north in Rock and Grave Creek Canyons.

Center Grove Till Member (of Trafalgar Formation)

Pleistocene: Indiana.

W. J. Wayne, 1963, Indiana Geol. Survey Bull. 25, p. 41—42, 72. Generally capped by thin layer (10 to 30 centimeters) of silt through which the modern soil profile extends where Cartersburg Till Member (new) is absent. This silt cap is series of thin lenses of fossiliferous gray to brown silt that form key bed for identification of top member in places where it underlies the Cartersburg. In some exposures, particularly along Wabash Valley in north-central Indiana, tongue or lens of outwash facies of Atherton Formation separates the two members, but in places where this separating unit is absent, differentiation within Trafalgar Formation is rarely possible.

W. J. Wayne, 1965, Indiana Geol. Survey Prog. Rept. 28, p. 7. Radio carbon dates indicate that Center Grove till was deposited when ice reached its maximum extent about 21,000 years B. P. and that the Cartersburg till is about 1,000 years younger. A fossiliferous silt bed, called *Vertigo alpestris oughtoni* bed (Wayne, 1963), which lies at top of the Center Grove and separates it from overlying Cartersburg till, is source of the wood fragments that were used to date the younger till.

Type section: Cutbank exposure along Honey Creek in NE¼SE¼SE¼ sec. 15, T. 13 N., R. 3 E., Bargersville quadrangle.

Center Hill Bentonite Bed (in Dowelltown Member of Chattanooga Shale)

Upper Devonian: Central Tennessee.

L. C. Conant and V. E. Swanson, 1961, U.S. Geol. Survey Prof. Paper 357, p. 24 (fig. 5), 30—33, pl. 7. A bed of benonite 0.05 feet to 0.14 feet thick about 2 feet below top of Dowelltown member.

Type exposure: At proposed standard locality of Chattanooga shale along east approach to Sligo bridge, De Kalb County. Named for exposures near Center Hill Reservoir in De Kalb, Putman, and White Counties.

Center Peak Latite

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines Mineral Resources Geol. Map. 17. Flow of light-gray latite with conspicuous acicular hornblende phenocrysts. Overlies Gillespie Tuff and underlies Park Tuff (both new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 52—54, pl. 1. A hornblende latite. Unconformably overlies Gillespie Tuff. Unconformably overlain by Park Tuff and OK-Bar Conglomerate. Maximum thickness (about 1,000 feet) between Center Peak and point about 2 miles to south. Thins in all directions from this area. Pinches out about 2½ miles north and 2 miles west of Center Peak.

Named for Center Peak, Walnut Wills quadrangle, Hidalgo County. Present only in southwestern part of quadrangle, within radius of several miles of Center Peak.

Centerville Stade, Drift, Till

Pleistocene (Illinoian): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 665, 672, 681 (fig. 3, table 6). Till below interstadial organic-rich silt, consisting of till units 1, 1, and 2 in Wildman, Smith, and Darrah Farm sections (figure 2), respectively, is considered to represent an Illinoian glacial stade, here called Centerville glacial stade. Centerville stade followed by Abington interstade (new). Centerville till overlies older drift and bedrock; underlies Abington silt.

Type section: Wildman farm section, which is composite of three nearby (0.1 mile) exposures along south bank of small stream in NE¼ sec. 33, T. 16 N., R. 14 E., Wayne County. Named from Centerville, the town nearest type area.

Central facies (of McAfee Adamellite)

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 132 (fig. 2), 141. McAfee Adamellite (new) is a complex of three texturally different facies—Aiken, Central, and Garden. The Aiken is porphyritic and the other two are equigranular. The Central facies has a grain size of about 4 mm. The Garden facies average 1 to 2 mm.

Within mapped area, Mount Barcroft quadrangle, is 31 square miles of Central facies, extending from Fish Lake Valley at an elevation of 5,500 feet to peaks greater than 12,000 feet. White Mountains.

Central Sheba Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 8, 26, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Central Sheba is a stage III flow in which the edge of the flow is visible. The present surface is rough but lava tops have broken down and cannot be recognized. Central Sheba vent produced one of the large lava flows of region. It can be traced for 13 miles into a canyon, a tributary of the Little Colorado River. In the canyon it is covered by deep deposits of volcanic ash so that the end cannot be seen. Central Sheba flow seems to have followed down lower part of preeruptive canyon of Walnut Creek. How far it went cannot be determined. Possible that the flow followed canyon of the Little Colorado past Grand Falls and is represented by lower flow at Grand Falls. South Sheba Crater produced a thick flow which traveled about 2 miles. This flow is superimposed on Central Sheba Flow and also on the flow from Saddle. Not known whether Central Sheba flow lies on Saddle flow or not.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 8, 28, 37, 53. According to Damon (1966, Geochronology Labs., Washington) paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II, all of stage III, IV, and V basalts were extruded during the last 0.85 m.y.

Central Sheba cone is north of Walnut Creek.

Cerro Alto Limestone (in Hueco Group)

Lower Permian: Western Texas and eastern New Mexico.

T. E. Williams, 1963, Yale Univ. Peabody Mus. Nat. History Bull. 18, p. 13 (fig. 6), 20—24, fig. 1 (geol. map), fig. 7. At type locality consists of a little more than 460 feet of medium-light-gray and medium-gray medium- and thin-bedded limestone, typically possessing undulatory bedding. Underlain and overlain conformably by Hueco Canyon formation and Alacran Mountain formation respectively (both new). Fauna listed.

Type section: Exposure in south walls of Hueco Canyon, in central part of Hueco Mountains, Hudspeth County, Tex. Named for exposures south-southwest of Cerro Alto in Hueco Mountains.

Cerro Gordo Formation

Cretaceous: Puerto Rico.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60—61, pl. 1. Mainly plagioclase-rich flow rock; minor tuff and breccia. Massive flows predominate over epiclastic tuffs and conglomerates. Estimated thickness about 1,000 to 2,000 feet. Overlies Río Orocovis Formation. Underlies Santa Olaya Formation (new).

Exposed in north-central Puerto Rico.

Cerro Rubio Quartz Latite

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 57—58, pl. 1. A light- to dark-gray rock which, at southerly of the two domes, weathers grayish red. Intruded into Cerro Toledo Rhyolite (new) on west side of Cerro Rubio. Tshirege Member (new) of Bandelier Tuff on east side of the dome lies unconformably against the quartz latite.

Type section: Two conical extrusive volcanic domes that form Cerro Rubio, Los Alamos area. Also exposed on unnamed peak on northeast side of Valles Caldera north of Valle de los Posos.

Cerros de Rio Basalt

Age not stated: New Mexico.

V. C. Kelley and others, 1961, New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 57 (fig. 7). Named on diagram showing stratigraphic relations of Santa Fe group and volcanic rocks of Jemez Mountains and Rio Grande area.

Cerro Toledo Rhyolite (in Tewa Group)

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 56—57, pl. 1. A fine-grained light-gray banded rock. Domes of Cerro Toledo Rhyolite cut across and lap onto rocks of Tschicoma Formation near Rito de los Indos at northwest end of Sierra de Toledo and at Rabbit Mountain. In turn, the Cerro Toledo Rhyolite is cut and overlapped by Cerro Rubio Quartz Latite (new) dome at Cerro Rubio, and by Valles Rhyolite (new) domes on south side of Sierra de Toledo. Overlain with erosional unconformity by Tshirege Member (new) of Bandelier Tuff on northeast side of Sierra de Toledo and by Quaternary fan deposits on edge of Valles Caldera.

Type locality: On northeast side of Valles Caldera in steep forested northwestward-trending ridge—the Sierra de Toledo—between Rito de los Indos and Valle de los Posos, Los Alamos area. Highest parts of ridge are more than 10,000 feet in altitude. Rabbit Mountain on southeast side of the caldera is a composite dome of Cerro Toledo Rhyolite. Name derived from Cerro Toledo, a peak in the Sierra de los Valles, northwest of the Valles Caldera.

Chadwell Member (of Lee Formation)

Mississippian and Pennsylvanian: Southeastern Kentucky.

K. J. Englund, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B30—B38. Name proposed for strata previously referred to as sandstone member A (Englund and others, 1963). Crops out in two resistant ledges of well-sorted quartzose sandstone which are separated by tongue of Pennington shale northeast of Chadwell Gap. Near White Rocks, lower ledge wedges out and at its extremity grades into sandstone of Pennington Formation. Both ledges are exposed in Cumberland Gap section where they total 150 feet in thickness, including intervening bed of carbonaceous shale with thin coal beds and associated underclay. Thickness 182½ feet at type section. Underlies White Rocks Sandstone Member and where White Rocks is absent the Dark Ridge Member (new). Locally overlies Pinnacle Overlook Member (new).

Type section: Chadwell Gap, a notch in Cumberland Mountain, about 10 miles northeast of Cumberland Gap.

Chagvan Glaciation

Chagvan Drift

Pleistocene: Southwestern Alaska.

S. C. Porter, 1967, Arctic, v. 20, no. 4, p. 227—246. Present investigation disclosed that glacier ice had invaded Chagvan Bay area from east and had pushed north into lower part of Salmon River Valley. Four drift sheets recognized, from oldest to youngest, Kemuk, Clara Creek, Chagvan, and Unaluk. Drill-hole information from the area between Happy Creek and head of Chagvan Bay shows that Chagvan Drift decreases in thickness progressively northward toward drift border. Maximum inferred thickness of drift sheet along constructed section (fig. 3) is 175 feet; average thickness is probably between 50 and 100 feet. South of last prominent recessional ridge, Chagvan Drift lies directly on oxidized preglacial sediments, but to north overlies younger gravels. These gravels may belong to Clara Creek drift sheet, but very likely they also include some preglacial Chagvan outwash. Radiocarbon dates provide minimum age for Chagvan Drift of about 45,000 years.

Named for Chagvan Bay, the northern perimeter of which is bounded by moraines of this drift sheet. Chagvan Bay area comprises approximately 75 square miles along the southeast side of Kuskokwim Bay and includes most of the land between Chagvan and Goodnews Bays.

Chalk Butte Formation (in Idaho Group)

Pliocene, middle: Eastern Oregon and western Idaho.

R. E. Corcoran and others, 1962, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. GMS 2. Loosely consolidated tuffaceous conglomerate, sandstone, and siltstone of lacustrine or fluvatile origin with lesser amounts of ash and fresh-water limestone; occasional interbedded basalt flows. Partial section at type locality about 538 feet. Overlies Grassy Mountain Basalt in northern part of quadrangle; along eastern margin rests with marked angular unconformity on westward dipping Sucker Creek Formation and Owyhee Basalt. Uppermost formation in Idaho Group.

Type locality: SE¼ sec. 22, T. 20 S., R. 45 E., Mitchell Butte quadrangle, Malheur County, Oreg.

Chalk Hills Formation (in Idaho Group)

Pliocene, middle: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1203, 1205—1206, pl. 1. Contains large amounts of siliceous volcanic ash, but ash is subordinate to other fine-grained detrital material, chiefly silt and sand. Thickness about 300 feet at type locality where it rests on faulted Banbury Basalt. At Castle Creek, overlies Idavada Volcanics (new). Underlies Glenns Ferry Formation (new).

Type locality: Chalk Hills, an area of badlands at head of Little Valley, 14 miles southwest of Bruneau, Owyhee County. Formation continuously exposed as badlands from little Valley eastward to head of Bruneau Valley at Hot Creek, 10 miles south of Bruneau. Also present along middle reach of Castle Creek and its western tributaries, Brown and Hart Creeks.

Chamberlin Glaciation

Pleistocene: Alaska.

G. W. Holmes and C. R. Lewis, 1959, (abs.) Canadian Oil and Gas Industries, v. 12, no. 12, p. 55; 1961, *in* Geology of the Arctic, First Internat. Symposium Proc., v. 2: Toronto, Canada, Univ. Toronto Press, p. 853-857. Chamberlin glaciation deposited till sheets and outwash aprons with well-defined topographic expression. Preceded by Weller glaciation (new). Followed by Schrader glaciation (new).

G. W. Holmes and C. R. Lewis, 1965, U.S. Geol. Survey Bull. 1201—B, p. B10—B13, pl. 1. Formal proposal of name. Is oldest glaciation in area represented by distinct end moraines. Maximum extent of Chamberlin Glaciation indicated in places by well-defined drift border and elsewhere by lateral drainage channels and scattered erratics. Ice from Hulahula River valley moved westward through lowland south of Kikiktat Mountain and joined glacier that flowed northward from Lake Peters valley. Northernmost limit of glaciation is marked by subdued end moraine, which merges with a more extensive outwash apron that flanks Sadlerochit River in northeast. Chamberlin till consists of fragments of all local bedrock types, notably quartzite, schist, sandstone, limestone, and conglomerate, and a dark-gray matrix derived in part from shale. Along its eastern border, till contains a small amount of granitic rocks, presumably from the Mount Michelson area. Follows Weller Glaciation and precedes Schrader Glaciation.

Named from Mount Chamberlin in Brooks Range.

Chamberino Member (of Fusselman Dolomite)

Silurian: Western Texas and southwestern New Mexico.

F. E. Kottlowski and L. C. Pray, 1967, Tulsa Geol. Soc. Digest, v. 35, p. 209—230. At type section the Fusselman Dolomite is subdivided into three members (ascending): Chamberino, Flag Hill, and Crazycat. At the type section the Chamberino Member is 261 feet thick and is entirely dolomite. Lower 138 feet are mostly white to very light-gray massive dolomite which is predominantly medium to coarsely crystalline. Upper part is largely of same texture, but is darker, ranging from light gray to medium-light gray. Disconformable above Cutter Dolomite of Montoya Group.

Type locality: In northern Franklin Mountains, Tex. Chamberino is a village one mile west of the Rio Grand and 4 miles north of Texas-New Mexico boundary (La Mesa quadrangle, New Mexico).

Chamisal Formation

Miocene, middle: Western California.

O. E. Bowen, 1965, *in* Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Type section divisible into two members of approximately equal thickness: lower, a nonmarine sandstone and conglomerate unit generally unfossiliferous and containing conspicuous red beds, here named Robinson Canyon Member, and an upper, marine brown sandstone and conglomerate unit containing abundant fossils, here named Los Tularcitos Member. Thickness about 800 feet. Beds here referred to as Chamisal Formation were mapped in part in Point Sur quadrangle by

Trask (1926), who referred them to Temblor Formation. Type locality of Temblor Formation, as described by F. M. Anderson (1905, California Acad. Sci. Proc. series 3, no. 2), is on the Lillis Ranch north of Cantua Creek in Temblor Range of Fresno County. This locality is far removed from Monterey and Salinas quadrangles; is separated from Monterey-Salinas area by structural elements of very large displacements and differs lithologically from type Temblor in having considerable proportion of conglomerate; original description of type Temblor was early rather than middle Miocene. Hence, it seems better to abandon use of name Temblor in this part of Santa Lucia Mountains and introduce a new local name. Stratigraphically above Carmelo Formation. In some area overlies granitic rocks. Stratigraphically below and in some places interfingers with, Monterey Formation. In some areas separated from the Monterey by olivine basalt flow. Name credited to E. Brown (1962, unpub. rept.).

Type locality and type section: Straddle boundary common to Point Sur and Monterey quadrangles along Robinson Canyon, a north-draining tributary to Carmel Valley. Type section begins at basement contact at a point 2,000 feet precisely southeast of B.M. 2035, at the crest of Chamisal Ridge, and trends N. 21° E. to confluence of Robinson Canyon with its east tributary, which drains the southside of Snivleys Ridge. It then turns N. 20° W. to the alluviated floor of Carmel Valley. Northern half of type section crosses sections 25 and 36, T. 16 S., R. 1 E. Southern part is in Rancho Potrero de San Carlos land grant in which the land net has not been established. Named for exposures on the northeast flank of Chamisal Ridge. Chamisal Ridge is in northeast corner of Point Sur quadrangle.

Chamisa Mesa Member (of Zia Sand Formation)

Miocene, lower and middle: Northwestern New Mexico.

Ted Galusha, 1966, Am. Mus. Novitates, no. 2271, 12 p. Name proposed for upper part of Zia Sand. Base of member not exposed in Arroyo Pueblo but is cut off and buried on west end by Arroyo Pueblo fault. About 300 feet of sediments are exposed below Blick quarry. The Jeep quarry occurs about 275 to 300 feet stratigraphically above Blick quarry. The limestone ledge that crops out stratigraphically 75 feet above Jeep quarry horizon and contains distinctive mammillary inclusions of silica is here considered the top of the member. Beds overlying the Chamisa Mesa Member are correlated as part of Santa Fe Formation. Overlies Piedra Parada Member (new) of the Zia.

Type section: Sec. 25, T. 16 N., R. 2 E., and sec. 30, T. 16 N., R. 3 E., Sandoval County. Section is in Arroyo Pueblo drainage system. Named for Chamisa Mesa, a prominent basalt-capped mesa on the flanks of which a part of the beds of the member crop out.

Champaign Substage

Pliestocene (Wisconsin): Illinois and Indiana.

C. A. Malott, 1922, Indiana Dept. Conserv. Pub. 21, p. 152, pl. 3. Map shows three substages of the Wisconsin glacial stage: Shelbyville, Champaign, and Bloomington. The Champaign is not well developed in Indiana.

A. F. Schneider and H. H. Gray, 1966, Indiana Geol. Survey Spec. Rept. 3, p. 34. Wisconsin episode of glaciation was not single event but was punctuated by several advances, standstills, and recessions of ice. The East White sublobe readvanced at least once after retreating from its maximum or so-called Shelbyville position. In Malott's interpretation two such readvances took place, the first during his Champaign Substage and the second during his Bloomington Substage at which times the ice deposited the Champaign and Bloomington Morainic Systems of Leverett (Leverett and Taylor, 1915, U.S. Geol. Survey Mon. 53). According to Wayne (1956, Indiana Geol. Survey Rept. Prog. 7; 1963, Indiana Geol. Survey Bull. 25) stratigraphic evidence indicates that the ice readvanced only once during Wisconsin time.

Named from Champaign, Illinois.

Chandler Ridge Formation (in Meduxnekeag Group)

Ordovician(?): Northeastern Maine.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, P. A54—A55. A lenticular deposit of local extent consisting of slate, graywacke, and conglomeratic graywacke and minor amounts of siltstone and quartzite. Estimated thickness about 5,000 feet. Apparently conformably overlain by thinned sequence of Ordovician and Silurian Carys Mills Formation (new). Unit has been called slate and graywacke member of Meduxnekeag Formation. Ordovician(?).

Type locality: Exposures on Chandler Ridge, Aroostook County.

Chapman Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.] v. 5, p. 9-17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Chapman sand occurs at depth of 8,989 to 8,993 feet in type well.

Type well: Arkansas-Louisiana Gas Co., No. 1 Chapman, sec. 32, T. 18 N., R. 1 E., Calhoun field, Ouachita Parish.

Chappo Member (of Wasatch Formation)

Paleocene, upper, and Eocene, lower: Southwestern Wyoming.

S. S. Oriel, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2161—2173. Name applied to lower part of main body of Wasatch Formation. Brightly colored, red, maroon, reddish-brown, orange, ocher, tan, and gray mudstone dominant; white, tan, brown, gray, and red sandstone and siltstone, and gray, brown, and red conglomerate also abundant; includes pisolitic limestone at most localities. Thickness more than 490 feet at type locality; more than 680 feet in Buckman Hollow, section incomplete; thicker in wells. Unconformably underlies La Barge Member (new). Rests directly on Paleozoic and Mesozoic rocks. Vertebrates and Mollusks are of latest Paleocene (Clarkfork) and earliest Eocene (Graybull). Names Almy and Knight not applicable to rocks in this area.

Type area: Near Hogsback Ridge, north of La Barge Creek, extends from Buckman Hollow eastward to exposures in Chappo Gulch, 1 mile southeast of old Salli mine. Type section: Incomplete exposure in NE¼ sec.

17, T. 26 N., R. 113 W., at Chappo Creek, Lincoln County. Reference section: In Buckman Hollow, sec. 12, T. 26 N., R. 114 W.

Chariot Gravel

Pleistocene: Northwestern Alaska.

R. H. Campbell, 1967, U.S. Geol. Survey Prof. Paper 395, p. 58—59, pl. 1. Deposits consist chiefly of friable well-rounded coarse- to fine-pebble gravel and interstratified sand. Thickness about 25 feet at Chariot campsite; elsewhere range in thickness from a few inches to about 10 feet. Younger than Ilyirak and Saligvik Gravels (both new). Sangamonian(?).

Gravels are represented near mouth of Ogotoruk Valley by an old bay mouth bar, whose top ranges in altitude from 34 to 42 feet. Named for Chariot base camp built on the deposits. Lisburne Peninsula.

Charlotte Group

Ordovician(?): New Brunswick, Canada, and southeastern Maine.

Original reference: F. J. Alcock, 1946, Canada Geol. Survey Prelim. Maps 46—2, 46—3.

D. H. Amos, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 173 (fig. 3), 174—175. In Maine, Charlotte Group of pre-Silurian age occurs in wide strip on northwest side of southeasternmost belt of plutonic rocks. This strip averages 25 miles in width and extends from south-central coast of Maine northeastward into New Brunswick where Carboniferous rocks overlie. Divided into two divisions: pale argillite and dark argillite. Estimated minimum thickness of each division 2,000 feet. Underlies Oak Bay Formation.

Named from exposures in Charlotte County, New Brunswick, Canada.

Chauga River Dolomitic Marble or Group

Upper Cambrian: Northwestern South Carolina.

T. E. Shufflebarger, Jr., 1961 South Carolina State Devel. Board Geologic Notes, v. 5, no. 3, p. 31, 33 (table 1), 37. Referred to as Chauga River Dolomitic marble, Chauga River dolomite, and Chauga River group. Older than Poor Mountain marble.

Chauga River area, Oconee County.

Chebanika Stade

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1983. Second of four stades in Siruk Glaciation (new). Preceded by Siruk Creek [Stade] and followed by Helpmejack Stade. Chebanika Stade was marked by brief advance of glacier far up Alatna Valley.

Alatna Valley originates near north flank of central Brooks Range and extends southeast through this mountain belt into the Koyukuk lowlands.

Chellis Limestone

Silurian(?): Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 18, 36 (table 1), pl. 1. Blue-gray fine crystalline, laminated to massive limestone with numerous calcite seams and coatings; some argillaceous and dolomitic beds. Thickness about 1,900 feet. Overlies Aura Formation (new); underlies Storff Formation (new); both contacts conformable.

Named after Chellis mine which is situated near contact of the limestone and underlying Aura Formation on north slope of White Rock Canyon, Bull Run quadrangle, Elko County. Forms sinuous band trending east-west across Bull Run Mountains. Continuity of exposure partially disrupted by faulting, which offsets formation.

Cheney Volcanics (in Challis Volcanic Group)

Oligocene, middle: East-central Idaho.

A. L. Anderson, 1961, Idaho Bur. Mines and Geology Pamph. 124, p. 43—47, pl. 1. Challis volcanic formation redefined and given group status and subdivided into three units of formational rank (ascending): Cheney, Yearian, and Kadletz Volcanics. Cheney Volcanics characterized by light-colored latitic and andesitic flows that have sparkling appearance on fresh surfaces. This light color and sparkle of rock are not shared by other units which, like the Yearian Volcanics, contain mostly dark-colored flows. Some flows in the Cheney may measure as much as several hundred feet but most are much thinner. They may aggregate more than 1,000 feet in thickness, but total thickness not easily determined because of faulting. Thickness is in excess of 2,000 feet and may be more. Largest exposures are between lower Hayden Creek and upper Muddy Creek, Lemhi quadrangle, where an isolated area of the volcanic rocks is surrounded by Yearian Volcanics, in part along fault contacts; along west margin of quadrangle from slopes north of Hayden Basin southward to Bear Valley Creek, extending eastward for about 1¼ miles to a fault contact with Yearian Volcanics and Apple Creek Phyllite (new), and across ridge between Hayden Creek and Lemhi Valley, particularly east of fault contact with Apple Creek Phyllite south of Meadow Creek. Cheney Volcanics become dominant volcanic formation in Salmon quadrangle.

Named for Cheney Creek in Salmon quadrangle.

Cherry Creek Quartz Latite

Oligocene: Western New Mexico.

P. E. Damon and others, 1967, Arizona Univ. Geochronology Labs. Ann. Prog. Rept. No. C00—689—76 to Research Div. U.S. Atom. Energy Comm. p. 65 (table 25), 66 (fig. 12), 68. Cherry Creek quartz latite was sampled above its vitrophyric base at the Ben Lilly Memorial in the Gila National Forest as a possible equivalent to Kneeling Nun or Caballo Blanco formations of Dwyer quadrangle. Apparent age K-Ar determination 31.2 ± 0.9.

Collection made in sec. 24, T. 16 S., R. 14 W., Grant County.

Cherry Hill Granite

Upper(?) Paleozoic: Eastern Massachusetts.

Priestly Toulmin, 3d, 1964, U.S. Geol. Survey Bull. 1163—A, p. A41, pl. 1. Coarse-grained altered pink-weathering alaskite granite, composed essentially of milky quartz and pink-weathering microperthite. Intrudes Wenham Monzonite (new).

Exposed in scattered outcrops near Cherry Hill, along Burley Street, and at Beverly Airport, all in Danvers, Salem quadrangle, northeast of Boston.

Cherry Point Clay

Pleistocene, upper: Northwestern Washington.

D. J. Easterbrook, 1963, Dissert. Abs., v. 23, no. 8, p. 2873. Oldest Pleistocene stratigraphic unit exposed in area. Consists of well-stratified silt and clay with minor interbeds of sand. Unconformably underlies Mountain View formation (new). Radiocarbon date greater than 38,000 years B. P. Obtained from shells in the clay.

D. J. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1470, pl. 3. Formal proposal of name. Consists of blue to brownish-gray well-stratified clay and marine fossils at several localities. Thickness not accurately known as base of unit is nowhere exposed. Maximum exposed thickness 140 feet in sea cliffs; 300 feet in nearby wells. At type section underlies Mountain View sand and gravel which is overlain by Vashon till and glaciomarine drift. North of type section the sand and gravel wedge out so that till and glaciomarine drift lie directly on Cherry Point silt. To south the sand and gravel thickens, and contact with the Cherry Point descends below sea level.

Type locality: Cherry Point on Strait of Georgia, northern Puget Lowland. Outcrops restricted to sea cliffs near type locality, but unit probably continuous beneath upland to east.

Chesterfield Range Group

Upper Mississippian: Southeastern Idaho.

J. T. Dutro, Jr., and W. J. Sando, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 11, p. 1963—1986. About 1,900 feet of sandstone, sandy limestone, and limestone previously called Brazer Limestone. Composed of Little Flat Formation below and Monroe Canyon Formation above (both new). Overlies Lodgepole Limestone; underlies Wells Formation.

Type section: Begins at top of Lodgepole Limestone at altitude of about 6,200 feet on a southwest-trending spur in NW¼ sec. 20, T. 7 S., R. 40 E., Bannock County in Chesterfield Range.

Chetco Formation

Jurassic: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4320—4321. Name proposed for wide-spread and heterogeneous assemblage of rocks, predominantly graywacke and mudstone. Divisible into two members gradational with each other, Macklyn and Winchuck. Macklyn Member considered older though evidence not convincing. Pistol River Complex (new) may be most westerly part of the Chetco. In fault contact with Whalehead Formation (new). Chetco considered older than Middle Portlandian and equivalent to Dothan Formation and the "Franciscan" of northernmost California.

Report discusses west-central Klamath province, southwestern Oregon and northwestern California. Chetco River and Chetco Peak are in Curry County, Oreg.

Cheyenne River facies (of Fox Hills Formation)

Upper Cretaceous: Southwestern South Dakota.

W. A. Pettyjohn, 1967, South Dakota Acad. Sci. Proc., v. 46, p. 41—47. In eastern Pennington County, the Fox Hills consists of a lower fossiliferous sandy shale herein called Cheyenne River facies; and overlying Bullhead and "Colgate" Members. Term Cheyenne River facies used only for convenience and not intended to imply a formal stratigraphic name. It is lateral equivalent of Trail City and Timber Lake Members. They lose their lithologic and most of their paleontologic characteristics when traced southwestward from their Missouri River outcrops and cannot be traced to eastern Pennington County. In local quadrangle mapping the Cheyenne River facies would probably be mapped as Pierre. Facies ranges in thickness from about 100 feet in northeastern part of county to about 15 feet in southeastern part. Contact with underlying Pierre is gradational and arbitrary.

Named for exposures along Cheyenne River west of Creighton, eastern Pennington County.

Chiapuk Rhyolite

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—G, p. G1—G9. Includes welded tuff and tuff-conglomerate, which are probably textural variants of same ash flow. Where basal contact is exposed, the welded tuff seems to lie conformably on Vekol Formation (new). Over a longer reach, the contact cuts obliquely across strike of Vekol, and the Chiapuk is probably separated from the Vekol by erosional surface of low relief. Top of unit either cut off by faults which abut the tuff against Escabrosa Limestone or is covered by alluvium. Truncated section about 200 feet thick.

Type locality: About 2 miles west of Reward mine, Vekol Mountains, Papago Indian Reservation. Named for nearby village of Chiapuk.

Chickabally Mudstone Member (of Budden Canyon Formation)

Upper Cretaceous: Northern California.

M. A. Murphy, G. L. Peterson, and P. U. Rodda, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 4, p. 496—502. Proposed to include mudstone and thin-bedded sandstone and limestone beds lying between Roaring River Member and Bald Hills Member. At reference section lower 400 to 600 feet of beds are mudstone with thin sandstone interbeds and limestone concretions. Vertically this changes gradually to mudstone with very few thin sandstone interbeds and limestone in concretions, lenses, and thin beds. Along Roaring River lower part of member separated from upper part by 10-foot bed of sandy and pebbly mudstone interpreted as extension of Huling Sandstone Member. Above this bed Chickabally characterized by siltstone and mudstone with few sandstone beds and with concretions of relatively pure, light-gray-weathering finely crystalline dark-gray limestone. Part of member between Roaring River conglomerates and extension of Huling Sandstone Member is about 900 feet thick along Roaring River. Upper part of member about 2,600 feet along Roaring River.

Reference section: Along Roaring River in secs. 32—35, T. 30 N., R. 7 W. Name derived from Chickabally Mountain near where unit crosses Middle Fork of Cottonwood Creek, Ono quadrangle.

Chickasawhay Stage

Oligocene: Gulf and Atlantic Coast Provinces.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper & Brothers, p. 404–405. As used in this book, Chickasawhay stage includes all strata in Gulf and Atlantic coastal province which can be reasonably demonstrated to be equivalent to the Chickasawhay formation (unrestricted sense of Shreveport Geological Society, 1934), or to the Chickasawhay limestone (restricted sense of MacNeil, 1944, Am. Assoc. Petroleum Geologists Bull., v. 28, no. 9), and Paynes Hammock sand and subsurface equivalents encountered in Continental Oil-Union Sulphur's H. J. Shoesmith No. 1 well in China field, Jefferson Davis Parish (Louisiana). These strata overlie the Vicksburgian stage as used herein and underlie Anahuacian, whose basal beds in many places in northern Gulf region are characterized by foraminifer *Marginulina howei*. As thus used the Chickasawhay stage is synonymous with Frio stage of Warren (1957, Gulf Coast Assoc. Geol. Soc. Trans., v. 7) and includes strata that contain following foraminiferal zones: *Operculinoides* sp., *Miogypsina (Miogypsinoides)*, *Cibicides hazzardi*, *Marginulina texana*, *Bolivina mexicana*, *Gyroidina scalata*, *Bolivina alazanensis*, *Nonion struma*, *Nodosaria blanpiedi*, *Discorbis* sp., *Textularia seligi*. Term Chickasawhay used mainly because (1) Frio has been used previously in at least three ways; (2) neither surface nor subsurface beds to which the term Frio is currently applied have a type locality; and (3) much of the modern use of Frio is loose and inaccurate stratigraphically. Probably the most common if unspecified usage of Frio is for arenaceous beds above argillaceous strata which contain Vicksburgian fossils. As lower sands wedge out downdip into clays, base of Frio is drawn stratigraphically higher. A very common and widespread usage of Frio has been for arenaceous sequence of Chickasawhay age. Adoption of Chickasawhay stage rather than Frio stage will better clarify the stratigraphic relationships and highlight the principles involved.

Chicken Creek Formation

Eocene-Oligocene: Northeastern Nevada.

D. I. Axelrod, 1966, Am. Jour. Sci., v. 264, no. 7, p. 497–506. Discussion of potassium-argon ages of some western Tertiary floras. Sample of Chicken Creek Formation is from a 2-foot bed of biotite rhyolite ash 5 feet above uppermost of the 10 florules that comprise the Bull Run flora. Radiometric age of 35.2 million years indicates this florule is basal Chadronian or transitional Eo-Oligocene and the florules stratigraphically below it are Duchesnean, or latest Eocene. Name taken from Axelrod manuscript.

Locality: 30 yards north of junction of Highway 11 and road to Cornucopia mining district, in NE¼ sec. 11, T. 42 N. R. 52 E., Bull Run quadrangle.

Chicken Creek Tuff

Eocene-Oligocene (Bridgerian-Whitneyan): Western Utah.

J. F. Evernden and G. T. James, 1964, Am. Jour. Sci. v. 262, no. 8, p. 965, 967. Potassium argon dates and Tertiary floras of North America. Pink tuff interbedded at top of "Green River" beds. Overlain by other volcanics which include Sage Valley limestone. Potassium-argon date 33.2

m.y. North American land mammal age according to references: Bridgerian to Whitneyan. North American land mammal age according to potassium-argon date: Chadronian.

Locality: U.S. Highway 91, 8 to 10 miles southwest of Levan, Juab County, just south of Chicken Creek Reservoir.

Chilson Member (of Lakota Formation)

Lower Cretaceous: Southwestern South Dakota and southeastern Wyoming.

E. V. Post and Henry Bell, 3d, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—173—D—177. Name applied to lower member of the Lakota. Consists of two conspicuous fluvial sandstone bodies, each of which fingers laterally into flood-plain, lacustrine, or paludal facies. These subdivisions are designated unit 1 and unit 2. No single type section is typical. In Chilson Canyon unit 1 is 140 feet thick and unit 2 is 210 feet thick; here the Chilson underlies Fuson member. Section at Red Canyon in Edgemont NE quadrangle, South Dakota, is typical of areas in southwestern Black Hills where unit 1 forms most of member and underlies Fuson member. Section at Flagpole Mountain in Cascade Springs quadrangle, South Dakota, is representative of member in southeastern Black Hills where it consists entirely of unit 2 and underlies Minnewaste member. Overlies Morrison formation or Unkpapa sandstone.

J. J. Connor, 1963, U.S. Geol. Survey Bull. 1063—D, p. 94—99, pl. 11. Member is exposed in all canyon walls in western half of Angostura Reservoir quadrangle, South Dakota. Composed of lenticular rim-forming sandstones and slope-forming siltstones and claystones. Thickness 225 to 325 feet. Underlies Minnewaste member; overlies Unkpapa sandstone.

G. B. Gott and R. W. Schnabel, 1963, U.S. Geol. Survey Bull. 1063—E, p. 149—158, pls. 12, 13. In Edgemont NE quadrangle, South Dakota, member is underlain by Morrison formation and is overlain by either Minnewaste member or Fuson member. Includes principally Nos. 1 and 2 sandstones and their fine-grained equivalents. A carbonaceous shale unit, 0 to 100 feet thick, unconformably underlies No. 1 sandstone in most places.

Name derived from Chilson Canyon, sec. 32, T. 8 S., R. 4 E., Flint Hill quadrangle, South Dakota.

Chiltepines Member (of Pitoikam Formation)

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. I1—I12. Mostly maroon and green shale containing thin beds of arkose quartzite, and in basal part, conglomerate. South of Fresnal Wash includes thin sequence of andesitic rocks. Uppermost part south of Fresnal Wash is thin series of andesite and andesitic breccia (laharic?) flows. Unit forms narrow valley between ridges composed of underlying Contreras Conglomerate Member (new) and overlying Mulberry Wash Volcanic Formation (new).

Type locality: Generally along lower part of tributary of Fresnal Wash that heads about a mile north of Peak 6164, Baboquivari Mountains, Papago Indian Reservation. Chiltepines Creek is south of area of report.

China Hat Gravel

Pliocene, upper: Central California.

R. J. Arkley, 1962, California Div. Mines Bull. 182, p. 26 (fig. 2), 28—29. A 20- to 40-foot layer of gravel, consisting largely of 2- to 6-inch pebbles and cobbles of vein quartz, quartzite, and other hard metamorphic rocks. Older than North Merced gravel (new).

Mantles China Hat pediment, an old erosion surface truncating Mehrten Formation in San Joaquin Valley, in vicinity of Merced River, Merced County.

China Tank Member (of Word Formation)

Lower Permian (Guadalupe Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U.S. Geol. Survey Bull. 1244—E, p. E7, pl. 2. Limestone members of Word Formation were numbered 1—4 in ascending order by King (1931, Texas Univ. Bull. 3038). Removal of the "First Limestone" member from the formation by establishing it as Road Canyon Formation destroys numbering system. Word limestone members are important because most of Word fossils are known from them and not from intervening shales. The limestone members are herein named (ascending): China Tank, Willis Ranch, and Apple [Appel] Ranch. The China Tank is the "Second Limestone" member of the Word (King, 1931). Member is siliceous brownish- to yellowish-gray limestone, 113 feet thick, and contains abundant silicified fossils. Merges into main mass of formation east of Old Word Ranch.

Type section: King's (1931) section 23 on west side of hill 5611, just east of the fault that bounds Hess Ranch horst in west-central quadrant of Hess Canyon quadrangle, Brewster County. Named for exposures near the cattle tank on Hess Ranch known as China Tank because of the nearby grove of chinaberry trees.

Chino Creek Granite

Precambrian: Central Arizona.

P. E. Damon, D. E. Livingston, and R. C. Erickson, 1962, New Mexico Geol. Soc. Guidebook 13th Field Conf., p. 56. Biotite yields K-Ar age of 1,330 m.y.

Location: Seven and three-tenths miles south of Seligman, Yavapai County.

Chinquapin Metabasalt Member (of South Fork Mountain Schist)

Upper(?) Cretaceous: Northern California.

M. C. Blake, Jr., W. P. Irwin, and R. G. Coleman, 1967, U.S. Geol. Survey Prof. Paper 575—C, p. C5. Name applied to metabasaltic rocks in South Fork Mountain Schist. Occurs as mappable, discontinuous lenses throughout the formation.

Type locality: Chinquapin Butte, sec. 21, T. 28 N., R. 8 E., and sec. 18, T. 28 N., R. 12 W., in southeast corner of Pickett Peak quadrangle.

Chiputneticook Quartz Monzonite

Devonian: Northeastern Maine.

D. M. Larrabee, 1963, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—269. Light-gray to gray, coarse-grained, biotitic, porphyritic quartz monzonite to granite. Mass intrudes metasedimentary rocks of Silurian

Type locality: Greenland Cove, East Grand Lake, Danforth quadrangle, Maine. Named for and best exposed on islands and shores of Chiputneticook Lakes, International Boundary, Maine-New Brunswick.

Chiricahua Rhyolite

Tertiary(?): Southeastern Arizona.

F. E. Kottlowski, 1963, New Mexico Bur. Mines and Mineral Resources Bull, 79, p. 83. Incidental mention in discussion of Paleozoic and Mesozoic strata of southwestern and south-central New Mexico.

Occurs in Pedragosa Mountains, Cochise County.

Chiuli Shaik Formation

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. I11. Comprises beds of discontinuous lenticular intertonguing sedimentary and volcanic rocks, which lie disconformably on eroded surface of as much as 300 feet of relief cut into Mulberry Wash Volcanic Formation (new). Consists of two apparently conformable units. Lower predominantly sedimentary and upper almost entirely volcanic. Thickness about 2,000 feet. Unconformably underlies Fresnal Conglomerate.

Named for village of Chiuli Shaik, Baboquivari Mountains, Papago Indian Reservation. Forms upper unit of Mesozoic(?) section in area.

Christmas Canyon Formation

Pleistocene(?): Southern California.

G. I. Smith, 1964, U.S. Geol. Survey Prof. Paper 457, p. 5 (fig. 2), 40—42, pls. 1, 2. Consists of two distinct facies, a sandstone facies is restricted to strip about one-half mile wide south of and parallel to Garlock fault. Type section located in this facies. A boulder conglomerate facies, characterized by a small percentage of vesicular andesite, basaltic, and rhyolitic boulders 1 to 2 feet across, is present both on top of and south of sandstone facies. Both facies exposed north of Garlock fault. Thickness 50 to 500 feet, commonly 75 to 150 feet. Conglomerate facies unconformable on Bedrock Spring Formation (new); sandstone facies not in depositional contact with it. Younger than Almond Mountain Volcanics and Lava Mountains Andesites (both new), and fresh-looking Pleistocene(?) basalts of Black Hills several miles to southeast. Also inferred to be younger than upper Pliocene(?) volcanic breccias. Older gravels and Quaternary andesite may be in part equivalent in age to the Christmas Canyon.

Type section: Sec. C8—E [SW¼NW¼] sec. 8, T. 28 S., R. 43 E.], in Lava Mountains, San Bernardino County. Named for Christmas Canyon, about 1 mile east of type section.

Christmas Tree Conglomerate (in Brushy Basin Member of Morrison Formation)

Jurassic: Southeastern Utah and southwestern Colorado.

R. G. Young, Isadore Million, and D. M. Hausen, 1960, U.S. Atomic Energy Comm. RME—98 (rev.). Informal name applied to colorful conglomerate that marks base of the Brushy Basin in much of southeastern Utah and southwestern Colorado. [Conglomerate described by Craig and others (1955, U.S. Geol. Survey Bull. 1009-E) as consisting mainly of red, green, white, and black chert pebbles.]

Church Creek Formation

Oligocene (Refugian): West-central California.

W. R. Dickinson, 1965, Calif. Div. Mines and Geology Spec. Rept. 86, p. 25—44. Name used to designate marine sequence of interbedded gray mudstone, soft brown siltstone, and brown and gray sandstone conformably overlying The Rocks Sandstone near The Caves on Church Creek. Name should be clearly distinguished from informal name "Church Creek beds" used by Reiche (1937). Maximum exposed thickness about 1,250 feet in Church Creek homocline due west of Black Butte. Composite thickness probably exceeds 1,500 feet. Thickness about 800 feet at type locality. Conformable contact with The Rocks Sandstone gradational in most places. Contact placed at top of highest bed of massive buff sandstone in sequence composed dominantly of sandstone.

Type locality: Exposures in valley of Church Creek in W½ sec. 13, T. 19 S., R. 3 E., Monterey County. Base of formation placed at top of massive sandstone bed exposed beside Church Creek trail at fossil locality 7475. Type section: Taken as sequence exposed along sides of small draw leading north from this point past fossil localities 7414 and 7470. Top of section terminated by Church Creek fault.

Churchill soil

See Wyemaha Formation.

Chute Canyon Sandstone lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Chute Canyon Sandstone lithosome 500 feet. Consists mostly of clean calcareous quartz sandstone.

Mapped in small area between Dell and Lima, Beaverhead County.

Cibecue Member (of Supai Formation)

Pennsylvanian(?) and Permian: East-central Arizona.

T.L. Finnell, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—545. Sandstone and shale. Sandstone predominates over shale in upper part of unit and shale forms lower half. Thickness 280 to 340 feet. Overlies unnamed limestone and shale member. Upper contact placed at top of reddish-brown sandstone that is overlain by paler reddish-brown, generally calcareous siltstone. Upper contact exposed in gully below Airport Tank, about a mile northwest of hill 5490 in Chediski Peak quadrangle.

Type section: Exposed in bluff north of road to Grasshopper, beginning in Cibecue quadrangle about a mile southwest of town of Cibecue, then offset about a half a mile to the northwest by tracing key beds to a point south of hill 5490 in the adjacent Chediski Peak quadrangle.

Cibola Beds

Miocene: Southeastern Arizona.

E. D. Wilson, 1962, Arizona Bur. Mines Bull. 171, p. 72 (fig. 12). Cibola beds listed with Miocene units in résumé of Arizona geology. [Wilson

(1933, Arizona Bur. Mines Geol. Ser. no. 7, Bull. 134) described marine Tertiary beds southeast of Cibola, but did not use formal term Cibola Beds.]

L. A. Heindl, 1962, Arizona Geol. Soc. Digest, v. 5, p. 13 (fig. 1, 3). Cibola beds listed with late Tertiary and Quaternary units in résumé of Cenozoic geology in Arizona.

Cibola is in Yuma County.

Cibuco Formation

Upper Cretaceous or Tertiary, lower: Northern Puerto Rico.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C3 (table 1), C14. Composed mostly of massive conglomerate or breccia conglomerate. About 2,000 m exposed in quadrangle. Base not exposed because of faulting. Overlain by and interfingers with Carreras Siltstone.

Type locality: In valley of the Rio Cibuco between coordinates 55,560 and 55,180, about 3 km west-southwest of Corozal, Corozal quadrangle.

Cinnabar Tuff Tongue (in Fields Creek Formation)

Upper Triassic(?): Northeastern Oregon.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548. Water-laid andesitic massive tuff. Ranges from flinty bluish-gray to coarse-grained dark-olive pumice fragments. Flinty tuff weathers to distinctive cinnamon brown.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Bull. 1244—A, p. A25. Thickness about 3,500 feet on Cinnabar Mountain. Thickens northeastward to about 8,500 feet and thins abruptly southeastward; locally grades upward into siliceous mudstone, shale, and graywacke.

Named for outcrops on Cinnabar Mountain. Forms most of peaks in Aldrich Mountains, Mount Vernon quadrangle, Grant County.

Cita Canyon beds

Pleistocene, lower: Northern Texas.

T. M. Oelrich, 1957, Jour. Paleontology, v. 31, no. 1, p. 238. Cita Canyon beds mentioned as collecting locality for fossil turbles.

Walter Auffenberg, 1966, Jour. Paleontology, v. 40, no. 4, p. 879. Lower Pleistocene. Contains *Geochelone johnstoni.*

In Randall County.

Citadel Flow, Basalt

Pleistocene, lower(?): Northeastern Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 5, 17. Toward close of Tertiary, basaltic lava flows occurred in San Francisco Mountain region. In this report the basaltic lavas are divided into five groups (stages) which are based on the stage of erosion they exhibit. Citadel flow is an example of a stage I flow, that is, the edges of the flow have been eroded back so far that the original extension of the flow is obliterated. Also the surface of the flow is so deeply eroded that, not only have all traces of the lava tops been removed, but also most of the vesicular upper portion.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4), 105 (fig. 8.5). Discussion of geomorphology and age of volcanic rocks in northeastern Arizona. Citadel flow listed on chart showing correlation of volcanic flows. Pleistocene, lower(?).

Caps series of small mesas. Can be recognized from a mile west of the Citadel ruin to the edge of monocline which forms west boundary of Wupatki basin.

City of Rocks Adamellite

Mesozoic or Tertiary: Southern Idaho.

R. L. Armstrong and F. A. Hills, 1967, Earth and Planetary Sci. Letters, v. 3, no. 2, p. 114. Discussion of Rb-Sr and K-Ar geochronologic studies of mantled gneiss domes, Albion Range, southern Idaho. Metamorphosed fossils and stratigraphic arguments indicate that the Dove Creek Group is Paleozoic (Cambrian through Pennsylvanian). This indicates a Precambrian age for the Green Creek Complex (new) and a Mesozoic or Tertiary age for the City of Rocks Adamellite.

Type locality and derivation of name not given.

Clairmont Member (of Judith Fancy Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Limestone and volcanic pebble conglomerate 50 feet thick.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 200, pl. 1. A resistant bed of limestone and volcanic pebble conglomerate 50 feet thick or less. Thins to a feather edge to east and west along strike. Judith Fancy Formation is largely undifferentiated, but the Clairmont and Blue Mountain Members can be separated and mapped in Northside Range.

Mapped for 1 3/4 miles in vicinity of Estate Clairmont and Kirkegaard Hill in Northside Range.

Clamgulchian Stage

Miocene(?) and Pliocene: Alaska.

J. A. Wolfe, D. M. Hopkins, and E. B. Leopold, 1966, U.S. Geol. Survey Prof. Paper 398—A, p. A20—A25. Name proposed as provincial time-stratigraphic unit that encompasses all plant-bearing strata in Alaska and in adjoining parts of same ancient province that are of approximately the same age as those parts of Kenai Formation that are represented in type section on east shore of Cook Inlet and reference section on north shore of Kachemak Bay. Rocks belonging to Clamgulchian are recognized primarily on basis of fossil floras that they contain. Younger than Homerian Stage (new).

Type section: Sequence of strata of Kenai Formation at least 2,000 to possibly 3,000 feet thick that is exposed in coastal bluffs along east shore of Cook Inlet from Happy Creek northward to a point 4 miles north of Clam Gulch. Named for village of Clam Gulch, Cook Inlet region.

Clara Creek Glaciation

Clara Creek Drift

Pleistocene: Southwestern Alaska.

S. C. Porter, 1967, Arctic, v. 20, no. 4, p. 227—246. Present investigation disclosed that glacier ice had invaded Chagvan Bay area from east and had pushed north into lower part of Salmon River valley. Four drift sheets recognized, from oldest to youngest: Kemuk, Clara Creek, Chagvan, Unaluk. As shown in bore hole, Clara Creek Drift is 105 feet thick. Massive morainal embankments of Clara Creek Glaciation, the most extensive of the ice advances, have been greatly modified by erosion and mass wasting, but sediments comprising them are less weathered than those of Kemuk drift sheet.

Drift is named for a northern tributary of the Salmon River which flows between subdued end-moraine ridges of this drift sheet. Chagvan Bay area comprises approximately 75 square miles along southeast side of Kuskokwim Bay and includes most of land between Chagvan and Goodnews Bay.

Clarence Member (of Onondaga Limestone)

Clarence Member (of Onondaga Formation)

Middle Devonian: Western New York.

M. A. Ozol, 1964, Dissert. Abs., v. 24, no. 10, p. 4145. Members of Onondaga formation are best developed in central area of New York but the formation changes to the west. The Nedrow member does not overlie the Edgecliff, but is higher in the section. The rocks which do overlie the Edgecliff in western New York are herein designated Clarence member, which is a massive unit of intergrading and intermixed mottled chert and limestone.

W. A. Oliver, Jr., 1966, New York State Geol. Assoc. Guidebook 38th Ann. Mtg., p. 38 (fig. 3), 39—40. Overlying Edgecliff Member of Onondaga Limestone in western New York (Buffalo area) is 40 to 45 feet of fine-grained limestone and dark chert named Clarence Member by Ozol (1964). In central New York the Edgecliff Member is overlain by Nedrow Member but in western New York the Nedrow is replaced by the much thicker Clarence Member that is distinctly different from the Nedrow, although in the same stratigraphic position. Underlies Moorehouse Member. Type section designated.

Type section: In and near village of Clarence (15 miles east of Buffalo) where member is well exposed, especially along Route 5 just east of village center, Erie County (Clarence 7½-minute quadrangle).

Clark Silt

Pleistocene: Northeastern Missouri.

J. E. Stone, 1961, Dissert. Abs., v. 21, no. 10, p. 3061. Underlies Revere loess (new); overlies Kahoka till (new).

Named for Clark County.

Clark Mountain flows

See Lousetown flows.

Clark Mountain Rhyolite (in Middlebrook Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 35, 36. An aphanitic reddish-brown to grayish-purple porphyry with phenocrysts of light-brown to light-red feldspar. Upper part of unit consists of flow breccia as much as 550 feet thick. Entire thickness may be over 1,000 feet.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Middlebrook group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in Wayne and Reynolds Counties, St. Francois Mountain area. Samples of rhyolite collected in SW¼NW¼ sec. 18, T. 29 N., R. 4 E., Wayne County. Clark Mountain is in Wayne County, northeast of Piedmont.

Clarks Ferry Member (of Catskill Formation)

Upper Devonian: Southeastern Pennsylvania.

J. L. Dyson, 1963, Pennsylvania Geol. Survey, 4th ser., Topog. and Geol. Survey Atlas A—137ab. In Peters Mountain, uppermost 1,950 feet of Catskill Formation is exposed. In upper 1,750 feet of this section are three main stratigraphic divisions based on lithology. Lowest of the three, about 250 feet thick, is relatively resistant quartzitic sandstone unit which forms bench on north side of Peters Mountain east of Susquehanna River and ridge (Pine Ridge), west of river. Unit is herein named Clarks Ferry Member of Catskill Formation. In Peters Mountain section, overlies about 300 feet of gray to grayish-red sandstones and pebbly sandstones; underlies about 600 feet of red siltstone, shale, and fine-grained sandstone.

J. L. Dyson, 1967, Pennsylvania Geol. Survey, 4th ser., Topog. and Geol. Survey Atlas A—137 cd, p. 36. Described in southern half of New Bloomfield quadrangle where it is 200 feet thick on north flank of Cove Mountain syncline and 140 feet thick at Marysville on south flank. Underlies Duncannon Member (new). Overlies Sherman Creek Member (new).

Type section: Peters Mountain section in southeast corner of Duncannon 15′ quadrangle in Middle Paxton Township, Dauphin County, on east side of Susquehanna River where it cuts through Peters Mountain. Measurement made along base of cliff on east side of Pennsylvania Railroad tracks.

Clarks Fork Formation

Devonian-Mississippian: Wyoming and Montana.

Gilbert Klapper, 1963, Dissert. Abs., v. 23, no. 8, p. 2875. Clarks Fork Formation of Sandberg (ms.) is interpreted as widespread time-transgressive unit immediately subjacent to Lodgepole Formation. Devonian-Mississippian boundary located precisely within Englewood Formation of Black Hills, and Clarks Fork Formation at Cottonwood Canyon, Bighorn Mountains.

Clarkson Till

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 12 (fig. 6), 30 (fig. 8), 37, 38. Consists of silty to sandy and pebbly yellowish-brown to olive-gray mottled boulder clay in upper 37 feet and olive-gray to brownish-gray in lower 20 feet. At type locality underlies Loveland Formation and overlies Cedar Bluffs and Nickerson Tills (both new). No exposures known at present time. Fluviatile equivalent of Clarkson Till is believed to be Grafton Formation (new). Early Illinoian.

Type locality: Ground Water Survey Test Hole A22—2—25dc, drilled in SW cor. SE¼ sec. 25, T. 22 N., R. 2 E., Stanton County, 8 miles north and one-half mile west of Clarkson.

Clark Valley Mudstone

Upper Cretaceous (Cenomanian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Mudstone 3,200 feet thick. Overlies Julian Rocks formation (new); underlies Venado formation.

In Elk Creek-Fruto area, Glenn County.

Clays Ferry Formation

Middle and Upper Ordovician: South-central Kentucky.

G. W. Weir and R. C. Greene, 1965, U.S. Geol. Survey Bull. 1224—B, p. B1—B18. Interstratified thin-bedded shale, limestone, and siltstone. Thickness 120 to 220 feet. Overlies and intertongues with Lexington Limestone; grades into overlying Garrard Siltstone. Late Middle and early Late Ordovician. Includes strata previously divided on basis of fauna into (ascending) Cynthiana Formation, Fulton Shale, and Million Shale.

D. F. B. Black, E. R. Cressman, and W. C. MacQuown, Jr., 1965, U.S. Geol. Survey Bull. 1224—C, p. C5, C6, C11. Overlies Tanglewood Limestone Member (new) of Lexington Limestone at type section of Tanglewood; in some areas overlies Nicholas Limestone Member of Lexington.

Type section: Exposed in gully a few tens of feet northeast of eastern span of Interstate Highway 75 over Kentucky River at Clays Ferry and in roadcuts on northeast side of the highway in southern part of Ford quadrangle, Madison County.

Clear Creek Drift

Recent: Alaska.

T. N. V. Karlstrom, 1964, U.S. Geol. Survey Misc. Geol. Inv. Map I—157. Listed with named glacial drifts included in moraine units.

Nenana Gorge area.

Clear Creek Formation

Pleistocene: Northeastern Texas.

P. S. Martin, 1967, *in* Pleistocene extinctions: New Haven, Yale Univ. Press, p. 81. The Clear Creek Formation includes *Geochelone* and probably *Bison latifrons*, both commonly considered pre-Wisconsin guide fossils. Radiocarbon date of 28,849±4,740 on shells from Clear Creek Formation indicates interstadial age in standard Wisconsin glacial chronologies of most geologists. Unless Clear Creek radiocarbon date is shown to be seriously in error or improperly associated with the fauna, it establishes *Geochelone* and *Bison latifrons* in a post-Sangamon horizon. [Slaughter and Ritchie (1963, Graduate Research Center Jour., v. 31, no. 3) discussed the Clear Creek local fauna.]

Clear Creek rises in eastern Montague County, runs southeastward through Cooke County, enters Denton County at its northwest corner, and joins Elm Fork of Trinity River northeast of city of Denton.

Clear Creek Silt

Pleistocene: Northeastern Missouri.

G. E. Heim, Jr., 1964, Dissert. Abs., v. 24, no. 9, p. 3688. Following Pleistocene units present in area: alluvium, Peoria(?) loess, terraces, Oakwood gravels (new), La Grange gravels (new), Clear Creek silt, Dover clay (new), Kahoka till, and pro-Kahoka sands and gravels. Fauna from Clear Creek silt indicate Kansan or Illinoian age material.

Hannibal-Canton area.

Clear Creek tuffs

A collective term applied to tuffs that accumulated in structural depression in Clear Creek area, Tushar Range, near Marysvale, Utah. Staley Pasture and Joe Lott Tuffs are in this area.

Clear Lake Flow

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 126, 145 (table 1). Flow was fed from a vent located half a mile southwest of Sand Mountain Cones and dammed the lake for which it was named. Wood from submerged trees in lake gave radiocarbon age of about 2,950 years B. P., thus fixing date of eruption of the flow at about 1,000 B. C.

Sand Mountain Lava Field, Three Fingered Jack and North Sister area.

Clear Stream Member (of Dixville Formation)

Ordovician: Northern New Hampshire.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 11 (fig. 3), 28—31, pl. 1. Middle member of Dixville. Consists of massive to laminated amphibolite, some pillow structure; a few intermediate to felsic gneisses and schists and thin beds of spessartitic granofels and schist. Thickness 1,500 feet. Overlies Dixie Brook Member (new); underlies Rice Mountain Member (new).

Well exposed in bed of Clear Stream, in Welch Brook, on west slope of Signal Mountain, and on sides of summit of Rice Mountain, Errol quadrangle.

Cleary Creek Serpentinite

Middle Devonian(?): East-central Alaska.

R. L. Foster, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2745. Rocks in study area classified into five groups: (1) Cleary Creek serpentinite and associated "rodingite" inclusions, (2) Amy Dome metadiorite, (3) Amy Dome metaperidotite, (4) Amy Dome metabasalt, and (5) flanking metasedimentary rocks.

Amy Dome area, Tolovana mining district.

Clegg Creek Member (of New Albany Shale)

Upper Devonian and Lower Mississippian: Southeastern Indiana.

J. A. Lineback, 1965, Dissert. Abs., v. 25, no. 11, p. 6538. Massive carbon-rich silty or dolomitic pyritic shale. Uppermost member of the New Albany. Overlies Camp Run Member (new).

Type locality and derivation of name not stated.

Click Member (of Packsaddle Formation)

Precambrian: Central Texas.

R. V. McGehee, 1964, Dissert. Abs., v. 24, no. 7, p. 2870. Uppermost member of formation. Overlies Rough Ridge Member (new).

Southeastern Llano uplift.

Clifton Phyllite

Age uncertain: Virginia.

J. C. Reed, Jr., and Janice Jolly, 1963, U.S. Geol. Survey Prof. Paper 414—H, pl. 1. Mentioned on map explanation of rock types in Washington, D.C. area. Name credited to Bennison and Milton (open-file report).

Clifton City Intraclastic physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 29—30. Distinguishing lithologic characteristic of the Clifton City Intraclastic Limestone Physiofacies is placement of the sparry calcite which tends to enclose groups of clastic particles, giving the rock a roughly reticulate appearance. Consists of intraclastic limestone, very light to dark-tannish-gray or light- to medium grayish-tan, light- to medium pinkish-gray, or pinkish-tan. Maximum thickness about 11 feet. Interfingers with and is otherwise closely allied to Calwood, Mineola, and Sandy Hook Facies of Callaway Limestone Lithofacies of Cedar City Formation.

Named from an outcrop in road ditch along the east side of a county road about 0.5 mile south of town of Clifton City, Cooper County. Also exposed in Saline, Pettis, Morgan, Moniteau, Cole, Boone, and Callaway Counties.

Climbing Arrow Formation (in Bozeman Group)

Eocene, middle or upper, and Oligocene, lower: Southwestern Montana.

G. D. Robinson and H. F. Barnett, 1963, U.S. Geol. Survey Prof. Paper 370, p. 10 (table 1), 61, 69—77, pl. 1. Olive thick-bedded sandy bentonitic clay and coarse sand with subordinate light-colored siltstone, sandstone, conglomerate, and limestone. Thickness 750 to 1,000 feet. Roughly divided into three units: lower dark unit, about 500 feet; middle white unit, 100 to 200 feet; and upper dark unit, 200 to 300 feet. Overlies Milligan Creek formation (new); grades upward into Dunbar Creek formation (new) over stratigraphic interval of about 50 feet by an alternation of dark bentonitic clay with white and yellow tuffaceous siltstones that characterize basal Dunbar Creek.

Type area: NW cor sec. 12, T. 1 N., R. 1 E., Three Forks quadrangle. Named for Climbing Arrow Ranch, of which the principal buildings (SW cor. sec. 8, T. 1 N., R. 2 E.) are on fairly typical outcrops of formation though rather remote from main areas of exposure.

Clinchfield Sand (in Jackson Group)

Eocene: Central Georgia.

R. E. Carver, 1966, Southeastern Geology, v. 7, no. 2, p. 83—92. In 1965 Vorhis (oral presentation and abstract Geol. Soc. America, southeastern sec. Ann. Mtg., Nashville) proposed name Clinchfield Sand for a sand which occurs at base of Jackson Group or just below Jackson Group and has been called Gosport Sand of Claiborne Group (Herrick, 1961, Georgia Geol. Survey Bull. 70; LeGrand, 1962, Georgia Geol. Survey Bull. 72). Inasmuch as name "Clinchfield" has been presented only in abstract it has no formal status and is used in an entirely informal sense in present report. Age of Clinchfield not known with any certainty, but its inclusion in Jackson Group seems reasonable. Herrick (1961) described section in Georgia Geological Survey well GGS 258. He reported 110 feet of fossiliferous glauconitic Ocala Limestone with 10 feet of sand at base. The well bottoms in the sand, here referred to Clinchfield sand of Vorhis. In Georgia Geological Survey well 339, Herrick showed the sands at the top of the Jackson Group as underlain by 56 feet of marl, 39 feet of limestone, and 10 feet of sand, all grouped as Barnwell Formation. The Cooper Marl, Ocala Limestone, and Clinchfield sand are lithologic units of formation rank and, on basis of lithology of lower part of Jackson Group in this well, they are herein plotted as Cooper Marl, Ocala Limestone, and Clinchfield sand in figure 3 of present report. Georgia Geological Survey well 195 consists of 26 feet of sand underlain by 125 feet of interbedded marl and limestone with 10 feet of sand at base. Herrick assigned the sand at the top of the Jackson Group to Cooper Marl, the marls to Twiggs Clay Member of the Barnwell Formation, the limestone, with exception of a thin limestone in a thick marl in the upper part of the section, to Ocala Limestone; and the basal sand to Gosport Sand of Claiborne Group. Herrick's Ocala Limestone units have been retained in figure 3 of present report, and other units reassigned on lithologic basis used in section 3 which shows Clinchfield sand at base. On the outcrop in Big Indian Creek section, the Clinchfield sand is 10 feet thick, fine-grained, structureless, and white to cream colored. It underlies Twiggs Clay Member of Barnwell Formation. [The abstract of Vorhis' paper, given at the Geological Society of America Nashville meeting, 1965, was published in 1966 (Geol. Soc. America Spec. Paper 87). It did not contain name Clinchfield sand.]

Exposed along banks of Big Indian Creek along Georgia Highway 274, 2.4 miles northwest of Houston-Pulaski County line.

Clinker formation

Permian (Wolfcampian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 5—6, pls. 2, 5. Thick-bedded sandstone unit above Curry formation (new). Thickness about 2,000 feet. Underlies Kirkman formation. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. For what other geologists consider Wolfcampian-age Oquirrh, Welsh and James proposed Curry and Clinker Formations. These names should be used with caution until further detailed work is done.

Type section: On western hill of South Mountain, sec. 18, T. 4 S., R. 6 W. Reference section, Freeman Peak. Named "Clinker" because rock gives high-pitched sound when struck with hammer.

Clipper Canyon Group or sequence

Ordovician: Central Nevada.

Marshall Kay, 1962, Geol. Soc. America Bull., v. 73, no. 11, p. 1423, 1425 (fig. 1), 1427 (fig. 2). Clipper Canyon Group (sequence) includes (ascending) Charcoal Canyon, Petes Summit, Sams Spring, and Joes Canyon Formations. [Kay, 1960, Internat. Geol. Cong., 21st, Copenhagen, pt. 12, used term Clipper Canyon sequence.]

Named for Clipper Canyon in Toquima Range.

Clove Brook Member (of Decker Formation)

Upper Silurian: Western New Jersey.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 9—10, 50—51. Herein proposed that (1) name Decker Formation (=Decker Ferry Formation of Weller, 1900, New Jersey Geol. Survey Ann Rept. of the state geologist for 1899) be applied to strata lying between Bossardville Limestone and Rondout Formation in northeastern Pennsylvania and New Jersey, (2) the calcareous facies northeast of Hainesville area, New Jersey, be designated Clove Brook Member, and (3) the arenaceous facies southwest of Hainesville area be designated Wallpack Center Member. The Clove Brook is predominantly medium-gray to medium-dark-gray medium- to coarse-grained flaggy to massive even-bedded fossiliferous limestone. A massive bed of moderate-reddish-brown to dark-reddish-brown coarse-grained iron-rich fossiliferous limestone forms excellent marker bed within the member. Thickness 50.2 feet at type section. Becomes more arenaceous southwest of type locality and near Hainesville, N.J., is almost entirely replaced by Wallpack Center Member.

Type section: Abandoned William Nearpass quarry, 1.8 miles southwest of Duttonville, N.J., in Port Jervis South quadrangle. Named for Clove Brook, 0.5 mile northeast of the quarry. Section is on the southeast slope of Wallpack Ridge.

Clover Creek Sandstone lithosome (in Beaverhead Formation)

Upper Cretaceous: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Clover Creek Sandstone lithosome 4,000 feet. Consists mostly of clean calcareous quartz sandstone.

Clover Creek is in Beaverhead County.

Cloverdale Till Member (of Jessup Formation)

Pleistocene: Southern Indiana.

W. J. Wayne, 1963, Indiana Geol. Survey Bull. 25, p. 54—56, 71. Name proposed for lower part of Jessup. Consists dominantly of sandy conglomeratic mudstone but includes lenses and thin beds of gravel, sand, silt, clay and low grade coal. Both top and bottom of member marked by major erosional unconformities. Marked at top by distinctive paleosol, from which carbonates have been leached to depth of 3 to 4 meters, and locally by lentils of weathered gravels, sands, silts, and coallike sediments. Where this "key bed" has been removed by erosion, Cloverdale Till is difficult to distinguish from younger Butlerville Till Member (new). Thickness about 29 feet at type section.

Type section: Cut on side of spillway for Cagle's Mill Reservoir, Putnam County, in SE¼NW¼ sec. 13, T. 12 N., R. 5 W., Poland quadrangle.

Coal Valley Member (of Chignik Formation)

Upper Cretaceous: Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 50, 55 (fig. 12), 52—53, 166—167, pt. 2, maps. In type area consists of carbonaceous to lignitic shales, siltstones, and sandstones, locally bentonitic and weathering to typical orange and reddish-brown colors. Upper third of member consists of pebble and cobble conglomerate containing largely volcanic, granitic, and chert clasts. Thickness 1,250 feet in type area. Underlies unnamed upper part of formation. In type area occurs above Herendeen Limestone.

Type area: Exposures in hills above Coal Valley and southeast of Staniukovich Mountain, Port Moller-Pavlof Bay, Alaska Peninsula.

Coberly Formation (in Colorado Group)

Upper Cretaceous: Central western Montana.

V. E. Gwinn, 1961, Dissert. Abs., v. 21, no. 8, p. 2247, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4), 1965, Billings Geol. Soc. Guidebook 16th Ann. Field Conf. p. 45—47. Defined as fossiliferous gray limestones and tan salt-and-pepper sandstones of early Late Cretaceous age lying between Dunkleberg member (new) of Blackleaf formation, below, and Jens formation (new), above. Upper boundary placed above highest (youngest) salt-and-pepper sandstone or limestone bed in the transitional interbedded sequence below the main body of Jens shale. Thickness 570 to 650 feet.

Type section: Composite of which upper 310 feet were measured in NE½ sec. 21, and lower 260 feet in E½ sec. 8, both in T. 10 N., R. 11 W., east and north of Jens respectively. Name derived from Coberly Gulch, about 6 miles southeast of Drummond, Granite County, where it is exposed along Coberly syncline for nearly 4 miles.

Coburn Hill Volcanic Member (of Moretown Formation)

Coburn Hill Volcanic Member (of Mississiquoi Formation)

Middle Ordovician: North-central Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Mapped as member of Mississiquoi formation. Consists of actinolite-epidote-chlorite-albite greenstone and hornblende-albite-epidote amphibolite; includes pillow lava.

W. M. Cady, A. L. Albee, and A. H. Chidester, 1963, U.S. Geol. Survey Bull. 1122—B, p. B—27, B—30—B—32, pl. 1. Formal proposal of name. Member of Moretown formation. Present in upper part of formation.

Type locality: In west slope of Coburn Hill in town of Newport, upper Mississiquoi Valley.

Cocoon Soil

See S Bar S Formation, Rye Patch Formation, **Eetza Formation**, and Rye Patch-Cocoon Stage.

Cocoraque Formation

Lower Cretaceous: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H8—H9. Consists mostly of gray-green arkose and graywacke, gray quartzite, red and gray mottled mudstone and pebble-conglomerate beds. Well bedded and well sorted. Most beds less than 18 inches thick. Formation folded along northwest trending axis and cut by numerous faults. Estimated thickness about 2,000 feet. Intruded by plutonic masses, commonly quartz diorite or quartz monzonite, presumed to be Late Cretaceous or early Tertiary. Base not exposed. Presumed to be younger than Nolia Formation (new). Appears to underlie Roadside Formation (new) unconformably at depth of 628 feet in abandoned No. 3 shaft of Roadside mine and at surface 2 miles west of Cocoraque Ranch. Similar to rocks of Amole Group of Kinnison (1959, Arizona Geol. Soc. Guidebook 2) which crop out in Tucson Mountains about 10 miles east of Roskruge Mountains.

Michael Bikerman, 1967, Geol. Soc. America Bull., v. 78, no. 8, p. 1029—1036. Discussion of K-Ar dating of igneous rock units in Roskruge Mountains, Pima County. Apparent age of Cocoraque formation (whole-rock andesite) 108.1±2.4 m.y. The 108-m.y. age of the whole-rock andesite in the Cocoraque formation is the first definitely mid-Cretaceous date obtained on volcanic rocks in Tucson-Roskruge area. The position of the sample within the Cocoraque formation of Heindl (1965) would place his younger Roadside formation in the Late Cretaceous.

Type localities: Along a northeast-trending dry creek and trail about 4 miles south-southwest of Cocoraque Ranch, and along a northeast-trending creek about 1 mile south of Cocoraque Ranch, Roskruge Mountains, Papago Indian Reservation.

Cocoraque Butte Granodiorite

Tertiary, middle: Southern Arizona.

P. E. Damon and others, 1965, Arizona Univ. Geochronology Labs. Ann. Prog. Rept. No. COO—689—50 to Research Div. U.S. Atom. Energy Comm., p. 27, app. A—XII—14 (table 2). Cocoraque Butte granodiorite gave K-Ar date of 68 m.y. on biotite.

Cocoraque Butte is in northeastern part of Roskruge Range.

Coffee Pot Member (of Dyer Formation)

Upper Devonian: West-central Colorado.

J. A. Campbell, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1573. Dyer Formation subdivided into two carbonate members. Upper member, Coffee Pot, consists of light-gray dense stromatolitic dolomite. Carbonates of Coffee Pot Member apparently were deposited in a tidal flat environment. Overlies Broken Rib Member (new).

Type locality and derivation of name not stated.

Coffee Run Dolomite (in Bellefonte Group)

Ordovician: Central Pennsylvania.

F. M. Swartz and others, 1955, Pennsylvania Geologists Guidebook 21st Ann. Field Conf., p. F—6, F—14, F—15 (geol. map). Thickness 1,000 to 1,200 feet. Underlies Tea Creek dolomite (new). Contains layers of dololutite that approach the dololutites of the Tea Creek in character, but these tend to be overshadowed by interbeds of finely crystalline to medium crystalline dolomite that weather medium to medium dark, somewhat brownish in color. Cyclic occurrences of dolomites of differing texture, fabric, and color occur in different parts of the Coffee Run. Overlies Axemann limestone.

Type section: In stream in Kishacoquillas Valley from which name is derived. In Bellefonte to Pleasant Gap area, Nittany Valley.

Cohocton Stage

Upper Devonian (Senecan): New York.

L. V. Rickard, 1964, New York State Mus. Sci. Service Geol. Survey, Map and Chart. Ser., no. 4. Name suggested for youngest stage of Senecan, encompassing all units between base of Rhinestreet (Moreland) Shale and top of Dunkirk Shale. Follows Finger Lakes Stage. Followed by Cassadaga Stage of Chautauquan Series. Name replaces Chemung as used by Cooper and others (1942).

Type (area): Consists of series of exposures located principally in Naples and Bath quadrangles.

Cokedale Formation (in Livingston Group)

Upper Cretaceous: South-central Montana.

A. E. Roberts, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B86—B92. Consists of siltstone and sandstone with claystone, tuff, bentonite, and coal in lower part. Thickness 1,550 feet at type section. Conformably underlies Miner Creek Formation (new); overlies Eagle Sandstone, contact not distinct.

A. E. Roberts, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—258. Mapped in Hoppers quadrangle where it overlies Eagle Sandstone and underlies Miner Creek Formation. Consists of andesitic siltstone and sandstone with claystone, tuff, bentonite and coal. Lower part carbonaceous with some thin coal beds; sandstone locally conglomeratic; contains fossil spores, plants, wood, dinosaur bones and fresh-water mollusks.

Type section: Exposed in S½ sec. 23 and NE¼ sec. 26, T. 2 S., R. 8 E., immediately north of former coal-mining town of Cokedale, Park County.

Coleville Member (of Coburn Formation)

Middle Ordovician: Central Pennsylvania.

R. R. Thompson, 1961, Dissert. Abs. v. 22, no. 1, p. 231—232. Contains interlayers of *Dalmanella* and *Dalmanella*-crinoidal bioskeletal calcirudites. Overlies Milesburg member.

R. R. Thompson, 1963, Pennsylvania Geol. Survey 4th ser., Bull. G—38, p. 26—28, 42—46, 88—90. Formal proposal of name. Thickness 173 feet at type section herein designated where it can be divided into three rock units on basis of fossil content of bioskeletal calcirudites. Lower, 9 feet thick, with interlayers of crinoidal bioskeletal calcirudite. Middle, 25 feet thick and extending from 9 to 34 feet above base, contains subequal percentages of *Sowerbyella* bioskeletal calcirudite. Upper, 139½ feet thick, distinguished by interbeds of *Dalmanella* bioskeletal calcirudite and *Dalmanella*-crinoidal bioskeletal calcirudite. Overlies Milesburg Member; underlies Antes Shale.

Type section: About 9,750 feet west of 77°45′ long and about 1,250 feet north of 40°55′ lat in Bellefonte quadrangle. Exposure is on northern edge of town of Bellefonte in cut along eastern side Route 53 that leads to Milesburg.

Collier Butte Diorite

Upper Jurassic: Southwestern Oregon.

R. H. Dott, Jr., 1965, Jour. Geophys. Research, v. 70, no. 18, p. 4688 (fig. 1), 4694 (table 3), 4697. Potassium-argon age 139 to 145 m.y.

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 53, 54. Discussion of late Mesozoic stratigraphy and tectonic history of Port Orford-Gold Beach area, southwestern Oregon Coast. Collier Butte diorite, 15 miles east of Gold Beach, intrudes serpentinite emplaced in phyllite and schistose Dothan rocks. Burt (1963, unpub. thesis) gave K-Ar analysis of a hornblende concentrate as 150±12 m.y. The Otter Point Formation contains many granitic clasts but none of serpentinite, and it is not in depositional contact with the serpentinite or dioritic pluton.

Collier Butte is in Curry County.

Colorado Chief marker bed (in Bluebell Dolomite)

Upper Ordovician, Silurian, and Devonian: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 64. A distinctive bed of laminated dolomite near middle of Bluebell which separates the formation into two members. The dolomite unit is about 10 feet thick and is characterized by medium-dark-gray and medium-light-gray laminae, a few millimeters to a centimeter or more in thickness, which are wavy and contorted. Lighter colored laminae are calcareous.

In East Tintic Mountains. Not present in Pinyon Peak area.

Columbia Stade

Colombia Stade

Pleistocene (Kansan): Southeastern Illinois and northern Kentucky.

W. J. Wayne and J. H. Zumberge, 1965, *in* The Quaternary of the United States—review volume for the 7th Congress of the International Association for Quaternary research: Princeton, N.J., Princeton Univ. Press, p. 67 (fig. 3). Kansan glaciation divided into (ascending) Alpine Stade, Garrison Creek Interstate, and Colombia [Columbia] Stade. Names credited to Gooding (in press).

A. M. Gooding, 1966, Ohio Jour. Sci., v. 66, no. 4, p. 426—433. Geologic-climate subdivisions of Kansan Stage in southeastern Indiana are named as follows (ascending): Alpine Stade, Garrison Creek Interstadial, and Columbia Stade. The second Kansan till (unit 3 in Townsend Farm section), in which the Yarmouth soil is developed, is named Columbia Stade.

Type section: Townsend Farm section located in streambank on south side of North Branch of Garrison Creek in Fayette County, Ind., in northwest corner of sec. 20, T. 13 N., R. 12 E., Alpine quadrangle. Named for town near type section.

Columbiana Shale

Columbiana Limestone and Shale

Pennsylvanian: Eastern Ohio

G. H. Dutton and others, 1961, Geol. Soc. America Guidebook for Field Trips, Cincinnati Mtg., p. 148 (fig. 5), 149. Near Salem, Ohio, rocks are mostly of Allegheny age and best outcrops are in ravines along Middle Fork of Little Beaver Creek. Brookwood Hollow is one of these ravines and exposes beds from Clarion (?) to Lower Freeport sandstone. Most significant members are between Lower and Middle Kittanning coals. In this interval three limestones are exposed: marine Columbiana (formerly Hamden) consisting of thin nodular limestone associated with fossiliferous shale above the Lower Kittanning coal; nonmarine lenticular Hamden limestone interbedded with Oak Hill underclay; and nonmarine Leetonia (formerly Salem) in a ledge at base of Middle Kittanning underclay. Until recently only two limestones, Hamden and Salem, were recognized in this interval. Term "Hamden" had been applied to both the marine limestone and shale over the Lower Kittanning coal and to the nonmarine limestone and ironstone associated with Oak Hill underclay. Type Hamden is nonmarine, hence name Columbiana has been proposed for the marine member. Name Leetonia proposed to replace name Salem in this interval. [Use of term "member" in this report not clear.]

R. M. DeLong and G. W. White, 1963, Ohio Geol. Survey Bull. 61, p. 64-65, pl. 1. Columbiana Limestone and Shale is marine member directly overlying Lower Kittanning (No. 5) Coal, and was formerly identified as "Hamden limestone and ore." Name "Columbiana" has been proposed by Sturgeon and DeLong (in press). In present report [Stark County], name "Columbiana" is used to designate the fossiliferous marine member overlying Lower Kittanning Coal where the member occurs in Stark County as a dark shale, a calcareous shale to shaly limestone, or as a nodular limestone or siderite imbedded in the dark shale matrix. Thickness 4 inches to 4 feet 3 inches. [Use of term "member" in this report not clear.]

Type location: Brookwood Hollow, 2 miles north of Salem on U.S. Route 62 and 50 yards south of Salem Plastics plant, S½NW¼ sec. 29, Salem quadrangle, Perry Township, Columbiana County.

Colvos Sand

Pleistocene: Northwestern Washington.

M. E. Garling, Dee Molenaar, and others, 1965, Washington (State) Div. Water Resources Water Supply Bull. 18, p. 32, pl. 1. A thick sequence of fine-grained, well-sorted sands. Deposits range from finely laminated varved clays and silt commonly found at base of formation, to thick, massive strata of sand, with strata and lenses of coarse sand and gravel. Thickness 0 to 300 feet. Overlies Kitsap Formation; underlies Vashon Drift.

Named for exposures in sea cliffs along Colvos Passage, Kitsap Peninsula.

Commercial Limestone Member (of Bingham Mine Formation)

Pennsylvanian: Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 8, 9, pl. 5. Overlies Lark limestone member and underlies Parnell limestone member (both new). Jordan limestone member (new) and Commercial limestone member occur on both sides of Bingham stock. On west side of district these units are known as Highland Boy and Yampa limestones. Commercial member is dark-gray to black very fine grained argillaceous and silty thin-bedded limestone with nodular chert. Sandstones of Bingham mine formation (new) are the rocks known as "Bingham quartzites" in mining district. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

Concord Pond Member (of Littleton Formation)

Lower Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 36—43, pls. 1, 2. Mainly gray-weathered coarse-grained quartz-feldspar-two mica-sillimanite, migmatitic gneiss interbedded with lesser amounts of gray to dull-brown quartz-feldspar-biotite granulite. Included in member are one or more 50- to 75-foot-thick horizons of calc-silicate granulite. In syncline that plunges northward from South Woodstock it is possible to consider half of outcrop pattern and obtain minimum thickness of 1,700 feet for unit. Estimated thickness 3,400 feet in northwest-plunging syncline in vicinity of Chamberlain Mountain. Assuming a one-third repetition of bedding due to folding, a thickness of 2,500 feet is reasonable estimate. Underlies Wilbur Mountain member (new); overlies Billings Hill formation (new).

Type locality: Concord Pond in Bryant Pond quadrangle. Also well exposed on Kimball Hill, Mount Zircon, Bean Mountain, and Davis Mountain.

Condor Canyon Formation (in Quichapa Group)

Oligocene: Eastern Nevada.

E. F. Cook, 1965, Nevada Bur. Mines Rept. 11, p. 8 (fig. 4), 23. Consists, in different sections, of from one to five highly welded vitric to vitric-crystal ignimbrites. Two of the members, Swett Ignimbrite and Bauers Ignimbrite, make up entire formation in southwest Utah, where they were named by Mackin (1960) and given member status in his Quichapa Formation. Overlies Leach Canyon Tuff. Underlies Harmony Hills Tuff in most areas. In some areas separated from it by unit of andesite flow breccia or by units of basalt. Oligocene.

P. L. Williams, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 2003. Quichapa Group consists of four formations (ascending): Leach Canyon, Condor Canyon, Pahranagat Lakes (new), and Harmony Hills. Isotope age determinations indicate Quichapa Group was deposited during early to middle Miocene.

Type section: In Condor Canyon along Pioche Branch of Union Pacific Railroad, in secs. 22, 23, 24, 26, and 27, T. 1 S., R. 68 E., Lincoln County.

Conner Creek Formation

Paleozoic: Southern Idaho.

R. L. Armstrong and F. A. Hills, 1967, Earth and Planetary Sci. Letters, v. 3, no. 2, p. 118 (fig. 3), 119 (fig. 4), 120. Discussion of Rb-Sr and K-Ar geochronologic studies of mantled gneiss domes, Albion Range, southern

Idaho. Four analyzed specimens of Conner Creek Formation schists, all from within 3,000 feet of the base of the metamorphosed Paleozoic section, do not define an isochron but lie scattered about an isochron for 600 m.y.

Type locality and derivation of name not stated.

Connersville Interstade, Silt

Pleistocene (Wisconsin): Southeastern Indiana and southwestern Ohio.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 667—668, 681 (fig. 3, table 6). An interstadial deposit overlying Fayette drift (new) is considered to represent climatically controlled rêtreat interval and is herein named Connersville interstadial. Interstadial deposit recognized and correlated by radiocarbon dates from central Indiana, across southwestern Indiana, into southwestern Ohio.

Named after Connersville, Fayette County, Ind.

Contreras Conglomerate Member (of Pitoikam Formation)

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. I1—I12. Pinkish-brown boulder conglomerate with interbedded thin beds of sandstone and siltstone. Thickness as much as 4,400 feet at its north end where it faulted against Ali Molina Metamorphic Complex (new); southward thins or grades laterally into and becomes indistinguishable from finer grained deposits of Chiltepines Member (new) of formation. Overlies unnamed lower conglomerate member.

Type locality: Along unnamed wash that heads nearly a mile north of Peak 6164. Named for Contreras Creek, Baboquivari Mountains, Papago Indian Reservation.

Contzen Pass Formation

Tertiary: Southwestern Arizona.

R. L. Mauger, P. E. Damon, and B. J. Giletti, 1965, Am. Inst. Mining and Metall. and Petroleum Engineers Trans., v. 232, p. 86. Mentioned in report on isotopic dating of Arizona ore deposits. Name credited to Imswiler (1959, unpub. thesis).

Occurs in northern part of Tucson Mountains, Pima County.

Convict Lake Formation

Middle Ordovician: East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 20—21, pls. 1, 2. Northwest of Convict Lake where structural deformation is least, formation is about 1,500 feet thick and divisible into two members, an upper siliceous calc-hornfels member about 300 feet thick and a lower siliceous hornfels member about 1,200 feet thick. Near southernmost exposure, formation is about 1,500 feet thick, but tongue of granodiorite obliterates upper stratigraphic contact. East of Mount Morrison, upper 1,000 feet of lower member is cut out by fault which intersects beds at small angle. Conformably overlies Mount Aggie formation (new). Near Convict Lake lower contact is placed at base of lowest prominent quartz sandstone unit and is quite sharp. About 1½ miles south of Convict Lake, the quartz sandstone lenses out and contact is gradational over stratigraphic interval of as much as 200 feet. Underlies Mount Morrison sandstone (new). Middle Ordovician (Caradoc) on basis of graptolites.

Type locality: Near west end of Convict Lake, Mount Morrison quadrangle, Sierra Nevada. Exposed from type locality along strike for a mile to north and discontinuously for 4 miles to south.

Cooks Formation (in El Paso Group)

Canadian (Demingian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Name applied to first endoceroid zone. Younger than Big Hatchet formation (new) and older than Victorio formation (new). Canadian treated as system in this report.

Type section: In northern end of Cooks Range. Named from defunct town of Cooks.

Cooks Range Member (of Upham Dolomite)

Ordovician: Southwestern New Mexico.

R. H. Flower, 1965, New Mexico Geol. Soc. Guidebook 16th Field Conf., p. 116 (fig. 1), 122, 123 (fig. 4). A white granular calcarenite. Restricted to Cooks Range and Lone Mountain.

Southwestern New Mexico.

Cooleyville Granitic Gneiss (in Prescott Intrusive Complex)

Devonian(?): West-central Massachusetts.

Peter Robinson, 1967, Massachusetts Univ. Conf. on Econ. Geology in Massachusetts, Proc., p. 34, 41. A part of the Prescott Intrusive Complex.

Prescott Intrusive Complex is in Bronson Hill anticline, a complex zone of gneiss domes and recumbent folds that lies near center of Appalachian tectonic belt of New England.

Coon Hollow Formation

Upper Jurassic: Northwestern Idaho and northeastern Oregon.

R. F. Morrison, 1964, Northwest Sci., v. 38, no. 3, p. 83—87. Characteristically thin-bedded black mudstone with subordinate amounts of pebble conglomerate and lithic graywacke. Because of structural complications, total thickness of formation cannot be measured through a single, continuous section. Minimum thickness estimated to be 2,000 feet. Overlies eroded surface of Upper Triassic limestone and associated fragmental rocks. Toward east and west underlies Miocene lavas of Columbia River Plateau. Toward north unit is terminated by intrusion of biotite diorite.

Type section: From about center to northeast corner of sec. 6, T. 30 N., R. 4 W., Nez Perce County, Idaho. Section includes rock exposed in north wall of valley cut by unnamed creek which empties from Idaho side into Snake River, opposite the northern of two small islands in bed of river. Named from typical exposure in Coon Hollow (45°57'25" N—116°53'18" W.), a small canyon cut by a creek flowing from Oregon into Snake River.

Cooper lithofacies (of Cedar City Formation)

Cooper limestone facies (of Callaway Formation)

Middle Devonian: Central and northeastern Missouri.

A. G. Unklesbay, 1952, Missouri Geol. Survey and Water Resources, 2d ser., v. 33, p. 30—32. Facies of Callaway formation. Typically sublithographic to very fine grained bluish-gray limestone, but away from type area, color ranges from light gray to nearly black.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Lithofacies of Cedar City formation (new). Divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Crrek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 9—14. Thickness of lithofacies at type section, herein designated, 43 feet. Lithofacies overlain by *Siphonodella* Beds of Bachelor Formation (Mehl, 1960) over most of outcrop area. Where the Bachelor is absent, lithofacies is overlain by Chouteau Formation. In other areas overlain by Holts Summit Formation (Mehl, 1960), Turpin Sandstone (Mehl, 1960), Grassy Creek Formation, or Callaway Lithofacies. Over most of outcrop area overlies Cotter-Jefferson City Formations. In places overlies St. Peter, Joachim, Kimmswick, and Maquoketa Formations. Contains megafossils in Boone County and elsewhere, where it interfingers with Callaway Lithofacies.

Type section: Abandoned quarry about 2 miles southwest of Otterville along north side of U.S. Highway 50, SE¼NW¼SW¼SW¼ sec. 5, T. 45 N., R. 19 W., Cooper County. Facies not continuous over large areas, but crops out in Pettis, Copper, Morgan, Moniteau, Saline, Boone, Ralls, and Marion Counties.

Coopers Mills Formation

Devonian(?): South-central Maine.

R. G. Doyle and Jeffrey Warner, 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., Trip B, p. 26 (table 1), 28, road log. Forms core of syncline. Composed of interbedded two-mica schist biotite quartzite. Quartzites distinct in texture from Vassalboro quartzites in that they are not calcareous or laminated. Top of formation never exposed. Minimum thickness estimated to be 3,500 to 4,500 feet. Formation traced south into Cape Elizabeth Formation of Casco Bay Group and northeast into Knox Gneiss of Perkins and Smith (1925). Listed as an unpublished name used informally for convenience of discussion and reference.

Type locality: At Coopers Mills.

Cooperstown Drift

Pleistocene: Southeastern North Dakota.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, pt. 1, p. 34—35. In Barnes County, Cooperstown drift covers an area of about 30 square miles northeast of Bald Hill Creek and west of Lake Ashtabula. Till of the drift is composed of calcareous cohesive, sandy silt. Thickness of drift averages less than 20 feet in test holes that have penetrated the unit. Younger than Kensal-Oakes drift and older than Luverne drift.

Type area: In vicinity of Cooperstown, approximately 15 miles north of Barnes County boundary.

Cooperstown Shale Member (of Moscow Formation)

Middle Devonian (Erian Series): East-central New York.

L. V. Rickard and D. H. Zenger, 1964, New York State Mus. Bull. 396, p. 12 63, (table 1), 88—91. Uppermost member of Moscow Formation in

Cooperstown quadrangle is equivalent to Windom Shale. Name "Windom" has been applied at Cooperstown and as far east as Schoharie County, to interval of silty shales, siltstones, and sandstones of the Hamilton above Portland Point Limestone. This "Windom" bears little resemblance to typical calcareous shales of true Windom of central New York. Name Cooperstown is proposed for the eastern, coarser facies of the Windom. Consists of bluish arenaceous shales and fine-grained gray and brown argillaceous sandstones; fossiliferous. Thickness 410 to 460 feet. Overlies Portland Point Limestone Member; underlies Gilboa Formation. Boundary with Gilboa is essentially a faunal one.

Type section: Composite sections along stream west of Platt Hollow Road and in Strong Ravine, 1.0 mile south and 2.7 miles south-southwest of Westville, respectively. Geographic extent of unit is from Cortland County to Schoharie County, where it grades laterally into continental beds.

Coosawhatchie Clay (in Hawthorn Formation)

Miocene: Eastern South Carolina.

S. D. Heron, Jr., G. C. Robinson, and H. S. Johnson, Jr., 1965, South Carolina Div. Geology Bull. 31, p. 24. Informal name for distinctive clay in Hawthorn Formation in Jasper County. Clay is yellow green to light blue; predominantly an almost pure montmorillonite. Thickness about 15 feet.

Named for exposures in Atlantic Coast Line Railroad cut south of Coosawhatchie, Jasper County. Also exposed at Dawson's Landing on Coosawhatchie River.

Copper Basin Formation

Lower Mississippian to Lower Permian: Central Idaho.

C. P. Ross, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 384—387; 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 45—48. Formation interleaves with and contains lithic equivalents of Milligen and Wood River Formations and White Knob Limestone (new). These include siltstone, sandy quartzite, argillite, conglomerate, and limestone in proportions that vary from place to place. May be more than 10,000 feet thick at type locality.

Type locality: Exposures in upper part of Star Hope Creek at southern edge of Copper Basin in Custer County. Copper Basin is topographic depression near middle of Mackay quadrangle.

Copper Canyon Formation

Pliocene(?): Southeastern California.

Harald Drewes, 1963, U.S. Geol. Survey Prof. Paper 413, p. 32—36, pl. 1. A Pliocene(?) sequence of more than 10,000 feet of moderate-red conglomerate, yellowish-gray siltstone and evaporites, and intercalated basalt. All of lower part of formation, much of middle part, and some of top part is conglomerate that intertongues laterally with siltstone and evaporite member that forms some of middle and top parts of the formation. Formation lies unconformably on tuffaceous rocks of older volcanics and is faulted against intrusive felsite of older volcanics along north side of basin. Conglomerate of Funeral formation unconformably overlies the Copper Canyon to east, and locally breccia member of the Funeral is faulted against the Copper Canyon. Fanglomerate and sedimentary breccia of the Copper Canyon are faulted over the Precambrian metasedimentary rocks on south side of basin on Turtleback fault. Deposited in basin that was closed part of its history. Sequence was informally referred to as Copper Canyon beds by Curry (1941, (abs.) Geol. Soc. America Bull., v. 52, no. 12, pt. 2).

Type area: Copper Canyon, Death Valley National Monument.

Copper Canyon Quartz Monzonite Porphyry

[Eocene]: Central Nevada.

J. H. Schilling, 1965, Nevada Bur. Mines Rept. 10, p. 43. Mentioned in report on isotopic age determinations of Nevada rocks. Age 38 m.y. (±10 m.y.). Refers to Clement (1961, unpub. thesis).

Location: South-central T. 31 N., R. 43 E., at Copper Canyon, Lander County. Exposed over one-half mile square area.

Copper Creek Granodiorite

Upper (?) Cretaceous or Tertiary: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 56–62, pl. 1. Name applied to a massive resistant plutonic igneous rock. Varies in mineralogical composition and appearance from place to place. Generally a greenish-gray to brownish-gray or pale-red medium-grained porphyritic and slightly cataclastic rock compound of plagioclase feldspar, quartz, potassium feldspar, and biotite. Intrudes rocks of Precambrian(?). Paleozoic, and Mesozoic (Cretaceous?) ages. Overlain unconformably by Galiuro Volcanics (new) of Tertiary age, and in two small areas by alluvium.

Named for occurrence in canyon of Copper Creek, in southwest corner of Klondyke quadrangle. Crops out over area of about 2 square miles, or less than 1 percent of quadrangle. Extends south into Galiuro Mountains quadrangle.

Copperfield Formation

Permian(?): Northeastern Oregon.

H. T. Stearns, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 226. Made up of thin-bedded gneisses and chlorite schist, in part granitized as result of an intrusion of quartz diorite body of Jurassic (?) age. Belongs to Seven Devils Volcanics(?).

In Oxbow area on Snake River near Homestead, 70 miles northeast of Baker.

Copper Hill Volcanics

Upper Jurassic: West-central California.

L. D. Clark, A. A. Stromquist, and D. B. Tatlock, 1963, U.S. Geol. Survey Geol. Quad. Map GQ-222. Mafic, intermediate, and sparse felsic volcanic rocks. Amygdaloidal mafic lava. Thick-bedded volcanic breccia. Tuff and lapilli tuff.

L. D. Clark, 1964, U.S. Geol. Survey Prof. Paper 410, p. 30–31, pls. 1–11. Name used for sequence of volcanic rocks that overlies and intertongues with Salt Spring slate (new). Volcanics are mainly pyroclastic rocks, probably mostly andesitic. Partial sections show volcanic rocks of unit are more than 7,000 feet thick on Consumnes River. More than 3,000 feet thick on Mokelumne River. Extends from north of Cosumnes River to south of Stanislaus River within and west of Bear Mountains fault zone. Volcanics are truncated on east by faults and top of formation probably not preserved in that area. Exposed along Stanislaus River and all rivers to north. Volcanics were mapped as diabase and amphibolite by Turner (1894, U.S. Geol. Survey Geol. Atlas, Folio 11) and Lindgren and Turner (1894, U.S. Geol. Survey Geol. Atlas, Folio 3). They were placed in Logtown Ridge formation by Taliaferro (1943) and Taliaferro and Solari (1949, California Div. Mines Bull. 145, map only). The part near Copperopolis was tentatively assigned to Amador group by Heyl and Eric (1948, California Div. Mines Bull. 144). Parts of volcanics were named Mountain Spring volcanics and Newton Mine volcanics by Heyl and Eric (1948).

Type section: On Cosumnes River, in Amador and El Dorado Counties. Named for inactive Copper Hill mine, in NE¼ sec. 34, T. 8 N., R. 9 E., Amador County.

Copper King Shale

Paleozoic: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12 (table 2). Stephens (1946, unpub. rept.) gave a stratigraphic section of the Mountain City quadrangle. Copper King Shale, 540 feet thick, consists of black and gray shale. Overlies Copper Mountain Quartzite and underlies Black Rock Quartzite. Nolan (1937, U.S. Geol. Survey open-file rept.) proposed section that differed from Stephens' section in several ways. He grouped the Rio Tinto Formation, Black Rock Quartzite, and Copper King Shale together as Rio Tinto Formation. The Copper Mountain quartzite was believed to have been thrust over the Copper King Shale.

Area is near Rio Tinto mine in Mountain City quadrangle.

Copper Mountain Quartzite

Paleozoic: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12 (table 2). Table 2 credited to E. C. Stephens (1946, unpub. rept.). Copper Mountain Quartzite has maximum thickness of 2,500 feet. Consists of massive light-colored quartzite with some crossbedding. Overlies Crosby Formation. Underlies Copper King Shale. Nolan (1937, U.S. Geol. Survey open-file rept.) believed the Copper Mountain Quartzite was thrust over the Copper King Shale.

Area is near Rio Tinto mine, Mountain City quadrangle.

Cora Member (of Clore Formation)

Upper Mississippian (Chesterian): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 6 (fig. 2). Basal member of Clore. Consists of shale and limestone. Thickness 40 feet. Underlies Tygett Sandstone Member (new); overlies Palestine Sandstone. Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 40, 41, 61, pl. 1. Name formally proposed in this report for lower member of Clore Formation of Elviran age. Commonly 15 to 45 feet thick. Type section consists of 12 feet of partly fossiliferous shale containing interbeds about 1 inch thick of dark-colored phosphatic sandy limestone overlying a 4-inch coal bed at top of Palestine Sandstone and separated from Ford Station Member above by a 22-foot covered interval.

Type section: Exposed in Mississippi Valley bluff at south edge of Degonia Creek Hollow, one-fourth mile north of Cora, SW¼SE¼ sec. 16, T. 8 S., R. 5 W., Campbell Hill quadrangle, Jackson County.

†Corkscrew Quartzite

Cambrian: Eastern California and western Nevada.

H. R. Cornwall and F. J. Kleinhampl, 1964, U.S. Geol. Survey Prof. Paper 454—J, p. J3—J4, pls. 1, 2. A vitreous pure quartzite that weathers to gray, pink, and reddish or purplish brown. Fine to medium grained, and locally conglomeratic, containing sparse red jasper pebbles. Thinly laminated to thin bedded; exhibits slabby to massive splitting. Crossbedding conspicuous in lower part; stratification in upper part tends to be obscure. Thickness about 1,200 feet near Corkscrew Peak; 1,140 feet in unfaulted section on Bare Mountain, Nye County, Nev. Forms major unit in thrust plate that has overridden Daylight Formation (new) in southwestern part of Bullfrog quadrangle at south end of Grapevine Mountains. Also thrust over Daylight Formation in northeastern corner of quadrangle and small exposure occurs near middle of quadrangle on west edge of Bullfrog Mountain. Underlies Carrara Formation. If Daylight Formation is equivalent to Wood Canyon Formation as defined by Nolan, then Corkscrew Quartzite may be considerably thickened section of Zabriskie quartzite member of Hazzard (1937, California Jour. Mines and Geology, v. 33, no. 4).

J. H. Stewart, 1966, U.S. Geol. Survey Prof. Paper 550—C, p. C72. Correlation of Lower Cambrian and some Precambrian strata in southern Great Basin, California and Nevada. Zabriskie Quartzite overlies Wood Canyon Formation and is recognized throughout Spring Mountain-Death Valley region. In Bare Mountain and Bullfrog quadrangles, Cornwall and Kleinhampl (1964) applied name Corkscrew Quartzite to rocks here considered to be Zabriskie Quartzite. Use of name Corkscrew Quartzite confined to above named quadrangles.

The U.S. Geological Survey has abandoned term Corkscrew Quartzite on basis of study now in progress.

Named for exposures on east flank of Corkscrew Peak, secs. 5 and 8, T. 14 S., R. 46 E., Inyo County, Calif.

Corning Member (of Gardeau Formation)

Upper Devonian: South-central New York and northern Pennsylvania.

D. L. Woodrow and R. C. Nugent, 1963, New York Geol. Assoc. Guidebook 35th Ann. Mtg., p. 64 (fig. 2), geol. map. Named on nomenclature chart and map.

R. G. Sutton, 1963, New York Geol. Assoc. 35th Ann. Mtg., p. 77. A sequence of very dark gray shales and thin-bedded gray siltstones about 40 feet thick. Present at top of formation. Underlies New Milford Formation. Type section stated. Name credited to Twigg (1961, unpub. thesis).

J. E. Sorauf and H. E. Roberson, 1963, New York Geol. Assoc. Guidebook 35th Ann. Mtg., p. 90, 95 (fig. 4). About 5 feet of Corning Member exposed in Corbisello quarry at Binghamton. Consists of gray fissile shale. Underlies New Milford Formation.

D. L. Woodrow, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 85. Geographically extended into northern Pennsylvania.

Type section: Cliff, south of New York 17 at west edge of Corning (elevation 975 feet) where 17 bridges the railroad.

Cornucopia tonalite

Lower Cretaceous(?): Southeastern Oregon.

W. H. Taubeneck, 1964, Geol. Soc. America Bull., v. 75, no. 11, p. 1096, 1097 (fig. 2), 1098 (fig. 3), 1099 (fig. 4), 1101—1108. Cornucopia stock contains at least five distinct tonalites and trondhjemites; each is separate injection. Oldest and largest is Cornucopia tonalite. Next oldest is Tramway trondhjemite. Following unit, first in series of three cordierite trondhjemites is the Big Kettle, and the two subsequent units are Pine Lakes and Crater Lake.

Stock is named for Cornucopia, a mining community near southeast corner of pluton, Baker County.

Cornwallis Limestone (in Hyd Group)

Upper Triassic: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Bull. 1241—C, p. C34, pl. 1. A medium-bedded to very thick bedded medium-gray oolitic limestone that overlies Keku Volcanics (new). Weathers to medium brown, has a knobby appearance, and contains thin wispy interbeds of resistant dark-brown weathering aphanitic limestone. Thickness at least 200 feet on northern part of Cornwallis Peninsula, and possibly thicker to southeast. At northwest tip of Cornwallis Peninsula, the Cornwallis Limestone is inferred to disconformably overlie Pybus Formation. Coeval with Hamilton Island Limestone (new). Late Triassic, ranging from late Karnian to earliest Norian.

Type locality: Northwest shore of Kuiu Island 0.75 to 2 miles east-southeast of Point Cornwallis.

Corona Hornblende Granodiorite Porphyry

Jurassic(?): Southern California.

C. H. Gray, Jr., 1961, California Div. Mines Bull. 178, p. 15—16, pls. 1, 4. Dark porphyry with slightly variable texture and composition of granodiorite. Older than Caljaco quartz monzonite. Relation to Home Gardens quartz monzonite porphyry (new) obscure. Name credited to Pameyan (unpub. thesis).

Crops out in two belts, one on each side of Temescal Canyon, in small body southeast of El Cerrito village, and in rectangular body in northeastern part of Corona South quadrangle.

Corral Canyon Red Beds (in Patagonia Group)

Lower Cretaceous: Southeastern Arizona.

R. C. Baker, 1962, Dissert. Abs., v. 23, no. 1, p. 201. Patagonia group divided into four formations. Corral Canyon red beds, Duquesne volcanics (new), and Bagby Ranch formation (new), tentatively correlated with Bisbee group (Lower Cretaceous); the Molly Gibson formation is younger than Bisbee group.

Area of report in southeastern part of Patagonia Mountains, Santa Cruz County.

Corral Creek Quartz Monzonite

Cretaceous: Northwestern Nevada.

J. D. Smith, 2nd, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 236. Plutonic units were intruded into older rocks during the Cretaceous. From oldest to youngest they are: Cove Camp syenodiorite (new); Corral Creek quartz monzonite; fine-grained quartz monzonite; Snow Creek trondhjemite (new); and Pole Canyon granodiorite (new).

Area of report is southern Pine Forest Range, Humboldt County.

Corral de Piedras welded tuff

Oligocene-Miocene: Southeastern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 71 (table 2). Listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Age 26.5±1.2 m.y.

Tumacacori Mountains, Santa Cruz Mountains.

Cossayuna Group

Lower Cambrian: New York.

D. W. Fisher and others, 1961, New York State Mus. Sci. Service Geol. Survey Map and Chart Ser: No. 5, p. 17, map sheets 3, 4, 5. Basin deposits: graywacke, chloritic quartzite, silty-micaceous shale, purple and green slate, and black shales or green argillites interbedded with limestone conglomerate of slump origin. Thickness about 5,000 feet. Includes (sequence not indicated): West Castleton and "Schodack" Formations, Nassau Formation with Stuyvesant limestone conglomerate, Zion Hill Quartzite, Curtiss Mountain Orthoquartzite, Bomoseen Subgraywacke, Mettawee green and purple slates, shales, argillites, Rensselaer Graywacke.

D. W. Fisher, 1962, New York State Mus. Sci. Ser. Geol. Survey Map and Chart Ser: No. 2. In Taconian series. Includes, in addition to above named units, Austerlitz Phyllite (new), Everett Schist, Elizaville Shale, Ashley Hill Limestone, Eddy Hill Subgraywacke, and Diamond Rock Quartzite.

Cossayuna is in Washington County.

Costilla Granite

Precambrian: North-central New Mexico.

F. E. Kottlowski *in* Zane Spiegel and others, 1963, U.S. Geol. Survey Water-Supply Paper 1525, p. 26 (table 2). Named on table of summary of Precambrian units near and north of Santa Fe. Name credited to P. F. McKinley (1951, ms. rept.).

Northeast of Taos.

Coteau Drift

Pleistocene: East-central North Dakota.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44, 55—56. Name applied to drift that covers the Missouri Coteau, a band of dead-ice moraine that extends from northwest to southeast across state. Drift occurs at elevations of about 300 to 400 feet higher than Grace City drift (new).

Occurs over about 6 square miles in southwest corner of Foster County.

Cotorra Tuff

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 15. Consists of pyroxene tuff and lava, pillow lava near top. Top repeated by faulting. Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

R. G. Briggs, 1967, U.S. Geol. Survey Bull. 1254—A, p. A27—A29. Formal proposal of name. Massive basaltic crystal-vitric tuff and tuff breccia. At base commonly contains bluish-black basaltic pillow lava, and about 5 km east of type locality, where unit is thin, formation is composed of basaltic lava. In area about 0.6 km northeast of type locality, lower 20 m of Cotorra contains blocks similar to those in Malo Breccia (new) in a typical Cotorra crystal-vitric tuff matrix. Thickness 0 to about 500 m. Thickest about 2 km south of type locality. Pinches out about 7 km east-southeast of type area in southwestern corner of Barranquitas quadrangle. Underlies Malo Breccia.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B13. Described in Jayuya quadrangle where it consists largely of dark-green and greenish-black coarse-grained tuff and lapilli tuff with minor volcanic breccia and basalt lava. Thickness 90 to 460 m with thickest part near Cerro de Punta. North of Quebrada La Mina overlies Tetuán Formation, probably conformably; overlies Robles Formation gradationally near Cerro de Punta. Overlain by Achiote Conglomerate (new) conformably or by an angular discordance too small to be measured by aval available data.

Type locality: Roadcut on Highway 559 (35,930 N., 151, 660 E.) about 1 km west of Quebrada La Cotorra.

Cottonwood Porphyritic Adamellite

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 139—141. Light gray. A distinctive rock because of its consistent and uniform porphyritic texture. Separated into eastern and western outcrop areas. Eastern units are in contact with McAfee Adamellite (new) and Quaternary alluvium. Bordering the western mass are two facies of the McAfee on the east and sedimentary rocks on the west.

R. G. Strand, 1967, Geologic map of California, Mariposa sheet (1:250,000): California Div. Mines and Geology. Cottonwood Adamellite mapped with Mesozoic granitic rocks.

Mapped in Barcroft quadrangle. Part of Inyo batholith in White Mountains.

Cottonwood Canyon Formation

Miocene(?) - Pliocene(?): Southwestern Utah.

J. J. Anderson, 1966, (abs.) Houston Geol. Soc., Bull., v. 8, no. 10, p. 21; 1966, Dissert. Abs., v. 26, no. 12, pt. 1, p. 7256. Geology of northern

Markagunt Plateau. Volcanic flows and mudflow-breccias at least 1,000 feet thick. Overlies Bear Valley Formation (new).

Type locality and derivation of name not stated.

Cottonwood Canyon Member (of Madison Limestone or Lodgepole Limestone)

Upper Devonian and Lower Mississippian: Northern Wyoming and Montana.

C. A. Sandberg and Gilbert Klapper, 1967, U.S. Geol. Survey Bull. 1251—B, 70 p. Name Cottonwood Canyon Member of Madison Limestone (or of Lodgepole Limestone in areas where the Lodgepole is basal formation of Madison Group) is applied to a dark shale unit of Devonian and Mississippian age. Member is divided into a lower and an upper tongue, each of which is further divisible into an eastern dolomitic facies and a western shale and siltstone facies. Both tongues are characterized by basal conglomeratic lag deposits containing abundant phosphatic nodules and coprolites, conodonts, and fish remains, and glauconitic grains. The lag deposits are continuous between the facies of each tongue, and the lag deposit of the upper tongue also continues at the base of the Lodgepole Limestone, even where the upper tongue is too thin to be differentiated. Thickness 0 to 80 feet. In Wyoming the member grades into and intertongues with other strata in lower part of Madison Limestone, whereas in Montana and extreme western Wyoming it generally lies at base of Lodgepole Limestone. Member rests unconformably and locally with marked angularity, on rocks ranging in age from Mississippian to Cambrian and on Precambrian rocks in isolated areas in southeastern Wyoming. Youngest unit that lies directly below the Cottonwood Canyon is Sappington Member of Three Forks Formation in vicinity of Bridger Range in southwestern Montana. East of limit of the Sappington, the Cottonwood Canyon rests unconformably on Trident and Logan Gulch Members of the Three Forks in decending order. Beyond limit of the Three Forks Formation, the Cottonwood Canyon unconformably overlies the thin subsurface Birdbear Formation or the exactly equivalent outcropping Birdbear Member at top of Jefferson Formation.

Type section: On north wall of Cottonwood Canyon, about 1 mile east of the mouth, in sec. 34, T. 57 N., R. 93 W., Big Horn County, Wyo. Named for Cottonwood Canyon on west side of northern Bighorn Mountains, 16 miles east of Lovell, in northern Wyoming. Reference section (shale and siltstone facies): In Beartooth Mountains at Clarks Fork Canyon, north of river in NE¼NE¼ sec. 7, T. 56 N., R. 103 W., Park County, Wyo., in Deep Lake 15-minute quadrangle. Subsurface reference section: Interval between core depths of 5,806.9 and 5,819.2 feet in Pan American 72 Elk Basin Madison Unit well of Elk Basin oil field in northwestern Bighorn basin. Well is in NW¼SE¼ sec. 30, T. 58 N., R. 99 W., Park County, Wyo.

Cougar Creek Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 402, 405, pl. 1. Smallest of the Plateau flows. Carries sparse, small phenocrysts of quartz, sanidine, oligoclase, and accessory ferroaugite and magnetite.

Crops out on eastern edge of Madison Valley, northwest of Mount Jackson, in upper reaches of Cougar Creek, Yellowstone National Park.

Cougar Mountain Formation

Miocene, lower: Washington.

P. E. Hammond, 1964, Dissert. Abs., v. 24, no. 7, p. 2869. Thickness 3,120 to 5,300 feet. Overlies Snow Creek Formation (new) of Keechelus Volcanic Group, west of the Cascade Crest. Youngest stratigraphic unit intruded by Snoqualmie batholith. Cougar Mountain and "Ellensburg" Formations are not in contact.

West-central Cascade Range.

Cougar Point Welded Tuff

Cougar Point Formation (in Idavada Volcanics)

Pliocene: Northeastern Nevada and southwestern Idaho.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141–M, p. M13–M15, pl. 1. Massive somewhat columnar lithoidal rocks, reddish-brown, yellowish-brown to brownish-gray. Where glassy, rocks are black or gray to orange red. Maximum thickness about 1,250 feet. Overlies Jenny Creek tuff (new); underlies Banbury formation. Malde and Powers (1962) applied name Idavada volcanics to unit that includes Cougar Point welded tuff and Jenny Creek tuff and possibly also other rocks not represented in Jarbidge quadrangle.

D. I. Axelrod, 1964, California Univ. Pub. Geol. Sci., v. 51, p. 6 (table 1), 9, 11. As defined by Malde and Powers (1962) the Idavada is sufficiently varied so that it seems desirable to recognize it as a group. Cougar Point formation is middle unit of Idavada in Trapper Creek area, Idaho. Overlies Beaverdam formation (new) and underlies Jenny Creek formation. Thickness about 700 feet in lower part of Trapper Creek. Rocks comprising Cougar Point in Trapper Creek area have been traced continuously westward across Cassia arch where they thicken to 1,500 to 1,700 feet on scarp west of Salmon Falls Reservoir a few miles southwest of Rogerson, Idaho. From this area they have been traced 25 miles farther west into Jarbidge region, Nevada, where Cougar Point has its type area. Formation crops out locally in Snake River Plains, where other names (Mount Bennett rhyolite, Shoshone Falls andesite, and Walcott tuff) have been applied to it by earlier workers. Since Cougar Point represents a thick, representative section, the name is used here even though it may not have priority. Also seems desirable to recognize the Cougar Point because it occurs in sections that have yielded floras in adjacent Nevada, and which are described in present report. Middle Miocene (Barstovian).

Type locality: Below Cougar Point on East Fork of Jarbidge River, Jarbidge quadrangle, Elko County, Nev. Occupies most of northern third of Jarbidge quadrangle, but is also exposed on margins of Snake River plain at many places from Goose Creek area in Cassia County, Idaho, to western Owyhee County, Idaho, and on north side of Snake River in southern slopes of Mount Bennett near Mountain Home, Idaho.

Coulson Tongue (of Rock Springs Formation)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 104, pl. 1. Consists of gray to dark-gray and brown shales, locally coaly to carboniferous. Average thickness 80 to 100 feet. Overlies Brooks sandstone tongue (new); underlies McCourt sandstone tongue (new).

Type locality: At old Coulson Ranch in sec. 13, T. 14 N., R. 104 W., Sweetwater County.

Counce Member (of Eutaw Formation)

Upper Cretaceous: Western Tennessee.

E. E. Russell, 1965, Dissert. Abs., v. 26, no. 4, p. 2139. A nearshore, glauconitic sand. Merges with Tombigbee Sand Member by intertonguing. Locally overlies Tuscaloosa and McShan Formations.

Present in McNairy, Hardin, Wayne, Chester, Henderson, Decatur, Benton, and Henry Counties.

Council Mountain Schist

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. An older pre-Cretaceous metamorphic rock with feldspathized layers and lenses, locally a granulite, grades into banded gneiss or quartz dioritic pegmatite on east. Name credited to D. L. Schmidt (1958, U.S. Geol. Survey open-file rept.).

Exposed along east flank of Council Mountain, Long Valley district, Boise Basin.

Cove Camp Syenodiorite

Cretaceous: Northwestern Nevada.

J. D. Smith, 2d, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 236. Plutonic units were intruded into older rocks during the Cretaceous. From oldest to youngest they are: Cove Camp syenodiorite; Corral Creek quartz monzonite (new); fine-grained quartz monzonite; Snow Creek trondhjemite (new); and Pole Canyon granodiorite (new).

Area of report is southern Pine Forest Range, Humboldt County.

Cowbell Member (of Borden Formation)

Lower Mississippian: Southeastern Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224—F, p. F14—F15. At type section includes most of beds that were assigned to Brodhead Formation by Stockdale (1939, Geol. Soc. America Spec. Paper 22). Consists chiefly of thick resistant units of gray, brownish-weathering indistinctly bedded siltstone separated by thin discontinuous units of less resistant gray shaly siltstone. In area from near Berea to near Stanton the Cowbell ranges from 0 to 175 feet in thickness. North of Disputanta section, conformably overlies Nancy Member (new). Conformably overlain by Nada Member (new). South of Disputanta section, member splits into two prominent mappable tongues of siltstone that pinch out a few miles southeastward within Nancy Member. Lower tongue is named Roundstone Bed (new) and upper tongue Conway Cut Bed.

Type section: Exposed along a forest road on the south ridge of Indian Fort Mountain. Named for outcrops in minor tributary of Cowbell Creek about 1.5 miles west of Bighill, Madison County.

Cowboy Spring Formation

Lower or Upper Cretaceous: Southwestern New Mexico.

R. A Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 21—23, pl. 1. Consists of massive and resistant beds of limestone conglomerate separated by beds of sandstone, shale, claystone, and tuff. More than 1,000 feet of formation exposed. Conformably overlies Mojado Formation. Sandstone and conglomerate beds typical of each formation are interbedded through transitional zone several hundred feet thick. Underlies Timberlake Fanglomerate (new) with angular unconformity. No type section measured.

Type locality: Southeast of Cowboy Spring, Walnut Wells quadrangle, Hidalgo County.

Cow Branch Member (of Leakesville Formation)

Triassic: South-central Virginia.

C. T. Meyertons, 1963, Virginia Div. Mineral Resources Rept. Inv. 6, p. 9—12, 51, pl. 1. Name proposed for the black and dark-gray claystones, shales, siltstones, and sandstones of Leakesville formation (new). Intertongues with Cascade Station member (new). No completely exposed section of all Cow Branch member tongues present in Danville basin, but a 217-foot and a 329-foot section is present at type section.

Type section: On State Road 856, 0.2 mile south of State Road 622 and 0.2 mile north of Virginia State line. Name taken from tributary of Cascade Creek near Leakesville Junction, Pittsylvania County.

Cow Creek Member (of Steele Shale)

Upper Cretaceous: Subsurface and surface in south-central Wyoming.

L. A. Hale, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 129—130, 131 (fig. 1), 132 (fig. 2). A prominent sandy zone that divides the Steel shale into upper and lower units. Sandy zone occurs between 3,890 feet and 4,240 feet on Cow Creek Unit well No. 1 and between 3,180 and 3,460 feet in Deep Creek Unit well No. 1. On outcrop to east, it forms mappable horizon and locally is well developed, in part glauconitic, sandstone. Eastward from Hatfield dome, member changes rapidly to silty shale and calcareous concretions.

Named for development in Sohio Oil Co. Cow Creek Unit well No. 1, in sec. 12, T. 16 N., R. 92 W., Carbon County.

Coyote Silt

Pleistocene, lower: Southern California.

California Department Water Resources, 1961, California Dept. Water Resources, Southern Dist., Bull. 104, p. 65, table 1. Consists of tan-brown silt and sand with concretions and abundant shells. Thickness 245 feet. Included in San Pedro formation of this report. Name credited to Hoskins (unpub. thesis).

In Coyote Hills, Los Angeles County.

Coyote Creek Member (of Fall River Formation)

Lower Cretaceous: Subsurface in Wyoming, Montana, and South Dakota.

D. W. Bolyard and and A. A. McGregor, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 10, p. 2221—2244. Fall River Formation subdivided into (ascending) Liscom Creek, Morton, and Coyote Creek Members (all new). Regionally, these members exhibit the geometric characteristics of roof shingles. Whereas the total formation maintains a relatively uniform thickness, each member, or shingle, is a sheetlike body which reaches maximum thickness where the other two are either relatively thin or absent. The Coyote Creek Member, or shingle, is at top of formation in Wyoming but pinches out northward into Montana and the Morton becomes upper unit of formation farther north. At type well, member was penetrated from 6,425 to 6,505 feet, is 70 feet thick, and consists principally of light-buff to gray fine to very fine grained, moderately well sorted sandstone, with subangular grains, dark gray shaly partings, and some carbonaceous material in the upper part. Upper 8 feet consists of medium gray micaceous siltstone and dark gray very finely micaceous silty to sandy shale. These rocks are in sharp but conformable contact with overlying lower Thermopolis Shale. They rest on an extremely thin equivalent of Morton Member. Member reaches maximum thickness of 60 to 80 feet or more in central and southern Black Hills and adjacent areas.

Type well: Mobil Producing Co. No. F—43—33—G (center of NE¼SE¼ of sec. 33 T. 49 N., R. 68 W.). Derives name from Coyote Creek oil field in Crook County, Wyo.

Coyote Flat basalt

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 6, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Coyote Flat basalt gave age of 9.6±.2 m. y.

Sample collected in Bishop quadrangle due east of southwest corner sec. 29, T. 7 S., R. 32 E.

Coyote Ridge Complex

Pre-Middle and Middle Cretaceous: Southern California.

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, p. 722 (table 1), pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features on which correlations are based. Coyote Ridge complex is one of six complexes used in these correlations. Several plutons and sills are listed and mapped. Coyote Ridge pluton also mapped.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Crandall Complex

Eocene(?): Northwestern Wyoming.

R. D. Krushensky, 1962, (abs.) Geol. Soc. America Spec. Paper 68, p. 214. Extrusive rocks of Hurricane Mesa are divided into four stratigraphic units of probable Eocene age. A series of intrusions followed the deposition of the layered volcanic rocks and resulted in emplacement of large ringlike dike complex, the Crandall ring dike in center of mesa and three smaller ringlike complexes on southeast flank of the mesa.

Hurricane Mesa area, Park County.

Crater Lake cordierite trondhjemite

Lower Cretaceous(?): Southeastern Oregon.

W. H. Taubeneck, 1964, Geol. Soc. America Bull., v. 75, no. 11, p. 1096, 1097 (fig. 2), 1102, 1103—1104, 1105. Cornucopia stock contains at least five distinct tonalites and trondhjemites; each is separate injection. Oldest and largest is Cornucopia tonalite. Next oldest is Tramway trondhjemite. Following unit, first in series of three cordierite trondhjemites, is the Big Kettle, and the two subsequent units are Pine Lakes and Crater Lake.

Crater Lake is in Baker County.

Crater Mountain Dacite

Oligocene(?) -Miocene(?) -Pliocene(?): Northwestern Wyoming.

F. S. Fisher, 1966, Wyoming Univ. Contr. to Geology, v. 6, no. 1, p. 71—86, pl. 1. Rocks of the Crater Mountain dacite are light to medium gray. They are all porpyritic. Crater Mountain dacite and its offshoots represent second major period of pluton emplacement in Stinkingwater region. Intrude Needle Mountain granodiorite (new) and Wiggins Formation.

Rocks of Crater Mountain intrusive sequence are exposed in two separate plutons covering area of about 2 to 3 square miles. Largest of the plutons makes up bulk of intrusive material underlying Crater Mountain. The smaller pluton is exposed on Needle Mountain. Stinkingwater mining region is located in southern Absaroka Mountains, Park County.

Crazycat Member (of Fusselman Dolomite)

Silurian: Western Texas and southwestern New Mexico.

F. E. Kottlowski and L. C. Pray, 1967, Tulsa Geol. Soc. Digest, v. 35, p. 209—230. At type section the Fusselman Dolomite is subdivided into three members (ascending): Chamberino, Flag Hill, and Crazycat (all new). The Crazycat is made up of a rather variable succession of strata, both vertically and laterally. Most strata are relatively pure dolomite but some of the beds of the lower 59 feet are calcitic dolomite, and some pure limestone occurs in uppermost 70 feet. Thickness 249 feet at type section. Underlies Devonian Canutillo Formation.

Type locality: Northern Franklin Mountains, Tex. Flag Hill and Crazycat (Mountain) are subordinate peaks (4,600-foot elevation) in southwesternmost Franklin Mountains that occur approximately a mile northeast and southwest, respectively, of Ranger Peak, a landmark on the north-south trending main divide of the Franklin Mountains near their southern terminus (Fort Bliss, Texas quadrangle).

Cree Camp Formation (in Halloran Complex)

Precambrian: Southern California.

D. A. Warnke, 1966, Dissert. Abs., v. 26, no. 9, p. 5374. Precambrian Halloran. Complex subdivided into following formations: Silver Lake Peak, mostly quartzfeldspathic gneisses; Cree Camp, quartzites and metarhyolites; and Riggs, metamorphosed metadiorite rocks. Complex intruded by metadiorite rocks.

In the Holloran Hills, central Mojave Desert.

Crescent Hill Rhyolite (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 217—219, 227 (fig. 11), pl. 1. A moderate red rhyolite which is thick and widespread. Characterized by aligned, elongate, dark-grayish-red autoliths, the coarsest of which (exceeding 5 inches in length) are found east and west of Sevier River, opposite mouth of Deer Creek. Base of Crescent Hill sequence may be marked by a glass with similarly aligned autoliths. This Crescent Hill glass marks start of volcanic episode. Thickness 1,500 feet in northern Gray Hills; 800 to 1,000 feet in Central Mining district; 300 to 500 feet east of Indian Hollow; 250 feet west of Indian Hollow. Gradationally overlies Indian Hollow tuff (new).

Crescent Hill, Tushar uranium area, near Marysvale, Piute County.

Crevasse Mountain granite

Precambrian: Southwestern Montana.

D. G. Brookins and L. E. Brown, 1966, Econ. Geology, v. 61, no. 3, p. 613—617. Crevasse Mountain granite mentioned in discussion of sulfur isotopic analysis from Jardine-Crevasse Mountain area.

L. E. Brown and D. G. Brookins, 1966, (abs.) Geol. Soc. America Spec. Paper 87, p. 20—21. Jardine-Crevasse Mountain area contains the only known econimic metal deposits associated with Precambrian rocks in Montana. Previous field investigations indicate that Crevasse Mountain granite was source of ore solutions and the emplacement of the granite ended the Precambrian history in the area. The K-Ar age determinations on minerals from Crevasse Mountain granite range from 1820 m.y. (muscovite) to 1180 m.y. (feldspar). Rb-Sr studies show 2700 m.y. whole rock age for the granite, and a 1900—2100-m.y. mineral isochron age for muscovite-biotite-microcline. Intruded country rock may be as old as 3000 m.y.

Jardine-Crevasse Mountain Mining district, Park County.

Crevison Sandstone

Upper Cretaceous (Maestrichtian): Central California.

F. A. Schilling, Jr., 1963, Dissert. Abs., v. 23, no. 11, p. 4320. Thickness about 1,000 feet. Fossiliferous; sparsely conglomeratic. Conformably overlies Moreno Formation; underlies strata of Tertiary age.

Pacheco Pass quadrangle.

Crooked Creek Shale Member (of Mahantango Formation)

Middle Devonian: South-central Pennsylvania.

R. L. Ellison, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Middle sequence of formation includes Backbone Ridge, Crooked Creek, and Donation members in Huntingdon County.

R. L. Ellison, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G—48, p. 30. Formal proposal of name. Composed of medium-gray claystone and shale that contain numerous thin beds of calcareous siltstone in lower 100 feet. Concretions and lenticular bodies of siltstone from 1 inch to 20 feet in diameter are common in upper two-thirds of exposed member. Thickness 124 feet at type section. A 250-foot concealed interval probably belongs to Crooked Creek Member, giving it a total thickness of nearly 400 feet. Overlies Backbone Ridge Siltstone Member. Contact with overlying Donation Siltstone Member(?) concealed.

Type section: Along Route 22, opposite Huntingdon. Underlies valley of Crooked Creek, a small tributary of Juniata River.

Crosby Breccia Member (of Wiggins Formation)

Oligocene: Northwestern Wyoming.

W. H. Wilson, 1963, Wyoming Univ. Contr. to Geology, v. 2, no. 1, p. 17—19. Hornblende-biotite andesite flows, flow breccias, and tuffs. Maximum thickness 525 feet. Separated from underlying Blue Point member (new) by sequence of grayish to brownish fairly well-bedded andesitic volcanic materials. Underlies unit composed dominantly of hornblende-biotite andesite and pyroxene andesite flows, breccias, and tuff breccias.

W. H. Wilson, 1964, Wyoming Geol. Survey Prelim. Rept. 2, p. 5—8. Described in Kirwin mineralized area. Type section stated. Here the member is exposed as a buff-weathering massive poorly bedded (to no bedding at all) vertically jointed "rim-rock-like" outcrop that is 525 feet thick.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 64—69. Areal extent of member unknown at present time. Has been traced along northwest side of Wood River from Horse Creek to Jojo Creek. Thickness of about 500 feet maintained from type locality to Galena Ridge north of Canyon Creek. Less than 25 feet of member are exposed on Yellow Ridge on Greybull River side of divide. On southwest side of Wood River, member is less than 100 feet thick and is discontinuously exposed along strike. Overlain and underlain by unnamed units of Wiggins Formation.

Type section: One-fourth mile west of Dollar's cabin on southeast flank of Mount Crosby, near Kirwin, Park County.

Crosby Formation

Paleozoic: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12 (table 2). Table 2 credited to E. C. Stephens (1946, unpub. rept.). Crosby Formation is 5,000 to 7,000 feet thick. Consists of bluish-gray well-bedded cherts with varying amounts of shale, schist, and sandstone. Overlies Van Duzer Formation. Underlies Copper Mountain Quartzite.

Area is near Rio Tinto Mine, Mountain City quadrangle.

Crosby Mountain Formation

Mesozoic(?): Northwestern Washington.

W. R. Danner, 1966, Washington Div. Mines and Geology Bull. 52, p. 360 (fig. 180). Named on map legend and shown on map of limestone deposits of Baring-Grotto area.

Map is secs. 12, 13, 24, and 25, T. 26 N., R. 10 E., King County.

Cross Creek facies (of Bacons Castle Formation)

Pliocene and (or) Pleistocene, lower(?): Southeastern Virginia.

N. K. Coch, 1965, U.S. Office Naval Research, Geography Branch Tech. Rept. 6, p. 35—45. Name applied to fine-grained facies of Bacons Castle Formation (new). Composed of silty sand with partings of clay less than 1 inch thick. In most exposures overlies Kilby facies (new), but the two are complexly interbedded. Maximum and average thicknesses are 18 feet and 5 feet, respectively. Where Cross Creek facies is in contact with Sedley Formation the contact is difficult to identify owing to similarities of grain size and color.

Type section: At Cross Creek Landing on east side of State Road 618, Isle of Wight County.

Crossroads Lentil (in Cook Mountain Formation)

Tertiary: North-central Louisiana.

C. O. Durham, Jr., 1964, Louisiana Geol. Survey Bull. 41, p. 18—26. A glauconite lentil in the middle sand of the Cook Mountain. Name credited to Jones (1962, unpub. thesis, pl. 3).

Type locality and derivation of name not given.

Croton Falls Mafic Complex

Age not stated: Southeastern New York.

R. M. Gates, 1967, Am. Jour. Sci., v. 265, no. 2, p. 119. Discussion of amphibolites. Croton Falls mafic complex listed with a number of intermediate to ultrabasic intrusives in Western Connecticut Highlands region. Name credited to Sneider (1963, unpub. thesis).

Crow Formation

Precambrian: Southwestern South Dakota.

J. A. Redden, 1963, U.S. Geol. Survey Prof. Paper 297—D, p. 207—212, pl. 21. Consists of interbedded calcareous and amphibolitic rocks, quartzite, microcline schist, and various other distinctive rocks. Thickness 100 to 200 feet; 151 feet at type section. Overlies Bugtown formation (new); underlies Mayo formation (new). Upper contact placed at top of thin resistant bed of quartzite that is conformable with schist of Mayo formation.

Type section: At Crow Creek in NW¼ sec. 30, T. 3 S., R. 4 E., Berne quadrangle, Custer County. Formation crosses northeastern part of Fourmile quadrangle and continues northwestward several miles and passes beneath Paleozoic rocks. To southeast extends as far as Beecher Rock, where it thins and either pinches out or is cut off by large fault a short distance to south.

Crowder Formation

Pliocene: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 49—56, pls. A sequence of fluviatile detrital sediments of mainly Pliocene age. Composed mainly of weakly consolidated sandstone and fanglomerate. Sandstone is gray white to buff white, friable, bedded, fine to coarse grained, conglomeratic, and arkosic. About 1,800 feet thick at Crowder and Cajon Canyons. Thins to northwest and southeast. Overlies Punchbowl Formation and pre-Tertiary crystalline rocks. Conformably overlain by alluvium.

Type locality: Crowder Canyon, S½ sec. 13, secs. 24, 25, 26, T. 3N., R. 6 W., Cajon Pass area, Mohave Desert.

Crowley Formation

Miocene, upper: Southeastern Oregon.

A. R. Hagood, 1963, Masters Abs., v. 1, no. 4, p. 13. Oldest unit in area is unnamed igneous complex. It is overlain by predominantly rhyolitic Crowley Formation. Contains late Miocene mammalian fossils.

Monument Peak area, Malheur County.

Crowsnest Gravel (in Snake River Group)

Pleistocene, upper: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1215, pl. 1. Varies in lithology according to area of outcrop. Thickness 25 to 50 feet at type locality where base is about 200 feet above Snake River. On the opposite (eastern) wall of canyon the Crowsnest overlies Thousand Springs Basalt and clay of Bruneau Formation (new). Older than Sand Springs Basalt.

Type locality: Typical exposures in gravel pits near lower end of Crowsnest Road which leads from highway, 4 miles south of Hagerman, Gooding County, to upland plains west of Snake River.

Crozet Granite (in Virginia Blue Ridge Complex)

Precambrian: North-central Virginia.

W. A. Nelson, 1962, Virginia Div. Mineral Resources Bull. 77, p. 14 (table 1), 15, pl. 1. A granite in Virginia Blue Ridge Complex. A porphyritic granite composed principally of feldspar, quartz, and epidote. Name used by Vernon (1952, unpub. thesis).

Occurs around Crozet, at dam of city of Charlottesville in gorge of Moormans River between Bucks Elbow Mountain and Pasture Fence Mountain, Albemarle County.

Crystal Springs Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 403, 409—410, pl. 1. Glassy, nonporphyritic, and filled with small angular fragments of basalt.

Crops out on plateau of welded tuff and basalt one-half mile north of northern boundary of flow, and one-half mile east of Obsidian Lake, Yellowstone National Park.

Cuba Mesa Member (of San Jose Formation)

Eocene: Northwestern New Mexico.

E. H. Baltz, 1963, Dissert. Abs., v. 23, no. 7, p. 2490. San Jose formation consists of mappable facies named Cuba Mesa, Regina, Llaves, and Tapicitos members.

E. H. Baltz, 1967, U.S. Geol. Survey Prof. Paper 552, p. 46—48, pls. Formal proposal of name. Basal member of formation. At type section about 782 feet thick. It consists mainly of buff and yellow rusty-weathering tangentially crossbedded arkosic coarse-grained conglomeratic sandstone. Lower part contains several thin lenses of gray and purplish-gray sandy shale. Upper third is split by two tongues of Regina Member.

Cuba Mesa is overlain by main part of Regina Member. At east side of Yeguas Mesas north of Canoncito de las Yeguas, the Cuba Mesa is overlain by Llaves Member. Overlies Nacimiento Formation.

Type section: Measured along State Highway 44 northwest of Cuba. Base of section is in NE¼NW¼ sec. 20, and section was measured westward across secs. 17, 8, 7, and 6, T. 21 N., R. 1 W., and secs. 1 and 2, T. 21 N., R. 2 W. Named for exposures on the upper slopes and top of Mesa de Cuba (known as Cuba Mesa) west of the Rio Puerco in T. 21 N., Rs. 1 and 2 W., east-central San Juan Basin.

Cuchillas Member (of Avispa Formation)

Upper Cretaceous: Northern Puerto Rico.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C10. Consists of dark-grayish-green massive volcanic breccia and lapilli tuff interstratified with fine-grained dark-greenish-gray to dark-gray volcanic sandstone, siltstone, and crystal tuff. About 500 m thick at type locality. Eastward along strike quite variable in thickness where it intertongues with andesite lava of the Avispa. Late Cretaceous.

Type locality: Along banks of the Rio Grande de Manati between coordinates 50,000 to 159,000 and 50,800 to 158,660 (reference to meter grid based on Puerto Rico coordinates). Named after barrio Cuchillas in Municipio de Corozal, Corozal quadrangle.

Cuevas Limestone (in Jacaguas Group)

Eocene, lower(?) and middle(?): Puerto Rico.

Lynn Glover, 3d, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I—335. Consists of fragments of calcareous algae, averaging about 5 millimeters in diameter, in a matrix ranging from nearly pure crystalline calcite to very pale pinkish gray, thick bedded to massive, and contains some greenish-gray sandstone beds. Thickness about 100 meters. Overlies Coamo formation.

Lynn Glover, 3d, and P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—A, p. A29—A39. Included in Jacaguas Group. A resistant formation that forms crest of Cerro de las Cuevas and its extension Cerro Raspaldo in southern Coamo quadrangle. About 35 m thick over most of area but may be thicker in eastern outcrops. Previous estimates of thickness were in error because structure was imperfectly known. Rests diconformably upon lower Paleocene to lower Eocene Raspaldo Formation (new) and on lower Paleocene and lower Eocene(?) Los Puertos Formation (new) in Coamo quadrangle, and upon the Los Puertos and Late Cretaceous Coamo Formation in Río Descalabrado quadrangle. Conformably overlain by middle Eocene Río Descalabrado Formation. Hence, age is probably middle Eocene, but possibly it may be as old as early Eocene.

Named for Cerro de las Cuevas, in southwestern part of Coamo quadrangle. Exposed along crest and flanks of range and Cerro Raspaldo which are in graben between Río Jueyes and Esmeralda faults.

Culvers Gap Drift

Pleistocene: Northern New Jersey.

L. A. Sirkin, 1967, Rev. Paleobotany and Palynology, v. 2, nos. 1—4, p. 210 (fig. 3), 216. Culvers Gap drift shown on correlation chart of Late

Glacial pollen stratigraphy in northeastern United States. Herb Pollen Zone is not recorded in conjunction with recession from Valley Heads moraine in central New York, Culvers Gap drift in northern New Jersey, or other recessional drift in southeastern New York in Late Port Huron time.

Curry Formation

Permian (Wolfcampian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 6—7, pls, 2, 5. Limestones, sandstones, and siltstones. Basal chert pebble conglomerate. Thickness about 2,800 feet. Underlies Clinker formation (new); unconformably overlies Oquirrh group. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. For what other geologists consider Wolfcampian-age Oquirrh, Welsh and James proposed Curry and Clinker Formation. These Names should be used with caution until further detailed work is done.

Type section: On South Mountain southwest of Bingham district, in sec. 17, T. 4 S., R. 5 W. Reference locality: Exposures on Markham Peak. Name taken from Curry Peak, near Dry Fork.

Curry Mountain Sandstone

Upper Cretaceous: West-central California

R. L. Rose and I. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 40 (strat. column), 42. Although dominantly sandstone, dark-gray silty mudstone occurs in thin interbeds and is abundant in middle part of section. Thickness 900 to 1,300 feet. Conformably overlies Oak Flat formation. Grades upward into lower Waltham shale member of Waltham Canyon formation (new). Unit formerly called Long Canyon sandstone. Usage of Curry Mountain sandstone follows that of McLaughlin (1953, unpub. thesis). According to Popenoe (1960) the Curry Mountain sandstone is Cenomanian. [Popenoe, (1960, Geol. Soc. America Bull., v. 71, no. 10, chart 10e, col. 15) used Curry Mountain shale member of Panoche formation. On the chart Curry Mountain shale underlies Long Canyon sandstone member and overlies Center Peak conglomerate member. Hence status of Curry Mountain shale not clear.]

Occurs in eastern part of Priest Valley quadrangle, Fresno County.

Curtis Canyon ignimbrite

See Hiko Tuff.

Curtis Mountain Quartzite (in Cossayuna Group)

Lower Cambrian: Southeastern New York.

D. W. Fisher, 1961, New York State Geol. Assoc. 33rd Ann. Mtg., p. D6. Within upper Elizaville (and upper Nassau) is conspicuous ridge-making green chloritic quartzite, 10 to 70 feet thick, named Curtiss Mountain Quartzite. Appears to be facies between the Nassau, Elizaville, and Rensselaer, and thus holds position similar to that of Zion Hill Quartzite in northern Taconics.

D. W. Fisher, 1962, New York State Mus. and Sci. Ser. Geol. Survey, Map and Chart Ser. no. 2. Formal proposal of name. Spelled Curtis Mountain in this report. Thickness 10 to 60 feet. Extends into Nassau red, purple, and green quartzose shales and thin quartzites, and into Elizaville green slate and argillite. Appears to be transitional into Rensselaer Graywacke. Cossayuna Group.

J. M. Bird, 1963, Dissert. Abs. v. 24, no. 4, p. 1567—1568. Lies about 400 to 800 feet below Dusenberry Hill quartzite (new).

E-an Zen, 1964, U.S. Geol. Survey Bull. 1174, p. 30—31. Cambrian(?) because it underlies fossiliferous Early Cambrian Ashley Hill Conglomerate in a conformable section. According to Dale (1904, U.S. Geol. Survey Bull. 142) two kinds of quartzite form three distinct beds on Curtis Mountain (Dusenbery Ridge). Fisher did not specify which of these beds is his Curtiss [sic] Mountain Quartzite, the lower two beds which are lithically alike, correspond to Fisher's description. Synonymy listed.

Type locality: Curtis Mountain, a prominent north-south ridge in southeastern quadrant of Troy quadrangle.

Custerian Series

Permian: Oklahoma.

R. O. Fay, 1965, Oklahoma Geol. Survey Bull. 106, p. 39—79, pl. 1. Custerian Series includes Whitehorse Group, overlain by Cloud Chief Formation, Doxey Shale, and Elk City Sandstone. Follows Cimarronian Series. Custerian Series [Custer Formation] was named by Roth (1932) for redbeds above El Reno Group to top of redbed sequence. Roth thought that this part of column was Triassic, but fossils in Whitehorse Group at the base are Permian.

Type region: Custer County and adjacent areas.

Cutler Diabase

Silurian(?): Southeastern Maine.

Olcott Gates, 1961, Maine Geol. Survey Quad. Mapping Ser. No. 1, p. 32—52, pl. More than half of bedrock in Cutler and Moose River quadrangles is intrusive diabase, most of it the direct continuation of the diabase southeast of Lubec shear zone in Eastport quadrangle. Term Cutler diabase is used here to designate collectively a complex of hypabyssal intrusive rocks consisting essentially of labradorite and pyroxene. Term dolerite might be equally applicable. Although geologic map implies Cutler diabase is one large body apparently intruded at one time, it is actually an intricate network of many interlacing separate sills, dikes, small lenticular plugs, and irregular plutons. Shown on geologic map as Silurian(?). Some of it may be about contemporaneous with Little River formation; some is younger than Little River and Pembroke formations. In Eastport quadrangle diabase intrudes Eastport formation, the youngest Silurian rocks, and to a minor extent Perry formation of Upper Devonian. Bulk of diabase is older than Perry formation as it has been sheared and folded during deformation which preceded development beneath Perry red sandstones and conglomerates. Some narrow dikes exposed along shoreline in Cutler quadrangle are unsheared and cut across structure and hence may be post-Devonian in age.

Named for town of Cutler, Cutler quadrangle.

Cuyon Formation

Upper Cretaceous: East-central Puerto Rico.

Lynn Glover, 3rd, 1967, U.S. Geol. Survey Bull. 1254—A, p. A18—A19. A heterogeneous unit that consists of about 75 m of rocks divided into three subequal units. Basal third is reddish- to purplish-gray poorly sorted volcaniclastic sandstone that is obscurely stratified in thin to medium-thick beds. Middle third is composed of drab thin- to thick-bedded reworked tuff with lenses of volcaniclastic conglomerate. Upper part is hard bluish-gray fossiliferous limestone in thin to medium-thick beds interleaved with volcaniclastic sandstone. Base appears to rest unconformably upon thin-bedded tuff and massive conglomerate of Albian to Santonian Robles Formation. No upper sedimentary contact known. Macrofossils from limestone member suggest Late Cretaceous. Microfossils suggest Maestrichtian age. Rocks previously included in Robles Formation (Berryhill and Glover, 1960).

Named for outcrops along Puerto Rico Highway 162 just south of headwaters of the Río Cuyon in northwestern Cayey quadrangle.

Dad Sandstone Member (of Lewis Shale)

Upper Cretaceous: South-central Wyoming (subsurface).

L. A. Hale, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 132 (fig. 2), 136, 137. In Dad area, wells have drilled a total of 2,300 feet of Lewis shale and disclose a series of sandstones and minor shales 1,000 to 1,400 feet thick which divides the Lewis into upper and lower shale units. This sandy zone is herein named Dad member of Lewis shale.

Typical development: Union Texas Gas Co. Dad Unit No. 2 well between 6,385 feet and 7,805 feet. Well is in sec. 13, T. 16 N., R. 93 W., Carbon County.

Daggett Ridge Formation

Silurian: Northeastern Maine.

D. M. Larrabee, 1963, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—269. Chloritic argillaceous quartzite, quartzite metaconglomerate with fractured pebbles and cobbles as large as 8 by 12 inches, gray and gray-green slate and metasiltstone, thin magnetite-bearing interbedded black slate and metasiltstone lenses which crop out in Wytopitlock quadrangle. Thin green cherty lenses of rhyolitic metatuff along Baskahegan Stream near South Bancroft, Danforth quadrangle. Exposed over width of 8,000 feet in Danforth quadrangle where quartzite and metaconglomerate form most of thickness estimated to exceed 1,000 feet. Older than Chiputneticook Quartz Monzonite (new). Silurian age based on presence of single dorsal valve of orthoid brachiopod.

Type locality: Along and south of Maine Central Railroad. Named for ridge where best exposed in Danforth quadrangle.

Dale Summit Sandstone Member (of Tea Creek Dolomite)

Ordovician: Central Pennsylvania.

F. M. Swartz and others, 1955, Pennsylvania Geologists Guidebook 21st Ann. Field Conf., p. F—6, F—14, F—15 (geol. map). At our near base of the Tea Creek. Thickness 0 to 20 feet. Contains perfectly rounded white sand grains. Locally conglomerate with pebbles of limestone and some chert and quartz. Small unidentifiable fragments of trilobites and gastropods. Overlies Coffee Run dolomite (new).

Exposed at Dale Summit, Nittany Valley.

Danburg Porphyritic Granite

Paleozoic(?): East-central Georgia.

V. J. Hurst and others, 1966, Mineral Resources of the central Savannah River area: Georgia Univ. Dept. Geology, v. 1, p. 61—62. Danburg granite is an oval-shaped pluton that is coarsely porphyritic and occupies about 50 square miles in area. Apophyses of porphyritic granite cross-cut the bounding layered rocks of Little River Series. Porphyritic granite like that at Danburg has intruded granite gneisses of Kiokee Series (new) and earlier nonporphyritic granites near Appling.

Occupies about 50 square miles in northeastern Wilkes County and northwestern Lincoln County. Named from Danburg, Wilkes County.

Dandan Flow Member (of Umatac Formation)

Miocene, lower: Guam.

J. T. Stark and J. I. Tracey, Jr., 1963, U.S. Geol. Survey Prof. Paper 403—C, p. C1, C29. Uppermost member of Umatac. Overlies Bolanos Pyroclastic Member. Consists of basalts and andesite flows, and beds of water-laid deposits.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A28—A29, pls. Formal proposal of name. Basaltic lava flows cap small areas of Bolanos pyroclastic member on top of Mount Bolanos, and are exposed in isolated outcrops on a ridge east of Mount Jumullong Manglo and on high points of dissected upland east of Mount Jumullong Manglo-Mount Sasalaguan ridge. Small patch of Bonya limestone overlies Dandan flow member near headwaters of Bonya River. Alifan limestone overlies lava of the Dandan near Almagosa Springs on east slope of Mount Almagosa. Thickness 50 feet at type section of Umatac. Derivation of name stated.

Named for exposures in Dandan area northwest of Inarajan.

Danger Point Tuff

Miocene, upper(?): Northeastern Nevada.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M10. Essentially glassy volcanic debris of andesitic to rhyolitic composition. Total thickness probably not more than 400 feet, of which less than half is exposed in scattered sections representing different parts. Underlies Jarbidge rhyolite. Rests unconformably on Paleozoic(?) metamorphic rocks, Dead Horse tuff, and Meadow Fork formation (new).

Type locality: Danger Point, a prominent ridge on east side of Coon Creek valley, Elko County.

Danville Till

Pleistocene (Wisconsinan): Eastern Illlinois.

J. C. Frye, H. D. Glass, and H. B. Willman, 1962, Illinois Geol. Survey Circ. 334, p. 3 (fig. 1). "Danville till" shown on time-space diagram of Wisconsinan deposits in Illinois. Older than Winnebago till. Altonian Substage.

H. B. Willman, H. D. Glass, and J. C. Frye, 1963, Illinois Geol. Survey Circ. 347, p. 2 (fig. 1), 8. At Danville, a pre-Shelbyville till, tentatively referred to as "Danville" till occurs in a valley that was incised through the Sangamon Soil profile developed on Illinoian till and is assigned to Altonian Substage. Till was first classed as Illinoian, but later was assigned to the Farmdale. As radiocarbon dating of wood from the "Danville" till indicates an age greater than 40,000 years, the "Danville" till may be mid-Altonian in age.

Occurs in vicintiy of Danville, Vermilion County.

Dardanelles Member (of Stanislaus Formation)

Pliocene, lower: Central eastern California.

D. B. Slemmons, 1966, California Div. Mines and Geology Bull., 190, p. 199—208. Latites now assigned to Stanislaus Formation were divided into three units by Ransome (1898, U.S. Geol. Survey Bull. 89) and Slemmons (1953, unpub. thesis). These units, now considered to be members are (ascending) Table Mountain Latite, Eureka Valley, and Dardanelles. At type locality the flows are similar to augite latites of Table Mountain Member, but plagioclase phenocrysts in them are smaller and more sparse. Eastward from West Dardanelle, the member includes a number of basalt and olivine basalt flows. Thickness 200 feet between the Dardanelles and eastern edge of Fales Hot Springs quadrangle. Has known distribution from Big Trees on west to Nevada-California boundary on east. Underlies Disaster Peak Formation (new).

Type locality: At West Dardanelle of the Dardanelles Cone quadrangle, Tuolumne County. Ransome (1898) referred to the "Dardanelle flow".

Dark Ridge Member (of Lee Formation)

Pennsylvanian: Southeastern Kentucky.

K. J. Englund, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B30—B38. Name applied to a section of thin-bedded sandstone and shale, previously referred to as sandstone and shale member B (Englund and others, 1963). At type locality, consists of 60 feet of medium-dark-gray shale with a few thin beds of very fine to fine-grained sandstone and includes Cumberland Gap coal bed at top. An argillaceous very fine grained partly ripple-bedded sandstone in upper part of member thickens northeastward to about 100 feet in vicinity of White Rocks, where it overlies 40 feet of medium-dark-gray shale in lower part of member. There basal contact with underlying White Rocks Sandstone is gradational; where the White Rocks wedges out, the base is gradational with Chadwell Member (new). Underlies Middlesboro Member (new).

Type locality: Near south end of Dark Ridge on north side of Cumberland Gap, where member occupies poorly exposed interval between massive sandstones of underlying and overlying members.

Darling Lake Anorthositic Gabbro

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert. Abs., v. 25, no. 12, pt. 1, p. 7205. Most of rocks underlying thesis area were formed under conditions of regional metamorphism and plutonism. After period of regional metamorphism, magmas ranging from peridotitic to granitic intruded the metamorphic rocks. Resulting igneous bodies have been mapped as Loup Loup Granodiorite, Pogue Mountain Quartz Monzonite, and Darling Lake Anorthosite Gabbro.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Darrington Phyllite

Pre-Middle Devonian(?): Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordilleran in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 102, 109, fig. 7—1. Consists of pelitic and semipelitic, commonly quartz-rich phyllites which in some areas grade into schistose feldspathic metagraywackes. Thickness in order of 10,000 feet. Underlies Shuksan Greenschist. Included in Shuksan Metamorphic Suite. Depositional age of suite not known but presumed to be Paleozoic and may be pre-Middle Devonian.

Darrington is in Snohomish County.

Davis Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Davis sand occurs at depth of 8,521 to 8,551 feet in type well. Davis has priority over McFearin. Retention of combination term, McFearin-Davis, east of Homer field, is recommended because of common usage. Prior to introduction of name Davis for the Cotton Valley sandstone, an interval in Glen Rose Formation had been identified as Davis zone. Therefore use of name Davis for a Cotton Valley sand is questionable.

Type well: United Gas Public Service No. 2 Davis, sec. 23, T. 21 N., R. 10 W., Cotton Valley field. Reference well: C. V. Operators Comm. No. 6 Ohio-Gleason, sec. 28, T. 21 N., R. 10 W., Cotton Valley field, Webster Parish.

Davis Sandstone Member (of Lake Murray Formation)

Pennsylvanian (Desmoinesian): Southern Oklahoma.

R. C. Lang, 1966, Ardmore Geol. Soc. Guidebook Ardmore Basin, p. 14 (table 1), 15. "Davis sandstone" member has been traced into Ardmore area from Grayson County, Tex. (where it produces oil), across Love County, and into the subsurface and surface of Carter County. Occurs above Bostwick member and below Lester member. Characteristically a fine micaceous sand.

Crops out at surface in sec. 22, T. 6 S., R. 2 E., Carter County, Okla.

Davis Canyon Formation

Lower Cretaceous: Northern California.

B. M. Page, 1966, California Div. Mines and Geology Bull. 190, p. 261, (fig. 3). Named on stratigraphic column credited to J. E. Lawton (unpub. thesis). Thickness 6,400 feet. Comprises Baldy Mountain Member below and Buck Island Member above. Overlies Little Valley Formation. Underlies Brophy Canyon Formation. [Lawton, 1956, Dissert. Abs., v. 16, no. 10, p. 1885, used term Davis Creek with Baldy Mountain and Buck Island Members. Davis Creek was listed in the Keroher Lexicon (U.S. Geol. Survey Bull. 1200).]

Occurs in Morgan-Wilbur area in Lake, Yolo, and Colusa Counties.

†Daylight Formation

Cambrian: Eastern California and western Nevada.

H. R. Cornwall and F. J. Kleinhampl. 1964, U.S. Geol. Survey Prof. Paper 454–J, p. J2–J3, pls. 1, 2. Predominantly clastic rocks. Micaceous shale and siltstone most abundant, but interbedded quartzitic sandstone beds common. Limestone and dolomite beds as thick as 50 feet occur at intervals, particularly in upper and lower parts. An arkosic conglomeratic quartzite as thick as 500 feet present near middle of formation. In upper 500 feet are quartzitic sandstone beds interbedded with siltstone, and some of sandstone beds contain vertical rods, perpendicular to bedding, that have been identified as *Scolithus.* In upper part of formation are one to three closely spaced beds of yellow to brown oolitic to pisolitic limestone and dolomite. The oolitic limestone or dolomite is persistent marker zone; it occurs about 800 feet below top of formation in unfaulted Bare Mountain section, but in Bullfrog quadrangle [this report] the overlying Corkscrew Quartzite (new) is faulted over Daylight Formation and most or all of the shale and siltstone above the oolite may be missing. Thickness about 4,000 feet on Bare Mountain, Nye County, Nev. Formations was first studied on Bare Mountain and was originally considered part of Johnnie(?) Formation (Cornwall and Kleinhampl, 1960, Geol. Soc. America Bull., v. 71, no. 12, pt. 2, 1960, U.S. Geol. Survey Mineral Inv. Field Studies Map Mf–177, 1960, U.S. Geol. Survey Geol. Quad. Map GQ–157). Present indications favor correlation with Wood Canyon Formation.

J. H. Stewart, 1966, U.S. Geol. Survey Prof. Paper 550–C, p. C71. Correlation of Lower Cambrian and some Precambrian strata in southern Great Basin, California and Nevada. Wood Canyon Formation conformably overlies Stirling Quartzite and is recognized throughout the Spring Mountains and Death Valley region. In Bare Mountain and Bullfrog quadrangles Cornwall and Kleinhampl (1964) applied name Daylight Formation to the rocks here considered to be Wood Canyon Formation. Use of name Daylight Formation is confined to these quadrangles.

The U.S. Geological Survey has abandoned term Daylight Formation on basis of study now in progress. Term Wood Canyon Formation extended and used in preference to term Daylight.

Named for exposures in southwestern part of Bullfron quadrangle where Daylight Pass is located in sec. 36, T. 13 S., R. 46 E., Inyo County, Calif.

DE member

See Big Skunk Formation.

Dead Horse Creek Member (of Parkman Formation)

Upper Cretaceous: Northeastern Wyoming (subsurface).

F. F. Sabins and F. A. Peterson, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 303. A widespread sheet sandstone. Defined as interval from 7,015 feet to 7,120 feet in type well. Underlies Ferguson member (new); overlies unnamed member of Parkman.

Type well: Farmers Union No. 1 Government Ferguson, SE¼SE¼ sec. 13, T. 49 N., R. 76 W., Campbell County. Present in Dead Horse Creek field.

Deadman Pass Glaciation

Deadman Pass Till

Pleistocene: Eastern California.

R. R. Curry, 1966, Science, v. 154, no. 3750, p. 770—771. Major glaciation in the Sierra Nevada of California resulted in the deposition of till which underlies latite 2.7×10^6 years old and overlies andesite 3.1×10^6 years old. This till, herein named Deadman Pass till, is oldest Pleistocene glacial deposit that has been found in temperate latitudes. Directly underlies and in some places is incorporated in Two Teats quartz latite. The glaciation that deposited the Deadman Pass till is herein named Deadman Pass glaciation. This glaciation occurred probably as a series of multiple advances. The presence of latite in the till (similar to that dated at 3.0×10^6 years), the intimate association of the till with large quantities of ash and pumice, and the presence of the lahar under the till in one area all suggest that the Deadman Pass glaciation may have been penecontemporaneous with the extrusion of the darker quartz latite; if so, it may have occurred about $2.7 \pm 0.1 \times 10^6$ years ago. The Deadman Pass glaciation is thus the earliest radiometrically established glaciation yet recognized in temperate latitudes.

In Mammoth Lakes area, Devils Postpile quadrangle in Mono and Madera Counties. Till is present in vicinity of Deadman Pass.

Dean Swamp Member (of Wicomico Formation)

Pleistocene, lower: Eastern South Carolina.

D.J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS—12. Upper Wicomico divided into five members: Toney Bay, Dean Swamp, Sandridge, Wassamassaw Swamp, and Four Hole. A clay member developed from northwest toward southeast with decreasing coarse- and medium-grained sand similar to that occurring in Toney Bay Member and then increasing fine sand. Drill-hole samples show definite thin laminations over about 10 to 20 feet of sample. Member represents lagoonal and tidal marsh sediments deposited after deposition of Sandridge Member.

Named for Dean Swamp in Eutawville quadrangle.

Dearborn River Volcanics

Upper Cretaceous: Central Montana.

S. L. Groff, 1963, Montana Bur. Mines and Geology Spec. Pub. 31, Chart 1. "Hogan" or Dearborn River Volcanics listed on correlation chart. Interfinger with Two Medicine Formation. Underlie Adel Mountain Volcanics.

In Wolf Creek—Big Belt—south Disturbed Belt area.

Decie Ranch Member (of Skinner Ranch Formation)

Lower Permian (Leonard): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1583, 1584 (fig. 2), 1585, 1587. In western part of Lenox Hills, consists mostly of calcarenite, calcirudite, and coarse limestone boulder conglomerate, with many patches containing huge crinoid stems (2 inches in diameter). In Dugout Mountain it is conglomerate with boulders several inches to more than 1 foot in diameter. Member extends across south base of Hill 5021 on east side of Sullivan (Yates) Ranch. There it forms saddle between westernmost two conspicuous knobs of hill. On east side of Hill 5021 it merges with Sullivan Peak Member (new) to form undivided Skinner Ranch Formation. Thickness 40 to 98 feet. Overlies Lenox Hills Formation. Underlies Poplar Tank Member (new). Mapped by King (1931) as Hess Formation.

Type section: Section 1¼ miles S. 25° W. of Peak 5300 in Lenox Hills, Altuda quadrangle, Brewster County. Named for Decie Ranch.

Deep Creek Conglomerate

Oligocene to Miocene: Northeastern California.

California Department Water Resources, 1963, California Depart. Water Resources Bull. 98, v. 1, (text) p. 29 (table 7), 60, 167 (table 14), 170 (fig. 20), 171 (fig. 21); v. 2, pls. Composed of westward-dipping beds of massive consolidated conglomerate separated by beds of shale, mudflows, and tuff. As shown on table of formation in Surprise Valley, underlies Miocene Cedarville series.

Crops out along western side of Surprise Valley, at foot of Warner Mountains.

Deep Creek Formation

Mississippian: Eastern Idaho.

W. J. Carr and D. E. Trimble, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—181—C—183. In type section, and elsewhere in region, formation divisible into two mappable members. Lower, 750 feet thick, mainly light-gray to brown or black siltstone interbedded with subordinate amounts of silty limestone and shale. Upper, 1,500 feet thick, gray to blue-gray, mostly thin- to medium-bedded limestone that contains dark chert, and locally is silty, platy, and weathers purplish. Lower contact is base of first shale or siltstone above Lodgepole limestone; upper contact, normally gradational, placed at change from thin-bedded cherty limestone to the more massive ledges of Great Blue limestone. Fossils rare; present age assignment based mostly on stratigraphic position. May contain beds of both late Osage and early Meramec age.

Type section: Measured in SW¼NE¼ sec. 35, T. 9 S., R. 31 E., Deep Creek Mountains, 25 miles southwest of Pocatello.

Deep Creek Sandstone Member (of Mesaverde Formation)

Upper Cretaceous: Subsurface and surface in south-central Wyoming.

L. A. Hale, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 130, 131 (fig. 1), 132 (fig. 2). Basal sandstone of Mesaverde. Thickness 30 to 50 feet. A well-developed fine- to medium-grained sandstone in wells and on outcrop forms prominent escarpment. Correlated over wide area in subsurface and on outcrop, but eastward from subject area [eastern Washakie Basin] it is split by shale tongue Espy (new) and eventually disappears in Steele shale.

Well developed in Amerada Petroleum Corporation Deep Creek Unit well No. 1, sec. 30, T. 16 N., R. 90 W., Carbon County.

Deep Creek Tuff (in John Day Formation)

Miocene, lower: Northeastern Oregon.

R. V. Fisher, 1962, Ore Bin, v. 24, no. 12, p. 197—203. Deep Creek is ashfall tuff formed from single explosive episode. Composed of more than 95 percent shards altered to cream-colored clinoptilolite. In thick exposures tuff weathers to orange-colored bluffs, but where it is thin, forms yellowish-white weathering layer generally indistinguishable at distance from other white or cream-colored thin resistant units. Thickness as much as 25 feet. In lower part of John Day Formation.

Named for exposures in vicinity of Deep Creek secs. 35 and 36, T. 10 S., R. 25 E., in Picture Gorge quadrangle.

Deep Lakes Member (of Fish Haven Dolomite)

Ordovician: Southeastern Idaho.

A. S. Keller, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2746. Fish Haven Dolomite divided into Paris Peak, Deep Lakes, and Bloomington Lake Members (all new).

Area is behond Bannock thrust in parts of Preston and Montpelier quadrangles.

Deep Springs clays

Quaternary: Southeastern California.

Necip Guven and P. F. Kerr, 1965, Selected Great Basin playa clays: U.S. Air Force Cambridge Research Lab. Sci. Rept 4, 35 p. Mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and Animas clays indicate that mica-type clay minerals, illite, vermiculite, and montmorillinite are prominent in the playa crusts.

Deep Springs Playa in southeastern California near Nevada line. Deep Springs Playa is in part wet because of marginal springs. Where dry, yields an uneven "puffy" surface.

Deep Springs Valley Basalts

Pliocene: Southern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380 (table 1), 387. Listed with units from which samples were collected for potassium-argon age determinations. Age determination 10.8 to 10.9 m.y. Axelrod and Ting (1960, California Univ. Pubs. Geol. Sci., v. 39) have correlated this basalt with basalt under Bishop Tuff [Pleistocene] in Owens Gorge, and with the basalt which overlies Coso Formation to south. Coso Formation has been dated late Blancan by mammalian faunas and by potassium-argon. Therefore previous correlations of the basalt are incorrect.

Collections made in Soldier Pass quadrangle.

Deer Butte Formation

Miocene, upper: Eastern Oregon.

L. R. Kittleman, Jr., 1962, Dissert. Abs., v. 22, no. 12, pt. 1, p. 4321. Contains mixed pyroclastic and detrital sedimentary rocks and at least two extensive units of olivine basalt. Divided locally into seven members. Thickness at least 3,000 feet. Overlies Owyhee basalt; unconformably underlies Grassy Mountain formation. Late Miocene and probably early Pliocene.

R. E. Corcoran and others, 1962, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. GMS 2. Contains section of fine-grained tuffaceous sediments with a few intercalated basalt flows in lower part, grading upward into massive sandstones and conglomerates. Thickness in Deer Butte 1,248 feet. Deer Butte beds in southwest corner Mitchell Butte quadrangle [this report] have been repeated several times by block faulting. Near mouth of Dry Creek overlies Owyhee Basalt; farther south overlies Sucker Creek Formation; underlies Kern Basin Formation (new). Upper Miocene.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 8—10, 36—38. Formal proposal of name. Name given to an assemblage of altered volcaniclastic rocks, extrusive basalts, arkose sandstones, and granite-cobble conglomerates exposed at Deer Butte. Underlain unconformably by Owyhee Basalt and overlain unconformably by Grassy Mountain Formation. Thickness 950 feet at type locality; at least 2,000 feet exposed locally; aggregate thickness may be 3,000 feet. Subdivided into (ascending): Red Butte, Orlano Spring, Holdout, Quartz Mountain Basalt, Burnt Mountain, Sourdough Basin Basalt, and Mitchell Butte Members (all new). Part of the Deer Butte may be laterally contiguous with strata of Poison Creek Formation of Buwalda (1923) along western margin of Snake River Plain. Deer Butte is part of Idaho Group defined by Malde and Powers (1962). Type locality designated.

Type locality: Deer Butte, E½ sec. 21, T. 21 S., R. 45 E., Malheur County.

Deerlodge Conglomerates

Paleocene-Eocene: Western Montana.

S. L. Groff, 1963, Montana Bur. Mines and Geology Spec. Pub. 31, Chart 1. Listed on chart of stratigraphic correlations for Montana and adjacent areas.

Missoula-Drummond, Philipsburg area.

Deer Park Andesite *

Quaternary: East-central Nevada.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). Discussion of variations within ignimbrite cooling units. Generalized Cenozoic section of Grant Range lists following Quaternary units (ascending): Local breccia sheets; Perish Spring Dacite (new); Deer Park Andesite, 0 to 500? feet thick; local breccia sheets.

Grant Range is in Nye County.

Deer Valley Formation

Upper Cretaceous (Maestrichtian): Northern California.

I. P. Colburn, 1964, Sacramento Geol. Soc. Guidebook to Mount Diablo Field Trip, June 6, p. 17–19, correlation chart, pl. 3, geol. map. A prominent ridge-forming coarse-grained sandstone that caps Marsh Creek formation (new). Thickness 500 feet at Oil Canyon. Between Oil Canyon and Kellogg Creek to south thickens to 800 feet. Thins to less than 50 feet northwest of Oil Canyon and is eventually truncated by fault near Nortonville-Clayton road. Gradational contact separates cliff-forming sandstones from chocolate mudstones of underlying Marsh Creek formation. Contact drawn in stratigraphic interval of 15 feet where light-gray sandstones begin to predominate. Concordantly overlain by "Martinez" formation in Oil Canyon area. Between Oil Canyon and Deer Valley Road, Meganos formation overlaps the "Mártinez" and rests on the Deer Valley.

Type section: Exposures on north wall of Oil Canyon between point at base of formation, 650 feet W. and 2,000 feet S. of NE cor. sec. 15, T. 1 N., R 1 E., and point at top of formation, 650 feet W. and 1,800 feet S. of NE cor. sec. 15, T. 1 N., R. 1 E., Contra Costa County. Formation exposed only on north flank of Mount Diablo on ridge separating Briones Valley from Deer Valley.

Deer Valley Limestone (in Mauch Chunk Formation)

Mississippian: Southwestern Pennsylvania and western Maryland.

N. K. Flint, 1962, Pennsylvania Geologists Guidebook 27th Ann. Field Conf., p. 8–9, figs. 4, 14, 16. Basal unit of the Mauch Chunk. Thickness 8 to 10 feet. Overlies Loyalhanna Limestone. May be correlative of Trough Creek Limestone.

N. K. Flint, 1965, Pennsylvania Geol. Survey, 4th ser. County Rept. C56A, p. 41–46, pls, measured sections. Formal proposal of name. Thickness 10 feet at type locality. Lower 7 feet is bluish-gray finely crystalling limestone which is sparsely fossiliferous. This limestone is overlain by 3 feet of gray, green, and pale-red siliceous limestone. Stratigraphically below Wymps Gap Limestone (in upper part of lower part of the Mauch Chuck Formation).

Type locality: At Keystone Lime Co., quarry, 1½ miles southwest of Mount Davis, Somerset County, Pa. Extends into Garrett County, Md. Mount Davis is highest point in Pennsylvania. Geographic area known as Deer Valley lies at heads of two valleys; one north of Glade Mountain at head of Cove Run: the other south of Glade Mountain at head of Glade Run. These are relatively broad valley heads at crest of Negro Mountain anticline.

Dee Wright Flow

Recent: West-central Oregon.

G. T. Benson, 1965, Ore Bin, v. 27, no. 2, p. 40. Dee Wright flow from Yapoah Crater overlaps Little Belknap flows and is therefore younger, as are the flows from Collier and Four-in-One Crater.

Named from Dee Wright Observatory, Linn County.

Defiance Member (of Joachim Formation)

Middle Ordovician: Eastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 60–61, 228. Mostly silty, partly argillaceous, thick-bedded dolomite that has smooth, white, weathered face. Contains several beds of gray-green shale in type area, including one 18- to 24-inch bed about 2 feet below top. In Ancell type section, Defiance Member consists of silty dolomite and limestone interbedded with pure limestone. Thickness 20½ feet in type section; as much as 50 feet in well near Grand Tower, Ill. Overlies Boles Member (new); underlies Matson Member (new).

Type section: Quarry in bluffs on north side of Missouri River, 1 mile southwest of Matson, St. Charles County, Mo., NE cor. SE¼SW¼ sec. 4, T. 4 N., R. 2 E., Augusta quadrangle. Named for village of Defiance, St. Charles County, 3 miles east of type section.

De Forest Formation

Pleistocene to Holocene: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, and G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 5, p. 473—487. Proposed for the silty alluvium in Willow River valley and its tributaries. Subdivided into (ascending): Soetmelk, Watkins, Hatcher, Mullenix, and Turton members. In Thompson Creek and Magnolia Creek valleys, overlies Kansan till. All members not exposed in one vertical section; two type sections designated. Tazewell to Recent [Holocene].

Type section (Soetmelk, Watkins, Hatcher, and Mullenix members): On Thompson Creek, 100 yards east of country road between secs. 13 and 14, in SW¼ sec. 13, T. 80 N., R. 43 W., Harrison County. Type section (Turton member): Two hundred feet west from confluence of Watkins Branch and Thompson Creek in NE¼ sec. 18, T. 80 N., R. 42 W., Harrison County.

Del Carmen Limestone

Lower Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pl. 1. A thick-bedded dense hard cherty gray limestone that weathers brown. Thickness about 350 feet. Overlies Telephone Canyon Formation (new) and underlies Sue Peaks Formation (new).

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 36—40, pls. Formal proposal of name. Term is used to designate a lithostratigraphic unit that in general corresponds to Edwards Limestone in central Texas. Normally forms sheer escarpment in lower part of faulted fault blocks and is terminated above and below by slopes that are underlain by soft limestone and shale. Thickness 350 feet in the Sierra del Carmen to 475 feet at mouth of Santa Elena Canyon. Overlies Telephone Canyon Formation. Underlies Sue Peaks Formation.

Name Del Carmen is from term Sierra del Carmen, a series of tilted faulted block mountains where the limestone is exposed. Forms lower part of most escarpments in the Sierra del Carmen, Big Bend National Park. Also forms lower vertical walls at Santa Elena Canyon and is present at Mariscal Canyon and in Christmas Mountains.

Dells Granite

Precambrian: North-central Arizona.

M. H. Krieger, 1965, U.S. Geol. Survey Prof. Paper 467, p. 44—47, pl. 1. A uniform massive medium- to coarse-grained rock having granitic (seriate), locally porphyritic, texture. Surrounded and unconformably overlain by

Cenozoic rocks. Concealed contact between the granite and Government Canyon and Prescott Granodiorites (both new) may be a fault trending west-northwest close to southwestern outcrop of the granite. Probably younger than Prescott Granite. Has been included in Bradshaw Granite (Jagger and Palache, 1905) which name is herein abandoned.

Named for Granite Dells about 5 miles northeast of Prescott. Forms somewhat triangular mass about 5 square miles in area. Forms bold outcrops.

Del Padre Sandstone

Age undetermined: North-central New Mexico.

J. P. Miller, Arthur Montgomery, and P. K. Sutherland, 1963, New Mexico Bur. Mines Mineral Resources Mem. 11, p. 20-25, pl. Name proposed for unfossiliferous orthoquartzitic sandstone of undetermined age in Sangre de Cristo area. Unconformably overlies Precambrian igneous or metamorphic rocks. This sandstone was included by Baltz and Read (1960, Am. Assoc. Petroleum Geologists Bull., v. 44, no. 11) as lower of four lithologic members of Espiritu Santo Formation. These authors did not describe the sandstone and conglomerates in outcrop areas of its maximum development. Conformably underlies Espiritu Santo Formation and upper part believed to interfinger laterally with Espiritu Santo. At type locality basal contact with Precambrian well exposed but upper contact with Mississippian limestone covered. Thickness 93 feet at type locality. Abnormal thicknesses of quartzitic sandstone assigned to Del Padre occur at three widely separated localities. All are near Picuris-Pecos fault and their anomalous features may be related to it in origin. Sandstone at all three localities underlain by Precambrian quartzite. Thickness 754 feet at Rio Chiquito. Minimum thickness exceeds 200 feet southwest of Pecos Baldy. More than 150 feet north of Rio Pueblo in Osha Canyon.

Type locality: Bluff on north side of Rito del Padre at its junction with Pecos River, Rio Arriba County, Sangre de Cristo Mountains.

Del Puerto Keratophyre Member (of Franciscan Formation)

Del Puerto Volcanics (in Franciscan Formation)

Upper Jurassic(?): Central California.

R. G. Coleman, 1961, Jour. Petrology, v. 2, no. 2, p. 231 (table 8), 233, 244. Mentioned in discussion of jadeite deposits in California. Name credited to M.E. Maddock (1955, unpub. thesis).

M. E. Maddock, 1964, California Div. Mines and Geology Map Sheet 3. Flows of keratophyre and quartz keratophyre form single elongated body extending nearly 5 miles southward from Del Puerto Creek. Structural considerations indicate these volcanic rocks occur stratigraphically near top of Franciscan section directly beneath Lotta Creek Tuff Member (new). Estimated thickness 1,500 feet. Completely bounded by faults. Body interpreted as anticlinal piercement through Cretaceous strata, north end of which is truncated by Tesla-Ortigalita fault.

Well exposed along Del Puerto Creek in SE¼ sec., T. 6 S., R. 6 E., Stanislaus County.

Demetrie Formation

Cretaceous-Tertiary: Southern Arizona.

J. A. Thoms, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. The Cretaceous(?) sequence and the Late Cretaceous leucogranite in area are unconformably overlain by the Cretaceous-Tertiary Demetrie formation—a distinctive grayish-blue dacite to andesitic tuff-breccia with maximum thickness of 2,000 feet. A closely associated mudstone and conglomerate has been given informal member status. Part of the Demetrie formation occurs in a north-northwest-trending belt from 1 to 2 miles wide.

Present in Tascuela area, which comprises about 25 square miles on the west side of the Sierrita Mountains in Palo Alto and Twin Buttes quadrangles, Pima County.

Deming Sand

Pleistocene, upper: Northwestern Washington.

D. J. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1475, pl. 3. Consists of stratified sand, clay, and gravel lying between Kulshan glaciomarine drift (new) above. At type locality sediments are mostly brown medium- to coarse-grained sand with some interbeds of gray blocky clay 1 to 2 feet thick. At Bellingham Bay, deposits consist of crossbedded sand with interbedded plastic blue clay and sandy gravel.

Type locality: Along Nooksack River 1¼ miles southeast of Cedarville. Deming is in Whatcom County.

Democrat Gulch Complex

Democrat Creek Complex

Precambrian: Central Colorado.

E. W. Heinrich and J. R. Shappiro, 1966, Am. Mineralogist, v. 51, no. 7, p. 1089 (fig. 1), 1103—1104. Shown on index map in southern part of Fremont County. Age of syenite in the complex, determined by zircon method, 595 m.y. Youngest Precambrian or earliest Cambrian(?). Occurs in vicinity of Iron Mountain-McClure Mountain complex and Gem Park complex.

E. W. Heinrich and D. H. Dahlem, 1967, Am. Mineralogist, v. 52, nos. 5—6, p. 817—831. Pinon Peak breccia pipes, herein described, are satellic to McClure Mountain-Iron Mountain complex, just as the Democrat Creek complex has marginal breccia masses. In Democrat Gulch the breccias are adjacent or near the syenite body.

Fremont County.

Denali Glaciation

Quaternary: Central Alaska.

T. L. Péwé, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—200—D—201. Four Quaternary glaciations recorded in headwaters area of Delta River. First two are unnamed. The last two advances are grouped together and named Denali glaciation. Well-preserved moraines, characterized by fresh knob-and-kettle topography, are typical of drift of late Denali age. Moraines of early Denali age are more subdued. Correlated with Donnelly glaciation of lower Delta River area.

Named after Denali Highway, which traverses deposits in Amphitheater Mountains.

Denay Limestone (in Nevada Group)

Middle Devonian: Northeastern Nevada.

J. G. Johnson, 1965, Canadian Petroleum Geology Bull., v. 13, no. 3, p. 376. Name proposed for post-McColley, pre-Devils Gate interval in northern Simpson Park Range. McColley Canyon Formation together with Denay Limestone constitute Nevada Group at westernmost localities where limestone is predominant carbonate rock.

F. G. Poole and others, 1967, *in* International Symposium on the Devonian System: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 1, p. 883. As shown on the correlation chart, the Denay comprises (ascending) Union Mountain and Telegraph Canyon Members.

Type locality and derivation of name not stated. Denay Creek is in southwestern Eureka County, North of Roberts Mountain.

Denkman Sand

Jurassic: West-central Mississippi (subsurface).

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Bros., p. 290, 291. Lowest or oldest stratigraphic unit known in eastern Gulf area above Louann salt, the stratigraphic relationships of the salt and overlying units not being clear in this area, is a sand herein named Denkman. Lies between 15,997 or 15,998 feet and total depth (16,276 feet) in type well. Sand is possibly continuous with Norphlet of north Louisiana and south Arkansas but is different lithologically. Overlain by carbonates which seem to be laterally continuous with Smackover of Arkansas and north Louisiana. Probably equivalent to lower part of Smackover of type area.

Type well: Lion Oil Co. No. 2 Denkman well, NW¼NE¼ sec. 22, T. 7 N., R. 4 E., Rankin County.

Denny Conglomerate Member (of Efland Formation)

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 125. A distinctive quartz conglomerate that occurs at or near upper contact of Efland Formation (new).

Named for exposures in roadcut at Denny Store in Person County.

Denny Creek Granodiorite Gneiss

Precambrian: Central Colorado.

Fred Barker and M. R. Brock, 1965, U.S. Geol. Survey Bull. 1224—A, p. A23—A25. Consists of gneissic biotite granodiorite and biotite-quartz diorite. Intruded by Browns Pass Quartz Monzonite (new) and Kroenke Granodiorite (new). Part of rock assigned to Denny Creek was called Pikes Peak Granite by Stark (1935) and Stark and Barnes (1935, Colorado Sci. Soc. Proc., v. 13).

Type area: Along Denny Creek at altitudes of 10,800 to 11,000 feet, Mount Harvard quadrangle, Chaffee and Gunnison Counties. Forms batholith that extends beyond boundaries of quadrangle.

Depue Limestone Member (of Coeymans Formation)

Lower Devonian: Northeastern Pennsylvania and western New Jersey.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 19—20, measured sections. Consists of medium-gray to medium-dark-gray dominantly fine-grained slightly argillaceous and arenaceous fairly evenly bedded limestone that weathers medium-light gray. Thickness 13 feet at type section; 29 feet at Wallpack Center, N.J. Southwest of Bevans, N.J., overlain abruptly or gradationally by Peters Valley Member (new). Northeast of Bevans, grades upward into Shawnee Island Member (new). Overlies Mashipacong Member (new) of Rondout Formation. In vicinity of Montague, N.J., grades laterally into Thacher Member of Coeymans Formation.

Type section: In cut along northwest side of road, 0.6 mile southwest of Shawnee on Delaware, Pa., in Bushkill quadrangle. Named for island in Delaware River south of its type section.

Derby Hill Schist

Ordovician(?): South-central Connecticut.

C. E. Fritts, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D32—D36. Rocks formerly assigned to west-central part of Orange Phyllite are here named Derby Hill Schist. Contains fine-grained thinly laminated argillaceous metatuff and impure quartzite. Metatuff predominates and is characterized by layers a few millimeters thick composed almost entirely of muscovite, which are separated by layers of similar thickness composed of quartz and layers of intergrown albite and chlorite. Veins and lenses of younger quartz injected between these layers. In northern exposures schist is characterized by shear cleavage, but to south rock is crenulated rather than sheared. Underlies Wepawaug Schist (new); overlies Southington Mountain Schist (new).

C. E. Fritts, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—199. Mapped for at least 12 miles south-southwest from Bethany Lake in Mount Carmel quadrangle. Thickness 1,000 to more than 3,000 feet.

C. E. Fritts, 1965, U.S. Geol. Survey Bull. 1224—A, p. A30. Subdivided to include Oronoque Member (new).

H. R. Burger, 3d, 1967, Connecticut Geol. and Nat. History Survey Rept. Inv. 4, p. 4 (fig. 3), 5. Fritts (1962, 1965) maps rocks in southeastern Ansonia and eastern Milford quadrangles, adjoining the area on the west, as Derby Hill Schist and divides the formation into two members, Oronoque Member and an unnamed member. Field mapping in New Haven quadrangle and inspection of field relations in the Ansonia and Milford quadrangles suggest that correlation of these rocks with type Derby Hill Schist at Derby Hill in Ansonia quadrangle is tenuous and difficult to substantiate. Present author makes following revisions: (1) Rocks mapped by Fritts (1965) as unnamed member of Derby Hill Schist in southeastern Ansonia and eastern Milford quadrangles are identical to those mapped by the author as Savin Schist in New Haven quadrangle and should henceforth be designated as Savin Schist; (2) The upper part of rocks mapped as Oronoque Member of Derby Hill should preferably be included as a unit in Maltby Lakes Volcanics; the lower part is regarded as merely interbedded within the Allingtown Volcanics.

Type locality: On west side of Derby Hill, Ansonia quadrangle.

Desert Creek Substage

Pennsylvanian (Desmoinesian): Utah, Arizona, Colorado, and New Mexico.

D. L. Baars, J. W. Parker, and John Chronic, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, p. 393—403. Proposed that the units (ascending) Barker Creek, Akah, Desert Creek, and Ismay (formerly "pay zones") be called substages and used as formal time-stratigraphic units in Four Corners Stage (new). *Fusulina novamexicana* is useful fusulinid.

Interval for the four substages of the Four Corners Stage is in Shell No. 1 Hovenweep well, sec. 5, T. 40 S., R. 26 E., San Juan County, Utah.

Desert Museum Andesite Porphyry

Upper Jurassic: Southeastern Arizona.

P. E. Damon and others, 1967, Arizona Univ. Geochonology Labs. Ann. Prog. Rept. no. C00—689—76 to Research Div. Atom. Energy Comm., p. 69, 70. In 1965 progress report (C00—689—50) Damon and others reported on chemical and isotopic studies of "Turkey Track" andesite porphyry problem. Large number of these rocks were analyzed for K, Rb, Sr, U, and Th. They are quite homogeneous in composition with a few examples. One of the discordant samples, Desert Museum andesite porphyry (Mayo, 1961) had about twice the strontium content of the other samples. [Mayo, 1961, Arizona Geol. Soc. Digest, v. 4, discussed phenocryst porphyry near Arizona-Senora Desert Museum, but did not use formal term Desert Museum andesite porphyry.] According to Mayo, it was intruded into the still moist mudstones, siltstones, and sandstones of Recreation Red Beds of Cretaceous (?) age. Because of this suggestion of early intrusion and the anomalous strontium content, the plagioclase was dated by K-Ar method and gave apparent age 150 ± 5 m.y. The apparent age is pre-Cretaceous. Concluded that Desert Museum andesite porphyry is late Jurassic in age and, consequently, the Recreation Red Beds are older. This leaves open the possibility that these sediments are Triassic red beds.

Occur in area near Arizona-Sonora Desert Museum in Tucson area.

Desert Valley Formation

Upper Cambrian: Southeastern Nevada.

Anthony Reso, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 904—905. Divided into four unnamed members. A consists of thin-bedded calcilutite. B is primarily massive-ledged cherty phaneritic dolomite with variable amounts of limestone in lower half. C is characterized by dark olive-gray dolomite with distinctive 5- to 17-foot-thick light-gray zones in lower part. D is less-resistant thin-bedded dolomite containing abundant chert. Thickness 2,200 feet. Overlies Dunderberg Formation; underlies limestones of Pogonip Group. Franconian and Trempeleauan.

Exposed on lower slopes of west face of Pahranagat Range overlooking Desert Valley, Lincoln County.

Desolation Valley granodiorite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Desolation Valley granodiorite shown on map in report on contact metamorphic reactions and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Devils Garden Basalt

Gardens Basalt

Pleistocene: Northeastern California.

California Department Water Resources, 1963, California Depart. Water Resources Bull. 98, v. 1, p. 57, v. 2, pls. Dark-colored olivine basalt. Consists of a great number of lava flows ranging in total thickness from 50 to over 200 feet.

G. A. Macdonald, 1966, California Div. Mines and Geology Bull. 190, p. 91, 92. Plateau basalt that is widely distributed between fault-block ranges of Modoc region is commonly referred to as Warner Basalt of Russell (1928). Later workers recognized that it might not be possible to group all of the "plateau" basalt of area into a single stratigraphic unit. Now considered preferable to use local formation names until correlation of the basalts throughout the region can be more firmly established. Name Burney Basalt has been used in this way for plateau basalt in Prospect Peak and Harvey Mountains quadrangles and in Burney and Little Valley quadrangles just to the north, and nâme Gardens Basalt [Devils Garden Basalt] as has been used by Ford and others (1963).

Forms plateaus in area. Most typical plateau is Devils Garden area northwest of Alturas. Basalt blankets most of area west and southwest of Goose Lake Valley, and extends westward about 40 miles nearly to Lava Beds National Monument, where it is overlain by basalts of Recent age. Basalt is broken by faults into many tilted blocks separated by nearly vertical scarps ranging in height from 10 to 100 feet.

Devils Garden flows

Recent (prehistoric): Central Oregon.

N. V. Peterson, 1965, Oregon Dept. Geology and Mineral Industries, Bull. 57, p. 19. Name applied to flows in the Devils Garden lava field where about 45 square miles is covered by thin flows of pahoehoe lava.

Devils Garden is a volcanic landform near center of the High Lava Plains of central Oregon, roughly 50 miles southeast of Bend.

Devils Homestead Flow

Recent: Northern California.

G. A. Macdonald, 1966, California Div. Mines and Geology Bull. 190, p. 88—89. An informal name applied to an aa flow in Lava Beds National Monument. Overlies Modoc Basalt.

The Devils Homestead is an area extending eastward for about three-quarters of a mile from Gillem Bluff in northern part of Lava Beds National Monument. Flow is visible from highway 6 miles north of Monument headquarters.

Devils Postpile basalt

Pleistocene: East-central California.

G. B. Dalrymple, 1964, Dissert. Abs., v. 24, no. 10, p. 4142. Believed to have been extruded between El Portal (Sherwin) and Wisconsin stages. Gives potassium-argon date of 940,000 ± 160,000 years.

Devils Postpile National Monument is in Madera County.

Devils Table basalt

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Devils Table basalt gave age of 3.5±.1 m.y. Sugarloaf Hill and Devils Mountain samples may be used to estimate minimum relief and elevation of range in this area during Pliocene.

Sample collected from Devils Table, an erosional remnant of lava flow near present South Fork of San Joaquin River, Kaiser Peak quadrangle, 1 mile northwest of Mono Hot Springs on Devils Table.

Devils Tower phonolite porphyry

Tertiary: Northeastern Wyoming.

W. A. Bassett, 1961, Science, v. 134, no. 3487, p. 1373. Phonolite porphyry with large phenocrysts of orthoclase. Potassium-argon determinations on orthoclase indicate age of 40.5 m.y. ± 4 percent.

Forms Devils Tower, Devils Tower National Monument, Crook County.

Dewey Bridge Member (of Entrada Sandstone)

Upper Jurassic: East-central Utah and west-central Colorado.

J. C. Wright, D. R. Shawe, and S. W. Lohman, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 11, p. 2057–2070. Proposed that earthy siltstone formerly called Carmel Formation in east-central Colorado be included in Entrada Sandstone and named Dewey Bridge Member. Commonly a siltstone or slightly clayey siltstone 50 to 150 feet thick. Underlies Slick Rock Member (new). Basal contact of Dewey Bridge Member with underlying Navajo Sandstone is sharp truncation plane.

E. B. Ekren and F. N. Houser, 1965, U.S. Geol. Survey Prof. Paper 481, p. 8–10. Described in Ute Mountains area, Colorado, where it is about 25 to 35 feet thick and consists of brick-red-argillaceous and silty very fine grained sandstone. Underlies Slick Rock Member. Forms bench over resistant Navajo Sandstone.

Type section: On north side of Colorado River about 1 mile east of Dewey Bridge, sec. 8, T. 23 S., R. 24 E., Grand County, Utah.

Deweyville Formation

Pleistocene, late(?) or Recent: Eastern Texas.

V. E. Barnes, proj. director, 1967, Geologic atlas of Texas, Palestine sheet (1:250,000): Texas Univ. Bur. Econ. Geology. Named on map legend. Consists of sand, silt, and clay, and some gravel. Includes point-bar, natural-levee, stream-channel, and backswamp deposits at a level only slightly higher than present flood plain. Thickness locally more than 50 feet. Overlies unnamed fluviatile terrace deposits. Underlies alluvium.

Type locality and derivation of name not stated.

Dexter Formation

Age not stated: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Five formations tentatively described in area. From southeast to northwest these are: Vassalboro, Waterville, Dexter, Hartland, and Ripley. Massive quartzites of the Dexter, Hartland, and Ripley may represent one and same unit through isoclinal folding. Indian Pond Limestone (new) is situated between the Dexter and Hartland.

Report discusses geology of Pittsfield quadrangle.

Diamond A Formation

Carboniferous: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12—18, pl. 1. Light- to dark-gray, mostly crystalline, bedded limestone with shale and hornfels members. Lenses of quartzite- and chert-pebble conglomerate near base. Thickness 610 to 1,500 feet. Youngest formation in northern part of Rowland quadrangle. Unconformably overlies unnamed argillaceous formation that contains a dark quartzite. Similar to Banner Formation in Mountain City quadrangle, and may be included in lower part of Mountain City Formation.

Named for exposures along north side of Bearpaw Mountain (sec. 17 and N½ sec. 19, T. 47 N., R. 57 E.; SE½ sec. 24, T. 47 N., R. 56 E.) and along Bruneau River from Rowland, west of hill 5767, northward to McDonald Creek. Name is from Diamond A Desert which lies just northwest of Bearpaw Mountain, Rowland quadrangle, Elko County.

Diamond Bar sand (in Topanga Formation)

Miocene: Southern California (subsurface).

D. L. Durham and R. F. Yerkes, 1964, U.S. Geol. Survey Prof. Paper 420—B, p. B10. An informal name used by Woodford and others (1944, U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 23) for a subsurface unit here included in Topanga formation. Occupies stratigraphic position similar to that of Buzzard Peak conglomerate member of Topanga in San Jose Hills. Woodford and others assigned the sand to Puente formation.

Named for occurrence in Western Gulf Oil Co. well Diamond Bar 1 where it underlies strata of La Vida member of the Puente.

Diamond Craters Lava

Recent: Eastern Oregon.

N. V. Peterson and E. A. Groh, 1964, Ore Bin, v. 26, no. 2, p. 17—34. Lavas that flowed from Diamond Craters. Younger than Voltage lavas believed to have been erupted during Pleistocene time. Shown on geologic cross section as overlying Danforth Formation.

Diamond Craters is isolated area of recent vulcanism near center of Harney County. Area is about 60 miles south of Burns in Tps. 28 and 29, R. 32 E.

Diamond Springs Formation

Pleistocene, middle or upper: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Fluvial sand and gravel. Maximum thickness about 15 feet. Overlies Norfolk Formation; underlies Kempsville Formation (new).

Diamond Springs is in northern Princess Anne County.

Dickinson Member (of Golden Valley Formation)

Paleocene, upper, to Eocene, lower: Western North Dakota.

L. J. Hickey, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 742. Thickness 140 to 160 feet. Overlies Hebron member (new). Illite and montmorillonite are principal clay minerals. Crossbedded sand lenses forming channel facies in this unit are interbedded with clays, lignites, and parallel-bedded sands and silts of interchannel origin. A leached and oxidized zone penetrates as much as 75 feet into the Dickinson beneath the unconformable White River Group.

Williston Basin, western North Dakota.

Dicks Lake granodiorite

Triassic(?) -Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology v. 7, no. 2, p. 221—245. Dicks Lake granodiorite mentioned and mapped in report on contact metamorphic reaction and processes in Mount Tallac roof pendant. Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Dickson Sandstone Member (of Savanna Formation)

Pennsylvanian (Desmoinesian): Northeastern Oklahoma.

C. C. Branson and others, 1965, Oklahoma Geol. Survey Bull. 99, p. 26, 27—29. Light-brown to light-grayish-yellow fine-grained sandstone and interbedded gray micaceous shale and grayish-yellow siltstone. Thickness about 12 feet. Separated from underlying Doneley Limestone Member by 15 feet of dark-gray to gray silty and sandy shale. Below Drywood coal.

Well developed along escarpment half a mile east of Dickson School along boundaries of secs. 1, 2, 11, 12, T. 26 N., R. 20 E., Craig County.

Difficulty Shale Member (of Goose Egg Formation)

Upper Permian: Southeastern Wyoming.

E. K. Maughan, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B53—B59. Freezeout Tongue of Chugwater Formation of Thomas (1934) is divided into an upper and a lower part of eastward extension of Ervay Member of Park City Formation. Because of this division of the Freezeout by the Ervay the concept of the Freezeout as a tongue is untenable. Freezeout is herein revised. Lower part is named Difficulty Shale Member. Mostly moderate-reddish-orange parallel laminated and thinly bedded mudstone and siltstone. Thickness commonly about 50 feet. Overlies Forelle Limestone Member; underlies Ervay Member.

Type section: In Freezeout Hills, in SW¼ sec. 10, T. 24 N., R. 80 W., about one-fourth mile northeast of location of old Difficulty post office, and seems to be in same location as section described near Difficulty by Thomas.

Dilles Bottom Limestone Member (of Dunkard Group)

Permian: East-central Ohio.

H. L. Berryhill, Jr., 1963, U.S. Geol. Survey Prof. Paper 380, p. 65. Name applied to persistent limestone that underlies Big Run coal bed throughout southeastern Belmont County. Member, which is 57 to 63 feet above Jollytown "A" coal bed, ranges in thickness from a few inches to 6 feet and in most places consists of several beds of limestone interbedded with clay. Limestone is impure and characteristically weathers into small slabs. Light-olive gray on fresh fracture. Weathers to yellowish gray or very light gray. In this report the Washington and Greene formations of the Dunkard group are undifferentiated.

Named for outcrops near summit of ridge that lies southwest of Big Run and north and northwest of Dilles Bottom in secs. 6, 7, and 13, Mead Township, Belmont County.

Dillon Falls Formation (in Maxville Group)

Middle and Upper Mississippian: East-central Ohio.

J. W. Scatterday, 1964, Dissert. Abs., v. 24, no. 11, p. 4635. Oldest formation in group. Divisible into two members (informal) that are equivalent to upper and lower parts of St. Louis Limestone of standard Mississippian. Underlies Jonathan Creek Formation (new).

Dillsboro Formation

Upper Ordovician: Southeastern Indiana.

G. D. Brown, Jr., and J. A. Lineback, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 5, p. 1020—1021. Name proposed for sequence of highly fossiliferous argillaceous limestones and calcareous shales that lie between the shale of Kope Formation and dolomitic limestone of Saluda Formation. Includes most of Maysville faunal zones and lower Richmond zones. Of the several limestone zones within the Dillsboro, only a few appear to be extensive. Rocks assigned by Fox (1962) to his Tanners Creek Formation are here included at top of the Dillsboro because present writers were unable to find a lithostratigraphic boundary corresponding to base of Tanners Creek. Kope-Dillsboro contact occurs typically in a gradational sequence in much of southeastern Indiana, but is well defined and conspicuous along U.S. High 50 1 mile west of Aurora, Dearborn County. North, south, and west of Aurora for several miles this contact is readily mapped. In southern Switzerland County and southeastern Jefferson County, the gradational zone in which contact occurs is 50 feet or more thick, and contact can be selected only with difficulty. Kope-Dillsboro contact is distinct in core taken from drill hole 124 at New Point, Decatur County, and in core from drill hole 57 near Richmond, Wayne County, where thickness of the Dillsboro is 309 and 350 feet respectively.

Type area: Southwestern Dearborn County and east-central Ripley County, in vicinity of Dillsboro, Dearborn County. No continuous exposure of Dillsboro known.

Dimple Dell Soil

See **Little Cottonwood Formation.**

Dinner Creek Welded Ash-Flow Tuff

Miocene (Barstovian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 18—19, 34—35. Pale-brown to grayish-red rhyolitic welded ash-flow tuff. Where completely displayed has lower zone of no welding; a zone of dense welding; an upper zone of partial welding, which includes a lithophysal zone; and perhaps an upper zone of no welding. Thickness 20 to 200 feet. Overlies unnamed igneous complex in Monument Peak and Malheur Gorge districts. Underlies Hunter Creek Basalt (new). Overlain, indirectly, by Butte Creek Volcanic Sandstone (new), which is late Miocene age. No underlying unit has been dated.

Type locality: On Conroy Creek, in NW¼SE¼ sec. 30, T. 21 S., R. 39 E., Malheur County. Named for exposures on Dinner Creek.

†Dinwoody Lake Glaciation, Till

Pleistocene: Northwestern Wyoming.

G. M. Richmond, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D132—D136. Name Dinwoody Lake Till applied to youngest of three pre-Bull Lake tills. Disconformably overlies Sacagawea Ridge Till (new); underlies Bull Lake Till. Thickness 45 to 60 feet at type section; 60 to 70 feet at Cedar Ridge. Cedar Ridge (new), Sacagawea Ridge, and Dinwoody Lake Tills may be equivalent to Rocky Flats Alluvium (oldest), Verdos Alluvium, and Slocum Alluvium of Denver Basin, which in turn are correlated with Nebraskan, Kansan, and Illinoian Glaciations. For purposes of correlation in Rocky Mountain region, terms Cedar Ridge, Sacagawea Ridge, and Dinwoody Lake Glaciations are proposed from type localities of their respective tills.

G. M. Richmond, 1964, U.S. Geol. Survey Prof. Paper 501—D, p. D104, D105. Mapping at Bull Lake shows that Dinwoody Lake Till is in fact the lower till of Bull Lake Glaciation. Terms "Dinwoody Lake Till" and "Dinwoody Lake Glaciation" are abandoned in favor of informal terms "lower till" and "early stade" of Bull Lake Glaciation.

Type locality: Escarpment of Sacagawea Ridge on north side Upper Dinwoody Lake, center sec. 31, T. 5 N., R. 5 W., Fremont County.

Disaster Peak Formation

Pliocene: Central eastern California.

D. B. Slemmons, 1966, California Div. Mines Bull. 190, p. 199—208. Thickest and most widespread of the post-Stanislaus Formation (new) lavas of Sonora Pass area are hornblende-rich andesites herein designated Disaster Peak Formation. Formation can be recognized in source area between Ebbetts Pass and Relief Peak by presence of large cobbles and breccia clasts or hornblende andesites, generally with abundant hornblende phenocrysts up to 1 inch in length. Deposits are mainly mudflow breccias, autobrecciated flows, and subordinate volcanic sediments. Section is about 1,000 feet thick, both near Disaster Peak and also farther south near Castle Rock and East Flange Rock where Disaster Peak andesites lie on latite. The Disaster Peak Formation may prove to be the equivalent of the Mehrten Formation in the type area, but owing to large gaps in mapping it seems best to apply a new name rather than guess at the correlation. Unconformably overlies either Stanislaus Formation, usually with an erosion of low relief, or early andesites of Valley Springs rhyolites with a deeply dissected surface of moderate relief.

Type locality: Slopes of Disaster Peak, Sonora Pass quadrangle.

Dismal Swamp peat

Recent: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Fresh-water peat, maximum thickness 11 feet. Stratigraphically above Sandbridge Formation (new). Pollen study indicates peat is entirely of fresh-water origin. Radiocarbon age 7,670 ± 60 years.

Underlies low area east of Suffolk scrap in Dismal Swamp area.

Divide Limestone Conglomerate lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene: Northeastern Idaho and southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Type section of Beaverhead Formation, described by Lowell and Klepper (1953, Geol. Soc. America Bull., v. 64, no. 2), is near mouth of McKnight Canyon, northwest of Dell, Mont. Here exposed section, about 9,700 feet thick, was divided into an upper conglomerate member, a limestone-siltstone member, and a lower conglomerate member. This section is bounded by faults, and its age relationship to rest of Beaverhead is not known. Members described at McKnight Canyon are very local units and are not representative of entire Beaverhead Formation. In present report, 11 lithologically distinct units, including the McKnight members, were mapped in study area. These units are mutually intertonguing and lack lateral continuity over a distance of 25 miles. They are herein mapped as lithosomes. Most of the lithosomes have distinct lithology, but in some cases two lithosomes may have same composition and require different names because they do not intertongue. Following lithosomes named: Divide Limestone Conglomerate, Divide Quartzite Conglomerate, Kidd Quartzite Conglomerate, Lima Limestone Conglomerate, McKnight Limestone Conglomerate, Dutch Hollow Sandstone, Monida Sandstone, Clover Creek Sandstone, Snowline Sandstone, Chute Canyon Sandstone, and McKnight Limestone-Siltstone. Maximum thickness of Divide Limestone Conglomerate lithosome about 6,000 feet. Clasts of Triassic and Jurassic formations predominate.

Mapped in Idaho and Montana.

Divide Quartzite Conglomerate lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene: Northeastern Idaho and southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Divide Quartzite Conglomerate 15,000 feet. Precambrian Belt clasts predominate.

Mapped in Idaho and Montana.

Dixie Brook Member (of Dixville Formation)

Ordovician: Northern New Hampshire.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 11 (fig. 3), 24—28, pl. 1. Basal member of Dixville. Consists of black to gray sulfidic slate, phyllite, schist, and quartzite. Thickness about 2,000 feet. Underlies Clear Stream Member (new); overlies Albee Formation.

Well exposed in Dixie Brook, South Valley Brook, Swift Diamond River, Blue Ridge, and Signal Mountain, Errol quadrangle.

Dixville Formation

Middle Ordovician: Northern New Hampshire and northern Maine.

J. C. Green, 1963, (abs.) Geol. Soc. America Spec. Paper 73, p. 162. Composed of (ascending) 2,000 feet of carbonaceous schist and quartzite, 1,500 feet of amphibolite and other metavolcanic rocks, and 1,500 feet of carbonaceous schist and quartzite. Upper metasedimentary member is exposed only in core of a sharp, doubly plunging syncline. Overlies Albee Formation. Unconformably overlain to northwest by

Siluro-Devonian metasediments and metavolcanic rocks. Correlated with the Ammonoosuc and Partridge of New Hampshire, the Cram Hill of Vermont, and upper Beauceville and Arnold River of Quebec.

N. L. Hatch, Jr., 1963, New Hampshire Div. Econ. Devel. Bull. 1, p. 7 (fig. 2), 12—18, pl. 1. Green (1960, unpub. thesis) proposed name Dixville for sequence of phyllites, schists, quartzites, and amphibolites that overlies Albee formation in Dixville Township. In Dixville quadrangle [this report], formation underlies area that extends from Blue Ridge southward to south slopes of Dixville Peak. Also present in narrow strip along east edge of area, two small areas in southeast corner of quadrangle, small xenolith north of Millsfield Pond, and on Keyser Mountain. Main body of formation consists primarily of dark-gray phyllites and quartzites. Amphibolites occur in two large lenses near top of formation. Total thickness about 4,500 feet. Older than Kidderville formation (new). Middle Ordovician.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 14 (fig. 3), 23—32, pl. 1. Formation, in Errol quadrangle, New Hampshire-Maine, divided into (ascending) Dixie Brook (metasedimentary), Clear Stream (metavolcanic), and Rice Mountain (metasedimentary) Members. Thickness 5,000 feet. Overlies Albee Formation. Underlies unnamed Siluro-Devonian rocks. Map bracket shows age Ordovician. Columnar section shows age Ordovician(?).

A. M. Hussey, 2d, and others, 1967, Preliminary geologic map of Maine (1:500,000): Maine Geol. Survey. Mapped in Franklin and Somerset Counties.

Named for exposures in Dixville Township, N.H.

Dobbins Shale Member (of Forbes Formation)

Upper Cretaceous: Northern California.

B. D. Brooks and others, 1962, California Div. Mines Bull. 181, p. 373. Incidental mention of Dobbins shale in road log of west side of Sacramento Valley.

D. O. Emerson and R. D. Roberts, 1962, California Div. Mines Bull. 181, pt. 4, map 3. Shown on map legend as Dobbins shale member of Forbes formation.

Dobbs Buttes Member (of Roskuge Rhyolite)

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H13, H14. Predominantly pyroclastic rocks. In the Dobbs Buttes, the rocks are mostly pyroclastic and sedimentary, and the Dobbs Buttes Member is about 1,250 feet thick. Here, the lowest unit, except for thin local lenses of basal conglomerate, is a 50-foot-thick grayish-purple to brown tuff-agglomerate; this unit is similar to lowest unit of formation exposed, the Roskruge Mountains, at several places. Member includes grayish-green dacite flows which were not observed in Pescadero Member (new). Intertongues with Pescadero Member. Because their basal members in their type localities are similar, the two units are believed to be generally equivalent.

Type section: Along a south-trending line through the main peaks of Dobbs Buttes, Roskruge Mountains, Papago Indian Reservation.

Dockendorff Group

Lower Devonian: Northeastern Maine.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. No. 2, p. 16 (table 4), 40—60, pl. 1. Name applied to sequence of volcanic and sedimentary rocks of Early Devonian age that occur in Chapman syncline. Hedgehog formation is basal unit. Three formations of more or less equivalent age conformably overlie the Hedgehog. Edmunds Hill andesite, which occurs at north end of syncline, interfingers southward with Chapman sandstone, which is believed to grade southward into Swanback formation (new). Maximum thickness 19,500 feet; average thickness about 12,000 feet. Complete section not available. Overlies Perham formation (new); underlies Mapleton sandstone.

M. L. Bottino and P. D. Fullagar, 1966, Geol. Soc. America Bull., v. 77, no. 11, p. 1172. Discussion of whole-rock rubidium-strontium age of the Silurian-Devonian boundary in northeastern North America. Samples collected from Hedgehog formation in lowest part of Dockendorff group and from Eastport formation which is at, or close to, Silurian-Devonian boundary. Results of study give an age of 413 ± 5 m.y. for the Silurian-Devonian boundary.

Name taken from Dockendorff Brook, a tributary of Presque Isle Stream in eastern part of Chapman Township, Presque Isle quadrangle.

Dolbee Creek Member (of Burlington Limestone)

Mississippian (Osage Series): Southeastern Iowa.

S. E. Harris, Jr., and M. C. Parker, 1964, Iowa Geol. Survey Rept. Inv. 1, p. 6 (fig. 3), 12—13, 19, 35, fig. 4. Dominantly very dense, coarsely crystalline, crinoidal limestone. Thickness about 9 feet at type locality. Underlies Haight Creek Member (new). At type locality overlies North Hill Member of Hampton Formation. At Crapo Park, Starr's Cove, and Leonhard quarry overlies Wassonville Member of Hampton. Subsurface data.

Type section: Along Dolbee Creek near Dolbee Cemetery, in SE¼SE¼ sec. 23, T. 72 N., R. 2 W., Des Moines County.

Dolly Varden Volcanic Series

Oligocene(?): Northeastern Nevada.

G. G. Snow, 1964, Dissert. Abs., v. 25, no. 3, p. 1851. Comprised of flow and pyroclastic rocks of intermediate composition. Thickness 2,500 feet. Rests with angular unconformity on rocks as young as Lower Cretaceous and as old as Leonardian (Permian).

Dolly Varden Mountains are in southern Elko County about 25 miles west of Utah-Nevada border.

Dolman Formation (in Hoxbar Group)

Dolman Member (of Hoxbar Formation)

Pennsylvanian: Southern Oklahoma.

J. M. Westheimer and F. P. Schweers, 1956, *in* Petroleum geology of southern Oklahoma: Tulsa, Okla., Am. Assoc. Petroleum Geologists, v. 1, p. 146—147. Hoxbar group, in Southwest Lone Grove oil field, Carter County, contains gray-green micaceous shales, sandstones, and four prominent limestones (or groups of limestones). Upper three believed to correlate with surface formations called in descending order Zuckerman, Daube, and Anadarche limestones. About 200 feet below Anadarche are two distinctive limestones about 40 feet apart. These beds between Anadarche and Crinerville limestones of surface section, have no recognizable surface equivalent. Name Dolman formation is applied to these persistent subsurface beds. Upper member, generally 5 to 10 feet thick, is amber-colored, generally finely arenaceous, fossiliferous limestone commonly containing *Ammovertella*. Lower limestone, about 20 feet thick, is finely sucrose, white to buff, and commonly contains crinoid fragments. Upper member is at 2,250 to 2,257 feet and lower at 2,293 to 2,313 feet in [type] well.

E. A. Frederickson, 1957, *in* Ardmore Geol. Soc. Guidebook Criner Hills Field Conf., p. 73, road log stop 6. Ridge forming center of Brock anticline is formed by thin limestones of Dolman member [of Hoxbar]. Heretofore, Dolman limestone has been described only from subsurface occurrence in Lone Grove oil field.

E. A. Frederickson, 1962, Oklahoma Geology Notes, v. 22, no. 11, p. 295—297. At type section herein proposed, Dolman Member of Hoxbar is 6 feet thick, and consists of lower argillaceous limestone 3½ feet thick, shale zone (covered) 1½ feet thick, and upper argillaceous limestone 1 foot thick. Occurs between Anadarche and Crinerville Limestones in trough of Pleasant Hill syncline. Beds are 250 feet below Anadarche member and about 400 feet above Crinerville member.

Type section: NW¼SW¼ sec. 14, T. 5 S., R. 1 E., Carter County. Named for Samedan Oil Corp. No. 12 Dolman C well in NE¼SW¼NE¼ sec. 7, T. 5 S., R. 1 W., Carter County.

Domebo Formation

Pleistocene: Southwestern Oklahoma.

C. C. Albritton, Jr., 1966, Mus. of the Great Plains, Contr., no. 1, p. 10—13. Headwater gullies of Domebo Branch are entrenched in Permian "red beds" of Rush Springs and Cloud Chief Formations. Downstream from confluence of these gullies, four benches of Quaternary alluvium rise in steps of 2, 7, 14, and 40 feet above the bed of the stream. Alluvium of the highest bench, containing elephant bones and associated artifacts is here named Domebo Formation. Thickness at type section 39.6 feet. Divided informally into a lower member and an upper member.

Type section: Steep eastern bank of creek at Domebo site located in deep arroyolike branch of Tonkawa Creek about 3 miles east of village of Stecker and 6 miles northwest of Cyril in NE¼SW¼SE¼ sec. 29, T. 6 N., R. 10 W., town of Tonkawa, Caddo County. Name "Domebo Branch" is suggested for the tributary of Tonkawa Creek on which the site is located.

Donation Siltstone Member (of Mahantango Formation)

Middle Devonian: South-central Pennsylvania.

R. L. Ellison, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Middle sequence of formation includes Backbone Ridge, Crooked Creek, and Donation members in Huntingdon County.

R. E. Ellison, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G—48, p. 30—31. Formal proposal of name. Consists of medium-gray argillaceous siltstone that is of micaceous composition, and silty claystone. Upper and lower parts of member are shalier than middle part. Lenticular beds of calcareous siltstone are present in lower part of member. Thickness at least 76 feet at type section; contacts with underlying Crooked Creek Member and overlying Frame Member concealed. In Martins Gap section, 135 feet are exposed.

Type section: Along U.S. Route 22 opposite Huntingdon. Name taken from village several miles northeast of Huntingdon in Stone Valley where Donation Member supports a conspicuous ridge.

Donner Member (of Chainman Formation)

Carboniferous: Eastern Nevada and western Utah.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978. Chainman, about 2,000 feet thick along Nevada-Utah boundary, is herein subdivided into six lithostratigraphic members which intertongue with each other. They are (ascending): Needle Siltstone; Skunk Spring Limestone; Camp Canyon; Donner, about 250 feet thick, consisting of molassic conglomerates and coarse clastics which thin eastward away from ancient Antler orogenic belt; Willow Gap Limestone; and Jensen.

Type locality and derivation of name not given.

Donner Lake Glaciation, Till

Pleistocene (pre-Wisconsin): Northern California.

G. B. Dalrymple, 1964, Dissert. Abs., v. 24, no. 10, p. 4142. Donner Lake (pre-Tahoe) glaciation mentioned in report on potassium-argon dates and Cenozoic chronology of the Sierra Nevada. Basalt underlying outwash correlated with Donner Lake glaciation has been dated as 1.3 m.y.

P. W. Birkeland, 1964, Jour. Geology, v. 72, no. 6, p. 810—825. Formal proposal of name. Second of four glaciations in Lake Tahoe region. Preceded by Hobart glaciation (new). Succeeded by Tahoe glaciation. Relatively long interglacial separates the Donner Lake glaciation from the Tahoe. Till is recognized by a 4- to 8-foot soil with distinct A — B — C profile in which boulders are weathered to about same degree as they are in Hobart Till. Donner Lake Outwash rests on Pleistocene volcanic flow which has been dated at 1.3 ± 0.1 m.y. Donner Lake glaciation is probably much younger than this flow. At type locality of Donner Lake Till, the till overlies gravels (Prosser Creek alluvium in Birkeland, 1963) which are interpreted as being same age as dated flow.

Type section of till: Ground moraine exposed in east roadcut of Highway 89 just south of overpass over Highway 40 Freeway, SW¼ sec. 11, T. 17 N., R. 16 E.

Dorsey Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 598—600, pl. 1. Consists of two contrasting facies grading laterally into one another. One facies is series of thin-bedded siliceous argillaceous lutites with thin chert units and some quartzose silt beds. Second facies dominantly volcanic, consisting of successive flows and local agglomerates. Closely folded; estimated thickness 650 feet. Overlies unnamed member; underlies Fry Creek Member (new). Contains fossils considered to be Mississippian.

Named for exposure on hilltop south of Dorsey Creek, Independence Mountains area, Bull Run quadrangle, Elko County.

Double Adobe Latite

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines and Mineral Resources Geol. Map 17. Mapped in southern Animas Mountains. Latite flows; rock is dark gray to dark purple, weathers rust brown, contains large clear euhedral plagioclase phenocrysts and small green phenocrysts of ferromagnesian minerals; aphanitic groundmass. Equivalent to OK Bar Conglomerate and Pine Canyon Formation (both new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 60, pl. 1. Described and mapped in Walnut Wells quadrangle, Hidalgo County, where it is exposed in westernmost part of quadrangle. Formation and its equivalent, Pine Canyon Formation, are youngest extrusive units in quadrangle. Tops of these formations not exposed. Rests upon Park Tuff, upon tongues of the Pine Canyon and upon basal OK Bar Conglomerate. About 900 feet of Double Adobe exposed in quadrangle and more than 1,000 feet in Animas Peak quadrangle.

Named for Double Adobe Creek which flows along most of northeastern boundary of formation.

Double Bluff Drift

Pleistocene: Northwestern Washington.

D. J. Easterbrook, 1965, *in* Internat. Assoc. Quaternary Research, 7th Cong., Boulder Colo., Guidebook Field Conf. J, Pacific Northwest, p. 68—75. Oldest glacial deposit recognized on Whidbey Island. Composed of till, gravel, pebbly clay, and associated drift. At type locality, at northwest end of sea cliffs, about 40 feet of till and poorly stratified diamicton interbedded with sand and silt overlies about 20 feet of gravel which in turn, overlies about 30 feet of crossbedded sand. Underlies Whidbey Formation (new).

D. J. Easterbrook, D. R. Crandell, and E. B. Leopold, 1967, Geol. Soc. America Bull., v. 78, no. 1, p. 13—20. Formal proposal of name. Type section consists of about 20 feet of gravel overlain by 10 to 12 feet of sand, silt, and clay and about 40 feet of compact gray till and poorly sorted, crudely stratified diamicton interbedded with sand silt. About 30 feet of cross-bedded, fairly well-sorted sand underlies the lower gravel unit at extreme northwest end of Double Bluff. Top of the Double Bluff Drift is exposed in low bluffs about a quarter of a mile east of southernmost point at Double Bluff. Double Bluff (older) and Possession Drift represent advances of the Puget lobe of the Cordilleran ice sheet more than 40,000 years ago. The nonglacial Whidby Formation between the drifts was formed in streams and lakes.

Type locality: Sea Cliffs at Double Bluff, Whidbey Island, Puget Sound.

Double D Andesite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 70, 75. Interfingers with Wiggins formation. In this section the rock is dominantly seriate porphyritic with phenocrysts of plagioclase, hornblende, biotite, and resorbed quartz embedded in a felted to microgranular matrix of plagioclase and quartz. Has crudely circular exposure of about three-fourths of mile in diameter.

Named for and located about 1 mile south of DD Ranch on Wood River, southern Absaroka Mountains.

Double Spring Formation

Upper Jurassic and (or) Lower Cretaceous: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. At least 10,000 feet of felsic to intermediate lapilli tuff, welded tuff, and lava. Younger than Gold Bug Formation (new).

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Douglas Quartzite Member (of Ellsworth Formation)

Silurian(?): South-central Maine.

Lester Greenwood and John Hogan, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trips E and J, p. 54. A dense gray quartzite with granular texture. Conglomerate at base. Thickness 250 feet. Separated from Pond Quartzite Member (new) by Banded Quartzite Member.

Type locality and derivation of name not given. Area of report is Blue Hill copper mine.

Douglass Mesa Gravel

Pleistocene (Wisconsin): Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 20-22, pls. 1, 6. Composed of reddish-brown fragments of Pikes Peak Granite ranging in size from sand to boulders 6 feet in diameter, and of varying amounts of silt and clay. Thickness 5 to more than 50 feet and probably averages about 30 feet. An intermediate-level pediment. Younger than Lehman Ridge Gravel (new) and older than Pine Valley Gravel (new). Kansan or Yarmouth.

Type locality: Douglass Mesa, Air Force Academy area, El Paso County. Crops out on knobs at east end of Jack Valley, on a southeast-trending spur in Lehman Valley, on Lehman Mesa, on Pine Mesa, on ridges west of mouth of Kettle Creek, and as a thin deposit on a low rolling area east of Monument Creek and north of Breed.

Dove Creek Formation or Group

Paleozoic: Northwestern Utah and southern Idaho.

W. L. Stokes, 1963, Geologic map of Utah, northwestern quarter (1:250,000): Utah Univ. College of Mines and Mineral Industries. Formation named on map legend. Consists of quartzite, schist limestone. Upper(?) Precambrian.

R. L. Armstrong and F. A. Hills, 1967, *in* Earth and planetary Science Letters, v. 3, no. 2, p. 114. Dove Creek Group mentioned in report on mantled gneiss domes, Albion Range, Idaho. Metamorphosed fossils and stratigraphic arguments indicate Dove Creek Group is Paleozoic (Cambrian through Pennsylvanian). The Dove Creek Group, more than 7 km thick, consists of quartzite, pelitic rocks and carbonate rocks, and unconformably overlies Green Creek Complex (new).

Type locality and derivation of name not stated.

Dover Clay

Pleistocene: Northeastern Missouri.

G. H. Heim, Jr., 1964, Dissert. Abs., v. 24, no. 9, p. 3688. Following Pleistocene units present in area: alluvium, Peoria(?) loess, terraces, Oakwood gravels (new), La Grange gravels (new), Clear Creek silt (new), Dover clay, Kahoka till, and pro-Kahoka sands and gravels. Dover clay believed to represent material deposited either in small temporary ponds or larger more permanent lakes. Stratification noted at one exposure.

Hannibal-Canton area.

Dowdle sandstone and conglomerate member (of Oak Flat Formation)

Cretaceous (Albian): West-central California.

R. L. Rose and I. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 40 (strat. column), 42, geol. map. Informal name for variable sequence of conglomerate and sandstone that occurs between lower and upper mudstone members of Oak Flat formation (new). Maximum thickness 3,000 feet.

Named for Dowdle Ranch near Coalinga Mineral Springs, east-central Priest Valley quadrangle.

Doyle Creek Formation

Upper Triassic: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Thickness 3,000 to 5,000 feet. Includes two members (both new): Ashby Creek Conglomerate and Piedmont Point. Conformably overlies Grassy Ridge Formation (new). May interfinger with Imnaha Formation (new) east of Fish Lake. Conformably overlain by Martin Bridge Formation. Karnian.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Drakes Formation

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D16—D19. Chiefly grayish-green unfossiliferous limy and dolomitic mudstone. Upper part contains thin beds of yellowish-gray sparsely fossiliferous fine-grained dolomitic limestone. Thickness 120 to 150 feet. Includes Rowland Member (new) below and Preachersville Member (new) above. Overlies Ashlock Formation (new); the lithologies of the two formations are transitional for several feet. Underlies Brassfield Dolomite in most of area. Where Silurian rocks are absent, the Drakes is unconformably overlain by Boyle Limestone or New Albany Shale of Devonian age.

W. L. Peterson, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—506. Described and mapped in New Haven quadrangle, Nelson and La Rue Counties, where it is as much as 111 feet thick. Comprises (ascending)

Rowland Member, unnamed member, and Saluda Dolomite Member (rank reduced and reallocated to the Drakes). Overlies Ashlock formation. Underlies Brassfield Dolomite. Salude Member and unnamed member occupy same stratigraphic interval as Preachersville Member of Drakes.

Type section: About 5 miles due west of Cartersville and about 1 mile west of Button Lick Knob, Garrard County, Paintlick quadrangle. Section begins about 500 feet southeast of East Fork of Drakes Creek and thence along dirt road connecting with road along Harmons Lick; at top of hill section measured along westward-trending ridge. Named for Drakes Creek, Garrard County. Mapped in parts of Lincoln, Garrard, Clark, Madison, and Estille Counties.

Draper Formation (in Lake Bonneville Group)

Pleistocene: Northern Utah.

R. B. Morrison, Aug. 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C112, C116. In Jordan Valley Utah, comprises three wedges of lacustrine sediments separated by interlacustrine diastems. The wedges, called lower, middle, and upper members, respectively, of the Draper, record the last three known cycles of Lake Bonneville, all of which were comparatively low and brief.

R. B. Morrison, Oct. 1965, U.S. Geol. Survey Prof. Paper 477, p. 36—42, pl. 1. Formal proposal of name. Younger than Graniteville Soil and older than Midvale Soil. Can be differentiated from older Little Cottonwood Formation (new) by soil stratigraphy, unconformity, distinctive lithology, and geomorphic relation. Makes up about 3.5 percent of total volume of Lake Bonneville Group and underlies about 60 percent of area underlain by the whole group in Draper quadrangle and eastern part of Midvale quadrangle.

Type area: A strip extending 0.25 mile to each side of Dry Creek from its mouth to center sec. 15, T. 3 S., R. 1 E., eastern Jordan Valley, south of Salt Lake City. Named for town of Draper, Salt Lake County.

Draper-Midvale Substage (of Sehoo-Toyeh Stage)

Pleistocene (Sehoo-Toyeh Stage): Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. [For explanation see Sehoo-Toyeh Stage.] Sehoo-Toyeh Stage divided into two substages, Draper-Midvale (younger) and Bonneville-Graniteville.

Type area: Eastern Jordan Valley, south of Salt Lake City, Utah.

Drewsey Formation

Pliocene: Southeastern Oregon.

J. A. Shotwell and others, 1963, Am. Philos. Soc. Trans., v. 53, pt. 1, p. 23 (map 5), 28—31, 32 (fig. 7). Predominantly rhyolitic pumice tuff, agglomeratic mudflows, agglomerates, gravels, grits, sands, silts, tuffs, cinders, volcanic ashes, and basalt flows. No single section includes all the lithologies. Roughly, formation includes (ascending) welded tuff member, tuff agglomerate member, and tuff and sandstone member. Thickness as much as 1,050 feet; 1,000 feet at type section. Unconformably overlies Juntura formation (new); underlies Drinkwater basalt (new). Hemphillian mammalian fauna.

Type section: Exposures in Table Mountain just north of town of Drewsey, Harney County, and directly across Malheur River. Formation lies mainly within northwest-southeast trending syncline that passes east of town of Drewsey and along west flank of Drinkwater Mountain.

Drinkwater Basalt

Pliocene: Southeastern Oregon.

J. A. Shotwell and others, 1963, Am. Philos. Soc. Trans., v. 53, pt. 1, p. 23 (map 5), 31—32. A nearly horizontal flow of olivine basalt that caps sediments in Juntura Basin. Deposited on erosional surface formed by base leveling of Juntura and Drewsey formations (both new). Thickness 15 to 60 feet. Younger than Hemphillian.

Type section: Drinkwater Pass, Juntura Basin, Harney County.

Drip Spring Formation

Miocene (Barstovian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 24—25, 39—40. Dark-yellowish-brown, yellowish-gray, and pale-yellowish-brown altered volcanic sandstones, peperites, feldspathic and arkose sandstones, diatomites, siliceous diatomites, and carbonaceous volcanic shales that include both slope- and cliff-forming strata. Thickness 260 feet at type section; 700 feet along middle reach of Cottonwood Creek. Aggregate thickness may be 1,500 feet. Overlies Littlefield Rhyolite (new); underlies Grassy Mountain Formation and Bully Creek Formation (new).

Type locality: In SE¼ sec. 20, T. 20 S., R. 42 E., Malheur County. Named for Drip Spring, SW¼NE¼ sec. 3, T. 22 S., R. 41 E.

Dry Coyote Conglomerate Bed (in Puddle Springs Arkose Member of Wind River Formation)

Eocene, lower: West-central Wyoming.

P. E. Soister, 1966, U.S. Geol. Survey Bull. 1244—A, p. A44—A45. Stratigraphically below middle of formation and below Muskrat Conglomerate Bed (new). Because of overlap on pre-Wind River erosion surface, bed rests on Mowry Shale of Early Cretaceous age about 4½ miles to southwest of Coyote Springs and is locally absent where hills of other pre-Wind River rocks protrude above its plain of deposition farther west. Approximately equivalent to uppermost part of East Canyon Conglomerate Bed (new). Thickness about 20 feet at type locality.

Type section: N½SE¼SW¼ sec. 6, T. 32 N., R. 90 W. Named for exposures along Dry Coyote Creek.

Dry Creek transition beds

Tertiary: Southwestern Idaho.

J. J. Peebles, 1962, Idaho Bur. Mines and Geology Pamph. 127, p. 3, 5, 9. Name applied to beds at top of Payette Formation. Consist of claystone, diatomite, tuff, siltstone, and arkose. Thickness 15 to 30 feet.

Occurs over part of Dry Creek drainage area, sec. 20, T. 25 N., R. 2 E., Cartwright Canyon quadrangle.

Dry Fork Formation

Triassic: South-central Virginia.

C. T. Meyertons, 1963, Virginia Div. Mineral Resources Rept. Inv. 6, p. 17—27, 54—62, pl. 1. Consists of graywacke and arkosic facies which grade into each other in area near Mt. Airy. Estimated thickness about 6,000 to 8,000 feet. Intergongues with Leakesville formation (new). Disconformably underlies Cedar Forest formation (new).

Type section: About one-half mile south of Dry Fork along Southern Railway cut, Pittsylvania County. Name taken from settlement on State Road 718 about one-half mile west of U.S. Highway 29.

Dry Lake flow member (of Lousetown Formation)

Quaternary: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Made of many flows that appear to have been extruded over a long interval of time. Cannot be dated relative to most other flows in area, but is older than Hirschdale olivine latite (new), youngest of the Lousetown flows in area. At least 20 flows (or groups of flows) recognized in area. Nine flows (or groups of flows) named and given informal member status in Lousetown Formation.

Mapped in vicinity of Dry Lake, Truckee area, north of Lake Tahoe.

Dry Lake Member (of Thirsty Canyon Tuff)

Pliocene: Southeastern Nevada.

D. C. Noble and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D24—D27. About 25 percent of a typical outcrop is composed of black to brown coarsely vesicular blocks of pumice as much as 3 feet in diameter. Only uppermost part of member is divitrified. Maximum thickness 30 feet. Overlies Trail Ridge Member (new); underlies Gold Flat Member (new).

Type locality: Lat 37°26′ N., long 116° 41′ W., Nye County. Section extending from Trail Ridge Member through Gold Flat Member is exposed.

Dry Union Formation

Pliocene: Central Colorado.

Ogden Tweto, 1961, U.S. Geol. Survey Prof. Paper 424—B, p. B—123—B—124. Floor of Arkansas Valley is overlain by massive brown sandy silt and interbedded gravel, sand, and minor amounts of volcanic ash. The deposits, the "lake beds" of earlier reports are here named Dry Union formation. A landslide scarp near mouth of Dry Union Gulch exposes about 260 feet of upper part of formation. Maximum thickness of about 800 feet is known from surface distribution and exploratory openings. Geophysical data suggest that locally formation may be as much as 2,000 feet. Covered by younger deposits in many places but is widespread at surface in Salida area, where about 500 feet is exposed.

Named for Dry Union Gulch, mouth of which is in sec. 23, T. 10 S., R. 80 W., 5 miles south of Leadville, Lake County.

Dugout Mountain Member (of Skinner Ranch Formation)

Lower Permian (Leonard Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U.S. Geol. Survey Bull. 1244—E, p. E4—E5, pls. 1, 2. West of Lenox Hills on Dugout Mountain a considerable thickness of rock occurs above Sullivan Peak Member of the Skinner

Ranch and below lowest beds of Cathedral Mountain Formation. This interval includes limestone members of old Leonard Formation numbered 2—4 by King (1931, Texas Univ. Bull. 3038). Investigation of the numbered beds in the Lenox Hills and those in Dugout Mountain has shown that the numbers do not all correspond. Rock and fauna of the first limestone in each of the two localities indicate a correlation—it is Sullivan Peak Member. The higher number limestones on Dugout Mountain do not resemble those bearing corresponding numbers in the Lenox Hills. Instead, the fifth limestone on Dugout Mountain corresponds to second limestone in Lenox Hills, and third and fourth limestones are tongues in overlying Cathedral Mountain Formation. The interval in Dugout Mountain between top of Sullivan Peak Member and base of fifth limestone is herein named Dugout Mountain Member. As such it includes the second, third, and fourth limestones of King (1931) and the shaly intervals between them. These three limestone beds appear to thin and perhaps to converge northeastward along the back slope of Dugout Mountain. They pinch out somewhere in covered valley between Dugout Mountain the Lenox Hills, and the shaly Dugout Mountain Member above the Sullivan Peak is only tentatively identified in the Lenox Hills. At type locality sequence is mostly yellow shale, has three limestone tongues, and is 514 feet thick. Thins to northeast.

Type locality: On north slope of Dugout Mountain along line of King's (1931, p. 133) section 7, Glass Mountains, Brewster County.

Dugway Ridge Dolomite

Upper Cambrian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 8 (table 4), 30—31, pl. 1. Light- to dark-gray thick-bedded sandy-textured dolomite. Some beds of light-gray limestone near top in eastern Dugway Range. Thickness 883 feet at type section. Overlies Fera limestone (new); underlies Garden City formation.

Type section: On south side of Straight Canyon, on east side of Dugway Range, Tooele County. Named for exposures on Dugway Ridge, which forms crest of Dugway Range. Crops out in band that extends discontinuously from point 0.8 mile north of Dugway Pass to canyon 1.5 miles north of Fera Canyon.

Dumplin Valley Dolomite Member (of Marysville Limestone)

[Middle Cambrian]: Eastern Tennessee.

R. D. Hatcher, Jr., 1966, Dissert. Abs., v. 26, no. 12, pt. 1, p. 7257. Discussion of structure of northern part of Dumplin Valley fault zone. Facies changes were noted in Maryville Limestone and in Nolichucky-Maynardvill sequence. A tongue of Honaker Dolomite is present in the Maryville Limestone ranging in thickness from 0 to over 200 feet in Dumplin Valley area. Proposed that this tongue be called Dumplin Valley Dolomite Member.

Dumplin Valley fault system is a major structure of Valley and Ridge province of Eastern Tennessee. It is easternmost fault in the Valley and Ridge at latitude of Knoxville, extending from near Etowah to Morrison.

Dunbar Gneiss

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1964, Michigan Acad. Sci., Arts and Letters, Papers, v. 49, p. 81—103. Consists of two main types: medium- to coarse-grained banded gneiss and fine-grained migmatitic gneiss. Younger than Quinnesec Formation and older than Marinette Quartz Diorite.

Town of Dunbar is in northern Marinette County.

Dunbar Creek Formation (in Bozeman Group)

Oligocene: Southwestern Montana.

G. D. Robinson and H. F. Barnett, 1963, U.S. Geol. Survey Prof. Paper 370, p. 10 (table 1), 61, 77—80, pl. 1. White to grayish-yellow thick-bedded tuffaceous siltstone, partly lacustrine and partly eolian, intricately laced with fluviatile sandstone and conglomerate; some dark bentonite clay and white limestone. Thickness 250 to possibly 1,000 feet; 350 feet in type area. Overlies Climbing Arrow formation (new), contact gradational over stratigraphic interval of about 50 feet by an alternation of dark bentonitic clay with the white and yellow tuffaceous siltstones that characterize basal Dunbar Creek. Overlain by Quaternary deposits, marked angular unconformity in most areas.

G. D. Robinson, 1967, U.S. Geol. Survey Misc. Geol. Inv. Map I—486. Unconformably underlies Sixmile Creek Formation (new) in Toston quadrangle.

Type area: E½ sec. 7, T. 1 S., R. 2 E., Three Forks quadrangle. Named for Dunbar Creek, a southward-flowing tributary of Mud Spring Gulch, that flows, occasionally, along east edge of wedge of Dunbar Creek rocks east of Highway 10 N. Forms spectacular bluffs on west bank of Madison River.

Duncan Church beds

Oligocene: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 11), 99 (fig. 13), 106, 113, pls. 2a, 2b, 2c. In panhandle the Oligocene is separable into several formations, Byram Formation, Marianna Limestone, and sediments differing from peninsular Suwannee Limestone, to which name Suwannee has been extended (Cooke and Mansfield, 1946, Geol. Soc. America Proc. 1935). The panhandle Oligocene sediments of Suwanne age are light gray to buff porous extremely fossiliferous coarse carbonate clastics composed of large numbers of *Lepidocyclina* sp., *Operculinoides* sp., mollusks and echnoids. These rocks could be more accurately referred to "Duncan Church beds." However, naming of this distinctive lithologic unit will be delayed until present drilling program is completed and until sediments can be traced from these exposures into adjacent exposures, particularly in Glendon, Ala., area. Shown on map legend above "Byram" Formation and below Suwannee.

Duncan church is in Washington County.

Duncannon Member (of Catskill Formation)

Upper Devonian: Southeastern Pennsylvania.

J. L. Dyson, 1967, Pennsylvania 4th ser., Topog. and Geol. Survey Atlas A—137 cd. Above Clarks Ferry Member in Peters Mountain section (Dyson, 1963) is approximately 1,200 feet of interbedded red and nonred strata. Dyson subdivided these 1,200 feet into two unnamed members, Upper Redbed Member and Upper Sandstone Member. Because these two units are not mappable over a sufficiently wide region, they are recombined on present map and herein named Duncannon Member of Catskill Formation. Lower part of member consists of about 600 feet of red siltstone, shale and fine-grained sandstone with six interbedded gray sandstone units varying in thickness from 5 to 36 feet. Lower part overlain by group of gray, in part pebbly, medium- to coarse-grained sandstone units separated by thinner units of grayish-red siltstone and shale. Aggregate thickness of these strata 585 feet. Underlies Spechty Kopf Member of Pocono Formation.

Type section: Peters Mountain section in southeast corner of Duncannon 15-minute quadrangle in Middle Paxton Township, Dauphin County, on east side of Susquehanna River where it cuts through Peters Mountain. Measurement made along base of cliff on east side of Pennsylvania Railroad tracks.

Dunkleberg Formation (in Colorado Group)

Dunkleberg Member (of Blackleaf Formation)

Upper Cretaceous: Central western Montana.

V. E. Gwinn, 1961, Dissert. Abs., v. 21, no. 8, p. 2247. Formation in Colorado group. Overlies Taft Hill formation: underlies Coberly formation (new).

V. E. Gwinn, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4), V. E. Gwinn, 1965, Billings Geol. Soc. Guidebook 16th Ann. Field Conf., p. 41—45. Rank reduced to member status in Blackleaf formation. Defined to include 1,700 feet of mudstone, siltstone, sandstone, and several thick beds of conglomerate between Taft Hill member below and Coberly formation above. Is apparent western equivalent of Vaughn bentonitic member and Bootlegger member of Blackleaf formation.

Type section: In unnamed gulch-network, which drains low hills on southwest side of Saddle Mountain in E½ sec. 8, T. 10 N., R. 11 W. Named for Dunkleberg Ridge and Creek, Granite County.

Dunn Brook Formation (in Hovey Group)

Dunn Brook Member (of Hovey Formation)

Ordovician or Silurian: Northeastern Maine.

Louis Pavlides, 1962, U.S. Geol. Survey Prof. Paper 362, p. 17—21, pl. 1. Member of Hovey formation (new). Contains diverse assemblage of slightly metamorphosed grayish-green silicia volcanic rocks that typically weather to white or cream. Most abundant types are keratophyre and tuff. Thickness 0 to 5,000 feet. Stratigraphically above Saddleback Mountain member (new). Lower Silurian.

Louis Pavlides, 1964, U.S. Geol. Survey Bull. 1194—B, p. B4 (fig. 2), B5. Rank raised to formation in Hovey Group. Formation now known to extend to west and southwest considerably beyond its previously mapped limits. In addition to keratophyre, tuff, and volcanic breccia, contains volcanic conglomerate and some metaperlite, pillow lavas, and other silicic and intermediate aphanitic and fine-grained volcanic rocks together with a few slate and sandstone interbeds. Thickness difficult to determine. Originally estimated to be mostly lenticular and as much as 5,000 feet thick. This thickness is still correct for formation in northeastern part of Howe Brook quadrangle. In central part of quadrangle minimum thickness at least 5,000 feet; may be as much as 8,000 feet or more. Overlies Nine Lake Formation (new); underlies Maple Mountain Formation (new). Ordovician or Silurian.

Named after valley of Dunn Brook which originates in valley between the two hills on which these rocks are generally exposed, Maple and Hovey Mountains area, Aroostook County.

Dunn Hill Member (of Rhinestreet Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Thickness 22 feet at type section. Overlies Millport Member and underlies Beers Hill Member (both new). Lithologically similar to Moreland Member (new) but contains less black shale.

Type section (elevation 1,070 feet): A southeastward flowing stream in Catlin Township. Dunn Hill, Chemung County, is 1½ miles north of outcrop.

Dunrud Peak Rhyolite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 72, 73. Intrudes Wiggins formation. Largest rhyolite body in area. Pluton is about 2 miles long and 1¼ miles wide with exposed thickness of at least 1,800 feet. Megascopically the rock is occasionally porphyritic with phenocrysts of quartz sanidine embedded in light-gray aphanitic groundmass.

Occurs at Dunrud Peak, southern Absaroka Mountains.

Duquesne Volcanics (in Patagonia Group)

Lower Cretaceous: Southeastern Arizona.

R. C. Baker, 1962, Dissert. Abs., v. 23, no. 1, p. 201. Patagonia group divided into four formations. Corral Canyon red beds (new), Duquesne volcanics, and Bagby Ranch formation (new), tentatively correlated with Bisbee group (Lower Cretaceous); the Molly Gibson formation is younger than Bisbee group.

Area of report is southeastern part of Patagonia Mountains, Santa Cruz County.

Durango Group

Durango Stage

Cretaceous (Coahuila Series): Gulf Coastal Province.

R. W. Imlay, 1944, Geol. Soc. America Bull., v. 55, no. 8, p. 1007, chart 10a. Coahuila group proposed by Imlay (1940) "to include all Lower Cretaceous strata other than *Dufrenoya texana* zone which were deposited in the ancestral Gulf of Mexico, in the Mexican sea, and in closely connected waters" is herein redefined as Coahuila series and is subdivided into Nuevo León and Durango groups. Durango group is in lower part of series and is limited basally by ammonites *Neocosmoceras, Spiticeras, Himalayites,* and corresponds to Berriasian, Valanginian, Hunterivian, of European sequence.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 299, 301. Durango and Nuevo León used as time-rock subdivisions (stages) of Coahuilian series to include all rocks in coastal province which can be reasonably demonstrated to be the equivalent to the Durango and Nuevo León of Imlay (1944). Imlay did not specify a type locality or type section, but it is obvious that name was derived from Mexican state of Durango.

Dusenberry Hill Quartzite

Cambrian: New York.

J. M. Bird, 1963, Dissert. Abs., v. 24, no. 4, p. 1567, 1568. A regionally extensive orthoquartzite, 10 to 20 feet thick. Lies about 400 to 800 feet above Curtis Mountain quartzite. To west, the Dusenberry Hill is interbedded with black quartzite in gray-green silty Mettawee argillite and is stratigraphically very close to overlying West Castleton black shale which also interbeds of black quartzite.

Nassau quadrangle, Rensselaer County.

Dutch Hollow Sandstone lithosome (in Beaverhead Formation)

Upper Cretaceous: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Dutch Hollow Sandstone lithosome 5,000 feet. Consists mostly of clean quartzose sandstone.

Mapped on Beaverhead County, Mont.

Dutton Group

Upper Jurassic-Lower Cretaceous: Central Wyoming.

W. H. Curry, III, 1962, Wyoming Geol. Assoc. Guidebook 17th Ann. Field Conf., p. 119 (fig. 1). Dutton Group comprises Morrison Formation below and Lakota Formation above. Thickness about 350 feet. Overlies Sundance; underlies Fall River Member of Thermopolis Formation.

Crops out in west center sec. 12, T. 33 N., R. 90 W., Fremont County.

Dutton Creek Formation

Paleocene: Southeastern Wyoming.

H. J. Hyden, Harry McAndrews, and R. H. Tschudy, 1965, U.S. Geol. Survey Bull. 1194—K, p. K1—K13. Consists essentially of beds of coarse-grained locally conglomeratic sandstone, interbedded mudstone, carbonaceous shale, fine-grained sandstone, conglomerate, and coal. Surface section not measured because of surficial cover, but thickness estimated to range from 200 to 500 feet. Thickness 203.8 feet from core obtained from hole in type area. Unconformably overlies Foote Creek Formation (new); underlies Wind River Formation. Names Dutton Creek Formation and Foote Creek Formation introduced in Laramie basin for rocks shown as Hanna Formation and Medicine Bow Formation on current State geologic map. Hanna basin names not appropriate in Laramie basin because beds cannot be traced from basin to basin to establish definite correlation.

Type area: Near where Dutton Creek crosses Albany-Carbon County boundary in secs. 32 and 33, T. 19 N., R. 77 W. Core obtained from hole drilled in SE¼ sec. 32, T. 19 N., R. 77 W., Albany County.

Duttonville Member (of Rondout Formation)

Upper Silurian or Lower Devonian: Western New Jersey, southeastern New York, and northeastern Pennsylvania.

A. G. Epstein and others, 1967, U. S. Geol. Survey Bull. 1243, p. 12–13, 50. Basal member of Rondout. Composed of interbedded limestone, dolomitic limestone, calcareous shale, calcareous dolomite, and dolomite. Limestone and dolomitic limestone beds are dark gray to medium gray, very fine grained to medium grained, and argillaceous, and weather medium gray. Calcareous shale is medium-dark gray, weathers medium gray, and contains desiccation cracks. Thickness at type section 22.5 feet. Near Port Jervis, northeast of type section, Duttonville thickens to 56.9 feet at Cuddebackville, N.Y. Thins to 11.5 feet at Minisink Hills, Pa. Underlies Whiteport Dolomite Member. Overlies Clove Brook Member (new) of Decker Formation and in some areas Wallpack Center Member (new) of the Decker.

Type section: In abandoned William Nearpass quarry, 1.8 miles southwest of Duttonville, N.J., and 0.5 mile due west of Clove School, in Port Jervis South quadrangle.

Duwamish Formation

Pleistocene: Northwestern Washington.

J. H. Mackin, D. R. Mullineaux, and W. J. Stark, 1950, Washington Univ. (Seattle), Trend in Engineering, v. 2, no. 4, p. 19–21. Consists of clay and silt with minor peat beds. Massive clay phase well exposed in workings of Klinker Sand and Gravel Co., above West Marginal Way, where it is at least 200 feet thick. Varved clay phase exposed in landslide scars on west side of Beacon Hill west of Marine Hospital and in adjoining low hills just north of Dearborn Street. Both phases of formation overlain by beds of clayey silt and sand with interlayered peat. Overlies Beacon till (new) without evidence of time break. Klinker till (new) overlies different members of formation.

Well exposed on both sides of Duwamish Valley from north end of Beacon Hill to south city limits of Seattle.

Dye Shale Member (of Bloyd Shale)

Lower Pennsylvanian (Morrow Series): Northwestern Arkansas.

L. G. Henbest, 1962, U.S. Geol. Survey Prof. Paper 450–D, p. D42–D43. Predominantly dark-gray to black shaly siltstone and claystone. Thin lenticular limestone beds and calcareous zones present locally. Basal unit is referred to as "caprock of the Baldwin coal." Thickness 60 to 110 feet. Overlies Woolsey Member; underlies Kessler Limestone Member.

Type locality: From E½ sec. 3 to center of north side sec. 4, T. 14 N., R. 30 W., Washington County. Named for Dye Creek.

Dyke Canyon Member (of Happy Creek Volcanic Series)

Permian(?): Northwestern Nevada.

J. G. Smith, 2d, Dissert. Abs., v. 28, no. 1, sec. B, p. 236, Happy Creek Volcanic series divided into five informal units characterized by varying proportions of volcanic and nonvolcanic debris. Dyke Canyon member, a thin-bedded unit 2,000 to 2,400 feet thick, is dominantly nonvolcanic metachert, siliceous hornfels, slate, sandstone, and carbonaceous iron-bearing limestone. Dyke Canyon is third in the sequence (ascending) and is underlain and overlain by unnamed units.

Present in southern Pine Forest Range, Humboldt County.

Eagle Evaporite

Probably lapsus for **Eagle Valley Evaporite**

Eagle Creek Interbed (in Columbia River Basalt)

Miocene, lower: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 20—21, fig. 18. A member of the "Lower" Basalt of Columbia River Basalt [Group]. Underlies Rock Creek Flow (new). Thickness 20 to 40 feet. Composed of basement detritus, is primarily fluvial and displays cut-and-fill structure. Silty and clayey layers commonly fossiliferous and exhibit leaf impressions. Middle Cenozoic.

Jane Gray and L. R. Kittleman, 1967, Am. Jour. Sci., v. 265, p. 257—291. Geochronometry of Columbia River Basalt and associated floras of eastern Washington and western Idaho. Within Lower Basalt of Columbia River Basalt in Clearwater Embayment, Bond (1963) named two members: Eagle Creek Interbed and overlying Rock Creek Flow. Eagle Creek Interbed is underlain by at least one unnamed flow, and the Rock Creek unit may be overlain by as many as three unnamed flows of Lower Basalt, although locally the Rock Creek Flow may form top of Lower Basalt sequence. Radiometric date of 21.3 m.y. on Rock Creek Flow provides approximate age both for underlying Eagle Creek Member and for unnamed sedimentary unit at Potlatch Creek that is interbedded in the Lower Basalt. Age estimate for Eagle Creek Member is minimum. Plant assemblages associated with Lower Basalt in Idaho appear to be of early Miocene age.

Named for exposures 500 feet up Salmon River Canyon wall above mouth of Eagle Creek, Lewis county.

Eagle Ford Stage

Upper Cretaceous (Gulfian): Atlantic and Gulf Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 342—349. Eagle Ford is used here as a major provincial division of Gulf series, younger than Woodbine stage and older than Austin stage, to include all strata which can reasonably be demonstrated to be equivalent to or correlative with the type Eagle Ford and its typical subdivisions in adjacent areas in east Texas. Some modifications or adjustments of boundaries may be demanded by the acquisition of additional data in the future. Disconformable relationships have been reported by various geologists for the contacts between Eaglefordian-Woodbinian and Eaglefordian-Austinian strata in different places.

Eagle Gorge Andesite (in Keechelus Volcanic Group)

Eocene, upper: Washington.

P. E. Hammond, 1964, Dissert. Abs., v. 24, no. 7, p. 2869. Thickness 730 to 4,150 feet. Unconformably overlies Huckleberry Mountain Formation (new); unconformably underlies Stampede Tuff (new).

West-central Cascade Range.

Eagle Lake Biotite-Dacite

Oligocene-Miocene: Northeastern California.

G. C. Gester, 1962, California Acad. Sci. Occasional Papers 34, p. 8 (table 1). Tilted tuffs, pyroclastics, dense basalt flows, and more acid intrusive rocks, approximately correlative with Alturas-Cedarville series.

In Modoc Plateau, Eagle Lake area, Lassen County.

Eagles House Rhyolite

Miocene, upper, to Pliocene, lower: Southwestern Nevada.

R. B. Morrison, 1964, U.S. Geol. Survey Prof. Paper 401, p. 9 (table 3), 10—11, pl. 3. At type locality consists of two flows. Upper, nearly 100 feet thick, is pink porphyritic rhyolite. Lower, about 200 feet thick, is pale-greenish-gray porphyritic dacite. Contact between flows conformable. Both flows have contorted flow structures. Rhyolite faulted against Truckee formation, which in a few places lies in depositional contact on the rhyolite. Unconformable above dacite of Rainbow Mountains.

Type locality: Eagles House Crags, in sec. 13, T. 18 N., R. 30 E., in Lahonton Mountains, Churchill County. Also exposed in White Throne and Desert Mountains, and Eetza Mountain.

Eagle Valley Evaporite

Pennsylvanian and Permian: Northwestern Colorado.

T. S. Lovering and W. W. Mallory, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D45—D48. Because Minturn and Maroon Formations are not distinguishable as cartographic units in evaporite sequence, name Eagle Valley Evaporite is here proposed for gypsiferous sequence exposed in Eagle Valley in vicinity of Avon. In type area is predominantly gypsiferous mudstone and siltstone, usually light colored, which contains bedded gypsum and a few cherty dark-gray limestone beds about 1 foot thick. Also included are beds of reddish shale and siltstone. Intertongues with Minturn and Maroon Formations. In Red Canyon, red gypsiferous siltstone beds of Eagle Valley are conformably overlain by Triassic Chinle Formation; the siltstones merge with uppermost Maroon Formation to northeast and lie upon dull-colored or gray gypsiferous mudstones and bedded gypsum. Evaporite dips west at Red Canyon and extends indefinite distance west and northwest into central part of Eagle basin. Near Eagle, Colo., about 16 miles west of Avon, 4,700 feet of evaporite-bearing rocks occur in a well. These rocks are anhydritic gypsiferous mudstone and siltstone. At surface, rocks are red gypsiferous clastics identified as Maroon Formation. Evaporite-bearing strata are present from surface down to top of Belden Shale, which regionally underlies Minturn Formation. Evidence in well suggests that west of type area Eagle Valley Evaporite is time equivalent of all of Minturn Formation and much of Maroon Formation.

D. M. Quigley, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 11, p. 1975. The U.S. Geological Survey has granted formation status to the Eagle Evaporite, though it is obviously only a facies change within the Minturn and Maroon Formations in response to the onset of a more saline depositional environment. No precise formation boundaries can be mapped because of the many oscillations in the shorelines and changing volume of clastic material filling the trough during deposition of the Minturn and Maroon.

Type section: Measured sections J8 and J9 on interfluve west of Nottingham Creek, north side of Eagle River, in secs. 6 and 7, T. 5 S., R. 81 W., in vicinity of Avon, Eagle County. Sequence extends from Tracer Creek, about 1 mile northwest of mouth of Gore Creek, to Red Canyon, about 9 miles west-northwest.

East Branch Group

Silurian: Northern Maine.

A. J. Boucot, and J. G. Johnson, 1967, Jour. Paleontology, v. 41, no. 5, p. 1231. Discussion of species and distribution of *Coelospira*. Species collected by Bradford Hall from Third Lake Formation of East Branch Group.

Approximately one-third mile southeast of the small pond north of the northeast end of Snake Pond, Spider Lake quadrangle.

East Canyon Conglomerate Bed (in Puddle Springs Arkose Member of Wind River Formation)

Eocene, lower: West-central Wyoming.

P. E. Soister, 1966, U.S. Geol. Survey Bull. 1244—A, p. A43—A44. At type locality consists of 130 feet of predominantly granite cobble-boulder conglomerate with a coarse sandy matrix, divided by a middle sandstone layer 23 feet thick. At type locality rests directly on Cody Shale but in subsurface its base is locally as much as 100 feet above base of the Wind River Formation.

Type locality: In W½SW¼NE¼ sec. 4, T. 33 N., R. 89 W., in Ervay Basin SW quadrangle. Named from exposures along East Canyon Creek. Bed is a long narrow tonguelike deposit about 2 to 3 miles wide and more than 15 miles long whose long axis is almost due north along Fremont-Natrona County line.

East End Member (of Caledonia Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. A 900-foot unit of tuffaceous sandstone and breccia about 3,500 feet below top of formation.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 187, 197—198, pl. 1. A 900-foot unit of tuffaceous rocks. About 3,000 feet below top of the Caledonia. Unit is an excellent marker and helps to illustrate form of Southgate anticline. Three divisions of member recognized to southeast, at Isaac Point, Hughes Point, and Grass Point. From oldest to youngest they include volcanic breccia and tuffaceous sandstone, 175 feet thick; black mudstone, 200 feet thick; and light-green coarse-grained tuffaceous sandstone, at least 300 feet thick. West of Grass

Point the mudstone unit thins to feather edge, and amount of volcanic breccia in the other subdivisions decreases to only 5 to 10 per cent.

Well developed in eastern part of island.

East Lake Obsidian Flow

Recent: Central Oregon.

M. W. Higgins and A. C. Waters, 1967, Ore Bin, v. 29, no. 3, p. 39 (fig. 2), 51, 52 (figs. 7,8). Discussion of Newberry Caldera. East Lake obsidian flows consist of two flows both erupted, probably contemporaneously, from a northeast-southwest trending fissure whose trace can be seen as a line of discontinuous cracks across highest parts of the flows. Both flows are mantled by as much as 2 feet of pumice erupted from pumice cones within Newberry caldera.

East Lake is on east side of Newberry Caldera.

East Union Norite

Cambro-Ordovician: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. East Union norite mentioned in discussion of geology of Knox County marble belt. Intrudes St. George formation (new). Intruded by granites that also intrude Appleton formation (new), Union marble belt and rest of St. George formation. Northern end of marble belt and the southern end of East-Union-Hope belt are on strike and are probably correlative, thereby defining the eastern limb of Warren antiform. East Union norite occupies the interval between the two belts, and tremolite becomes increasingly abundant in both belts near the norite. Reference made to Bastin (1908, Jour. Geology, v. 16). [Bastin described pyrrhotitic peridotite from Knox County, but did not use formal term East Union norite.]

Occurs near East Union, northwestern Knox County marble belt.

Echo Lake granodiorite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Echo Lake granodiorite shown on map in report on contact metamorphic reactions and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Echooka Member (of Sadlerochit Formation)

Permian: Northern Alaska.

A. S. Keller, R. H. Morris and R. L. Detterman, 1961, U.S. Geol. Survey Prof. Paper 303—D, p. 176 (fig. 27), 178—182, pls. 21, 23. Varies in facies from one part of area to another. In northern Canning River area is typically sandy to conglomeratic and locally contains fossiliferous limestone. From Canning to Echooka River characteristically consists of massively bedded dense cherty siltstone that is dark blue gray and locally limonite spotted. In Flood Creek area consists of blue-gray limy brown-weathering siltstone, gray limy shale, and blue-gray limestone. Thickness 300 to 600 feet. Underlies Ivishak member (new).

Type locality: On upper part of Kemik Creek between lat 69°22′ N. and lat 69°23′ N., Shaviovik and Sagavanirktok Rivers, north of Brooks Range. Named for Echooka River.

Edgecumbe Volcanics

Pleistocene and Holocene: Southeastern Alaska.

H. C. Berg and D. W. Hinckley, 1963, U.S. Geol. Survey Bull. 1141—O, p. O4—O15, pl. 1. South half of Kruzof Island is formed almost entirely of post-glacial basaltic and andesitic lava and pyroclastic debris extruded from Mount Edgecumbe and nearby vents. These rocks are herein named Edgecumbe Volcanics. Flat-lying to gently dipping lava flows unconformably overlie vertical beds of Sitka Group (new) on north shore of Mud Bay and near Port Krestof, and lie nonconformably upon quartz diorite of Jurassic or Cretaceous age on south shore of Mud Bay and probably on some of Magoun Islands. Assigned to Recent.

The U.S. Geological Survey currently designates the age of the Edgecumbe Volcanics as Pleistocene and Holocene on the basis of a study now in progress.

Named from Mount Edgecumbe, now dormant volcano which may have been active in historic time.

Edgemont Formation

Cambrian: Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 15, 36 (table 1), pl. 1. Blue-gray to brown slate and phyllite; upper beds calcareous and lower more sandy (schistose quartzite). Thickness about 700 feet, uncertain because of close folding. Overlies Prospect Mountain Quartzite; underlies Porter Peak Limestone (new). Lower contact gradational.

Named after Edgemont Canyon on west flank of Bull Run Mountains, Bull Run quadrangle, Elko County.

Eds Limestone

See 111 [One hundred eleven] Ranch Beds

Eetza Formation (in Lahontan Valley Group)

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—111. Oldest formation in group. Consists of as much as 90 feet of lacustrine gravel to clay and tufa. Locally divisible into two tongues separated by tongue of alluvium and colluvium of Eetza age, which bears a very weak soil. Lower tongue extends as high as highest Lake Lahontan shoreline, 4,380 feet altitude; upper tongue reaches about 4,340 feet altitude; intervening tongue noted as low as 4,065 feet altitude. Overlies pre-Lake Lahontan soil which in turn overlies Paiute formation (new); conformably underlies Wyemaha formation (new).

R. B. Morrison, 1964, U.S. Geol. Survey Prof. Paper 401, p. 28—37, pls. At type locality, herein stated, overlies Bunejug formation and underlies Wyemaha formation. Exposed only in highlands where it consists of lake gravel and minor amounts of lacustrine sand, clay, and tufa. Extends as high as highest shoreline of Lake Lahontan—at an altitude of about 4,380 feet along south margin of Carson Desert—about 10 feet higher than next younger main unit of deep-lake sediments, the Sehoo formation. Upper and lower boundaries sharp and readily identifiable. Overlies Cocoon soil.

Type locality: Upper one-eighth mile of large southward-draining gulch in western part of Eetza Mountain (SW¼ sec. 21, T. 18 N., R. 30 E.), Carson Desert (Fallon) area.

Eetza-Churchill Stage

Pleistocene: Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. [For explanation see Sehoo-Toyeh Stage.] Eetza-Churchill Stage preceded by Rye Patch-Cocoon Stage and followed by Sehoo-Toyeh Stage.

Type area: Bluffs along the Truckee River north of Wadsworth, Washoe County, Nev.

Efland Formation

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 122—126, geol. map. Water-laid sequence consisting of andesitic tuffs with interbedded greenstones, conglomerates, graywackes, and flows. Includes Denny Conglomerate Member (new) in upper part at most localities in Person County. Total thickness may be as much as 10,000 feet. Conformably overlies Uwharrie Formation (new) and grades upward into Tillery Formation of Albemarle Group (both new).

Named for town of Efland, Orange County. Occurs only east of Troy anticlinorium and is traceable from northern Moore County to northern Person County. Most typical part of formation is best exposed in Duke University quarry between Efland and Hillsboro.

Egypt Group

Ordovician-Silurian: Southeastern Maine.

J. D. McGregor, 1965, Dissert. Abs., v. 25, no. 11, p. 6539. The Ordovician-Silurian Ellsworth Schist is divisible into two major groups, the Lamoine and Egypt (younger). The Egypt consists of about 10,000 to 15,000 feet of porphyroblastic quartzofeldspathic schist with plagiclase porphyroblasts.

Near Ellsworth, southeastern coastal region of Maine.

Eider Point Basalt

Pleistocene and Holocene: Alaska.

Harald Drewes and others, 1961, U.S. Geol. Survey Bull. 1028—S, p. 641—642, pl. 75. Numerous small volcanic cones, associated volcanic mud flows and lava flows that largely retain details of their constructional forms, are scattered about on northern bulge of Unalaska Island. One of these cones is still active. These rocks lie unconformably on deeply dissected surfaces of Makuskin volcanics (new) or older rocks. Rocks from these vents are not contemporaneous, but chronology is not available. These rocks are herein named Eider Point basalt.

Rocks above Wide Bay Cone above Eider Point, Unalaska Island in Aleutian Islands, are typical of unit.

Eight Lake Glaciation

Eight Lake Drift

Pleistocene, upper: Northern Alaska.

D. A. Livingstone, 1955, Ecology, v. 36, no. 4, p. 593. Represented by small body of till that shows little erosion. Pollen profiles discussed.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 452. Eight Lake drift mentioned in report on late Pleistocene glacial chronology of north-central Brooks Range.

Eight Lake is a few miles south of Chandler Lake, at lat 68°21′N.; long 152°50′ W. in central Brooks Range.

Elberon Formation (in Columbia Group)

Pleistocene (Yarmouth?): Southeastern Virginia.

N. K. Coch, 1965, U.S. Office Naval Research, Geography Branch Tech. Rept. 6, p. 46—50, geol. map. Proposed for a silty sand, fine sand, and silty clay that overlies Bacons Castle Formation (new) beneath the Sussex and Isle of Wight Plains, and that is overlain by beach facies of Norfolk Formation at Suffolk Scarp. Maximum thickness 30 feet.

Named from town of Elberon in Surrey County. Crops out from Suffolk Scarp to Savedge, and from James River southward at least to North Carolina State line.

Elbow Ridge Sandstone

Lower Devonian: South-central Pennsylvania, western Maryland, and eastern West Virginia.

Z. P. Bowen, 1966, Jour. Paleontology, v. 40, no. 5, p. 1051—1062. Name proposed for a thin fossiliferous and calcareous orthoquartzite of Early Devonian age cropping out in south-central Pennsylvania, western Maryland, and eastern West Virginia. Overlies either Keyser Limestone or thin lens of New Creek Limestone (new) and underlies strata bearing brachiopod *Macropleura macro-pleura* that have been correlated with the New Scotland Formation of New York. Unit is crossbedded in part, and where fossiliferous, the fossil debris is commonly concentrated on cross laminae. Thin, irregular beds and lenses of limestone are present in the unit and at several localities it grades into a sandy calcarenite. Maximum thickness of the sandstone is on east side of Licking Creek where it is crossed by U.S. Route 40, one-half mile north of Potomace River. There the Elbow Ridge is at least 20 feet thick and very fossiliferous. No beds of New Creek lithology are exposed below the Elbow Ridge at that outcrop, but at Cherry Run, only one mile away, the sandstone is 17 feet thick and is underlain by a lens of New Creek Limestone about 5 feet thick. On basis of fossils the Elbow Ridge is concluded to be pre-New Scotland and post-Ravenna in age. Name Elbow Ridge has been used by several authors informally in describing these rocks, but none appears to have accepted it as a formal stratigraphic unit. Most have used the name "Coeymans sandstone" or "Coeymans sandstone member". In present report it is recommended that use of name Coeymans for this sandstone unit be discontinued, and the name Elbow Ridge Sandstone is proposed as a formal rock-stratigraphic name with the type section at the northeastern end of Elbow Ridge, about 1,000 feet west of Stone Bridge Church, Maryland.

F. M. Swartz, (1939, Pennsylvania Geol. Survey Bull. G—19, p. 86) used name Elbow Ridge sandstone as a member of the Coeymans Limestone and noted the section near Warren Point at northeastern end of Elbow Ridge.

Type section: Near Warren Point, Pa., along Licking Creek, at southern end of Keefer Mountain, 6 miles east-northeast of Hancock, Md. It is exposed on both the north and south sides of the creek at the border of Pennsylvania and Maryland. Name is derived from the arcuate ridge on the south side of the creek known as Elbow Ridge.

El Cajete Flow, Pumice

[Pleistocene]: Northwestern New Mexico.

V. C. Kelley, E. H. Baltz, Jr., and R. A. Bailey, 1961, New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 53 (fig. 5), 54. A post-Bandelier flow. Diagram shows the El Cajete between Battleship Rock flow below and Banco Bonito flows above.

El Cajete is low crater at base of Redondo Mountain, Jemez Mountains.

Eldorado Gneiss or Orthogneiss

Age not stated: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Westernmost unit of Skagit gneiss. A homogeneous, meta-hornblende-quartz diorite, presumably derived from basement crystalline material genetically related to Le Conte belt. To west, Eldorado gneiss appears to have been tectonically mixed with Cascade River schist (new) during metamorphism. Becomes feldspathized to east where it grades into migmatitic Skagit gneiss.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 102, 105. The basement is presumed to be earlier Paleozoic and (or) Precambrian in age. Its top is a profound unconformity. Basement rocks occur as tectonic slices on western flank of range, and as anticlinal belts within this metamorphic core. The rocks of these belts include Marblemount Meta Quartz Diorite and Eldorado orthogneiss.

Area south of Cascade Pass, northern Cascade Mountains.

Eldridge Drift

Pleistocene: Southeastern North Dakota.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, pt. 1, p. 24—27. Eldridge drift forms surface deposits throughout much of southeastern Stutsman County and extends into southwestern Barnes County where it covers about 240 square miles. Drift consists primarily of glacial till in Barnes County. Average thickness about 75 feet. Thins toward south and east and is locally less than 10 feet. Younger than Millarton drift. Older than Buchanan drift. [Winters, 1963, North Dakota Geol. Survey Bull. 41, described drift associated with Eldridge moraine but did not use formal term Eldridge drift.]

Named for occurrence in vicinity of Eldridge, a community on the proximal side of the moraine in sec. 35, T. 140 N., R. 65 W., Stutsman County.

Eldridge Creek Member (of Cody Shale)

Upper Cretaceous: Southwestern Montana.

A. E. Roberts, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—258. Thin-bedded marine glauconitic sandstone. Contains middle Niobrara fauna. Thickness 120 feet at type section. Occurs above unnamed shale member and below unnamed shale member.

Named for exposures (type locality) near Eldridge Creek in NE¼ sec. 27, T. 2 S., R. 8 E., Hoppers quadrangle.

Electron Mudflow

Holocene: Western Washington.

D. R. Crandell, 1963, U.S. Geol. Survey Prof. Paper 388-A, p. A9 (table 4), A50—A51, pl. 1, An unsorted mixture of subangular rock fragments in matrix of purplish-gray clayey sand. Thickness featheredge to more than 26 feet. Younger than Osceola mudflow. Originated at Mount Rainier.

Named for exposures in south bank of Payallup River in SW¼SW¼ sec. 32, T. 18 N., R. 5 E., near community of Electron, just south of south edge of Lake Tapps quadrangle.

Elephant Canyon Formation

Permian (Wolfcampian): Southeastern Utah.

D. L. Baars, 1961, (abs.) New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 196. Name applied to Wolfcampian carbonates in report on Permian system in Colorado.

D. L. Baars, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 2, p. 172—177. Proposed for marine carbonate section of Wolfcampian age in upper Cataract Canyon to San Rafael Swell area, east-central Utah. At type section divisible into three units that could be used as members. Lower is interbedded limestone, sandstone, and siltstone, with minor thin shales. Middle unit is red to brown or purple sequence of sandstones, siltstones, and shales with some thin limestone beds. Upper unit is interbedded limestones, dolomites, red siltstones, and light-colored sandstones similar to overlying Cedar Mesa Sandstone. Thickness 1,050 feet at type section. Lower contact not obvious because underlying Honaker Trail Formation is similar lithologically to the Elephant Canyon. Hence many geologists believe Elephant Canyon should be included in Hermosa Group. Grades into Halgaito redbeds toward south.

W. E. Hallgarth, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 8, p. 1496—1497. In Straight Wash Canyon, overlies Hermosa(?) Formation; underlies Coconino Sandstone. Thickness about 290 feet. Early Permian(?).

Type section: Elephant Canyon, secs. 4 and 9, T. 30 S., R. 19 E., San Juan County. Alternate type section: General Petroleum 45—5—G well in sec. 5, T. 24 S., R. 15 E., Emery County, where formation is recognizable between 2,940 and 4,415 feet in depth. Cored samples available from University of Utah.

Eli Limestone (in Baird Group)

Upper Devonian: Northwestern Alaska.

I. L. Tailleur, W. P. Brosgé, and H. N. Reiser, 1967, International Symposium on the Devonian System, Calgary, 1967: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1345—1361. Baird Group in western Baird Mountains consists of Skajit Limestone and a ferruginous limestone unit, herein named Eli Limestone. Generally well-stratified ferruginous muddy limestone and interbeds or zones of calcareous to noncalcareous shale; locally includes some sandstone. Characteristically grayish orange and brown. Thickness about 165 feet at type section.

Overlies Skajit Limestone and is overlain by Mississippian Lisburne Group in places. May interfinger with or underlie Skajit Formation in some places.

Type section: Exposed at 67° 47½′ N. and 161° 51′ W., on a short eastern tributary of north branch of Eli River, western Baird Mountains, Brooks Range.

Elijah Ridge Schist

Upper Paleozoic or pre-Upper Jurassic: Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. Vol. 8, p. 103, 115, pl. 7-1. Eastern metamorphic belt comprises Jack Mountain Phyllite (new) and Elijah Ridge Schist. Grades into North Creek Volcanics (new).

In Skagit region of Northern Cascades.

Elk Creek Till

Pleistocene, lower: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 23—24, 49. Name applied to oldest known till in Nebraska. A medium-gray to brownish-gray mottled till. Thickness about 10 feet at type locality; 50 feet or more in test holes in southeastern part of State. A pro-glacial sand and gravel (David City) occurs in some localities below the Elk Creek. Rests upon Pennsylvanian limestone and shale bedrock. Underlies about 60 feet of Late Nebraskan silts at type locality. Seward Formation is periglacial equivalent of the Elk Creek. Older than Iowa Point Till (new).

Type locality: In NW¼SW¼ sec. 1, T. 3 N., R. 11 E., Pawnee County. Well exposed at places along west side of North Fork Big Nemaha River valley in Pawnee County between Elk Creek and Table Rock.

Elkins Limestone

Silurian (Niagaran): East-central Kentucky.

A. F. Foerste, 1906, Kentucky Geol. Survey Bull. 7, p. 177. Limestone interbedded with clay. Thickness 3 1/3 feet. Overlies Plum Creek clay; underlies Oldham limestone. Page 47 states that a thin limestone interbedded with clay, 3 feet, 4 inches thick, forms base of Oldham limestone section.

Section measured beneath overhead bridge across railroad, south of station at Brassfield, and thence eastward along railroad. Home of J. T. Elkins is about 5 miles west of south Indian Fields, along road to Vienna, Clark County.

Elk Mound Group

Upper Cambrian (Dresbachian-Franconian): Wisconsin.

M. E. Ostrom, 1966, Wisconsin Geol. and Nat. History Survey Inf. Circ. 7 (also Michigan Basin Geol. Soc. Guidebook Ann. Field Conf. May 21—22), p. 7 (fig. 2), 8 (fig. 3), 15—33. Includes (ascending) Mt. Simon, Eau Claire, and Wonewoc (new) Formations. Underlies Tunnel City Group (new). Overlies Precambrian.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Proposed that names Dresbach and Franconia be reserved for use as stage names in biostratigraphy and that names Elk Mound and Tunnel City be used as lithostratigraphic replacements with minor modifications. Elk Mound Group is defined as the quartzose sandstones, shaly sandstones, and shales below the finer grained Franconian sandstones and above the basement and the Hinckley Sandstones and incorporates those strata previously referred to the Dresbach Hinckley Sandstones and incorporates those strata previously referred to the Dresbach plus the overlying coarse-grained and poorly sorted Ironton Member of the Franconian (Ostrom, 1966). By this definition the Ironton forms the top of the Wonewoc Sandstone.

Town of Elk Mound is in Dunn County.

Elk Spring Dolomite

Ordovician: Southern California.

J. H. Maxson, 1963, Death Valley Origin and Scenery, Bishop, California: Chalfant Press, p. 57. Listed on stratigraphic column for Death Valley. Thickness 300 feet. Listed above Eureka quartzite and below Hidden Valley dolomite. [May be lapsus for Ely Springs Dolomite.]

Elkton Siltstone Member (of Tyee Formation)

Eocene, middle: Northwestern Oregon.

E. M. Baldwin, 1961, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map OM—204. Name applied to predominantly siltstone sequence in upper part of Tyee formation. Member is more argillaceous than underlying part of the Tyee formation or overlying Coaledo formation. Thickness about 2,000 feet. Member not present beneath Coaledo formation in southwestern part of mapped area either because the siltstone grades laterally into sandstone west of its outcrop or is overlapped by Coaledo formation. Member crops out in southern part of Elkton quadrangle and in easternmost part of Scottsburg quadrangle, and extends beyond south border of mapped area.

Typical strata well exposed in cut along Henderer Road, 1½ miles west of Elkton, Douglas County, and in banks of Umpqua River in that vicinity. Entire member exposed between SE¼ sec. 23, T. 22 S., R. 9 W. (base of member), and center of sec. 8, T. 23 S., R. 8 W. (top of member), in cuts along road that parallels lower part of Luntsinger Creek.

Ellisville Granodiorite

Mississippian(?): Northern Virginia.

H. R. Hopkins, 1961, Dissert. Abs., v. 21, no. 7, p. 1912. During or immediately following major deformation of probable Mississippian age, Green Springs diorite (new) and Ellisville granodiorite were intruded into sedimentary rocks of area.

Western Louisa County.

Elmhurst Sandstone Member (of Eau Claire Formation)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 27 (fig. 9), 32. Name proposed for basal sand of Eau Claire. Consists chiefly of fine- to medium-grained sandstone with varying amounts of interbedded gray shale. Thickness 10 to more than 200 feet. Occurs between 1,640 and

1,759 feet in type well. Underlies Lombard Dolomite Member (new); overlies Charter Member of Mount Simon Formation.

Type well: Layne-Western The Wonder Co. No. 11, sec. 10, T. 39 N., R. 11 E., Du Page County. Name derived from Elmhurst, one-half mile east of type well.

El Revés Member (of Coamo Formation)

Upper Cretaceous: Puerto Rico.

R. P. Briggs and P. A. Gelabert, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—336. Consists principally of thin-bedded sandstone, but calcirudite and limestone conglomerate are common. Thin lenses of limestone present throughout member. Thickness 30 to as much as 250 (100 to 800 ft). Overlies Botijas limestone member (new).

See **Revés Member** (of Pozas Formation).

Type locality: Series of outcrops on and near road between barrio Barrancas and barrio Botijas in drainage of Quebrada La [El] Revés just east of village of Botijas, Barranquitas quadrangle.

Elsey Formation

Mississippian (Osagean): Southwestern Missouri, Arkansas, Kansas, and Oklahoma.

C. E. Robertson, 1966, Missouri Geol. Survey and Water Resources Rept. Inv. 38, 62 p. Name "Grand Falls chert" restricted to distinctive body of massive chert which crops out in vicinity of Grand Falls south of Joplin. Recommended that name "Grand Falls" be discontinued except for this limited chert unit, and that the widespread, mappable, sedimentary unit which immediately overlies Reeds Spring Formation and which has been previously referred to as "Grand Falls Formation" in southwestern Missouri be given name "Elsey Formation." In most localities, the Elsey consists of beds of dense to fine-grained gray to brown limestone which is interbedded with irregular masses of beds of smooth, compact, light-colored mottled chert. Thickness 15 to 50 feet. Underlies Burlington-Keokuk Formation. Extends into Arkansas, Oklahoma, and Kansas.

Type section: Roadcut on northside of Missouri State Highway 148 in NW¼NW¼SE¼ and NE¼NE¼SW¼ sec. 5, T. 24 N., R. 24 W., Stone County, Mo. Locality is about 2.5 miles south of town of Elsey and 4.7 miles west of Galena, Mo.

Eltey Mountain Granite

Devonian: North-central Vermont.

W. M. Cady, A. L. Albee, and A. H. Chidester, 1963, U.S. Geol. Survey Bull. 1122—B, p. B—8, B—50—B—53, pl. 1, table 1. A medium- to fine-grained biotite granite that forms elliptical to tabular plutons emplaced nearly parallel to steeply dipping beds of enclosing metamorphosed sedimentary and volcanic rocks, which are generally the Moretown formation and its Coburn Hill volcanic member (new).

Named for exposures on Eltey Mountain, upper Mississquoi Valley.

Elviran Stage

Upper Mississippian (Chesterian): Illinois.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 23, 65, pl. 1. Elviran Stage proposed for exact equivalent of Elvira Group of Weller

(1939). Includes all Chesterian rocks younger than Glen Dean Limestone. Overlies Hombergian Stage; underlies Pennsylvanian System.

Named for Elvira Township, T. 12 S., R. 2 E., Vienna, Dongola, Carbondale, and Marion quadrangles, Johnson County, Ill.

Emanuel Dolomite Bed (in Marlow Formation)

Permian (Guadalupean): West-central Oklahoma.

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, p. 65 (fig. 22), 66, 69—72. A sandy dolomite, about 9 inches thick, at top of formation. Thins to about 1 inch or less outside type area. Found in association with underlying Relay Creek Dolomite Bed. Has been designated as Upper Relay Creek Dolomite.

Type section: In Red Hills, northwest of Greenfield, Blaine County, secs. 29 and 30, T. 15 N., R. 11 W., and sec. 25, T. 15 N., R. 12 W. Named for community of Emanuel, NE¼NE¼ sec. 31, T. 15 N., R. 12 W.

Embayment Megagroup

Mesozoic and Tertiary: Mississippi Embayment.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Name proposed for poorly consolidated Mesozoic and Tertiary clastic sediments that underlie the Mississippi Embayment. Formations of megagroup are in part nonmarine and almost entirely clastic. Only Upper Cretaceous, Paleocene, Eocene, and Pliocene beds occur near north boundary, but these grade southward into thicker, finer, more marine, more calcareous sediments of Coastal Plain proper. Megagroup is about 2,500 feet thick near southwest corner of Tennessee, but not more than 1,000 feet in southern tip of Illinois. Pronounced unconformity lies beneath megagroup. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Named for Mississippi Embayment.

Embden Formation

Quaternary: Western Maine.

H. W. Borns, Jr., and D. J. Hagar, 1965, Geol. Soc. America Bull. 76, no. 11, p. 1240—1243. Name proposed for extensive body of sand that underlies the plain and which postdates Presumpscot Formation in Kennebec River valley area. Thickness 0 to at least 60 feet. Characterized by medium- to coarse-sand composition with a higher percentage of silt- and clay-sized particles near base. No single type section given because of lateral lithologic variations within the unit and absence of large, properly positioned exposures.

Exposures are primarily in area north of Anson, North Anson, Embden, and Solon Kennebec and Carrabassett River valleys.

Emerald Member (of Laib Formation)

Cambrian: British Columbia, Canada, and northeastern Washington.

J. T. Fyles and C. G. Hewlett, 1959, British Columbia Dept. Mines Bull. 41, p. 26—27. In lower part of formation. A black argillite. Conformably overlies Reeves member. Grades upward into green and brown phyllite of Upper Laib.

R. G. Yates, 1964, U.S. Geol. Survey Misc. Geol. Inv. Map I—412. Geographically extended into Deep Creek area, Stevens and Pend Oreille Counties, Wash., where it is identified as part of Maitlen Phyllite. Laib Formation is Canadian equivalent of Maitlen Phyllite.

Named for exposures near Emerald mine, Salmo Lead-Zinc area, British Columbia.

Emerson School Member (of Cassin Formation)

Ordovician (Canadian): Western Vermont.

C. W. Welby, 1961, Vermont Geol. Survey Bull. 14, p. 77—81, 250—251, pl. 1-B. Upper member of Cassin formation. Chiefly bluish-gray very finely crystalline to sublithographic limestone with thin black irregular encrusting shale and silt partings. Thickness 102 feet at type section; 94.6 feet at type section of underlying Thorp Point member (new). Contact between the two members gradational.

C. W. Welby, 1964, Geol. Soc. America Bull., v. 75, no. 8, p. 781—784. An earlier correlation of Burchards Member of Chipman Formation with part of Emerson School Member of Cassin Formation is revised. In studying section at Ellsworth Ledge, Cornwall, Vt., author (1961) concluded that the Burchards resembled limestones in upper part of sequence to which he gave name Emerson School Member of Cassin Formation. This led to erroneous correlations of Thorp Point Member of Cassin with beds "5a" and "5b" of Cornwall section described by Wing (in Dana, 1877, Am. Jour. Sci., 3d ser., v. 13), the Emerson School Member with "5c" of Wing's section, and the Burchards with upper part of Emerson School Member. These errors led to recommendation that term Chipman Group be dropped (Welby, 1961). Burchards Member as described by Kay and Cady (1947) is unit "5c" as described by Wing. Beds of Wing's "5a" and "5b" can be correlated with Thorp Point and Emerson School Members of Cassin, respectively, whereas the Burchards ("5c" of Wing) is correlated with lower part of Bridport Dolostone.

Type section: At north end of ridge running northeastward from Thorp Point proper, about 50 yards south of Thompson Point Road. Section measured on compass traverse running S. 40° E., and beginning at base of ridge which is about 1 mile S. 19° E. of Cedar Island (in Lake Champlain). Traverse starts 100 yards south of road to Thompson Point. Supplemental section: Type section of Thorp Point member. Name taken from abandoned school at intersection a little over 1 mile S. 75° E. of Cedar Island.

Emigrant Springs Limestone

Middle and Upper Cambrian: East-central Nevada.

H. E. Kellogg, 1963, Geol. Soc. America Bull., v. 74, no. 6, p. 689—690, pl. 1. Name applied to thick sequence of thinly bedded to massive limestones above Patterson Pass Shale (new). Subdivided into three unnamed members. Member A, 104 to 256 feet thick, is sequence of intraformational limestone breccias and agnostid trilobite-bearing limestone. Member B, 1,482 to 1,509 feet thick, consists of light-olive-gray, pink, or yellowish, quartz-silty, calcisiltite and mudstone at base, becoming medium-light-gray thinly to thickly bedded calcisiltite and calcilutite above. Member C, 467 to 494 feet, is medium-gray oolitic calcarenite, calcilutite, and calcisiltite and oolitic calcarenite; massive in power part with "tiger-stripe" weathering pattern.

Complete sections are on south side of Patterson Pass and just north of mouth of Dry Canyon, sec. 8, T. 9 N., R. 62 E., 2 to 3 miles northeast of Emigrant Springs. Upper half of formation exposed south of road at west entrance to Shingle Pass and on northwest flank of Patterson Mountain, Lincoln County.

Emily Rhyolite

Tertiary: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4320. Tertiary mafic dikes and large rhyolite dikes and sills, named Emily Rhyolite, intrude Jurassic formations approximately parallel to fault systems.

Report discusses west-central Klamath province in southwestern Oregon and northwestern California. Mount Emily is in Curry County, Oreg.

Endicott Group

Upper Devonian and Lower and Upper Mississippian: Northwestern Alaska.

I. L. Tailleur, W. P. Brosgé, and H. N. Reiser, 1967, International Symposium on the Devonian System, Calgary, 1967: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1345—1361. The succession of shale, sandstone, and conglomerate above the Skajit Limestone, or above a locally intervening unnamed limestone, siltstone, conglomerate, and graywacke unit, and below the Lisburne is herein named Endicott Group. As thus defined, the Endicott in its type area includes (ascending) Hunt Fork Shale, Kanayut Conglomerate, and Kayak Shale. Elsewhere, group includes Hunt Fork Shale, Kanayut Conglomerate, Noatak Sandstone, Kekiktuk Conglomerate, and the Kayak and Kayak Shale(?).

Type area: Exposures in Mountains, Brooks Range.

Engelmann Formation

Middle and Upper Devonian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 8 (table 4), 51—53, pl. 1. Consists of massive sandy-textured light-gray to black dolomite with some interbedded light-gray to black limestone in lower half of formation. Thickness 2,200 feet on ridge north of Goshoot Canyon. Overlies Sevy dolomite; underlies Goshoot formation (new). Lower 350 feet of formation lying west of Spor Mountain was described by Staatz and Osterwald (1959, U.S. Geol. Survey Bull. 1069) as Simonson-Guilmette, undivided.

Type locality: Engelmann Canyon, in northeast part of Dugway Range, Tooele County. Entire formation present only in vicinity of Engelmann Canyon.

Enning facies (of White Owl Creek Member of Fox Hills Formation)

Upper Cretaceous: Western South Dakota.

W. A. Pettyjohn, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 7, p. 1366. In upper part of White Owl Creek Member (new). A unit of purple clay-shale, light-green silt, and white to yellow sand and sandstone. Thickness as much as 195 feet.

Well exposed near Enning, in Stoneville quadrangle, Meade County.

Ericson Ranch facies (of Ericson Formation)

Upper Cretaceous: Southwestern Wyoming.

W. B. Douglass, Jr., and T. R. Blazzard, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 84, 85 (fig. 4). Term applied to inland facies of the Ericson. This facies is the typical massive sand development as observed in the outcrop. Term Table Rock applied to lowland facies of formation.

Well exposed in southern part of T. 19 N., R. 101 W., Sweetwater County.

Ernst Member (of Boquillas Formation)

Upper Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pl. 1. Gray, buff, and yellowish-brown flaggy limestone interbedded with gray and buff marl. Thickness about 475 feet. Underlies San Vicente Member (new). Members are separated by an erosion surface, but beds below and above the diastem are so nearly alike that it is difficult to distinguish between them unless the rocks are fossiliferous. Basal member of formation. Overlies Buda Limestone.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 55—64, pl. Formal proposal of name. Lower member of redefined Boquillas. Underlies San Vicente Member. Overlies Buda Limestone. Thickness 450 feet in Big Bend National Park. Consists of silty limestone flags, siltstone, and calcareous clay.

Named from Ernst Tinaja about 2 miles east-northeast of old Boquillas post office, Brewster County.

Escabrosa Ridge Porphyries

Jurassic: Southeastern Arizona.

D. G. Bryant, 1964, Dissert. Abs., v. 25, no. 3, p. 1841. Intrusion of igneous rocks and associated hydrothermal activity in Warren (Bisbee) mining district occurred late in Jurassic period, not after Lower Cretaceous as commonly cited. Intrusion of Escabrosa Ridge Porphyries, Lavender (new), and underground feldspar-quartz porphyries occurred in fourth stage of activity. Juniper Flat granite and Sacramento quartz porphyry (new) were intruded in first stage.

Bisbee mining district, Cochise County.

Escambia Sand Member (of Pensacola Clay)

Miocene, middle and upper: Subsurface in Alabama and Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 1), 194, 195. Name proposed by Marsh (1964, ms.) for middle member of Pensacola Clay (new). Thickness 20 to 160 feet. Overlies and underlies unnamed clay members.

O. T. Marsh, 1966, Florida Geol. Survey Bull. 46, p. 10 (fig. 2), 11 (fig. 3), fig. 5 (facing p. 18), 19 (fig. 6), 20 (fig. 7), 21 (fig. 8) 54, 56, (fig. 14), 57, 60, 61, 62, 125, 127. Formal proposal of name Pensacola Clay and Escambia Sand Member. Distribution of Escambia Sand Member everywhere coincides with distribution of upper unnamed member of Pensacola, for where upper member grades laterally into sand of Miocene coarse clastics, the Escambia loses its upper contact and becomes indistinguishable from Miocene coarse clastics. The Escambia thickens southwestward from minimum of 20 feet at Chemstrand Plant, about 6 miles north of mouth of Escambia River, to maximum of 160 feet in area 4.5 miles west of mouth of Perdido River. The Escambia consists predominantly of light-gray to brownish-gray fine to coarse quartz sand. Northwest of Pensacola the member is made up of very coarse sand and quartz granules in lower part and pea-size gravel in upper part. In southern Santa Rosa County, member contains some carbonaceous material and an abundance of black grains, possible phosphate, in lower 5 feet. Three oil test holes in southeastern Baldwin County, Ala., were selected as type wells for the Pensacola. Escambia is represented in these wells but best displayed in Temple-Sherrill No. 1.

Type well: Temple-Sherrill et al No. 1, SE¼NE¼ sec. 15, T. 7 S., R. 4 E., Baldwin County, Ala.

Esch Creek Glaciation

Holocene: Western Alaska.

C. L. Sainsbury, 1967, U.S. Geol. Survey Prof. Paper 575—D, p. D203—D213. A Recent [Holocene] glaciation in Bering Strait area. Followed the Pleistocene Mint River Glaciation. Presumed to be of Recent [Holocene] age because the moraines lie in or near cirques. Moraines consist entirely of limestone; they are practically undissected and are enclosed by modified end moraines (probably Mint River) about 1 mile down stream. The moraines lie on broken bedrock and have only scattered patches of tundra grass on top. Moraine at type locality is confined to cirque and extends only about half a mile from the headwall. During Esch Glaciation, ice was confined entirely to high-level cirques facing north in the central York Mountains.

Type locality: Well-defined moraines which are in large cirque in headwaters of Esch Creek, a tributary of Lost River, Seward Peninsula.

Escoheag Quartz Diorite Gneiss

Mississippian or older: Connecticut and Rhode Island.

Tomas Feininger, 1965, Dissert. Abs., v. 25, no. 8, p. 4649. Named in list of rocks mapped in area of Rhode Island batholith. Oldest named unit. Older than Potter Hill Granite Gneiss (new).

Area of report is Ashaway and Voluntown quadrangles, Connecticut and Rhode Island.

Espy Tongue (of Steele Shale)

Upper Cretaceous: South-central Wyoming.

L. A. Hale, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 130—133. Overlying Deep Creek sandstone (new) and associated paludal shales is sequence of dark-gray marine shales and lenticular sandstones. This sequence is herein named Espy tongue of Steele shale. Average thickness 250 feet. Gradational into overlying Hatfield sandstone member (new) of Mesaverde formation.

Typical exposure: Near Espy Ranch in sec. 18, T. 19 N., R. 88 W., Carbon County.

Estacada Formation

Pleistocene, upper(?): Northwestern Oregon.

D. E. Trimble, 1963, U.S. Geol. Survey Bull. 1119, p. 10 (fig. 4), 56—58, pl. 1. Cobble gravel and bouldery cobble gravel with minor amounts of mudflow deposits; weathered to depth of about 10 feet. Thickness as much as 100 feet along Sandy River; 30 to 50 feet along Clackamas River and Clear Creek. Younger than Gresham formation (new). May be found to correlate with Linn gravels when mapping of intervening area is completed. Relative topographic position and degree of weathering suggest late Pleistocene age.

Named for town of Estacada, Clackamas County, part of which is sited on the formation.

Etchart Limestone

Middle Pennsylvanian to Upper Pennsylvanian or Lower Permian: North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U.S. Geol. Survey Prof. Paper 431, p. 30—36, pl. 1. Predominantly limestone and sandy limestone sequence with some intercalated dolomite, minor amounts of calcareous shale and lenticular beds of conglomerate. Thickness 250 to 300 feet in southern part of Osgood Mountains; may be 1,000 feet in northern part of range; possibly more than 2,000 feet exposed just east of northeast corner of quadrangle. Along crest of Osgood Mountains south of Hogshead Canyon and east of orange crest, rests conformably or with slight erosional disconformity on Battle formation. On west of range unconformably overlies folded Osgood Mountain quartzite. In northeast corner of quadrangle separated from underlying Valmy formation by thrust fault.

Named for Etchart Canyon on west side of Osgood Mountains in secs. 4, 5, and 8, T. 37 N., R. 41 E., Humboldt County.

Etna Furnace Member (of Nittany Dolomite)

Ordovician: Central Pennsylvania.

A. R. Spelman, 1965, Dissert. Abs., v. 26, no. 4, p. 2139. Uppermost member of formation. Overlies Shoenberger Member (new).

In vicinity of Bellefonte, Centre County.

Eureka Valley Member (of Sanislaus Formation)

Pliocene, lower: Central eastern California and western Nevada.

D. B. Slemmons, 1966, California Div. Mines and Geology Bull. 190, p. 199—208. Latites now assigned to Stanislaus Formation were divided into three units by Ransome (1898, U.S. Geol. Survey Bull. 89) and Slemmons (1953, unpub. thesis). These units, now considered to be members are (ascending) Table Mountain Latite, Eureka Valley, and Dardanelles. Eureka Valley consists of several latite flows with interbedded biotite-augite quartz latite tuff, probably the type "quartz latites". Varies in thickness from a few tens of feet near Big Trees to 400 feet in Sonora Pass area and Bell Meadows, 3 miles southeast of Pinecrest Reservoir.

Type locality: Ridge between Bald Peak and Red Mountain, Tuolumne County.

Eutawville Member (of Okefenokee Formation)

Miocene, post-late: Central South Carolina.

D. J. Colquhoun and D. A. Duncan, 1964, Southeastern Geology, v. 5, no. 3, p. 135—139. Consists of fine-grained silty, clayey, very poorly sorted sand. Thickness as much as 20 feet. Holly Hill Member (new) is in lower part of formation.

D. J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS—12. Okefenokee Formation shown on map legend as upper Miocene-Pleistocene(?)

Named after town of Eutawville in central part of Eutawville quadrangle.

Evans Creek Stade

Evans Creek Drift

Evans Creek Glaciation

Pleistocene, upper: Western Washington.

D. R. Crandell, 1963, U.S. Geol. Survey Prof. Paper 388—A, p. A9 (table 4), A32—A35, pl. 1. Deposits of an alpine glacier that moved down valley of Carbon River about to present position of Fairfax in early phase of Vashon glaciation are here named Evans Creek drift. The Evans Creek consists of till in vicinity of Fairfax, and of proglacial sand and gravel that forms valley train in Carbon River valley downstream from Fairfax. Till is complexly interbedded with poorly sorted sand and gravel and is referred to as drift complex. At type locality complex contains many boulders as large as 5 feet and adjacent streambed is choked with boulders as large as 12 feet. Complex is locally at least 50 feet thick. As far as 1 mile downstream from Fairfax, the outwash occurs in pro-glacial fill terraces in valley and is at least 100 feet thick; downstream typically forms veneer less than 20 feet thick lying on bedrock straths. Evidence suggests that Evans Creek and Wingate Hill (new) glaciations were separated by nonglacial interval of weathering and erosion and that the Evans Creek is not simply a recessional stage of the more widespread Wingate Hill glaciation and that Wingate Hill drift and Evans Creek drift were separated by an interval at least as long as the elapsed time from Evans Creek deglaciation to present.

J. E. Armstrong, and others, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 321—330. Six geologic-climate units proposed for late Pleistocene sequence in southwestern British Columbia and northwestern Washington. They include two major units, Olympia Interglaciation and Fraser Glaciation, and four subdivisions of latter—Evans Creek, Vashon, and Sumas Stades, and Everson Interstade. During Evans Creek Stade, alpine glaciers formed in mountains of western Washington and British Columbia while nonglacial sediments were still being deposited in southern Puget Lowland.

Typically exposed in banks of Evans Creek, in SE¼NW¼ sec. 35, downstream from Carbon Glacier Road, Lake Tapps quadrangle, Pierce and King Counties.

Everson Interstade

Pleistocene, upper: Northwestern Washington, and southwestern British Columbia, Canada.

J. E. Armstrong and others, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 321—330. Glaciomarine, marine, and related deposits accumulated in coastal lowlands of northwestern Washington and southwestern British Columbia during retreat of Vashon ice. Name Everson Interstade is given to episode represented by these deposits. Episode began with invasion of lowlands by the sea and apparently ended in eastern half of Fraser

Lowland during advance of Sumas ice. Deposits reach maximum thickness of at least 550 feet and include interbedded fossiliferous stony clay, stony silt, and till-like mixtures, marine clay, deltaic sand and gravel; fluvial and lacustrine clay, silt, sand and gravel; and peat. At type section two fossiliferous glaciomarine deposits are separated by fluvial sand. Easterbrook (1963) named these (ascending) "Kulshan glaciomarine drift," "Deming sand" and "Bellingham glaciomarine drift." In British Columbia, the interstade is represented by a more complex sequence of deposits. Radiocarbon dates indicate duration of interstade probably was at least 2,000 years in Fraser Lowland, extending from about 13,000 to 11,000 years B.P.

Type section: Outcrops on south bank of Nooksack River, NE¼ sec. 34, T. 39 N., R. 4 E., Whatcom County. Name derived from town of Everson about 7 miles downstream from outcrops.

Exhibit Sandstone Member (of Hannold Hill Formation)

Eocene, lower: Southwestern Texas.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology, Pub. 6711, p. 104—105, pl. 2. Occurs 320 feet above base of Hannold Hill. Thickness 12 to 15 feet. Commonly fossiliferous. Forms cuesta or series of knobs from bone quarry northward for several miles, and is again exposed in Canoe Valley. Southward from the bone quarry the Exhibit Sandstone is less continuous but was traced with reasonable certainty to near the abandoned rock crusher site in southern Tornillo Flat.

Named from Exhibit Ridge in central Tornillo Flat, Big Bend National Park, Brewster County.

Facey Rock Limestone

Pre-Upper Jurassic: Northwestern California.

G. A. Davis and others, 1965, Geol. Soc. America Bull. 76, no. 8, pl. 1. Facey Rock limestone mapped south-central Klamath Mountains. Occurs above Duzel Formation. Page 494 refers to the limestone at Facey Rock.

Mapped in area north of Callahan, Siskiyou County.

Facpi Volcanic Member (of Umatac Formation)

Miocene, lower: Guam.

J. T. Stark and J. I. Tracey, Jr., 1963, U.S. Geol. Survey Prof. Paper 403—C, p. C1, C2, C29. Basal member of Umatac. Underlies and intertongues with Maemong Limestone Member (new). Consists of pillow lavas interbedded with increasing amounts of pyroclastics near top.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A22—A25, pls. Formal proposal of name. Member consists of about 1,400 feet (425 m) of mafic lava flows and pillow basalts cut by dikes and includes, especially in upper 500 feet, beds of gray to green tuffaceous shale and sandstone representing about 10 percent of total thickness of member. Includes tongues of Maemong limestone member which range in thickness from 15 to 260 feet. Underlies Bolanos pyroclastic member. Derivation of name given.

Named for exposures at Facpi Point on the west side of Guam.

Fairfield Pond Phyllite or Member (of Underhill Formation)

Lower Cambrian: Northern Vermont.

J. G. Dennis, 1961, New England Intercollegiate Geol. Conf. Guidebook 53d Ann. Mtg., Trip D—1, table 1. Upper unit of Underhill Formation. Overlies White Brook Dolomite [Member].

C. G. Doll, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Greenish quartzitic schist (quartz-sericite-albite-chlorite-biotite); sericite-quartz-chlorite phyllite, locally purple or red, common in lower part.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 20—21, pl. 1. Fairfield Pond Member includes West Sutton Slate and lower (phyllitic) part of Gilman "Quartzite" of Clark (1936). Overlies White Brook Member. Underlies Cheshire Formation (name applied to upper part of Clark's Gilman Quartzite). Name Gilman abandoned in this report.

Mapped in vicinity of Fairfield Pond, Enosburg Falls and St. Albans quadrangles.

Fair Oaks Formation

Pliocene(?) and Pleistocene(?) and Pleistocene: North-central California.

R. J. Shlemon, 1967, Sacramento Geol. Soc. Guidebook Ann. Field Trip May 1967, p. 24, 25, 29, 30, 31, pls., table 2. A sequence of silt and fine-grained granitic sand about 145 feet thick. At present cannot be directly correlated to previously described alluvial sediments in Sacramento-San Joaquin Valley. Near top contains two strongly developed buried soils. Divided into two unnamed members. Overlies Mehrten Formation and underlies Riverbank Formation. Considered an informal name.

Type locality: At Sunrise Boulevard Bridge across American River, northern Sacramento County. Named for exposure at Fair Oaks.

Fairpoint Member (of Fox Hills Formation)

Upper Cretaceous: Western South Dakota.

A. F. Agnew and P. C. Tychsen, 1965, South Dakota Geological Survey Bull. 14, p. 174. Listed in a guide to stratigraphy of South Dakota. Includes Stoneville lignite facies.

W. J. Pettyjohn, 1967, Am. Assoc. Petroleum Geologists Bull. v. 51, no. 7, p. 1361—1367. Formal proposal of name. In Stoneville and Fairport quadrangles, 100 miles west of type area, the Fox Hills is subdivided into (ascending) Fairpoint and White Owl (new) Members. The Fairpoint consists of as much as 280 feet of silt, sand, sandstone, shale, and lignite. Thickness 167 feet at type section herein designated. Includes Stoneville coal facies at top member. Overlies Pierre Shale.

Type section: Measured along east-west road north of Fairpoint between NE¼NW¼NE¼ sec. 13, T. 9 N., R. 10 E. (lower contact) and NW¼NW¼NE¼ sec. 16, T. 9 N., R. 11 E., (upper contact), Meade County.

Falcon Heights Sand

Pleistocene (Wisconsin): Southeastern Minnesota.

H. E. Wright and others, 1965, Internat. Assoc. Quaternary Research 7th Cong., Boulder, Colo., Guidebook Field Conf. C, Upper Mississippi

Valley, p. 47 (fig. 6-3), 50 (fig. 6-6), 51, 52. Sand apparently derived from mixed red and gray tills produced when Grantsburg Sublobe, carrying gray till from west, incorporated red till previously deposited by Superior Lobe.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2 (with text), p. 6 (table 2), 12—20. Formal proposal of name. A light-gray to very pale brown poorly sorted gravelly medium to coarse sand. A retreatal outwash deposit. Type section and alternate type section stated.

Type section: West face of abandoned borrow pit just northeast of intersection of Larpenteur and Hamline Aves., Roseville, SW¼SW¼SE¼ sec. 15, T. 29 N., R. 23 W. Alternate type section: Roadcuts along Interstate Highway 94 from Dale St. west to Snelling Ave., St. Paul. Named for Falcon Heights. Extends from New Brighton quadrangle into St. Paul West and St. Paul East quadrangles.

Fallon Formation

Holocene: Southern Nevada.

R. B. Morrison, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—113. Comprises subaerial sediments (eolian sand, alluvium, and colluvium) and intertonguing shallow-lake sediments of Recent age. Locally divided into lower and upper members at altitudes below or slightly above maxima of post-Lahontan (Fallon) Lakes. Lower member comprises two lacustrine tongues, separated and overlain by subaerial tongues. Upper member comprises three lacustrine tongues, separated and overlain by subaerial tongues. The lacustrine tongues record five post-Lahontan Lake cycles whose maxima (oldest to youngest) were at altitudes of 3,950, 3,930, 3,922, 3,919, and 3,919 feet.

R. B. Morrison, 1964, U.S. Geol. Survey Prof. Paper 401, p. 79—85, pls. Formation consists of subaerial and shallowlike [shallow-lake] sediments of Recent [Holocene] age directly overlying Turupah formation and Toyeh soil. Divided into lower and upper unnamed members. Lower member is the thicker. It includes sand, silt, gravel, and tufa, of the first two lakes (lake cycles) of Fallon time. Upper member consists of late Recent [Holocene] to present day intertonguing and shallow-lake sediments that overlie but are very similar to those of lower member. They record at least three very shallow lake cycles. Type locality given for each member.

Type locality: Lowlands of Carson Desert near Fallon, Churchill County. Type locality (lower member): Fallon Naval Auxiliary Air Station reservation (as of 1950—not as subsequently enlarged), secs. 14, 15, 22, and 23, T. 18 N., R. 29 E. Plain on which station is located is compound delta of Carson River that was built into the first and second Fallon lakes. Type locality (upper member): Raymond Cushman Ranch, in secs. 28, 29, and 33, T. 18 N., R. 29 E.

Fallon Stage

Recent: Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. Subdivided into two informally named substages. Preceded by Sehoo-Toyeh Stage.

Type area: Lowlands of southern Carson Desert near Fallon, Nev.

Falls City Formation

[Eocene]: Southern Texas (subsurface).

R. N. Hargis, 1962, South Texas Geol. Soc. Bull., v. 2, no. 6, p. 12—19, 25, 27; 1962, Contributions to geology of south Texas: San Antonio, South Texas Geol. Soc., p. 129—145; 1962, Gulf Coast Assoc. Geol. Soc. Trans., v. 12, p. 9—25. Name proposed to designate all marine and alternating marine and near marine or deltaic strata that occurs in Carrizo-Wilcox group between the Midway and base of overlying nonmarine Indio or Carrizo. The different lithologies in formation are result of varying volumes of sediments being deposited in oscillating sea. Subdivided in units 1 through 5 in descending order. Subdivision based on four most extensive transgressions of sea during Falls City time in Rio Grande embayment. On San Marcos arch, the Falls City is represented at surface outcrop by entire Wilcox group as defined by Plummer (1932, Texas Univ. Bull. 3232). In Rio Grande embayment, Falls City does not crop out. Ellisor (1933) proposed name Falls City shales for "zone" in Whitsett formation. Eargle (1959) revised stratigraphic nomenclature of Jackson group and replaced name Falls City with name Conquista.

Named after corresponding subsurface section at Falls City field in Karnes County.

Fambro Sandstone Member (of Posideon Formation)

Pennsylvanian: North-central Texas.

R. L. Laury, 1962, Jour. Grad. Research Center, v. 30, no. 3, p. 119—120, 149, 159, pls. 1, 2, table 1. Discussion of type area of Canyon Group. In portion of Canyon area and in region to south, a thick, massive, crossbedded reddish-brown ferruginous sandstone overlies Palo Pinto Limestone. The sandstone and the thin 5- to 10-foot shale which often separates it from the underlying limestone was named Fambro Sandstone Member of Brownwood Formation by Reynolds (1953, unpub. thesis). In present report the Fambro is included as member of Posideon Formation. Reynolds described the Fambro in its type section as a reddish-brown to yellowish-orange coarse-grained to conglomeratic massively crossbedded sandstone 48½ feet thick. Fambro is only sandstone mapped in area of this report. It forms linear north-south trending body with maximum thickness about 45 feet. Width averages about 1¼ to 1½ miles. Linear extent about 6 miles. It extends to the north and south beyond map area of this report. Underlies unnamed shale unit (P_p).

Type locality: On T. C. Fambro Ranch in northeast Eastland County, one-half mile south of U.S. Highway 80 and three-fourths mile west of State Highway 16.

Fandangle Limestone

Middle Cambrian: West-central Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 9 (table 4), 22—24, pl. 1. Characterized by massive beds, medium-blue gray, and in upper part interbeds of laminated light-gray limestone that weathers white, pink, or yellow. Base marked by prominent cliff of massive gray limestone above partly covered slopes underlain by Trailer limestone (new). At top is unit of thin-bedded gray limestone containing beds of intraformational conglomerate. Because this unit is commonly covered, top of formation is placed at base of massive cliff-forming *Girvanella*-bearing limestone or dolomite that marks base of Lamb dolomite. Thickness 1,669 feet at type section.

Type section: Along ridge on north side of Straight Canyon, east side of Dugway Range, Tooele County. Named from outcrops near Fandangle Canyon where it forms wide band along west side of valley for about 3½ miles.

Farallon Andesite Member (of Manatí Formation)

Upper Cretaceous (Campanian): East-central Puerto Rico.

Guillermo Otalora, 1961, Dissert. Abs., v. 22, no. 5, p. 1583. Upper member of formation; overlies Botijas member. Includes massive and pillowed lavas and minor marine-laid tuffs.

Guillermo Otalora, 1964, Am. Jour. Sci., v. 262, v. 6, p. 726—734. Discussion of zeolites and related minerals in Cretaceous rocks of east-central Puerto Rico. Upper member of formation. Overlies Botijas Limestone Member. Contains prehnite, analcime, albite, chlorite, quartz, calcite, and rare epidote.

In Barranquitas quadrangle.

Fargo Granite

Precambrian: Southern California.

J. J. W. Rogers, 1961, California Div. Mines Spec. Rept. 68, p. 11. Maclellan (1936, unpub. thesis) studied area south of Joshua Tree National Monument in Little San Bernardino Mountains. His interpretation of geologic history is: first, metamorphism of sediments to form Berdoo series; second, greater metamorphism and migmatization of part of Berdoo series to form Thermal Canyon series; and third, intrusion of Fargo granite. Descriptions of Fargo granite indicate that it is probably correlative with White Tank quartz monzonite described in this report [western Joshua Tree National Monument].

Little San Bernardino Mountains, Riverside County.

Farmers Creek Rhyolite

Oligocene: Southwestern Colorado.

J. C. Ratté and T. A. Steven, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D49, D50. Mentioned in diccussion of magmatic differentiation in a volcanic sequence related to Creede caldera.

T. A. Steven and J. C. Ratté, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D54, D56, D58. Formal proposal of name. A heterogeneous assemblage of pyroclastic rocks and minor flow rocks deposited locally on rough topography left by subsidence of Bachelor Mountain cauldron. Divided into three subequal parts in type area and along West Bellows Creek to east. Lower third is soft cavernous-weathering pumiceous tuff breccia that forms massive unsorted layers a few feet to a few tens of feet thick. Middle third is succession of layers of differentially welded tuffs whose harder units form prominent ledges along hill slopes. Crystal-rich welded tuff forms upper third of unit along West Bellows Creek. Thickness more than 1,000 feet in type area. Larsen and Cross (1956, U.S. Geol. Survey Prof. Paper 258) refer the rocks here called Farmers Creek Rhyolite to basal part of lower member of their Piedra Rhyolite. Middle or upper Tertiary.

T. A. Steven and J. C. Ratté, 1965, U.S. Geol. Survey Prof. Paper 487, p. 26—28, pls. In Farmers Creek-West Bellows Creek area, the exposed beds of Farmers Creek Rhyolite are tilted northward and are overlapped by the more flatlying sheet of younger Mammoth Mountain Rhyolite.

The U.S. Geological Survey currently designates the age of the Farmers Creek Rhyolite as Oligocene on the basis of a study now in progress.

Type area: Along Farmers Creek, 1½ to 4½ miles east of town of Creede, central San Jaun Mountains.

Farrel Canyon Formation

Pennsylvanian(?) to Permian(?): North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U.S. Geol. Survey Prof. Paper 431, p. 38—40, pl. 1. Interbedded sequence of sandstone, shale, chert, metavolcanic rocks, and small amounts of limestone. Neither top nor bottom of formation exposed. Thickness probably several thousand feet. Along west side of range exposed thickness is on order of 3,000 to 4,000 feet. Stratigraphic position relative to other sedimentary rocks unknown. Bounded on west and north by alluvium and Tertiary volcanic rocks. Limited on east and south by high-angle reverse faults. Nonfossiliferous. Tentatively assigned a Pennsylvania(?) to Permian(?) age.

Farrel Canyon is on northwest side of Osgood Mountains, about 1 mile south of Anderson Canyon, in northeastern part T. 38 N., R. 41 E., and southeastern part of T. 39 N., R. 41 E., Humboldt County.

Farrington igneous complex

Age not stated: North-central North Carolina.

H. D. Wagener, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 261. Primarily composed of two adjacent contemporaneous intrusions, with total surface area of about 55 square miles. Complex was emplaced regional strike of metasedimentary and metavolcanic rocks of North Carolina slate belt.

H. D. Wagener, 1965, Southeastern Geology, v. 6, no. 2, p. 49—75. Discussion of areal modal variation in Farrington complex which is made up of two adjacent stocks. Western stock has dioritic margins and a granodioritic center. Eastern stock has generally porphyritic quartz monzonitic margins and an equigranular granodioritic central zone.

Present in Chatham and Orange Counties.

Fayette Stade, Drift, Till

Pleistocene (Wisconsin): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 677, 681 (fig. 3, table 6). Fayette stade follows New Paris interstade (new) and is followed by Connersville interstade (new). Fayette drift seems to be bracketed by radiocarbon dates of $>$ 40,000 and 20,000±500.

Named after Fayette County.

Feazel Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.] v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Feazel sand occurs at depth of 8,896 to 9,008 feet in type well.

Type well: Southwest Gas Prod. Co. and Feazel Interests No. 1 Simonton (V—28), sec. 2, T. 19 N., R. 4 W., Knowles field. Reference well: California Co. No. V. 7 McFearin, sec. 22. T. 20 N., R. 4 W., Hico field, Lincoln County.

Fenton Pass Formation

Pleistocene(?): Northwestern Wyoming.

W. L. Rohrer and E. B. Leopold, 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C45—C48. Name proposed to replace name Tatman Mountain Gravels to avoid confusion with Tatman Formation. At type section consists of a lower conglomerate member about 36 feet thick and upper sandstone member about 10 feet thick. Unconformably overlies Tatman Formation.

Type section: N½SE¼SE¼ sec. 24, T. 50 N., R. 98 W., sixth principal meridian, Park County, and is slightly less than 1 mile west of Fenton Pass. The conglomerate occurs on both sides of Fenton Pass, about 35 miles northwest of Worland. Caps Tatman Mountain.

Fera Limestone

Upper Cambrian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 9 (table 4), 28—30, pl. 1. Upper one-quarter, thin-bedded gray limestone with silty partings; lower three-quarters, very light gray to pink locally mottled limestone with minor dolomite. Thickness 401 feet at type section. Overlies Straight Canyon formation (new); underlies Dugway Ridge dolomite (new).

Type section: On east side of Dugway Range, on ridge 1 mile south of Straight Canyon, Tooele County. Named for occurrence in Fera Canyon. Crops out in continuous band along east side of Dugway Range from point 0.1 mile north of Dugway Pass to valley 1½ miles north of Fera Canyon. Also crops out in discontinuous band about 1½ miles west of southern part of Fandangle Canyon.

Ferguson Member (of Parkman Formation)

Upper Cretaceous: Northeastern Wyoming (subsurface).

F. F. Sabins and F. A. Peterson, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 303. Formal proposal of name. Unit, which is upper producing sandstone in Dead Horse Creek and Barber Creek fields, has been informally referred to as Ferguson sandstone (Lawton, 1958, Wyoming Geol. Assoc. Guidebook 13). Defined as interval from base of Pierre shale tongue at 6,965 feet in type well to top of sheet sandstone member at 7,015 feet. Overlies Dead Horse Creek member (new). Member is bar sand deposit and is presently known only in Dead Horse Creek and Barber Creek area.

Type well: Farmers Union No. 1 Government-Ferguson, SE¼SE¼ sec. 13, T. 49 N., R. 76 W., Campbell County.

Fern Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies Billiard Ball limestone member and underlies G. J. limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

In Bingham mining district, Oquirrh Mountains.

Fiddle Creek Schist (in Riggins Group)

Paleozoic or Mesozoic: Western Idaho.

C. P. Ross, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 63, 64. Oldest formation in group. Consists of metamorphosed schistose tuff and lava, 9,000 feet thick. Name credited to Warren Hamilton (in press).

Warren Hamilton, 1963, U.S. Geol. Survey Prof. Paper 436, p. 16, 18—20, pl. 1. Formal proposal of name. Structurally lowest formation of Riggins Group (new). Consists of white and green schist derived from silicic and intermediate volcanic flows and tuffs. Thickness about 9,000 feet. Underlies Lightning Creek Schist (new). Lower limit is structural contact. To north the schist is separated from underlying Martin Bridge Limestone and other formations of Permian and Triassic sequence by Rapid River thrust.

Type section: Along Fiddle Creek and ridge to north. Formation occupies belt 2 miles wide in northeast limb of Riggins syncline and is exposed discontinuously along Salmon River and along Riddle Creek at north edge of Riggins quadrangle.

Fields Creek Formation (in Aldrich Mountains Group)

Upper Triassic(?): Northeastern Oregon.

T. P. Thayer and C. E. Brown, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—438. Mostly graywacke, shale, and siliceous mudstone. Upper Triassic(?). Mapped in Aldrich Mountain quadrangle, Grant County.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Misc. Geol. Inv. Map I—447. Formal proposal of name. Lower 10,000 to 11,000 feet of formation dominated by black shale and beds of siliceous mudstone mostly less than a foot thick. In lowermost 4,000 feet, andesite flows, andesitic to dacitic volcanic breccia, lenticular rubbly conglomerate consisting mostly of reworked debris from Triassic rocks, lenses of slide breccia made up entirely of basement rocks, banded chert, and water-laid ash are complexly intercalated. Massive to obscurely bedded andesitic tuff, rich in pumiceous fragments and about 3,500 feet thick, makes up most of upper part of formation. Tuff thickens northeastward to about 8,500 feet and thins rapidly southeastward; locally grades upward into siliceous mudstone, shale, and graywacke. Thickness 15,000 feet at type section. Lies unconformably on Paleozoic rocks, serpentine, gabbro, and Vester Formation. Top of formation in places is faulted against, in places unconformable with, and elsewhere grades into, Laycock Graywacke (new).

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548. Mapped in Mount Vernon quadrangle, Grant County. Includes Cinnabar Tuff Tongue (new).

Type section: Extends northeast across Fields Creek and ridge north of Fields Creek. Named for Fields Creek, along eastern side of Aldrich Mountain quadrangle, Grant County.

Fillmore Alluvium

Recent: South-central New Mexico.

A. L. Metcalf, 1967, Texas Univ. at El Paso, Sci. Ser., no. 1, 62 p. [See Tortugas Alluvium.] Ruhe (1964, Assoc. Amer. Geography Annals, v. 54) listed four valley bordering surfaces below Picacho Surface, all comprised in master unit he called Fort Selden Surface. Hawley (1965, New Mexico Geol. Soc. Guidebook 16) showed that older and upper two surfaces can be combined in mapping unit designated Leasburg Surface Complex, and two lower surfaces are similarly combined and designated Fillmore Surface Complex. The lower, or Fillmore Surface, consists of that part of Fort Selden group originally described by Ruhe (1962, Jour. Geology, v. 70) as a coalescent valley-slope alluvial-fan piedmont. This surface extends upstream along tributaries of Rio Grande where it and its underlying sediments have been incised by arroyo cutting. Where it borders Rio Grande floodplain, Fillmore alluvium has been scarped in many places by the river in the process of meandering. The meander scarps vary in height depending upon where the river intersected the medially sloping Fillmore Surface and its associated alluvium.

Fillmore alluvium is well developed along west side of Mesilla Valley between Chamberino and Anapra, N. Mex. Here Picacho Surface is absent and the graded Fillmore Surface extends from the floodplain back a mile or more to rim of La Mesa.

Fir Crags gravel member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1962, Sacramento Geol. Soc. Guidebook Ann. Field Trip, June 9—10, p.61, fig. 2 (map). A gravel deposited by northeastward-flowing ancestral Ward Creek at a time when drainage of Upper Truckee Canyon was blocked by basalt flow cropping out along the canyon.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. An informal member of Lousetown Formation. Rests on andesite bedrock and underlies Tahoe City olivine latites (new). Unit consists mostly of weathered andesite gravels, some cobbles of which are up to 8 inches across, with minor amounts of sand. Maximum thickness about 240 feet. Appears to have been deposited by Ward Creek at time canyon was dammed by Big Chief basalt (new).

Crops out 2 or 3 miles downstream from Lake Tahoe outlet, Truckee area. Named for settlement of Fir Crags.

Firehole Bed (in Wilkins Peak Member of Green River Formation)

Eocene, lower and middle: Southwestern Wyoming.

J. D. Love, 1964, U.S. Geol. Survey Prof. Paper 474—E, p. E—10, pl. 5. In lower part of member. Consists largely of analcite and lesser amounts of authigenic euhedral albite(?) or other feldspar, and some pyrrhotite. Breaks into hard brown rectangular brick-sized blocks. Ranges in thickness from 3 inches to 1 foot throughout distance of 30 miles along outcrop.

Named from exposures in Little, Middle, and South Firehole Canyons, Sweetwater County.

Fish Brook Gneiss

Silurian(?) or older: Northeastern Massachusetts.

R. O. Castle, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C81—C86. Name introduced for an irregularly shaped gneiss body cropping out in southeast quarter of South Groveland quadrangle. Typically a pearly white to very light gray, distinctly foliated but generally unlayered biotite-quartz-plagioclase rock. The gneiss is either an isolated intrusive rock predating subalkaline intrusive series in area or an ancient "dome" gneiss similar to those of western New England. May be a plutonic igneous rock intruded against adjacent Boxford Formation (new). Remotely possible that Fish Brook Gneiss and Boxford Formation are in fault contact, and that the temporal relation between the two, and thereby the origin of the Fish Brook, consequently may be indeterminate. Part of the Fish Brook was mapped with the Andover Granite and remainder included with either the Marlboro Formation or the Salem Gabbro-Diorite by Emerson (1917, U.S. Geol. Survey Bull. 597). Fish Brook Gneiss and Boxford Formation together comprise the metamorphic rocks in South Groveland quadrangle exclusive of Merrimack Group.

Type locality: Exposures in vicinity of Fish Brook, in Boxford, South Groveland quadrangle, Essex County.

Fish Lake Flow

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 126. Name applied to lava flow that moved west from Nash Crater and dammed Hackleman Creek to form Fish Lake.

In Sand Mountain Lava Field, Three Fingered Jack and North Sister area.

Fish Lake Valley Formation

Fish Lake Valley Beds (in Esmeralda Formation)

Pliocene, lower: Western Nevada.

R. A. Stirton, 1929, California Univ. Pubs., Bull. Dept. Geol. Sci., v. 18, no. 11, p. 291—302. Discussion of fossils from Fish Lake Valley beds.

R. A. Stirton, 1932, Science, new ser., v. 76, no. 1959, p. 60—61. Correlation of Fish Lake Valley beds and Cedar Mountain beds in Esmeralda formation. Fish Lake Valley fauna is predominantly lower Pliocene.

J. F. Evernden and others, 1964, Am. Jour. Sci., v. 262, no. 4, p. 162. Fish Lake Valley Formation mentioned in report on potassium-argon dates and Cenozoic mammalian chronology of North America.

In upper end of Fish Lake Valley, 7 miles north of Arlement or Chiatovich Ranch, Esmeralda County.

Fishtrap dolomite

Paleozoic: Northwestern Montana.

J. W. Keim, 1964, Geol. Soc. America Bull., v. 75, no. 6, p. 577. Gray dolomitic limestone about 2,500 feet thick. Overlies Wolsey Shale. Overlain by undifferentiated series of sandstones, quartzite, and micaceous shales. Informally referred to as Fishtrap dolomite.

Fishtrap Creek area, Sanders County.

Fitz Creek Siltstone (in Tuxedni Group)

Middle Jurassic: Southeastern Alaska.

R. L. Detterman, 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C30—C34. Name proposed to replace term siltstone member of former Tuxedni Formation of older reports. Composed mainly of massive bluish-gray arenaceous siltstone that commonly weathers rusty brown and contains many small fossiliferous limestone concretions. Interbedded fine-grained sandstone and, locally, conglomerate. Thickness 1,090 feet at type locality. Overlies Gaikema Sandstone; underlies Cynthia Falls Sandstone. Both contacts conformable.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 29—31, pls. On Iniskin Peninsula, outcrops of Tonnie syncline. These belts, 1,000—1,500 feet wide, lie between two prominent hogback ridges on lower slopes of mountain mass formed by Tonnie syncline. The hogback ridges are formed by sandstone and conglomerate of the under lying Gaikema and overlying Cynthia Falls Sandstones. Thickness 650 to 1,280 feet.

Type locality: On Tonnie Creek, a tributary of Fitz Creek, starting 7,000 feet S. 55° E. of Tonnie Peak and continuing upstream for 1,400 feet. Fitz Creek is principal stream on Iniskin Peninsula, Cook Inlet region.

Fitzhugh Member (of Clarita Formation)

Silurian: South-central Oklahoma.

T. W. Amsden, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 942—945. Clarita elevated to formation rank and divided into two members, Prices Falls below, and Fitzhugh above. The Fitzhugh is an evenly bedded limestone which is composed largely of fossil debris. Most common fossils are crinoid plates, many with an orange-pink color, but other fossils are well represented and in several places the Fitzhugh is an ostracode coquina. Brachiopods suggest an early Wenlockian age.

Type locality: Along bed of Chimneyhill Creek in SE¼ sec. 5, T. 2 N., R. 6 E., Pontotoc County. Named for town of Fitzhugh in southern part of Pontotoc County. Strata do not crop out in the town but are well exposed in Lawrence uplift a few miles toward the east.

Flag Hill Member (of Fusselman Dolomite)

Silurian: Western Texas and southeastern New Mexico.

F. E. Kottlowski and L. C. Pray, 1967, Tulsa Geol. Soc. Digest, v. 35, p. 209—230. At type section the Fusselman Dolomite is subdivided into three members (ascending): Chamberino, Flag Hill, and Crazycat (all new). The Flag Hill consists of 98 feet of white massive dolomite, predominantly of medium to coarsely crystalling texture. This forms a distinctive light-color band on the outcrops that is only broken by a medial two-foot-thick darker bed of more finely crystalline dolomite. Sporadic and poorly preserved fossils.

Type locality: In northern Franklin Mountains. Flag Hill and Crazycat (Mountain) are subordinate peaks (4600—foot elevation) in southwesternmost Franklin Mountains that occur approximately 1 mile northwest and southwest, respectively, of Ranger Peak, a landmark on the north-south trending main divide of the Franklin Mountains near their southern terminus (Fort Bliss, Texas quadrangle).

Flamingo marl

Recent: Florida.

William Spackman and others, 1964, Geol. Soc. America Guidebook for pre-convention field trip, Nov. 16, 17, 18, p. 38, 39. Name given to a storm levee of bay mud that rises 18 to 24 inches above sea level in vicinity of Flamingo, Florida.

Flanner Beach Formation

Pleistocene, upper: Eastern North Carolina.

J. R. Du Bar and J. R. Solliday, 1963, Southeastern Geology, v. 4, no. 4, p. 213—233. In past the Neogene (post-Oligocene) deposits exposed along Neuse Estuary downstream from New Bern have been divided into a Pliocene formation (Croatan) and a Pleistocene formation (Pamlico or Chowan). Older (Pliocene?) deposits are herein redefined and named James City Formation. "Pamlico" is rejected as stratigraphic term and late Pleistocene deposits of lower Neuse Estuary which unconformably overlie James City beds are referred to Flanner Beach Formation. Lithology of formation is variable laterally and vertically. Commonly comprised of unconsolidated clays, sandy clays, argillaceous sands, and peaty sands and clays. Sedimentary sequence is that of a transgressive-regressive cycle. Five phases of cycle recognized: basal transgressive, upper transgressive, transgressive-regressive, basal regressive, and upper regressive. Thickest exposed section about 35 feet.

W. C. Fallaw, 1966, Dissert. Abs., v. 26, no. 7, p. 3860. Terms "Pamlico Formation" and "Flanner Beach Formation" have been used for deposits herein termed Neuse Formation. Flanner Beach includes deposits of Horry Clay and Pliocene Croatan Formation and is not a distinct lithologic unit.

Type section: Right bank of Neuse River, Flanner Beach, Havelock quadrangle, Craven County.

Flatbrookville Member (of New Scotland Formation)

Lower Devonian: Western New Jersey and southeastern New York.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 31—33, measured sections. Consists of medium-dark-gray siliceous and calcareous fossiliferous limestone that weathers medium gray; beds and lenses of medium-gray fine-grained argillaceous very fossiliferous limestone that weathers medium-light gray; and lenses of dark-gray chert. Generally poorly exposed. Abruptly overlies Stormville Member of Coeymans Formation southwest of Hainsville, N.J., and grades down into Kalkberg limestone northeast of Hainsville. Underlies Maskenozah Member (new) of New Scotland Formation abruptly. Upper contact placed at highest occurrence of abundant dark-gray chert and abundant pure limestone beds and below the dark-gray laminated shales of Maskenozha Member. Flatbrookville Member persists to the southwest end of Godfrey Ridge in Saylorsburg quadrangle. Thickness about 20 feet in Lake Maskenozha quadrangle and 33 feet at Minisink Hills, Pa. Complete exposures unknown in New Jersey and Pennsylvania.

Type section: In woods and along northeast side of Flatbrookville-Wallpack Center Road, 3.2 miles (road distance) from intersection with the trans-Kittatinny road joining it from the southeast, in Lake Maskenozha quadrangle. About 3.5 miles northeast of Flatbrookville, N.J. Reference section: On northeast bank of Brodhead Creek at Minisink Hills, Pa., in Stroudsburg quadrangle.

Flat Rock Member (of Raccoon Mountain Formation)

Lower Pennsylvanian: Eastern Tennessee.

R. L. Wilson, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2488. Formation subdivided into Norwood Cove and Flat Rock Members (both new).

Northern Sand Mountain.

Flat Swamp Mountain sequence

Age uncertain: Central North Carolina.

A. A. Stromquist and J. F. Conley, 1959, Carolina Geol. Soc. Guidebook Ann. Mtg., Oct. 24, p. 20, 24, 27, 30—32. An informal term applied to a vitric crystal tuff unit that is a key horizon in Albemarle and Denton quadrangles.

J. F. Conley, 1962, North Carolina Div. Mineral Resources Bull. 75, p. 7. Major rock type of "Flatswamp Mountain sequence" in Albemarle quadrangle is light- to dark-gray fine-grained to aphanitic massive felsic tuff which weathers chalky white. Bedding or other sedimentary features rarely present. Rocks grade upward into water deposited felsic tuffaceous argillite. Sequence may interfinger with mafic members of tuffaceous argillite unit in Denton quadrangle.

Flat Swamp Mountain is in Davidson County.

Flattop Basaltic Andesite

Oligocene-Miocene: Southeastern Arizona.

P. E. Damon and others, 1967, Arizona Univ. Geochonology Labs. Ann. Prog. Rept. No. C00—689—76 to Research Div. U.S. Atom. Energy Comm., p. 65 (table 25). Flattop basaltic andesite listed with units studied in K-Ar age determinations on volcanic rocks in southwestern New Mexico and southeastern Arizona. Apparent age 27.5 ± 0.8 m.y.

Occurs in Greenlee County.

Flechado Formation

Pennsylvanian (Morrowan-Desmoinesian): North-central New Mexico.

J. P. Miller, Arthur Montgomery, and P. K. Sutherland, 1963, New Mexico Bur. Mines Mineral Resources Mem. 11, p. 20 (fig. 6), 33—36, 70—73, pl. 1. Approximate northern equivalent of La Pasada Formation (new). Composed mainly of sandstone (with low feldspar content) and shale. There is abrupt facies change in the 5 miles between predominantly carbonate-rock sequence at Jicarilla Ridge (La Pasada Formation) to predominantly clastic sequence at Jicarita Peak and Rio Pueblo, as well as marked increase in thickness. Thickness 2,500 feet at type section. Overlies Mississippian limestone; underlies Alamitos Formation (new).

Type section: On north side of Rio Pueblo valley starting at base of Pennsylvanian near point where Tio Maes Creek enters valley 3 miles east of junction of New Mexico Highway 3 with New Mexico Highway 75, Rio Arriba County. Top of formation is few hundred yards up hill eastward from mouth of Gallegos Creek. This creek enters Rio Pueblo valley from north about 1.4 miles east of lower part of section. Name taken from next large creek east of Gallegos Creek which also enters valley from north.

Flor de Alba Limestone Lentil (in Pozas Formation)

Upper Cretaceous: Puerto Rico.

A. E. Nelson and W. H. Monroe, 1966, U.S. Geol. Survey Bull. 1221—C, p. C11—C12, pl. 1. A somewhat lenticular body of light-gray generally crystalline limestone. Rests on and is overlain by beds of calcareous volcanic sandstone, some of which is also interbedded with the limestone at several horizons.

Type locality: On an improved trail at coordinates 144, 260—51560, Florida quadrangle. Named after Hacienda Flor de Alba which is about 500 m east of main part of lentil.

Florida Formation (in El Paso Group)

Canadian (Cassinian): New Mexico and Texas.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 149. Beds designated C by Cloud and Barnes (1946, Texas Univ. Bur. Econ. Geology Pub. 4612), 35 feet thick, are named Florida formation. Canadian treated as system in this report.

Well developed in Florida Mountains.

Fluorspar Canyon Formation

Middle Devonian: Western Nevada.

H. R. Cornwall and F. J. Kleinhampl, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—157. Medium- to dark-gray, locally petroliferous fine- to medium-grained saccharoidal dolomite with minor but conspicuous zones of deep pink and brown quartzitic and dolomitic sand and a thick zone of medium-gray limestone. Three partial sections measured with total thickness of about 1,700 feet. Basal part of formation, 300 feet thick, crops out on south side of Tarantula Canyon and conformably overlies Lone Mountain dolomite. Second incomplete section, composed of three units, 550, 75, and 215 feet thick, respectively, is exposed on north end of Razorback Ridge. Third incomplete section, 580 feet thick, is 1½ miles northeast of Meiklejohn Peak; overlies Meiklejohn formation (new).

Type section: On north end of Razorback Ridge, at head of Fluorspar Canyon, Bare Mountain quadrangle, Nye County.

Fly Pond Member (of Tatnic Hill Formation)

Fly Pond Member (of Putnam Gneiss)

Middle(?) Ordovician or older: Southeastern Connecticut.

G. L. Snyder, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—144. Member of Putnam gneiss. Includes two distinct rock types: layered gray-green medium-grained granular calcsilicate rock, and dirty-white to green graphitic marble.

H. R. Dixon, 1964, U.S. Geol. Survey Bull. 1194—C, p. C3 (fig. 1), C5—C6. Reallocated to member status in Tatnic Hill Formation (new). Overlies unnamed member; underlies Yantic Member (new). In Tatnic Hill area, Fly Pond Member is about 600 feet thick, including about 200 feet of pegmatite. This thickness is relatively consistent to south, though Snyder (1961) showed rapid local thinning to 150 feet. To north, unit thins, and at north edge of Danielson quadrangle it is about 125 feet thick, of which about half is pegmatite. Member is dominantly medium-grained light- to medium-gray diopside-hornblende-epidote-biotite-quartz-andesine gneiss.

Locally lenses of mica schist or of sillimanite-biotite schist from 5 to 25 feet thick are interlayered with calcareous gneiss. Snyder mapped area of marble in Norwich area. Marble has not been found to the north.

Robert Zartman and others, 1965, U.S. Geol. Survey Prof. Paper 525—D, p. D1, D6. Implications of new radiometric ages in eastern Connecticut and Massachusetts. Tatnic Hill Formation, as well as equivalents and underlying rocks including Quinebaug Formation, is probably Middle Ordovician or older.

Named for exposures near Fly Pond, Norwich quadrangle. Member occurs in well-defined belt extending from Rogers Road to Colegrove Hill.

Foley Stage

Pliocene: Gulf Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 417—418. Literature concerning latest Tertiary strata of coastal province, beds which are commonly considered equivalent to Pliocene of Europe, is conflicting and confusing. A great variety of names have been applied to these deposits. For most part they are principally arenaceous and nonfossiliferous at outcrop in Atlantic and Gulf coastal regions of the United States, except in Florida and southern Atlantic areas where calcareous, usually fossiliferous, marine beds are present. Arenaceous facies, subordinately argillaceous, predominate at the outcrop in Mexico. In this book, term Foley stage is used as a provincial division in the northern Gulf province to include all deposits which can be demonstrated to be younger than Clovelly stage (in whose upper beds in central part of northern Gulf *Rangia johnsoni-Miorangia micro-johnsoni*, species of *Bigenerina* and *Amphistegina*, and *Bucoella mansfieldi* are typically present) and older than Pleistocene strata. As thus used, Foley stage is essentially synonymous with beds generally considered Pliocene in Atlantic and Gulf regions. Although type section of Foley "formation" is essentially an updip sequence of marginal character, it may be used for general reference purposes as the type of the stage.

Foley Formation was named for town of Foley, central Allen Parish, La.

Fontanelle Soil

See Nickerson Till and Cedar Bluffs Till.

Foot Brook Member (of Underhill Formation)

Lower Cambrian: Northern and central Vermont.

C. G. Doll, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Consists of sericite (muscovite-paragonite)-quartz-chlorite-chloritoid schist; minor carbonaceous interbeds.

Foote Creek Formation

Upper Cretaceous and Paleocene: Southeastern Wyoming.

H. J. Hyden, Harry McAdams, and R. H. Tschudy, 1965, U.S. Geol. Survey Bull. 1194—K, p. K1—K12. Consists of fine- and medium-grained sandstone, dark shale, siltstone, and coal. Sandstone occurs in lenticular beds and grades locally into siltstone. Shale and siltstone are gradational and interlaminated. Carbonaceous material abundant. Coal beds locally grade into carbonaceous shale or siltstone and are lenticular. Thickness 227.8 feet at type section; 0 to 400 feet in north part of Laramie basin. Underlies Dutton Creek Formation (new); overlies Lewis Shale. Names Foote Creek Formation and Dutton Creek Formation are introduced for rocks shown as Medicine Bow Formation and Hanna Formation on current State geologic map. Hanna basin names inappropriate in Laramie basin because beds cannot be traced from basin to basin to establish definite correlation.

Type locality: NE¼ sec. 13, T. 20 N., R. 79 W., and NW¼ sec. 18, T. 20 N., R. 78 W., Carbon County. Named for exposures on Foote Creek.

Forbes Hill Conglomerate

Forbes Hill Conglomerate (in Hortonville Slate)

Middle Ordovician: West-central Vermont.

E-an Zen, 1961, Geol. Soc. America Bull. 72, no. 2, p. 311, pl. 1; 1964, U.S. Geol. Survey Bull. 1174, p. 38. Name applied to conglomerate or breccia(?) in Hortonville slate. Five areas listed, one of which is due east of Forbes Hill. Here black slate encloses boulders of black quartzite, similar to the Mudd Pond, up to 4 feet across. Other pebbles are of Bomoseen graywacke type, a dolomitic quartzite, up to 6 inches across, and many angular green slate and sandstone chips less than 1 inch across.

E-an Zen, 1963, Am. Jour. Sci., v. 261, no. 1, p. 92–93; C. G. Doll and others, 1961, Am. Jour. Sci., v. 261, no. 1, p. 94–96. Discussion of correlations and interpretations on "Centennial Geologic Map of Vermont."

Type locality: East of gravel road due east of Forbes Hill, town of West Haven.

Ford Station Member (of Clore Formation)

Upper Mississippian (Chesterian): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 6 (fig. 2), 20, pl. 1. Uppermost member of the Clore. Consists of shale and limestone. Thickness 40 feet. Overlies Tygett Sandstone Member (new); underlies Caseyville Formation (Lusk Shale Member). Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 40, 41, 42, 66, pl. 1. Name formally proposed in this report for upper member of Clore Formation of Elviran age. Consists of interbedded shale and limestone with rare sandstone lenses. Typically 20 to 50 feet thick. Type section consists of 38 feet of shale containing limestone units a few inches to 5 feet thick that is overlain by Degonia Sandstone and separated from Palestine formation by 35 feet of poorly exposed shale assigned to other members of the Clore. Overlies Tygett Sandstone Member.

Type section: In abandoned quarry on east side Illinois Highway 3, but not visible from highway, about 1¼ miles southeast of bridge over Marys River and one-fourth mile southeast of Ford Station siding of Missouri Pacific Railroad, NW¼SE¼ sec. 33, T. 7 S., R. 6 W., Chester quadrangle, Randolph County.

Forest Creek Formation

Pleistocene, upper: Southeastern Alaska.

G. M. Haselton, 1966, Ohio State Univ. Inst. Polar Studies Rept. 18, p. 7—8. A blue-gray thin-bedded fossiliferous marine clay and silt which appears massive in fresh exposure. At Forest Creek gorge, at 24 m above present sea level, it rests on striated crystalline basement composed of porphyritic dike rock. Exposure at the gorge covered in part by recent talus. At headwaters of Forest Creek, formation overlies igneous basement rock at 59 m above present sea level, and is only a few centimeters to a meter in thickness. Directly overlain by Muir Till (new). Thickness 0 to 7 m. Shells in upper part of formation dated 10,000 ± 220 years B.P.

Crops out in Forest Creek Gorge, Muir Inlet area in northeast part of Glacier Bay National Monument.

Forestdale Member (of Underhill Formation)

Cambrian(?): West-central Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Buff to rusty weathered sandy dolomite and limestone.

E-an Zen, 1967, Geol. Soc. America Spec. Paper 97, p. 25 (fig. 5), 26 (fig. 6). Discussion of time and space relationships of the Taconic allochthon and autochthon. Forestdale shown on east limb of Middlebury synclinorium. Above the Nickwaket and below the Moosalamoo.

Forest Home Ignimbrite

Oligocene: East-central Nevada.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). Discussion of variations within ignimbrite cooling units. Generalized Cenozoic section of Grant Range lists following Oligocene formations (ascending): Railroad Valley Rhyolite; Blind Spring Formation (new); Calloway Well Formation; Saddle Mountain Formation (new); Stone Cabin Formation; local andesite flows; Currant Tuff; Windous Butte Formation; Forest Home Ignimbrite, 0 to 400 feet; Needles Range Formation; and Shingle Pass Formation.

Grant Range is in Nye County.

Forest Road Flow

See Lava Cast Forest Flow.

Fort Collins Member (of Muddy Sandstone)

Lower Cretaceous: Northeastern Colorado.

D. B. MacKenzie, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 2, p. 186—206. A 12—50-foot-thick, very fine to fine-grained clayey sandstone, with subhorizontal stratification and abundant tracks, trails, and burrows on bedding planes. Overlain along knife-edged contact by Horsetooth Member (new). Grades downward and southward into Skull Creek Shale.

Type section: In roadcut 0.15 mile east of south end of Spring Canyon Dam at center N½SE¼ sec. 32, T. 7 N., R. 69 W., Larimer County. Named for town of Fort Collins, located about 3 miles east of Dakota Group outcrop along east side of Horsetooth Reservoir.

Fort Columbia Volcanic Series

Eocene, lower and middle: Southwestern Washington.

Walter Youngquist, 1961. Annotated lexicon of names applied to Tertiary stratigraphy in Oregon and Washington west of the Cascade Mountains, with bibliography: Ann Arbor, Mich., Edwards Bros., Inc., p. 24—25. Name applied by R. K. Williams (1952, unpub. thesis) to designate volcanics in his map area. Williams states that the Fort Columbia volcanics and his Cape Disappointment volcanics are similar to Metchosin volcanics and are probably part of same sequence. It is doubtful if he meant to propose new stratigraphic names, and as they were not published, it seems best to retain term "Metchosin" for these rocks (or utilize U.S. Geological Survey's version of "Crescent" formation).

Type section: Fort Columbia.

Fort Defiance Member (of De Chelly Sandstone)

Permian: Northeastern Arizona.

H. W. Pierce, 1964, Mus. Northern Arizona Bull. 40, p. 15—32. Composed of slope-forming flat-bedded water-deposited siltstones and sandstones, slightly in excess of 100 feet thick. Overlies Black Creek Member (new); unconformably underlies Triassic Shinarump Member of Chinle Formation. Baars (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 2) suggests that this unit might be facies of San Andres Limestone of New Mexico.

H. W. Pierce, 1967, New Mexico Geol. Soc. Guidebook 18th Ann. Field Conf., p. 57—62. Discussion of Permian stratigraphy of Defiance Plateau. Uppermost 100 feet of Permian strata at Bonito Canyon, consisting of water-deposited sandstones and siltstones, are unlike any other part of major sections exposed on Defiance Plateau and are given emphasis by naming them Fort Defiance Member. In this section the member is in sharp contact with underlying Black Creek Member. Baars (1962) considered these strata as San Andres Limestone correlatives, a distinct possibility when it is recalled that there is evidence for San Andres Limestone having been deposited close to if not in area now occupied by Fort Defiance Plateau. There can be little doubt, too, that post-De Chelly-pre Shinarump erosion had unequally stripped away unknown quantities of Permian strata. However, the De Chelly Sandstone is thicker where it is overlain by the Shinarump than where it is overlain by the Moenkopi.

Named for Fort Defiance, Apache County.

Fort Hancock Formation

Pleistocene: Southwestern Texas and northern Mexico.

W. S. Strain, 1965, Dissert. Abs., v. 25, no. 9, p. 5216. Composed of clay, silt, fine sand, and gypsum. Unconformably underlies Camp Rice Formation (new). Fossils indicate Fort Hancock is probably Aftonian.

W. S. Strain, 1966, Texas Mem. Mus. Bull. 10, p. 16—19, 51, 52, 53, 54. Formal proposal of name. Consists of horizontal strata composed of bentonitic claystone, siltstone, and silt, ranging in color from grayish-red to shades of brown and occasionally to greenish-yellow, with yellowish-brown most common. Composite section reveals thickness of about 350 feet, but maximum thickness measurable at any single outcrop is about 80 feet. Lower boundary not exposed. Upper limit is unconformity which separates Fort Hancock from overlying Camp Rice. Exposures of formation form typical badlands-type topography unless they are protected by overlying Camp Rice where they form steep slopes. Blancan fauna establish age of upper part of formation as probably Aftonian. Type section and reference section designated.

Type section: On east side of arroyo in NW¼NW¼ sec. 19, T. 7, Blk. 73, Hudspeth County. Type locality is 3.5 miles S. 84° W. of Finlay, Tex. Reference section: On east side of Campo Grande Arroyo in SE¼NE¼ sec. 9, T. 7, Blk. 74, Hudspeth County. Formation exposed in Rio Grande Valley in El Paso and Hudspeth Counties, Tex., and adjacent to the Rio Grande in Chihuahua, Mexico.

Fortification Basalt Member (of Muddy Creek Formation)

Pliocene(?): Northwestern Arizona.

C. R. Longwell, 1963, U.S. Geol. Survey Prof. Paper 374—E, p. E7 (fig. 2), E 10 (table 1), E29—E31, p. 1. Near Lake Mead, upper part of Muddy Creek formation includes thick sheets of basalt; these form cap of Fortification Hill, these and their probable equivalents to east and south are mapped separately as Fortification basalt member. On Fortification Hill, there are about 50 superposed flows of olivine basalt with combined thickness of 500 feet. The volcanic rocks in Muddy Creek formation represent the fourth of five episodes of vulcanism within map area [Lake Mead-Davis Dam, Arizona-Nevada].

Named for occurrence on Fortification Hill, south of Lake Mead, Mohave County.

Fort Pierce Formation

Upper Jurassic(?) or Lower Cretaceous(?): Florida (subsurface).

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 17 (fig. 8), 35, 37. Name applied to Upper Jurassic(?) or Lower Cretaceous(?) unit. Name credited to Applin and Applin (in press).

P. L. Applin and E. R. Applin, 1965, U.S. Geol. Survey Prof. Paper 447, p. 18—29. Formal proposal of name. Underlies beds of early (Comanche) age and is oldest sedimentary stratigraphic unit found so far by drilling in south Florida. Occurs at depths of 10,460 to 12,680 feet in type well.

Type well: Amerada Petroleum Corp. Cowles Magazines 2, sec. 19, T. 36, S., R. 40 E., St. Lucie County.

Fort Preston Formation

Miocene: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 116, 117 (fig. 14), 119, 138 (fig. 15), 139 (fig. 16), 185, 203 (stop 54), 204, pls. 2a, 2b, 2c, 9. Name suggested for clastic sediments of middle Miocene age, as exposed at Alum Bluff and old Fort Preston. At type locality consists of basal conglomerate member 1 foot thick and upper, 18.3 feet thick, consisting of argillaceous, calcareous, yellow, gray, and white variegated crossbedded sand. Unconformably overlies Chipola Formation. Unconformably underlies Jackson Bluff formation (new). Alum Bluff Stage.

Type locality: Stop 54 (on road log) at Alum Bluff on Apalachicola River, near Bristol, Liberty County. Named from old Fort Preston.

Fort Randall Formation

Tertiary: South-central South Dakota.

M. F. Skinner and B. E. Taylor, 1967, American Mus. Novitates, no. 2300, 53 p. The two Bijou Hills adjacent to Missouri River in south-central South Dakota were the site of Hayden's early fossil veterbrate collections and are the type locality for four of Leidy's generic taxa: *Leptarctus primus, Merycodus necatus, Hippodon speciosus*, and *Merychippus insignis.* Present report is result of an investigation and the fauna obtained from them. Two sets of deposits are exposed at the Bijou Hills. A lower set, herein named Fort Randall Formation is the deposit from which the neotype and paratype of *Merycodus necatus* were collected. Thickness 60 to 120 feet and represents a cyclic type of deposition of siltstone and clays and a secondary deposition of barite crystals in one destinctive zone ("rock rose" zone) about 50 feet above base at type locality. Unconformably overlain by undifferentiated sediments approximately equivalent to the Valentine-Ash Hollow formations and rests unconformably on the Cretaceous. The Fort Randall is a limited remnant of a former site of deposits of unknown areal extent. Erosional hiatus between the Fort Randall and Cretaceous indicates an immense gap in time. Fauna from the Fort Randall suggests that the erosional hiatus between the overlying undifferentiated beds and the Fort Randall Formation represents a span of time partially equivalent to that between the Lower Snake Creek beds and lower Valentine Formation of Nebraska. Superficial examination of color and texture of Fort Randall sediments suggests that they might be correlated with Rosebud Formation as defined by Matthew and Gidley (1904).

Type section: South Bijou Hill in northwest corner of Charles Mix County, in N. ½ sec. 8, T. 100 N., R. 71 W. Named for old Fort Randall and Fort Randall Reservoir on Missouri River.

Fort Rock Formation

Pliocene, middle and upper: South-central Oregon.

Phil Brogan, 1962, Geol. Soc. Oregon County News Letter, v. 28, no. 2, p. 10. Incidental mention of Fort Rock formation in discussion of Fort Rock Park.

E. R. Hampton, 1964, U.S. Geol. Survey Prof. Paper 383—B, p. B5 (fig. 4), B7—B11, pl. 1. Formal proposal of name. Composed principally of four rock types. They are, in order of abundance, tuff, diatomite, basaltic agglomerate, and basaltic lava. Thickness 69.6 feet at type section. Unconformably overlies unnamed volcanic rocks of intermediate composition and Picture Rock Basalt (new). Unconformably overlain by Hayes Butte Basalt (new) and younger rocks. On basis of stratigraphic position, lithologic similarity to rocks in adjacent areas, and fossils evidence, the Fort Rock is tentatively assigned a middle and late Pliocene age. No single exposure typical of formation as a whole. Several reference localities named.

Type section: In NE¼SW¼ sec. 33, T. 27 S., R. 17 E., on west side of Seven Mile Ridge, Lake County. Named for Fort Rock, a remnant of an eruptive center of this unit, which rises above valley plains as mesalike butte in secs. 29 and 30, T. 25 S., R. 13 E. Characteristic exposures also at Table Rock Butte and Fandango Canyon-St. Patrick Mountain area.

Fort Sage Sandstone

Tertiary, lower: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 28 (table 7), 59, 208 (table 17); v. 2, pls. A hard, consolidated sandstone. Generally massive but contains some widely spaced joints. In Honey Lake Valley overlies granitic rocks of basement complex and underlies Gold Run Sandstone (new).

Crops out along western side of Fort Sage Mountains.

Forty-Nine Camp Formation

Miocene: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 60, 167; v. 2, pls. Principally sandy tuff and volcanic gravel. May be sedimentary phase of Cedarville series. Thickness about 750 feet. Dips to west. Overlain by Miocene basalt flows.

Only recognized outcrops are to northeast of Surprise Valley.

Forty-niner Member (of Rustler Formation)

Permian: Southeastern New Mexico.

J. D. Vine, 1963, U.S. Geol. Survey Bull. 1141—B, p. B6, B10—B11, B17—B18, pl. 1. Overlies Magenta member and forms youngest unit of Rustler in Nash Draw quadrangle. In outcrop the Forty-niner consists of about 40 to 65 feet of broken and slumped gypsum and a bed of massive siltstone near base. The bed of siltstone is separated from Magenta member by about 22 feet of gypsum and anhydrite in AEC drill hole 1. A bed of gypsum about 35 feet thick overlies the massive siltstone and forms top of Forty-niner. Underlies Pierce Canyon redbeds.

Named for Forty-niner Ridge on east side Nash Draw where member is exposed on minor bluff below Livingston Ridge, Nash Draw quadrangle, Eddy County.

Fossil Mountain Member (of Kaibab Formation)

Permian (Leonardian): Northwestern Arizona.

J. E. Sorauf, 1963, Dissert. Abs., v. 24, no. 2, p. 702. Composed of uniformly cherty limestone. Represents maximum extension of Kaibab sea. Lower member of formation; underlies Harrisburg Member. Overlies Woods Ranch Member (new) of Toroweap Formation.

Whitmore area, Mohave County.

Fountain Gabbro

Tertiary: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. After deposition of Upper Cretaceous sedimentary rocks, region was folded, faulted, and intruded by igneous rocks. Two small stocks (Fountain gabbro and Southgate diorite) were intruded along axial planes of several younger folds and sedimentary rocks adjacent to intrusions were contact metamorphosed to a pyroxene hornsfels facies.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 217—219, 225. A two-pyroxene gabbro with accessory biotite, magnetite, and apatite. Contact with adjacent metasedimentary rocks is sharp and steeply dipping, in many cases vertical.

Exposed in wide valley near Estate Fountain. In vicinity of Fountain, Parasol, Hermitage, Solitude, and Prosperity the intrusion is shaped in plan like a malformed letter "H". The exposed pluton is 2¼ miles long and a maximum of 1¼ miles wide.

Four Bears Conglomerate

Pleistocene: South-central North Dakota.

Lee Clayton and T. F. Freers, 1967, North Dakota Geol. Survey Misc. Ser. 30 (Guidebook 18th Ann. Field Conf. Friends of the Pleistocene), p. 16. One and one-fourth miles south of Stop 10 (near Napoleon) is classic exposure of pre-Wisconsin outwash gravel underlying Napoleon drift. It is much more weathered than Napoleon drift, cemented, and is reddish yellow. Similar weathered gravels are exposed at several other places in Logan County and at many places in Coteau Slope in northwestern part of state, where they have been called the "Four Bears conglomerate."

Named from an exposure near Four Bears Bridge near Newtown.

Four Corners Stage

Pennsylvanian (Desmoinesian): Arizona, Colorado, New Mexico, and Utah.

D. L. Barrs, J. W. Parker, and John Chronic, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, p. 393—403. Proposed that the Barker Creek, Akah, Desert Creek, and Ismay Substages (all new) be considered together as a formal time-stratigraphic unit, the Four Corners Stage, a subdivision of the Desmoinesian Series. The proposed stage overlaps with the Cherokee and Marmaton "series" which are often used as subdivisions of the Desmoinesian Series but not designated as stages.

Type well: Shell No. 1 Hovenweep well, sec. 5, T. 40 S., R. 26 E., San Juan County, Utah.

Four Craters Basalt, Lava

Recent: Central Oregon.

N. V. Peterson and E. A. Groh, 1964, Ore Bin, v. 26, no. 9, p. 164, 166, pl. 1. Four Craters lava field formed from basatic lava that flowed mainly south and east from center along fissure trending N. 30° W. The sluggish flows piled up a hummocky layer of black spiny aa lava on slightly sloping Green Mountain lava surface. Younger than Green Mountain basalt (new). Eruption of Four Craters lava, the accompanying subsidence, and opening of Crack-in-the-Ground fracture probably took place no more than 1,000 years ago.

Four Craters lava field is in northern Lake County.

Four Forks Creek basalt

[Pleistocene]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v., 47, p. 4 (table 1), 35, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 2.9 ± 0.1 m.y. Refers to Birman (1957, unpub. thesis). Figure 12 mentions basalts at Four Forks Creek.

Four Forks Creek is tributary of South Fork of San Joaquin River in Kaiser Peak quadrangle.

Four Hole Member (of Wicomico Formation)

Four Hole Swamp Member (of Wicomico Formation)

Pleistocene, lower: Eastern South Carolina.

D. J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS—12. Upper Wicomico divided into five members: Toney Bay, Dean Swamp, Sandridge, Wassamassaw Swamp, and Four Hole. The Four Hole Swamp Member contains fluvial, estuarien, and palustrine environmental facies.

Present within the embayment of the Surry Scarp in vicinity of Four Hole Swamp, Eutawville quadrangle.

Four-in-One Flows

Recent: Southwestern Oregon.

G. T. Benson, 1965, Ore Bin. v. 27, no. 2, p. 39 (geol. map). Name applied to flows from Four-in-One Crater.

E. A. Groh, 1965, Oregon Dept. Geology and Mineral Industries Bull. 57, p. 29. Yapoah, Four-in-One, and Collier lavas are youngest in region (Belknap Crater-Yapoah Crater—Collier Cone area).

Four-in-One Crater is in Lane County.

Fourmile Canyon Formation

Lower Silurian: North-central Nevada.

James Gilluly and Harold Masursky, 1965, U.S. Geol. Survey Bull. 1175, p. 12, 54—57, pl. 1. Principally chert, siltstone, argillite, and shale, and a few thin beds of fine-grained sandstone. On fresh fracture nearly all rocks are very dark gray. Lack of marker beds and irregularity of the attitudes of formation throughout area of outcrop preclude accurate measurement of thickness. Thickness may be 4,000 to 6,000 feet. Both upper and lower contacts are mechanical. Rocks make up thrust slice that rests directly on Roberts thrust along east wall of Mill Canyon and is overridden at north by higher slice of Valmy Formation and at south by one of the Vinini.

Exposed on both sides of Fourmile Canyon, near northeast corner of Cortez quadrangle. Crops out over area of nearly 10 square miles in drainage areas of Fourmile and Mill Canyons, and in unnamed stream next northeast of Fourmile Canyon.

Fox Limestone

Upper Silurian: Maine.

P. B. Myers, Jr., 1964, Vermont Geol. Survey Bull. 27, p. 10 (fig. 2), 14 (table 1), 27. Underlies Seaboomook Slates. Has yielded fossils of upper Silurian age. Name may have been used by Boucot (1953, unpub. thesis) or by Marleau (1958, unpub. thesis).

Shown on map in southwestern Maine.

Fox Hill Flow

Recent: Alaska.

Allan Cox, D. M. Hopkins, and G. B. Dalrymple, 1966, Geol. Soc. America Bull., v. 77, no. 9, p. 891. Discussion of geomagnetic polarity epochs in Pribilof Islands. Recent Fox Hill flow displays a series of linear fractures that evidently represent surface traces of tectonic fractures. [Figure 4 shows lava flow of Fox Hill.]

Present on St. Paul Island, Pribilof Islands.

Foxs Camp Formation

Silurian: Northwestern Maine.

R. S. Naylor and A. J. Boucot, 1965, Am. Jour. Sci., v. 263, no. 2, p. 161—162, fig. 2. Principally quartz- and feldspar-rich conglomeratic sandstone which contains calcareous mudstone and massive limestone. Thickness 500 to 1,000 feet. Sally Mountain conglomerate (new) and Foxs Camp formation were deposited on quartz monzonite of Somerset Island basement complex and are overlain by Seboomook formation. Name credited to Albee and Boudette (in preparation).

Jackman area, northwestern Maine.

Fox Valley Member (of Ironton Sandstone)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 26 (fig. 9), 37. Name applied to persistent dolomitic sandstone overlying Buelter Member (new) and underlying Marywood Member (new). Thickness 10 to 25 feet. Occurs between 1,168 and 1,180 feet.

Type well: Miller-Batavia No. 3, sec. 22, T. 39 N., R. 8 E., Kane County. Type well is at Batavia in Fox River valley.

Franklin Hill Igneous Series

Tertiary: Central New Mexico.

J. G. Wargo, 1964, Econ. Geology, v. 59, no. 8, p. 1528 (fig. 2), 1530, 1533. Three igneous units are grouped together to form Franklin Hill igneous series. Units include syenite and monzonite intrusives that are younger than monzonite porphyry but older than coarse-grained monzonite.

Cerrillos mining district, Santa Fe County, about 1 mile north of town of Cerrillos.

Franklin Mountains Rhyolite

Precambrian: South-central New Mexico.

W. R. Muehlberger and Rodger E. Denison, 1964, New Mexico Geol. Soc. Guidebook 15th Field Conf., p. 64. Mentioned in discussion of Precambrian geology of south-central New Mexico.

Fraser Glaciation

Pleistocene, upper: Southwestern British Columbia, Canada, and northwestern Washington.

J. E. Armstrong and others, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 321—330. Last major glaciation during which glaciers occupied mountains and lowlands of southwestern British Columbia and western Washington. Glaciation includes what has been referred to as an early alpine phase of Vashon Glaciation (Crandall, 1963, U.S. Geol. Survey Prof. Paper 388—A), Vashon Glaciation (Willis, 1898, Geol. Soc. America Bull., v. 9), and Sumas Glaciation (Armstrong, 1957, Canada Geol. Survey Paper 57—5). Divided into Evans Creek, Vashon, and Sumas Stades and Everson Interstade (new).

Named from Fraser Lowland of British Columbia where deposits attributed to episode are typically exposed.

Frazier Mountain Formation

Pleistocene: Southern California.

M. F. Carman, Jr., 1964, California Div. Mines and Geology Spec. Rept. 81, p. 47—48, pls. 1, 5. Consists mainly of coarse clastic deposits. No single section includes all members of unit, but two—member one (conglomerate) and member four (landslide conglomerate)—are well exposed on northwest side Frazier Mountain. These are designated as type sections exemplifying lithology and stratigraphic relations of member as a whole. Four members present in Lockwood Valley. Member one, exposed around lower flanks of Frazier Mountain, is 450 feet thick and thins progressively east and south of that point. About 200 feet of member two, a fanglomerate deposit, is present on flanks of Mount Pinos. On Seymour Peak, its base lies at 6,250 feet elevation and projects westward over Big Spring Valley. Member three, a gray-green channel-fill rests with marked discordance on Caliente member one, south of and along Big Pine fault zone at western edge of area. This member is overlain unconformably by the higher of the younger terraces in the area. Member four (debris of Chuchupate landslide) is a brown to gray-green breccia. It underlies the low hills south of Chuchupate Ranger Station. It extends in narrow band from road leading to Jewel mine northeastward to outcrops of Plush Ranch Formation.

Type section: Exposures on flanks of Frazier Mountain, Ventura County. Member 1: G.60, X.81 to F.80, XI.00 (California grid). Member 4: C.74, XII.52 to C.50, XII.58.

Fredericksburg Stage

Cretaceous (Comanche Series): Gulf and Atlantic Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 318—324. In this book Fredericksburg is used as a provincial stage—as a subdivision of the Comanchean series—to include all beds in Gulf and Atlantic coastal province of North America which can reasonably be demonstrated to be equivalent in age to the type Fredericksburgian and its characteristic units. Stage includes beds which are commonly judged to be about equivalent to the middle Albian and lower part of the upper Albian of Europe. Follows Trinity stage and followed by Washita stage.

Fredericksburg strata named for exposures in vicinity of Fredericksburg, Gillespie County, Tex. According to Adkins (1933, Texas Univ. Bull. 3232), the town of Fredericksburg is the nominal type locality, unfortunately chosen, as the group is unequally developed over Texas, its basal part (Walnut and Comanche Peak) being most fully shown in the Brazos and Bosque valleys, and its upper part (Edwards) most typically developed in the canyons of the Nueces, the Pecos, and the Rio Grande.

Frenchie Creek Quadrangle Volcanics

Tertiary: Central Nevada.

J. H. Schilling, 1965, Nevada Bur. Mines Rept. 10, p. 62. Frenchie Creek Quadrangle Volcanics mentioned in report on isotopic age determinations of Nevada rocks. Age 27 m.y. (+4 -2 m.y.). Refers to Armstrong (1963, unpub. thesis).

Location: SW¼ sec. 23, T. 30 N., R. 49 E., Eureka County, in Granite Hills.

Frenchie Creek Rhyolite (in Pony Trail Group)

Mesozoic: North-central Nevada.

L. J. P. Muffler, 1964, U.S. Geol. Survey Bull. 1179, p. 32—37, pl. 1. Consists predominantly of maroon or black rhyolite and rhyodacite flows. Subordinate rock types include altered green and white flow breccias and scarce volcanic rocks. Thickness about 2,500 feet at type section. Uppermost formation in group. Overlies Sod House Tuff (new). Cut by Lower Cretaceous(?) plutons.

Type section: Pony Trail Canyon in Frenchie Creek and Pine Valley quadrangles. Named for Frenchie Creek.

Frenchman Mountain Schist

[Triassic]: Southeastern Nevada.

J. H. Schilling, 1965, Nevada Bur. Mines Rept. 10, p. 75. Frenchman Mountain Schist mentioned in report on isotopic age determinations of Nevada rocks. Refers to Armstrong (1963, unpub. thesis).

Location: SW¼ sec. 24, T. 20 S., R. 62 E., Clark County; Frenchman Mountain.

Frenchman Springs Member (of Yakima Basalt)

Frenchman Springs Basalt Member (of Yakima Basalt)

Miocene, upper: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 20, p. 5, 8, 12, 39—40. Includes (ascending) Ginkgo Flow, Sand Hollow Flow, and Sentinel Gap Flow (all new), and Squaw Creek Diatomite (new). Overlies Vantage Sandstone Member (new); underlies Roza Basalt Member (new). Thickness about 300 feet.

J. W. Bingham, and K. L. Walters, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C87—C90. Name modified to Frenchman Springs Member. Geographically extended into Whitman and eastern Franklin Counties. Consists of six flows in Devils Canyon where it is about 265 feet thick and of three flows in Yakawawa Canyon where it is about 230 feet thick. Underlies Roza Member. Not subdivided in this area. Includes Squaw Creek Diatomite Bed of Mackin (1961), or its equivalent in places.

J. W. Bingham and M. J. Grolier, 1966, U.S. Geol. Survey Bull. 1244—G, p. G3 (fig. 1), G6—G8. Frenchman Springs Member contains two to six basalt flows. Of these, the three flows comprising the member in Vantage-Sentinel Gap area were named from nearby localities. Lowermost flow, Gingko, was named from Gingko Petrified Forest, the Sand Hollow was named for a tributary valley on east of Columbia River nearly opposite Vantage, and Sentinel Gap was named for water gap through Saddle Mountains The three flows and additional unnamed flows exposed east of Connell make up member within central Washington. Total thickness as much as 375 feet. Includes Squaw Creek Diatomite Bed. Overlies Vantage Sandstone Member. Underlies Roza Member.

Named for occurrence in Frenchman Springs Coulee, Grant County, where two flows and Squaw Creek Diatomite Bed are present.

French Mills Felsite (in Van East Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Van East group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. French Mills is in T. 32 N., R. 5 E., Madison County.

French Valley Formation

Jurassic(?): Southern California.

H. P. Schwarcz, 1966, Geol. Soc. America Bull., v. 77, no. 5, p. 511 (fig. 1), 512. Study of chemical and mineralogic variations in an arkosic quartzite during progressive regional metamorphism. Collections for the study were made from the French Valley Formation which, according to figure 1, consists of three unnamed members (ascending) A, B, and C, and overlies the Bedford Canyon Formation.

Present in Winchester area, Riverside County.

Frenchville Formation

Silurian: Northeastern Maine.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. No. 2, p. 16 (table 2), 31—33, pl. 1. Name proposed to replace William's and Gregory's (1900, U.S. Geol. Survey Bull. 165) Sheridan sandstone. Name Sheridan preoccupied. Principally light-gray or buff-gray fine-grained feldspathic sandstone. Estimated thickness about 1,110 feet. Overlies Pyle Mountain argillite (new); underlies Perham formation (new).

R. B. Neuman, 1967, U.S. Geol. Survey Prof. Paper 525—I, p. I—22—I23. Gray fine- to coarse-grained feldspathic sandstone and conglomerate in narrow outcrop belt in southeast corner of Stacyville quadrangle are classed with Frenchville Formation of Presque Isle area. Most of this rock in Stacyville quadrangle is medium- to coarse-grained sandstone in massive beds 2 to 4 feet thick, but contains lesser amounts of fine-grained quartzitic sandstone and some conglomerate. Similarity of the rocks and their fossils of the Stacyville quadrangle to the Frenchville Formation of Presque Isle area governed decision to identify them as Frenchville, although no rocks are so identified in the 50-mile interval that separates these outcrop areas. From structural data the position of the Frenchville in the Stacyville quadrangle is equivocal; however, implicit in its identification as Frenchville is its stratigraphical position low in the Silurian sequence, and this presumably beneath the Allsbury Formation in the core of an anticline.

Type area (Williams and Gregory): Along Aroostook River and nearby roadcuts in vicinity of town of Sheridan in Ashland quadrangle. Named from town of Frenchville 4 miles east of Sheridan, Presque Isle quadrangle.

Freshwater Bay Formation

Upper Devonian: Southeastern Alaska.

R. A. Loney, W. H. Condon, and J. T. Dutro, Jr., 1963, U.S. Geol. Survey Bull. 1108—C, p. C7 (table 1), C23—32, pl. 1. A sequence, 5,000 to 6,000 feet, of volcanic intercalated sedimentary rocks overlying Cedar Cove formation (new) and, in places Kennel Creek limestone (new), and underlying Iyoukeen formation (new). Upper and lower contacts appear to represent unconformities. On southwest limb of Freshwater Bay syncline consists of lower greenstone member, middle rhyolite member, and upper andesitic member. On northeast limb of syncline consists predominantly of massive porphyritic andesite flows with minor amounts of flow breccia, maximum thickness about 4,450 feet.

Type locality: Near head of Freshwater Bay, Chichagof Island. Rocks of formation form northwestward-trending belt of exposures averaging about 2 miles wide at Freshwater Bay, on southwest limb of Freshwater Bay syncline. Belt widens to more than 3 miles to northwest near margin of map area.

Fresnal Conglomerate

Miocene: Southeastern Arizona.

C. L. Fair, 1961, Arizona Geol. Soc. Digest, v. 4, p. 93—94. Pebble- to boulder-size fragments. Interbedded andesites in upper part. Thickness about 2,000 feet. Top of section in area under study. Unconformably overlies rest of section.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. Ill. Unconformably overlies Chiuli Shaik Formation (new).

Fresnal Canyon, Baboquivari Mountains, Pima County.

Fresnal Quartz Monzonite

Tertiary, lower: Southern Arizona.

J. A. Thoms, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. Rocks of Early Tertiary age include Red Boy rhyolite (new) and Fresnal quartz monzonite. Major deformation in area in Early Tertiary; all rock units older than Fresnal quartz monzonite have been deformed.

Present in Tascuela area, which comprises about 25 square miles on the west side of the Sierrita Mountains in Pima County.

Fresno Formation (in Bofecillos Group)

Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 17 (table 6), 26, road logs. Bofecillos Group comprises (ascending) Chisos Formation, Mitchell Mesa Tuff. Fresno Formation, Santana Tuff (new) and Rawls Basalt. Fresno is correlative with Tascotal Formation of Goldich and Seward (1948). In Three-dike Hill, underlies Rawls Formation.

J. W. Dietrich, 1966, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 28 (with text). Succession of interbedded conglomerate, sandstone, tuff, and flow rock between Mitchell Mesa Tuff and Rawls Formation in southeastern Presidio area is mapped as Fresno Formation (Dietrich and Maxwell ms.). Flows predominate near center of Bofecillos Mountains; flow rock is rare in outcrops near Torneros Creek and west of mountains. Flow rock mapped separately as three informal members: porphyritic trachyandesite, trachyandesite, and basalt. Other rock of formation mapped and described as sedimentary rock. Only upper 200 to 250 feet and lower 150 to 200 feet of formation are exposed. Total thickness of formation in Presidio area, based on these outcrops and more complete exposures southeast of Redford, probably is between 500 to 700 feet.

Type locality: In Fresno Canyon, 7 miles north of Fresno Creek bridge, Presidio County.

Fridley Formation

Pleistocene: Southeastern Minnesota.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2 (with test), p. 7 (table 2), 23—24. Has two lithofacies almost identical to corresponding facies in New Brighton Formation: light-gray to very pale brown fine to medium sand and gray silty clay. Mostly deposited in a lake. Upper 5 to 15 feet have been substantially modified by wind action and soil-forming processes. Unit includes sand dunes at surface. Occurs above New Brighton Formation and below West Campus Sand. Type section and alternate type sections given for each facies.

Type section (sand facies): Drainage ditch at intersection of U.S. Highway 8 and Hillview Road in Mounds View, NE¼SE¼SE¼ sec. 5, T. 30 N., R. 23 W., New Brighton quadrangle; alternate type section: Water well for Spring Lake Park, NE¼NW¼NE¼ sec. 1, T. 30 N., R. 23 W. Type section (silt facies): Municipal well no. 3, Fridley, SW¼SW¼SE¼ sec. 14, T. 30 N., R. 24 W.; alternate type section: Water well for Spring Lake Park. Named for Fridley.

Frog Lake Till

Pleistocene: Northern California.

P. W. Birkeland, 1964, Jour. Geology, v. 72, no. 6, p. 821. Named for glacial deposits at heads of many tributary valleys north of Lake Tahoe. At type locality moraine crests are numerous, rather sharp, and are up to about 40 feet above surrounding terrain. Stream draining Frog Lake has cut vertically about 20 feet through one moraine but not laterally. Not possible to say if Frog Lake Till represents separate advance or standstill during Tioga deglaciation. Evidence from Frog Lake suggests a readvance. If it is a readvance, it is thought to have taken place soon after disappearance of Tioga glacier, or at least its withdrawal farther into the cirque.

Type locality: Frog Lake, a cirque lake about 3½ miles north of Donner Pass. All deposits are within five-eighths mile of cirque wall and between 7,400 and 7,900 feet in elevation.

Frontenac Formation[1]

Lower Devonian: Southeastern Quebec, Canada, and northern Maine.

Original reference: H. W. McGerrigle, 1935, Quebec Bur. Mines Rept. Minister Mines 1934—1935, pt. D, p. 71, 74—78.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 160, 171—173. Geographically extended into Somerset and Piscataquis Counties, Maine. Includes variety of rock types, most frequent are gray to dark-green phyllite or slate and dark subgraywacke, which constitute about 80 to 90 percent of exposures studied. Remainder largely arkose and graywacke plus minor amount of basalt and felsite. Thickness unknown, may be several thousands of feet. Overlies Seboomook formation.

Name Frontenac Formation was listed in the Wilmarth Lexicon but was not listed in Bulletin 1200 because there was no information available at that time to show that it had been used within the United States.

Named for occurrence in Mount Megantic area, Frontenac County, Quebec.

Frost Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 601, pl. 1. Along upper half-mile of Frost Creek, consists of sequence of pale-olive, siliceous argillaceous lutites which are thin bedded or shaly in places. Lower part of member, just north of Ott Creek, is uniformly bedded, light olive-gray chert with argillaceous interbeds and fewer thicker quartzose siltite beds which weather to brown hues. Thickness not more than 650 feet but extremely thickened by folding. Overlies Ott Creek Member (new); underlies Bailey Creek Member (new).

Named for occurrence along Frost Creek, Bull Run quadrangle, Elko County.

Frost Creek Volcanics

Eocene, upper: Northeastern Nevada.

D. I. Axelrod, 1966, Am. Jour. Sci., v. 264, no. 7, p. 497—506. Discussion of potassium-argon ages of some western Tertiary floras. Frost Creek Volcanics sample is a biotite quartz latite welded tuff interbedded at the base of sedimentary section. Lowest of the 10 plant horizons (Mori Road florule) that comprise the Bull Run flora is about 1,500 feet higher stratigraphically. Potassium-argon date of 42.5 m.y. indicates this horizon is late Uintan or late Eocene. Name taken from Axelrod manuscript.

Locality: East margin of Bull Run basin in drainage of Frost Creek in SE¼ sec. 14, T. 43 N., R. 52 E., Bull Run quadrangle.

Frosty Peak Volcanics

Pleistocene: Alaska.

H. H. Waldron, 1961, U.S. Geol. Survey Bull. 1028—T, p. 692—695, pl. 79. Name applied to lava flows and pyroclastic rocks erupted from Frosty Volcano; mostly augite basalt or hypersthene-augite basalts; some hornblende basalts. Age of Frosty Volcano not known; presumed to be no older than Pleistocene.

Type locality: Frosty Peak, a nested summit cone of Quaternary volcano on western end of Alaska Peninsula, between Cold Bay on east and Morzhovoi Bay on west.

Frozen Sandstone Member (of Breathitt Formation)

Middle Pennsylvanian: Eastern Kentucky.

W. R. Hansen, E. V. Post, and G. E. Prichard, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C46—C49. Consists chiefly of medium- to light-gray fine- to medium-grained calcareous micaceous highly crossbedded sandstone that contains carbonized plant fragments along bedding planes. Contains interbeds of shaly siltstone that thicken locally. Thickness 25 to 60 feet; 55 feet at type section. Base about 80 to 100 feet above base of Breathitt. Overlain by thick sequence of shale, sandstone, clay, and interbedded coals. To northwest, appears to merge laterally with Lee Formation.

Type section: Exposures in newly opened highway cuts along right bank of North Fork of Kentucky River just north of Frozen Creek Post Office, Breathitt County.

Fruto Sandstone Tongue (of Venado Formation)

Upper Cretaceous (Turonian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Thickness 1,000 feet.

In Elk Creek-Fruto area, Gleen County.

Fry Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 600, pl. 1. Mainly bedded chert; commonly medium-dark gray to black. Maximum thickness 450 feet. Overlies Dorsey Creek Member and underlies Mikes Creek Member (both new).

Named for exposures on ridge east of Fry Canyon, Wildhorse quadrangle, Elko County.

Fumarole Butte Basalt

Tertiary: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 27, pl. 1. A basalt flow which occurs south of Keg Mountains. Younger than Honeycomb Basalt (new). Overlies Topaz Mountain Rhyolite (new).

Named for occurrence in vicinity of Fumerole Butte, western Juab County.

Funnel Creek Limestone

Lower Cambrian: East-central Alaska.

E. E. Brabb, 1967, U.S. Geol. Survey Prof. Paper 559—A, p. A6—A7. A massive carbonate formation. Seems to be predominantly limestone. A few interbeds of dark-gray chert. Thickness in type area not less than 1,300 feet, which is a partial thickness because base is not exposed. Along Limestone Hogback, seems much thinner, about 500 feet, but 1,200 feet of section below lowest exposure of Funnel Creek Limestone and highest exposure of Tinder Group is covered. Underlies Adams Argillite (new). Inasmuch as top of Tinder Group has been designated top of Precambrian, Funnel Creek Limestone is herein considered to be of Early Cambrian age.

Type area: Includes valley walls of three unnamed tributaries of Tatonduk River from 1 mile southwest to 3 miles south of mouth of Funnel Creek, in sections 17, 20, 21, 27, and 28, T. 2 N., R. 33 E., where formation forms craggy cliffs and scenic gorges. Named for exposures 1 to 3 miles south and southwest of Funnel Creek.

Furnace Creek Volcanics

Upper Cambrian: Southeastern Missouri (subsurface).

F. G. Synder and P. E. Gerdemann, 1965, Am. Jour. Sci. v. 263, no. 6, p. 465—493. Discussion of explosive volcanic activity along an Illinois-Missouri-Kansas axis. Eight geologic events, characterized by intrusive or extrusive igneous activity and (or) intense localized deformation, are aligned in a 400-mile east-west trending structural zone. These features are, from east to west: Hicks dome in Illinois; Avon diatremes, Furnace Creek volcanic crater, Crooked Creek disturbance, Hazel Green volcanics (new), Decaturville disturbance, and Weaubleau fault zone in Missouri; and Rose dome area in Kansas. Furnace Creek structure represents period of extrusive vulcanism in Upper Cambrian time. Core drilling revealed crater about 7,000 feet in diameter and about 400 feet deep in Lamotte sandstone. Crater is filled with basic volcanic ejecta and fragments of basement rocks. Surrounding crater is thin layer of volcanic ash. Ash bed is in lower part of Bonneterre formation, and ash and crater are overlain by normal Bonneterre section. Hazel Green volcanics, in Laclede County, represent similar period of volcanic activity in early Lamotte time.

Occurs in Washington County.

Gabriel Peak Orthogneiss

Paleozoic(?): North-central Washington.

J. B. Adams, 1964, Am. Jour. Sci., v. 262, no. 3, p. 292 (footnote). Skagit Gneiss has been restricted by Misch (ms.). All the gneisses that can be shown to be derived from plutonic rocks are now separated from Skagit Gneiss (restricted). They include: Eldorado Orthogneiss, Gabriel Peak Orthogneiss, and Bonanza Orthogneiss.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 115. In southeast part of map area [Northern Cascades of Washington] the Skagit Gneiss is bordered by a band of lower grade, predominantly quartz-dioritic orthogneiss [Gabriel Peak]. The igneous rock was cataclastically sheared and recrystallized moderately well in albite epidote and oligoclase-epidote amphibolite subfacies. At least part of contact with Skagit Gneiss is tectonic. On south, the orthogneiss seems to grade into Black Peak batholith. Farther north it is cut by Ross Lake fault. Though the orthogneiss band trends northwest, its internal structure strikes northeast in an area where adjacent Skagit Gneiss and, east of Ross Lake fault, Elijah Ridge Schist strike northeast too. The orthogneiss, first considered basement(?), is probably derived from a post-Skagit Suite intrusive, but the sheared northeasterly strike remains unexplained. Paleozoic(?).

Area is northern Chelan County.

Gahanna Drift

Pleistocene: Central Ohio.

R. P. Goldthwait and others, 1965, *in* The Quaternary of the United States—a review volume for the 7th Congress of the International Association for Quaternary research: Princeton, New Jersey, Princeton Univ. Press., p. 92, 94 (fig. 6). Mentioned in discussion of Pleistocene deposits of the Erie Lobe. Presumably the Sunnybrook Till in Toronto area, Canning Till at Paris, and Bradtville Till, found on Devonian bedrock in borings at Port Talbot, Ontario, all deposited by major "Early" Wisconsin glacial advance, should correlate with first Wisconsin invasion southward into Ohio (Magadore Till and Gahanna Drift), but dated gravel in Gahanna Drift suggests glaciation ended there only 47,000 years ago.

Gahanna is in Franklin County.

Gakona Diorite

Mesozoic: Alaska.

A. W. Rose, 1967, Alaska Div. Mines and Minerals Geol. Rept. 28, p. 10, 11, fig. 1. Hornblende diorite and related rocks are exposed just east of Gakona River between Spire and Mendenhall Creeks. A typical speciman of the outcrops west of Magnetite Creek contains minor amounts of biotite, quartz, and orthoclase in addition to hornblende and labradorite-andesine. Texture is granitic to seriate-porphyritic, with a tendency toward clustering of mafic minerals. On east side of Magnetite Creek most of the diorite is medium grained and equigranular, and it is possible that this is a separate intrusive, but local phases are very similar to the slightly coarser grained diorite. The diorite intrudes argillite of Mankomen formation, and metamorphosed rock of contact zone is overlain by a small patch of Tertiary Gakona formation.

In upper Chistochina River area, Mount Hayes quadrangle.

Gale Hills Formation

Upper Cretaceous(?) and Tertiary, lower(?): Southern Nevada.

C. R. Longwell and others, 1965, Nevada Bur. Mines Bull. 62, p. 44—45, pl. 1. Clastic deposits younger than and unconformable to Aztec Sandstone are widely distributed south of Muddy Mountains. Oldest unit in this diverse assemblage has basal conglomerate, 20 to 30 feet thick, made up of rounded pebbles and cobbles derived from several Paleozoic and Mesozoic formations succeeded by layers of fine-grained sand, silt, and clay with maximum thickness of about 200 feet. Assemblage resembles Willow Tank Formation. Deposits that strongly resemble Baseline Sandstone overlie the beds described above. Widespread deposits of bouldery rubble, locally many hundreds of feet thick, overlie the Baseline-like deposits. In make up and stratigraphic position this unit resembles Overton Fanglomerate. With thorough field study it may be possible to distinguish and map in the southern part of Muddy Mountains area the Willow Tank Formation, Baseline Sandstone, and Overton Fanglomerate. As this cannot be done now with assurance, the units described above are here designated Gale Hills Formation.

Type section: In hills southeast of Gale anticline, in NW¼ of T. 20 S., R. 65 E., Clark County. Type locality: In hilly terrane known as Gale Hills.

Gambier Bay Formation

Middle(?) Devonian: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 13—20, pl. 1. Identified by metamorphic foliation of its rocks, which are fine-grained green schist and phyllite in which individual minerals are generally too small to be identified in hand specimen. Chief rock types are chlorite-epidote-calcite phyllite or schist, quartz-albite, phyllite, marble, and phyllitic slate. Thickness a few thousand feet. Unconformably underlies Cannery Formation (new). Coeval with Hood Bay Formation (new). Formation as mapped may contain minor amounts of rocks of Permian age. Resembles in general way Wales Group of southern southeastern Alaska.

E. H. Lathram and others, 1965, U.S. Geol. Survey Bull. 1181—R, p. R9 (table 1), Reconnaissance geology of Admiralty Island. From Pybus Bay northwestward to Point Retreat, schist and marble form backbone and western side of island. Belt of outcrop is not continuous but is interrupted by batholith at Thayer Lake, which divides belt into a northern and a southern segment. Rocks of northern segment are assigned to Retreat Group. In southern segment, rocks are continuous with those of Gambier Bay Formation mapped by Loney (1964) in Gambier Bay region, and are assigned to that formation.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C15—C18, pl. 1. Formation on Kupreanof Island is composed primarily of greenstone, greenschist, and pelitic and quartzo-feldspathic phyllite. Marble and recrystallized dolomite form sporadic layers up to 50 feet thick throughout the formation. Relations of formation to other stratigraphic units uncertain. Contact with Cannery Formation (Lower Permian) west of Pinta Point appears to be a fault. Contact to east with Seymour Canal Formation (Upper Jurassic and Lower Cretaceous) is obscured along the shore by alluvium and may be either a fault or an unconformity.

Type locality: Exposures along shore of western Gambier Bay from Snug Cove on south to vicinity of triangulation station "Butt" on north, Admiralty Island.

Garda Stade

Holocene: Central Washington.

D. R. Crandall and R. D. Miller, 1964, U.S. Geol. Survey Prof. Paper 501—D, p. D110—D114. Younger of two stades in Winthrop Creek Glaciation (new). Drift of Garda age along Wonderland Trail near Winthrop Glacier includes forested lateral moraines that probably were formed during latter part of 17th century and bare, unstable moraines formed within the last decade and still partly underlain by stagnant ice. Terminal moraine of Garda age north of Winthrop Glacier has trees as old as 140 years growing on it, suggesting that it was formed in early part of 19th century. Oldest terminal moraine of Garda age yet recognized in Mount Rainier National Park lies in front of Cowlitz Glacier at Moraine Park. It bears trees that started to grow early in 13th century, and its topographic position indicates that Carbon Glacier was thicker at Moraine Park in early part of 13th century than it is today. Thus, Garda Stade may have begun some time in late 12th century or early 13th century. Moraines of Garda age differentiated from those of Burroughs Mountain age by absence of pumice layer C.

Type section: Lateral and terminal moraines near Garda Falls, at Mount Rainier.

Garden facies (of McAffe Adamellite)

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 132 (fig. 2), 141, 142. McAfee Adamellite is a complex of three texturally different facies—Aiken, Central, and Garden. The Aiken is porphyritic and the other two are equigranular. Central has a grain size of about 4 mm. The Garden facies average 1 to 2 mm. Contacts between the facies are gradational and can only be approximately located.

Present in Mount Barcroft quadrangle.

Gardena Sand

Pleistocene, upper: Southern California (subsurface).

R. F. Yerkes, D. S. Gorsline and G. A. Rusnak, 1967, U.S. Geol. Survey Prof. Paper 575—C, p. C97—C105. Discussion of origin of Redondo submarine canyon, southern California. Although head of Redondo Canyon lies in area where no land river debauches, Zielbauer and Burnham (1959, West coast barrier basin project geologic investigation—Manhattan Beach to Palos Verdes Hills [California]: Los Angeles County Flood

Control Dist. unnumbered report) recognized and mapped a buried deposit of fluviatile alluvium, their Gardena Sand, directly opposite head of the canyon as a result of detailed drilling program. Gardena Sand occupies a channellike depression about 1.5 km wide at shoreline; base of sand slopes westward from altitude of about 37 m below present sea level 1.6 km east of shoreline to about 73 m below present sea level at shoreline. Position, orientation, and altitude of channel occupied by the Gardena indicate that it was formed by stream that drained into area now occupied by head of Redondo Canyon. Gardena channel was cut into deposits older than Palos Verdes Sand and the channel fill was locally buried by deposits equivalent to the Palos Verdes. [Compiler unable to obtain copy of Ziebauer and Burnham's report.]

Redondo submarine canyon heads in water about 15 m deep, about 300 m from the shoreline, and about 4 km north of Palos Verdes Hills on southern California coast.

Gardens Basalt

Lapsus for Devils Garden Basalt.

Gardnerville Formation

Upper Triassic and Lower Jurassic: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Oreana Peak (new) and Gardnerville Formations, composed of 5,500 to 6,000 feet of marine carbonate and clastic rocks and interbedded volcanic material. These formations were warped and eroded near end of Jurassic time. During Middle and (or) Late Jurassic, Preachers Formation (new) was deposited.

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Garrison Creek Interstade or Interstadial

Pleistocene (Kansan): Indiana and northern Kentucky.

W. J. Wayne and J. H. Zumberge, 1965, *in* The Quaternary of the United States—a review volume for the 7th Congress of the International Association for Quaternary research: Princeton, New Jersey, Princeton Univ. Press, p. 67 (fig. 3). Kansan glaciation divided into (ascending) Alpine Stade, Garrison Creek Interstade, and Colombia [Columbia] Stade. Names credited to Gooding (in press).

A. M. Gooding, 1966, Ohio Jour. Sci., v. 66, no. 4, p. 426—433. Geologic-climate subdivisions of Kansan Stage in southeastern Indiana are named as follows (ascending): Alpine Stade, Garrison Creek Interstade, and Columbia Stade. The organic deposit at top of the sand (unit 2 at Townsend Farm section) records an interval of ice retreat and is named Garrison Creek Interstadial.

Type section: Townsend farm section located in streambank on southside of North Branch of Garrison Creek in Fayette County, Ind., in northwest corner sec. 20, T. 13 N., R. 12 E., Alphine quadrangle.

Gasperian Stage

Upper Mississippian (Chesterian): Illinois.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 21—22, 67, pl. 1. Gasperian Stage is here recognized to include Chesterian rocks equivalent to and older than Beech Creek Limestone. Comprises strata deposited contemporaneously with beds in Butts (1917, Kentucky Geol. Survey, ser. 5, v. 1, pt. 1) along Gasper River northwest of Bowling Green, Warren County, Ky. Corresponds to unit generally recognized as Lower Chester in Indiana and Kentucky. Differs from Lower Chester or New Design [Group] (abandoned), as these terms have been used in southeastern Illinois, by including at top the Cypress and Beech Creek (basal Golconda) Formations. Differs from New Design Group, as used along Mississippi River in type area of that group, in that both top and bottom of the Gasperian are younger. Agrees reasonably with Lower Chester or Gasper Limestone as these terms have been used outside Illinois Basin. Underlies Hombergian Stage; overlies Genevievian Stage of Valmeyeran Series. Name Gasperian has priority over New Design, Girken, and West Baden. Both top and bottom boundaries of New Design would have to be revised in its type area. West Baden has been revived with slightly different meaning and Girken was never clearly defined.

Named for Gasper Limestone first described by Butts (1917) whose type section overlies *Platycrinites pencillus*-bearing Ste. Genevieve Limestone in bluffs of Gasper River in and near eastern half of G—35, Hadley quadrangle, Warren County, Ky.

Gas Point Member (of Budden Canyon Formation)

Upper Cretaceous: Northern California.

M. A. Murphy, G. L. Peterson, and P. U. Rodda, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 4, p. 496—502. Described by Rodda (1959, unpub. thesis) as formational unit. It is herein reduced to member status in Budden Canyon Formation (new). Composed of about 3,600 feet of mudstone and medium-bedded sandstone. Lower 2,500 feet at reference section are composed of mudstone and siltstone with limestone concretions. Succeeding 600 feet of member composed of medium- to coarse-grained micaceous, feldspathic sandstones. These are overlain by about 600 feet of mudstone and siltstone. Overlies Bald Hills Member. Underlies either Red Bluff Formation or Tehama Formation.

Reference section: On Crow Creek, Ono quadrangle. Settleman of Gas Point is in Shasta County.

Gaylor Sandstone

Lower Mississippian: Northern Arkansas.

Mackenzie Gordon, Jr., 1964, U.S. Geol. Survey Prof. Paper 460, p. 11, 12. Gray-weathering buff to ocher calcareous coarse- to fine-grained sandstone. Thickness 0.25 to 0.5 feet. Overlies Penters chert; underlies Walls Ferry limestone (new). Kinderhook.

Type locality not stated. Gaylor is in Stone County near Mountain View.

G. C. Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), pl. 5. Overlies G. J. limestone member (new); underlies Highland limestone member (new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

In Bingham mining district, Oquirrh Mountains.

Gearyan Stage

Lower Permian: Kansas.

H. G. O'Connor, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 10, p. 1874—1877. Report on changes in Kansas stratigraphic nomenclature. Three-fold series terms Lower, Middle, and Upper Permian as used in Kansas are replaced with two-fold classification Lower and Upper. West Texas Permian stage names, Wolfcampian, Leonardian, Guadalupian, and Ochoan, as have been used in Kansas, are abandoned and replaced with locally derived stage names. Gearyan stage includes rocks from base of Onaga Shale to top of Nolans Limestone and includes Admire, Council Grove, and Chase Groups. Rocks are about 780 feet thick and consist of cyclic deposits of abundantly fossiliferrous marine limestone and shale alternating with sparsely fossiliferrous red and green shale. Succeeded by Cimarronian Stage.

J. M. Jewett and others, 1964, Geologic map of Kansas (1:500,000): Kansas Geol. Survey. Map legend shows Gearyan Stage includes Admire, Council Grove, and Chase Groups.

Named for Geary County where there are good exposures along Kansas River valley and its tributaries.

†Gem Volcanics (in Gentile Valley Group)

Pleistocene, upper: Southeastern Idaho.

R. C. Bright, 1964, Dissert. Abs., v. 25, no. 4, p. 2440. Consist of extensive flows of porphyritic olivine basalt and pyroclastics, the latter being in form of cinder cones, mantle deposits, accidental blocks, and bombs. Partly interbedded with Lake Thatcher Formation (new). Overlain by Niter Loess (new) and Bonneville Formation.

R. C. Bright, 1967, Tebiwa, v. 10, no. 1, p. 1—7. Discussion of late Pleistocene stratigraphy of Thatcher Basin. Gentile Valley Group redefined to include Main Canyon Formation and Gem Valley Volcanics (both new). Author states that the four rock-stratigraphic units described herein were previously named by Bright (1964). However he considered the names *nomen nudem* and invalid according to the 1961 Stratigraphic Code and has renamed the units. [Although not mentioned specifically, the Gem Volcanics was one of the "four stratigraphic units" described by Bright (1964) hence, it is assumed the Gem Volcanics is included in the newly defined Gem Valley Volcanics.]

In Gem and Portneuf Valleys.

Gem Park Complex

Cambrian: South-central Colorado.

R. L. Parker and F. A. Hildebrand, 1963, U.S. Geol. Survey Prof. Paper 450—E, p. E8—E10. Name Gem Park complex applied to an intrusion of mafic alkalic rocks. Genetically related to McClure Mountain complex (new). Both complexes intrude gneissic granite and other metamorphic rocks of Precambrian age. The Gem Park complex is partly overlain by rhyolite of Tertiary age. Both complexes are cut by carbonatite dikes, some of which contain niobium, rare earths, and thorium. Probably late Precambrian.

The U.S. Geological Survey currently designates the age of the Gem Park Complex as Cambrian on the basis of a study now in progress.

Occurs at Gem Park, about 5 miles southwest of McClure Mountain Complex in northern Wet Mountains, Fremont and Custer Counties. Roughly rectangular in plan and covers about 2 square miles.

Gem Valley Volcanics (in Gentile Valley Group)

Pleistocene, upper: Southeastern Idaho.

R. C. Bright, 1967, Tebiwa, v. 10, no. 1, p. 1—7. Upper formation in Gentile Valley Group (redefined). Consists mostly of dark gray and very dark gray vesicular porphyritic olivine basalt, which is fine to medium grained. Thick exposures usually show two or more flow units, each of which is oxidized and markedly vesicular at top. Thickness 80 feet at type section. Log of water well 1.5 miles south of type section indicates that formation is 167 feet thick and that it overlies Main Canyon Formation (new). In exposed sections where the Gem Valley overlies Main Canyon Formation there is marked metamorphosed zone 1 to 12 inches thick at top of latter. Base of oldest exposed flow lies at altitude of about 4920 feet at Thatcher bridge. Youngest flow, which is exposed on edge of flat plain in secs. 27 and 28, T. 11 S., R. 40 E., is older than Bonneville Formation and younger than about 27,000 years. Unfossiliferous.

Type section: West wall of Black Canyon, adjacent on the south to the bridge on Turner Road, 1.05 miles due west of Grace, and in northeast corner of NW¼ sec. 11, T. 10 S., R. 40 E., Bancroft quadrangle. Type area: Between Turner Road west of Grace and northern boundary of T. 12 S. Named for Gem Valley, southwestern Caribou County, where abundant flat-lying basalt flows and associated cinder coned and mantle deposits of pyroclastics that characterize the formation are widely exposed.

Genevievian Stage

Mississippian (Valmeyeran Series): Illinois.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 20—21, 26, 27, pl. 1. Name proposed for only stage now recognized in Valmeyeran Series. Overlies rocks generally placed in St. Louis Limestone and underlies Gasperian Stage (new) of Chesterian Series. Includes equivalents of youngest *Platycrinites penicullus*-bearing beds placed in Ste. Genevieve Limestone, which are younger than youngest beds of this formation at its type locality. Thus includes Aux Vases Sandstone, Levias Limestone Member which is now placed in the Renault, and probably some unfossiliferous beds included in Renault in its type region.

Named for Ste. Genevieve Limestone of Shumard (1860) the type section of which is in Mississippi River bluffs, 1 to 4 miles southeast of the town of Ste. Genevieve, in northern part of T. 37 N., and southern part of T. 38 N., R. 9 E., extended, Weingarten quadrangle, Ste. Genevieve County, Mo.

Georgetown Complex

Lower Paleozoic: Central Maryland.

C. A. Hopson, 1964, The geology of Howard and Montgomery Counties: Maryland Geol. Survey, p. 154, pl. 7. Name given to poorly exposed complex ultramafic, gabbroic, dioritic, and dark quartz dioritic rocks that underlie a large part of Washington, D.C., and adjacent parts of Montgomery County.

Rocks are concentrated along a zone 1 to 2 miles wide that extends for about 10 miles from Georgetown, in District of Columbia, northwest to Beane in Montgomery County. Also crop out along Potomac River, just west of Glen Echo.

German Rancho Formation

Paleocene-Eocene: Northwestern California.

C. M. Wentworth, Jr., 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 237. Paleocene and Eocene section in area consists predominantly of gray-white arkose rich in potassium feldspar, and is herein named German Rancho Formation.

Present in Gualala area, Northern Coast Ranges, immediately west of San Andreas fault.

Germantown Formation (in Wappinger Group)

Upper Cambrian and Lower Ordovician: Southeastern New York.

D. W. Fisher, 1961, New York State Geol. Assoc. Guidebook 33d Ann. Mtg., p. D9. Consists of ribbon limestones, thin siltstones, brecciolas, and interbedded black shales bearing *Callograptus* and *Dendrograptus.* Underlies Stuyvesant Falls Formation (new).

D. W. Fisher, 1962, New York State Mus. Sci. Service Geol. Survey Map and Chart Ser., no. 2. Formal proposal of name. Formation rests disconformably on Early Cambrian Mettawee argillite and is overlain by Early Ordovician green shales and green siltstones or siliceous argillites. At least 350 feet and likely as much as 700 feet may be present in Columbia and Rensselaer Counties. At or near top is peristent conglomerate. This is Claverack Conglomerate of Chadwick (1964) believed by him to be within Early Cambrian Schodack Formation. Much, if not all, of what Ruedemann (1942) and Goldring (1943) mapped as Schodack is Germantown. Claverack Conglomerate commonly grades into a calcareous ferruginous sandstone—Ruedemann's "Zion Hill Quartzite" of Catskill quadrangle. The Burden iron ore (ferruginous limestone) now appears to lie within or at top of Germantown.

D. W. Fisher, 1963, New York State Mus. Sci. Service Geol. Survey Map and Chart Series, no. 3. Overlies Stuyvesant Falls Formation. Shown on chart as Upper Cambrian and Lower Ordovician. Wappinger Group.

Type area: In central part of Catskill quadrangle (roadcut along U.S. Route 9, one-half mile south of Becraft Mountain and adjacent quarry, and Fisher's quarry, 2½ miles southeast of Germantown).

Geyser Creek Fanglomerate

Pliocene(?): Eastern Utah.

W. D. Carter and J. L. Gualtieri, 1965, U.S. Geological Survey Bull. 1224—E, p. E1—E11. Name applied to extensive fanglomerate of Tertiary age. Consists mainly of well-consolidated yellowish-brown conglomerate and sandstone in lenticular beds. Thickness ranges from very thin to as much as 1,000 feet; 117.5 feet at type section. Unconformably overlies Mancos Shale; unconformably overlain by Harpole Mesa Formation. Probable Pliocene age.

Type section: Measured in north side of Deep Creek in NE¼ sec. 36, T. 26 S., R. 25 E., Grand County. Named for Geyser Creek, an eastward flowing tributary to Roc Creek.

Ghent phyllite facies (of Appleton Formation)

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. A lustrous gray phyllite. No such phyllite occurs in the nearby marble belt southeast of St. George River so Ghent phyllite is inferred to be equivalent to the chiastolite-bearing lustrous gray phyllite of Round Pond facies (new) in the riverbed at Appleton Center. Vaughan Neck gneiss (new) may be stratigraphic equivalent of Ghent phyllite.

Crops out at Ghent on St. George River in southern Searsmont and along Route 131 west of North Appleton, northwestern Knox County marble belt.

Gibbon River Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), pl. 1. A rhyolite flow. On list, Gibbon River flow occurs above Cougar Creek flow (new) and below Pitchstone Plateau flow (new).

Mapped near headwaters of Gibbon River, Yellowstone National Park.

Giesler Limestone

Ordovician (Champlainian): Southwestern Virginia.

B. N. Cooper, 1961, Geol. Soc. America Guidebook Cincinnati Mtg., p. 35, (also Virginia Polytech. Inst. Eng. Ext. Ser., Geol. Guidebook 1). West of junction of Routes 80 and 745 in Washington County, the Tumbez is succeeded by about 175 feet of limestone including a few intercalated dolomitic layers, which bear *Maclurites magnus*, *Multicostella*, *Mimella*, *Bumastus*, *Calliops declivis*, and *Billingsaria*, all of which are characteristic fossils of middle and upper zones of type Lenoir. If lower division of type Lenoir is split off and named either Tumbez or Mosheim, depending on facies locally present, Lenoir is not proper name for middle and upper divisions. Name Giesler is here introduced for middle and upper Lenoir. At Draper, the Giesler overlies the Tumbez. Along Route 100 at south interchange off Interstate 81, Giesler overlies the Mosheim and is only 10 feet thick.

Named for occurrence near Giesler Mill, Washington County.

Gilbert Substage

[Recent?]: East-central California.

D. A. Rahm, 1964, (abs.), Geol. Soc. America Spec. Paper 78, p. 221. Listed as youngest substage of Neoglacial stage. Younger than Basin Mountain substage.

Bishop area, Sierra Nevada.

Gillaspy Tongue (of Sanhedrin Formation)

Upper Jurassic (Portlandian): Northern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Sandstone-conglomerate, 6,200 feet thick. Lowermost tongue of Sanhedrin (new). Underlies Briscoe tongue (new).

In Elk Creek-Fruto area, Glenn County.

Gillespie Tuff

Tertiary: Southwestern New Mexico and northern Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines Mineral Resources Geol. Map 17. Pink, welded, quartz latite tuff. Formation generally thick, uniform in composition and texture throughout, well indurated, and commonly exposed in bold columnar-jointed cliffs. Underlies Center Peak Latite (new); overlies Walnut Wells Monzonite and Animas Monzonite (new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 50—52, pl. 1. Quartz latite composition. Thickness more than 1,500 feet. Rests with apparent conformity upon Cedar Hill Andesite (new) from Cowboy Spring area northward; to south lies with apparent conformity upon Bluff Creek Formation (new). In southern part of quadrangle, formation overlain unconformably by unit of well-bedded sandstone and breccia about 30 feet thick. Above this unit is Center Peak Latite. In northern part of quadrangle, unconformably underlies Park Tuff.

Named for exposures on Gillespie Mountain. Most prominent and widespread volcanic unit in Walnut Wells quadrangle. Extends into Mexico.

Gills Gravel

Quaternary: Southwestern Texas.

C. C. Albritton, Jr., and J. F. Smith, Jr., 1965, U.S. Geol. Survey Prof. Paper 479, p. 99—100, pl. 1. Gravels on surfaces of erosion in Sierra Blanca area are named (ascending): Miser, Madden, Gills, Ramey, and Balluco. The Gills consists of limestone, sandstone, quartzite, and extrusive and intrusive igneous rocks and some claystone in thin layers and angular fragments. Thickness 1 to 25 feet.

Type locality: West side Arroyo Calero about 2½ miles north of Gills Ranch, Hudspeth County.

Gilman Canyon Formation or Loess

Pleistocene, upper: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 42, 62, 63. Upper 12 inches is medium-dark-gray slightly humic silt; middle 1 foot is light-brownish-gray silt; basal 3 feet 8 inches is dark-brownish-gray humic soillike silt. Entire thickness noncalcareous. Overlies Loveland Loess; underlies Peoria Loess. Top of formation placed at "weak" soil horizon that is believed to represent Farmdale Interstadial Soil and marks contact between Early and Medial Wisconsinan deposits.

Type locality: In west fork of Gilman Canyon in Buzzard's Roost section in roadcut extending from center of SW¼SE¼ sec. 8, to SW¼SE¼ sec. 7, T.10 N., R. 26 W., Lincoln County; top of section at Buzzard's Roost with an elevation of about 2,040 feet and base of section in headwaters of west branch of Gilman Canyon at elevation of 2,858 feet.

Gilpin Peak Tuff (in Potosi Volcanic Group)

Tertiary, middle and upper: Southwestern Colorado.

R. G. Luedke and W. S. Burbank, 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C42 (table), C43. Gilpin Peak Tuff was formerly called Treasure Mountain Quartz Latite (Cross and Larsen, 1935) and Treasure

Mountain Rhyolite (Larsen and Cross, 1956); the formation is here renamed for specific sequence of rocks exposed in 1,400—foot—thick section at Gilpin Peak. Subdivided into seven mappable units; six are moderately crystal-rich welded ash-flow tuffs, and one consists of reworked air-fall tuff moderatly rich in fossil plant fragments. Units are even bedded and range in thickness from 0 to about 500 feet. Basal formation in group. Underlies Sunshine Peak Rhyolite.

Well exposed at Gilpin Peak, near head of Canyon Creek, about 7 miles west-southwest of Ouray in western San Juan Mountains.

Gilson Dolomite

Upper Devonian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 8 (table 4), 56—59, pl. 1. Consists of light- to dark-gray dolomite. Thickness 914 to 1,312 feet. Overlies Goshoot formation (new); underlies Hanauer formation (new).

Type section: Along Hanauer Ridge, Tooele County. Named for Gilson Canyon in northeastern part of Dugway Range. Well exposed on both sides of canyon. In this section, it is cut by faults, hence type section designated elsewhere.

Ginkgo Flow (in Frenchman Springs Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines Rept. Inv. 19, p. 8, 12—15. Flow in lower part of Yakima Basalt. Petrified logs occur in a layer of pillows and palagonite breccia which rests directly on Vantage Sandstone Member at most places in Vantage-Priest River area. Maximum thickness 150± 20 feet. Underlies Sand Hollow flow.

Type locality: In lower part of Schnebly Coulee, west of Vantage, Kittitas County.

Giraffe Creek Member (of Twin Creek Limestone)

Upper Jurassic: Southwestern Wyoming, southeastern Idaho, and northeastern Utah.

R. W. Imlay, 1967, U.S. Geol. Survey Prof. Paper 540, p. 50—53, pls. Consists mostly of yellowish-greenish- or pinkish-gray silty to finely sandy ripple-marked thin-bedded limestone that is interbedded with sandstone, but includes some shaly limestone and some medium-bedded limestone. Thicker beds commonly oolitic and sandy. Thickness 25 to 295 feet (111 feet at type section). Overlies Leeds Creek Member (new). Grades upward into Preuss Sandstone.

Type section: On north side of Thomas Fork Canyon in NW¼SW¼ sec. 20, T. 28, N., R. 119 W., Lincoln County, Wyo. Named for Giraffe Creek that flows into Thomas Fork Canyon about 1 mile east of type section.

G. J. Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies Fern limestone member and underlies G. C. limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

Glacier Bay Till or Formation

Recent: Southeastern Alaska.

G. M. Haselton, 1966, Ohio State Univ. Inst. Polar Studies Rept. 18, p. 16. Highest stratigraphic unit in area. Mainly a dark-gray boulder- to- pebble-rich loam or sandy loam. Weathered and unleached and shows little or no oxidation. Thickness less than 1 m to 33 ms. Overlies Van Horn Formation (new). On rock knob near south end of Burroughs Glacier, wood covered by Glacier Bay Till and therefore overridden by last ice advance was dated at 2,735 + 160 years B.P. This last ice advance was probably under way several decades before this. Wood in place on west side of White Thunder Ridge was dated at 2,100 ± 115 years B.P.

G. M. Haselton, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2480. Referred to as Glacier Bay Formation.

Named for exposures throughout the bays and inlets of Glacier Bay National Monument, which is northeast of Juneau.

Glascock Member (of Tuscaloosa Formation)

Cretaceous: Eastern Georgia.

John Sandy, R. E. Carver, and T. J. Crawford, 1966, Geol. Soc. America Southeastern Sec., Guidebook Field Trip 3, p. 4, 15, 16 (fig. 6). Term "Glascock Member" used in informal sense to refer to the flint kaolins in the Tuscaloosa. At Albion Kaolin Mine, Hephzibah, the Glascock consists of about 25 feet of hard sandy white kaolin with about 3 feet of harder, gray sandy kaolin at top. Underlies Albion Member (new) of Barnwell Formation.

Named for exposures in Glascock County.

Glen Alphine granodlorite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Glen Alpine granodiorite mentioned and shown on map in report on contact metamorphic reactions and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Glencoe Member (of Spechts Ferry Formation)

Middle Ordovician (Champlainian): Northeastern Missouri, western Illinois, northeastern Iowa, and southwestern Wisconsin.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 110, 235. Bentonite, limestone, and shale. Bentonite (near base of member) is commonly 1 to 3 inches thick, locally 8 inches thick, and occurs in a 1- to 2-foot zone of interbedded green, gray, or brown shale with thin beds of fine-grained limestone, coquina, or calcarenite. This is most persistent Ordovician bentonite in Mississippi Valley. Thickness commonly 5 to 8 feet near Mississippi River but thins to east; maximum thickness about 15 feet near Decorah, Iowa. Upper member of formation; overlies Castlewood Member (new); underlies Mincke Member of Kings Lake Formation (both new).

Type section: Exposure in south bluff of Meramec River along St. Louis-San Francisco Railroad, a quarter of a mile northeast of Mincke Siding, St. Louis County, Mo., near center E½ SE SE 21, 44N—4E, Manchester quadrangle. Named for village of Glencoe, 3 miles west of type section.

Glenns Ferry Formation (in Idaho Group)

Pliocene, upper, and Pleistocene, lower: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1206–1209, pl. 1. A collection of nonindurated, complexly intertonguing lake and stream deposits of great areal extent and thickness. Three principal facies recognized: lacustrine, fluviatile, and floodplain; facies rarely continuously exposed and many of their intertonguing relations are still poorly understood. Exposed thickness about 2,000 feet in type area. From type area formation is exposed continuously upstream as far as canyon wall west of Hagerman where it includes part of Hagerman Lake Beds as used by Stearns (1936). Near Glenns Ferry and Hagerman, overlies Banbury Basalt; from Bruneau River to Sinker Creek overlies Chalk Hills Formation (new); farther west overlies Poison Creek Formation. Underlies Tuana Gravel (new). South of Snake River, near Glenns Ferry, beds of Glenns Ferry and Bruneau (new) Formations are extensively beveled by erosion surface that terminates 550 feet above river level. This surface is covered by gravel herein named Black Mesa. Age uncertain. Mollusks interpreted as largely Pliocene and invertebrates as early Pleistocene, despite apparent intertonguing of sedimentary facies containing both. Assigned to late Pliocene and early Pleistocene.

Type area: Typical exposures begin 11 miles east of Glenns Ferry, Elmore County, at junction of Hog Creek and Clover Creek and extend westward along canyon walls of Snake River to Indian Cove, 14 miles west of Glenns Ferry.

Glenshaw Formation (in Conemaugh Group)

Pennsylvanian: Southwestern Pennsylvania.

N. K. Flint, 1965, Pennsylvania Geol. Survey, 4th ser., County Rept. C56A., p. 70–85, pl. 1. Name proposed for lower part of Conemaugh Group. Upper part of group named Casselman Formation. Boundary between the two formations is designated as top of Ames limestone. Lower boundary of the Glenshaw is at top of upper Freeport coal bed, the traditional boundary between Conemaugh and underlying Allegheny. Formation averages about 375 feet in thickness. For descriptive purposes divided into three stratigraphic units or intervals. Upper Freeport coal-Brush Creek coal interval, 110 to 115 feet thick, contains nine stratagraphic units (ascending): upper Freeport coal bed, lower Mahoning sandstone, Mahoning coal, upper Mahoning sandstone, Mahoning red bed, Humbert coal, Corinth sandstone, Irondale limestone, and Brush Creek clay. Associated shale beds not named except Uffington shale, present in some areas just above upper Freeport coal; Uffington absent in southern Somerset County [this report]. Brush Creek coal-lower Bakerstown coal interval, commonly 110 feet thick, includes (ascending) Brush Creek coal, Brush Creek limestone and associated marine shale, Buffalo sandstone, double Meyersdale red bed, Cambridge limestone, in association with lower part of Meyersdale, Albright limestone and Thomas clay below lower Bakerstown coal. Lower Bakerstown coal-Ames marine bed interval, about 150 feet thick, extends to top of formation and includes (ascending): Friendsville shale, Ewing limestone, upper Bakerstown coal, Saltsburg sandstone, Pittsburgh red bed, Lavansville limestone (new), and Ames coal and limestone and marine shales.

Type area: At Glenshaw, a community north of Etna, Shaler Township, in valley of Pine Creek on northern outskirts of city of Pittsburgh, Allegheny County. All four marine beds exposed at various places in vicinity of Glenshaw. No specific type locality designated because entire unit is nowhere exposed at one place.

Glory Hole Volcanics

Mesozoic or Cenozoic: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 38–41, pl. 1. A thick nearly flat-lying sequence of volcanic and metavolcanic rocks. A rather drab and heterogeneous group of tuffs, welded tuffs, breccias, lavas, and flow breccias probably dominantly of andesitic or dacitic composition. Pyroclastic rocks more abundant than lavas or flow breccias, particularly in lower part of section. Colors mostly light to medium gray, brown-grayish purple, or purple. Overlain by Galiuro Volcanics (new) along contact that lies at altitudes of from 4,950 feet at head of Dry Camp Canyon to 5,100 feet at west edge of quadrangle and 5,350 feet at its most southerly point and that attains maximum altitude of 5,650 feet near the center east edge of sec. 34. Contact appears to be conformable or at most disconformable at its southeast end and also at places in Dry Camp Canyon, whereas elsewhere, it is unconformable. Local apparently conformable nature of contact is unexpected in view of fact that Glory Hole Volcanics are older than and intruded by Copper Creek Granodiorite (new), whereas Galiuro Volcanics are younger than the granodiorite and rest unconformably upon it. Total thickness not known because base of formation is exposed at only one place. Thickness about 1,500 feet on south flank of Galiuro Mountains; 700 feet in Dry Camp Canyon.

Named after Glory Hole mine in S½ sec. 3, T. 8 S., R. 18 E. Crop out in southwest corner of Klondyke quadrangle. Occupy an area of slightly more than 3 square miles, or a little more than 1 percent of quadrangle.

Goat Mountain Phyllite

Pre-Tertiary: Central Washington.

M. L. Stout, 1964, Geol. Soc. America Bull., v. 75, no. 4, p. 323. Mentioned in discussion of pre-Tertiary rocks in part of Cascade Mountains. Name credited to Misch. [Compiler unable to locate publication in which Misch used term Goat Mountain Phyllite.]

Goff Creek Member (of Canaseraga Formation)

Pleistocene: South-central New York.

G. G. Connally, 1965, Dissert. Abs., v. 25, no. 11, p. 6532. Conglomeratic lenses of bright valley-fill deposits.

In western Finger Lakes region.

Gold Bug Formation

Middle and (or) Upper Jurassic: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Composed of 1,200+ feet of lava and welded tuff of intermediate composition. Overlies Veta Grande Formation (new); underlies Double Spring Formation (new).

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Gold Creek Greenstone

Upper Triassic: Northeastern Oregon.

H. J. Prostka, 1962, Geology of the Sparta quadrangle, Oregon (1:62,500): Oregon Dept. Geology and Mineral Industries. Name "Gold Creek Greenstone" used in this report to designate sequence of spilite and keratophyre flows with minor beds of mudstone, graywacke, and breccia which is exposed in area of about 3 square miles in northeastern part of quadrangle. Unit is corelative with what has been called Clover Creek Greenstone in earlier papers. In Sparta quadrangle distinguished from Clover Creek Greenstone because it occupies different stratigraphic position. "Gold Creek Greenstone" underlies "Lower Sedimentary Series" whereas Clover Creek rocks nearer their type locality underlie Martin Bridge Formation. This corresponds to stratigraphic difference of about 3,000 feet. Because of small extent of Gold Creek Greenstone in this quadrangle a formal formational name is not proposed. Base of sequence not exposed but section must be at least 2,000 feet thick.

Golden Door Volcanics

Eocene(?) to Miocene(?): Northwestern Arizona and southern Nevada.

C. R. Longwell, 1963, U.S. Geol. Survey Prof. Paper 374—E, p. E7 (fig. 2), E10 (table 1), E20—E24, pl. 1. Five episodes of vulcanism recognized along Colorado River south of Lake Mead. Golden Door volcanics, second of the eruptive series, consist of lavas, breccias, tuffs, and glasses that average higher in silica content than the next older and younger units. Golden Door volcanics are generally light colored in contrast to somber brown tones of underlying Patsy Mine volcanics (new) and dark gray, brown, and black of overlying Mount Davis volcanics (new). Thickness at least 5,000 feet at type locality. Golden Door volcanics may be equivalent to Ransome's (1923) Gold Road latite, Flag Creek latite, Meadow Creek latite, Sitgreaves tuff, and Cotton [Cottonwood] rhyolite.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2941. In Eldorado mining district, Clark County, Nev., Tertiary rocks consist of middle to late Tertiary flows and pyroclastic beds of andesite, basalt, and rhyolite. These are assigned to three volcanic formations: Patsy Mine, Golden Door, and Mount Davis volcanics.

Type section: Near Golden Door mine, about 3 miles southwest of Mount Perkins, Mohave County, Ariz.

Goldenrod Sandstone Member (of Senora Formation)

Pennsylvanian (Desmoinesian): Northeastern Oklahoma.

C. C. Branson and others, 1965, Oklahoma Geol. Survey Bull. 99, p. 34, 38. Tan to reddish-brown, slightly calcareous, fine- to medium-grained sandstone interbedded with gray shale. Thickness 0 to 35 feet. Overlies Fleming cap rock and channels down to top of Russell Creek Limestone Member. Separated from overlying Croweburg coal by 10 to 20 feet of tan, silty shale and argillaceous fine-grained sandstone.

Type locality: Exposures along Russell Creek about 3 miles northeast of Goldenrod School in walls of strip pit and in hill above strip pits, secs. 23, 24, T. 29 N., R. 20 E., Craig County. Mappable from Kansas-Oklahoma line southward to sec. 31, T. 28 N., R. 20 E.

Golden Spike Formation

†Golden Spike facies (of Elkhorn Mountains Volcanics)

Upper Cretaceous: Central western Montana.

V. E. Gwinn, 1961, (Feb.) Dissert. Abs., v. 21, no. 8, p. 2247. Named in report on Drummond area. Uplift and minor folding occurred in area during mid-Late Cretaceous time prior to deposition of unconformable Golden Spike formation and Elkhorn Mountains volcanics.

T. A. Mutch, 1961, (Feb.) Dissert. Abs., v. 21, no. 8, p. 2250. In Flint Creek Range, Cretaceous rocks consist of about 15,000 feet of clastic rocks. The youngest Cretaceous(?) sequence, Golden Spike formation, is characterized by presence of immature conglomerates and volcanic sandstones. Golden Spike is probable equivalent of Elkhorn volcanics, 70 miles to east. Probable angular unconformity between Kiss Creek and Golden Spike formations marks first pulse of local Laramide deformation.

V. E. Gwinn, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4). Facies of Elkhorn Mountains Volcanics. 4,000 to 6,000-foot sequence of andesitic lava, andesitic tuff, limestone- and chert-pebble conglomerate, sandstone, and siltstone. Unconformably overlies Carter Creek formation (new).

T. A. Mutch, 1961, Montana Bur. Mines and Geology Spec. Pub. 22 (geol. map 5). Golden Spike facies described in Flint Creek Range where it consists of about 4,000 feet of conglomerate, sandstone, and siltstone, with some volcanic sandstone as well as extrusive volcanic rocks. Age not definitely known since no fossils have been found. Although no angular unconformity was observed between the Golden Spike and the Carter Creek formation, one is suggested by sharp lithologic break between the two units and by variable thickness of the Carter Creek.

V. E. Gwinn and T. A. Mutch, 1965, Geol. Soc. America Bull. 76, no. 10, p. 1125—1144. Formal proposal of name Golden Spike Formation. Treatment of Golden Spike strata as member or facies of Elkhorn Mountains Volcanics was attempted earlier (Gwinn, 1961, Mutch, 1961) but was not consistent with articles 6 and 7 of 1961 Code of Stratigraphic Nomenclature and was therefore abandoned. Thickness 4,000 to 8,000 feet. Nonvolcanic rocks predominate in northwestern sixth of the 9-mile-long outcrop belt. In southeastern area, a relatively thick sequence comprises mostly lavas and volcaniclastic rocks. Throughout formation many volcanic tongues wedge out within a short distance to northwest. At type section, herein designated, formation consists of basal conglomerate unit, lower mixed unit with chaos beds 500 to 700 feet above base and nonvolcanic lenses in lower half, middle lava unit, middle mixed unit with prominent nonvolcanic zone near base, upper lava unit, and upper mixed unit. Base of formation is everywhere a topographically prominent zone of conglomerate and sandstone. Outcrop belt is terminated on northwest by northeast-trending high angle fault. Correlated with Upper Cretaceous Elkhorn Mountains Volcanics.

R. L. Konizeski, 1965, Billings Geol. Soc. Guidebook 16th Ann. Field Conf., p. 10, 12, 15. In absence of definitive fossil evidence, age of Golden Spike and similar patches of conglomerate scattered about base of Flint Creek Range remains purely conjectural. Tertiary(?).

Type section: Extends 2.5 miles west-southwestward from sides of northeast projecting meander neck along Clark Fork River (NE¼SE¼ sec. 15, T. 9 N., R. 10 W.) to alluviated valley of Independence Creek (NE¼SE¼ sec. 20, T. 9 N., R. 10 W.), Garrison County. Name taken from locality in NE¼NW¼ sec. 9, T. 9 N., R. 10 W., where sections of Northern Pacific Railroad being constructed from east and Pacific Northwest were joined; union was commemorated by driving of "golden spike" at point on southside of Clark Fork River. Occurs near town of Garrison, Mont., 40 miles northwest of Butte at north end of Deer Lodge Valley.

Gold Flat Member (of Thirsty Canyon Tuff)

Pliocene: Southeastern Nevada.

D. C. Noble and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D24—D27. Base of member consists of several inches to 8 feet of densely to partially fused light-brown tuff probably of air-fall origin. This unit succeeded by densely welded generally devitrified dark-green to bluish-gray tuff as much as 20 feet thick which passes abruptly upward into densely to moderately welded yellow-brown or brownish-red devitrified tuff. Maximum thickness about 200 feet; 170 feet at type locality. Overlies Dry Lake Member (new); underlies Labyrinth Canyon Member (new).

Type locality: About 10 miles south of Gold Flat in upper reach of Thirsty Canyon (lat 37°15′ N.; long 116°36′ W.) Nye County.

Gold Fork Granodiorite

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. Medium to coarse leucocratic, granular granodiorite. Contains local unsystematic areas of quarta monzonite, and grades westward into quartz diorite and eastward into quartz monzonite. Name credited to D. L. Schmidt (1958, U.S. Geol. Survey open-file rept.).

Widespread exposures occur on east side of Long Valley, Boise Basin.

Goldman Meadows Formation

Precambrian: Southwestern Wyoming.

R. W. Bayley, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—458. Mapped in South Pass City quadrangle. Consists of a quartzite member, white, gray, or pale-green vitreous quartzite with thin interbeds of pale-green muscovite (fuchsite) schist, about 40 feet thick, and a main iron-formation member about 150 feet thick. Base of section in mapped area. Underlies Roundtop Mountain Greenstone (new).

R. W. Bayley, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—460. Formal proposal of name. Consists of four units. Lower quartzite member about 40 feet thick; schist member of variable composition; lower iron-formation member; main iron-formation member, about 150 feet thick. Type locality stated. Underlies Roundtop Mountain Greenstone (formal proposal).

Type locality: Along a northwest side of Goldman Meadows, sec. 26, T. 30 N., R. 100 W., Miners Delight quadrangle, Fremont County.

Gold Meadows Quartz Monzonite

Post-Upper Cambrian: Southwestern Nevada.

N. M. Short, 1963, (abs.) Geol. Soc. America Spec. Paper 73, p. 241. A quartz monzonite that intrudes Upper Cambrian Wood Canyon quartz sandstone.

North of Rainier Mesa, Nevada Test Site.

Gold Mountain Tuff (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 222, 227 (fig. 11), pl. 1. A massive porous cream-colored tuff, more than 2,000 feet thick. Intergrades with older Staley Pasture tuff (new). Interfingers with Indian Hollow tuff (new).

Forms crests of Gold Mountain and Signal Peak, in Tushar Range, Marysvale area.

Gold Run Sandstone

Tertiary, lower: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 29 (table 7), 59, 208 (table 17); v. 2, pls. A semiconsolidated, poorly cemented sandstone and shale. As shown on table of formations in Honey Lake Valley, overlies Fort Sage sandstone (new) and underlies Auriferous gravels. Thickness not known.

Occurs along Gold Creek.

Good Creek Formation

Pleistocene, upper: Northern Texas.

W. W. Dalquest, 1962, Jour. Paleontology, v. 36, no. 3, p. 568—582. Name used for late Pleistocene deposits along Good Creek and Monument Creek. Deposits are extensive and include, in upper part of stream valleys, sluggish-stream, pond, and marsh sediments, mostly consisting of gray clays, bordered by yellowish sandy silts and yellowish sandy gravel. Crossbedded sand, gravel, and conglomerate overlaid by yellowish sandy gravel occupy central parts of valley. Entrenched in Blaine formation. Has been considered an outcrop of Seymour Formation (Cummins, 1893). Fauna described.

Type locality: Fossil site on Easley Ranch, in roadcut just west of bridge where State Farm Market Road 654 crosses Monument Creek, Foard County.

Goodhue Greenstone

Carboniferous: Northern California.

V. E. McMath, 1966, California Div. Mines and Geology Bull. 190, p. 173—183. Revision of stratigraphy in Taylorsville region. Name Goodhue Greenstone is applied to a distinctive pyroclastic breccia which Diller (1908, U.S. Geol. Survey Bull. 353) called Taylor and referred to as lavas. The Goodhue, restricted to the upper plate of the thrust, overlies Peale Formation, whereas the Taylor underlies the Peale. Andesite of the Taylor is characterized by augite phenocrysts, whereas andesite or basalt of the Goodhue contains augite plus a relict second ferromagnesian phenocryst now represented by magnesian chlorite or a serpentine mineral. Thickness 1,500 feet. Underlies Reeve Formation. Peal is dated Mississippian and the Reeve is Permian.

Type section: In NE¼ sec. 22, T. 25 N., R. 11 E., northern Sierra Nevada. Type locality includes east slope of Peale Ridge immediately west of Ward Creek. Name derived from Goodhue homestead on Ward Creek in NE¼SW¼SW¼ sec. 14, T. 25 N., R. 11 E. The building is shown on earlier topographic maps, though not on the latest (Kettle Rock, 1950).

Goodlet Dolomite

Permian: Texas.

H. C. Fountain and Joseph Neely, *in* R. H. Dott, 1939, Am. Assoc. Petroleum Geologists Guidebook 24th Ann. Mtg., chart facing p. 9. Named on geologic section of "Texas Blaine" from Childress and Foard Counties, Tex. Occurs above Acme dolomite and below Guthrie dolomite.

Goodwin Canyon Quartz Monzonite

Tertiary: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 66–68, pl. 1. A granitoid rock that varies greatly in mineralogical composition and texture, ranging from equigranular granite, quartz monzonite, and diorite to porphyritic granite and granodiorite and ophitic diorite. Intrusive contacts with Bolsa Quartzite, Horquilla Limestone, and Pinkard Formation. In fault contact with Pinal Schist, Escabrosa Limestone, Santa Teresa Granite (new), and locally Bolsa Quartzite.

Named for occurrence in Middle and South Forks of Goodwin Canyon in T. 5 S., R. 20 E., Klondyke quadrangle. About 8 square miles, or 3 percent of quadrangle, is underlain by this rock.

Goodwin Point Formation

Post-Miocene: Southeastern Virginia.

J. E. Sanders and others, 1962, Preliminary report on the geology of southeastern Virginia and adjacent coast and continental shelf, with remarks on sediment sampling techniques using fibro-drilling methods: New Haven, Conn., Yale Univ., Dept. Geology, p. 25 (fig. 15), 27. Tentative designation for alluvial fill in James River valley. Consists of silty sands and clays. Stratigraphic relationships and areal distribution of formation not yet determined.

Occurs in narrow strip parallel to James River and east of Suffolk scarp, Suffolk County.

Goon Dip Greenstone

Permian(?) and Triassic(?): Southeastern Alaska.

R. A. Loney and others, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I–388 (with separate text). Name given to sequence of greenstone, greenschist, and marble several thousand feet thick that crops out in belt more than 30 miles long in western Chicagof Island. Lower contact everywhere obscured by plutonic igneous intrusions. Overlain in type locality by Whitestripe Marble (new); southeast of Pinnacle Peak is largely overlain by Pinnacle Peak Phyllite (new). The Goon Dip is equivalent to "greenstone" unit of Rossman (1959, U.S. Geol. Survey Bull. 1058–E) in northwestern Chicagof Island and largely equivalent to both "greenstone schist" and "greenstone" units mapped by Reed and Coats (1941, U.S. Geol. Survey Bull. 992) in Chicagof mining districts.

Type section: In upper valley of Goon Dip River east of Portlock Harbor, Chicagof Island.

Goosenecks Member (of Honaker Trail Formation)

Pennsylvanian (Des Moines-Missouri): Southeastern Utah.

S. A. Wengerd, 1963, Four Corners Geol. Soc. Guidebook 4th Field Conf., p. 235, 236. Member of Honaker Trail. Thickness 530 feet. Underlies Shafer member; overlies Ismay zone (fusulinid zone).

Named for occurrence at Goosenecks of San Juan River.

Gopher Ridge Volcanics

Upper(?) Jurassic: West-central California.

L. D. Clark, A. A. Stromquist, and D. B. Tatlock, 1963, U.S. Geol. Survey Geol. Quad. Map GQ-222. Bedded mafic or intermediate tuff and volcanic breccia.

L. D. Clark, 1964, U.S. Geol. Survey Prof. Paper 410, p. 27—29, pls. 1—11. Consists largely of pyroclastic rocks but contains lavas with and without pillows. Base not exposed hence only partial thicknesses known. Exposed part of Gopher Ridge below lowest bed of Salt Spring slate (new) is about 4,000 feet in Mokelumne River, 7,000 feet in Calaveras River, and 12,000 feet in Stanislaus River. Maximum exposed thickness, 15,000 feet, is in Stanislaus River. Intertongues with Salt Spring slate; underlies and intertongues with Merced Falls slate (new). Volcanics were mapped as diabase, porphyrite, and amphibolite schist by Turner (1894—1897). Included with Amador group by Taliaferro (1943) and Heyl and others (1948, California Div. Mines Bull. 144) and with Logtown Ridge formation by Taliaferro and Solari (1949, California Div. Mines Bull. 145, map only).

Underlies and is named for Gopher Ridge, a prominent topographic feature near west side of exposed belt of metamorphic rocks between Stanislaus and Calaveras Rivers, lower western slopes of the Sierra Nevada, Calaveras County.

Gordonville Member (of Dutchtown Formation)

Middle Ordovician (Champlainian): Eastern Missouri, southeastern Illinois, and northwestern Kentucky.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13 (fig. 2), 54. Normally consists of dolomite with subordinate amounts of limestone. Thickness 50 feet in well at Cape Girardeau, Mo., over 45 feet in southernmost Jackson County, Ill., to 97 feet in Pulaski County, near Mound City; 130 feet in well in Ballard County, Ky. Corresponds to lower member of Dutchtown as used by McQueen (1937). Underlies Sharpsboro member (new).

Type section: Geiser quarry on north side of State Highway 75, 1¼ miles east of Dutchtown, SW¼NW¼NW¼ sec. 20 projected, T. 30 N., R. 13 E., Cape Girardeau quadrangle. Named from Gordonville, Cape Girardeau County, Mo., 4½ miles northwest of type section.

Goreville Member (of Kinkaid Formation)

Upper Mississippian (Chesterian): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 6 (fig. 2). Named on rock classification chart where it is uppermost member of Kincaid. Overlies Cave Hill Member (new); underlies Lusk Member of Caseyville Formation.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 42, 44, 68, pl. 1. Name formally proposed in this report for massive upper limestone member of Kinkaid Formation of Elviran age. A limestone unit 15 to 45 feet thick. Overlies Cave Hill Member and underlies Grove Church Formation. Type section consists of about 33 feet of cherty limestone without shale interruptions.

Type section: In quarry of Southern Illinois Rock and Stone Co. on west side of Illinois Highway 37 at north edge of Buncombe, 4 miles south of Goreville, SW¼SW¼SE¼ sec. 10, and NW¼NW¼NE¼ sec. 15, T. 12 S., R. 2 E., Vienna quadrangle, Johnson County.

Goshoot Formation

Upper Devonian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 8 (table 4), 53—56, pl. 1. Consists of light- to dark-gray dolomite interbedded with brown-weathering dolomitic and calcareous quartzite units from 0.4 to 47 feet thick. Thickness 386 feet at type section. Overlies Engelmann formation (new); underlies Gilson dolomite (new).

Type section: Exposures on ridge on north side of Goshoot Canyon, Juab County.

Gosling Volcanics

Pleistocene: Alaska.

D. M. Hopkins, 1963, U.S. Geol. Survey Bull. 1141—C, p. C47, C49, C50 (fig. 9), C57—C64, pl. 1. Name proposed for group of basaltic and andesitic lava flows and endogenuous domes that overlie silt mantle on Imuruk volcanics and that are overlain locally by Camille and Lost Jim lava flows. Thickness commonly 10 to 50 feet; 150 to 300 feet near some of source vents. One of youngest flows assigned to Gosling volcanics has invaded canyon that has been carved by Kugruk River in lava flows of Imuruk and Kugruk volcanics (both new).

Named for Gosling Cone, located at source vent of typical lava flow of Gosling volcanics. Formation covers extensive areas between southeast end of Imuruk Lake, the head of Kugruk Canyon, the head of Koyuk River, and headwaters of Kuzitrin River, Seward Peninsula.

Gottsche Member (of Rock Springs Formation)

Gottsche Tongue (of Rock Springs Formation)

Upper Cretaceous: Southwestern Wyoming.

H. W. Roehler, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 11. Gottsche Tongue is thin sequence of paludal rocks. Underlies Ericson Formation.

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Field Conf., p. 17, pl. 4. Member consists of carbonaceous shales, thin coals, and some lenticular sandstones and gray shale. Thickness 20 to 70 feet. Overlies McCourt Tongue.

Typical exposure: On Gottsche Ranch in sec. 30, T. 16 N., R. 102 W., Sweetwater County, where Highway 430 crosses Rock Springs-Ericson contact.

Goughs Canyon Formation

Lower and Upper Mississippian: North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U.S. Geol. Survey Prof. Paper 431, p. 24—28, pl. 1. Predominantly altered volcanic rocks and interbedded limestone; approximately 60 percent altered volcanic rocks; 30 percent limestone; 10 percent calcareous shale, siliceous shale, and chert. Exposed thickness uncertain because of complex folding but may be more than 5,000 feet. Stratigraphic position unknown because of thrust faulting. Fossil evidence establishes age as probably Early and early Late Mississippian (Viséan).

Named for Goughs Canyon near center of Osgood Mountains quadrangle, Humboldt County. South of Goughs Canyon, formation exposed in discontinuous remnants of thrust plate 1½ miles to upper part of Perforate Canyon; to north extends continuously for 5 miles to north side of Farrel Canyon.

Government Canyon Granodiorite

Precambrian: North-central Arizona.

M. H. Krieger, 1965, U.S. Geol. Survey Prof. Paper 467, p. 34—35, pl. 1. Weathers light-yellowish brown to light brown. Disintegrates to sandy soil. Fresh rock is medium to medium-light gray and has salt and pepper appearance. Typical granodiorite is medium-grained rock having seriate texture. Cut by dikes of Prescott Granodiorite (new). Forms two masses in southwestern part of area [Prescott and Paulden quadrangles]. Western mass separated into two parts by Cenozoic rocks and must end somewhere between its northern-most exposures and the Dells Granite (new) less than 2 miles to north. Has been included in Bradshaw Granite (Jagger and Palache, 1905) which name is herein abandoned.

Named for exposures in Government Canyon (1,280,000 N., 341,000 E.) in vicinity of Prescott.

Gozar Gravel

Quaternary: Western Texas.

J. P. Brand and R. K. DeFord, 1962, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 24. Contains gypsite and silt, and near central part of map area [Kent quadrangle] contains Toy Member (new). Name credited to DeFord (in preparation).

Grace City Drift

Pleistocene: East-central North Dakota.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44, p. 24—25. Consists of till of Grace City end moraine and other associated drift that was deposited by the Grace City ice. Only a few feet thick along James River at the Pierre Shale outcrops and more than 300 feet thick about 2 miles south of Grace City. Older than McHenry drift (new). Locally underlies Kensal drift (new).

Named for town of Grace City in north-central Foster County. Covers most of western two-thirds of Foster County, southwestern part of Eddy County and parts of Stutsman and Wells Counties.

Gracemont Shale (in Marlow Member of Whitehorse Formation)

Gracemont Member (of Marlow Formation)

Permian: Western Oklahoma.

O. E. Brown, 1937, Am. Assoc. Petroleum Geologists Bull., v. 21, no. 12, p. 1543. Pink shale, about 3 inches or less thick, 1 foot above the upper Relay Creek dolomite in the Marlow member of the Whitehorse formation in T. 9 N., R. 9 W., is known locally as "Gracemont shale."

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, pt. 1, p. 67, 68. In type area of the Marlow Formation, the Emanuel and Relay Creek Dolomites range in thickness from paper-thin to four inches are separated by 15 to 20 feet of sandstone and shale, with a thin pink shale 1 foot below Emanuel Dolomite. This shale was termed "Gracemont" by Brown (1937). The named members of the Grady County area, such as Agawam, Gracemont, and Verden were not found in Blaine County [this report].

Present near Gracemont, Caddo County.

Grafton Formation or Loess

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 38, 58. An alluvial depositional sequence grading from coarse clastics below, upward into greenish-gray silts. Thickness about 70 feet at type locality where it underlies Beaver Creek Formation (new). Formation was deposited in channels eroded into Sappa Formation of Late Kansan age and older deposits in region. Upland eolian equivalent of Grafton Formation is Grafton Loess. Believed to be fluviatile equivalent of Clarkson Till (new). Early Illinoian.

Type locality: N½SW¼SW¼ sec. 6, T. 8 N., R. 3 W., Fillmore County (3½ miles north of Grafton, in a cut bank along southwest side of West Fork Big Blue River valley) where meander of stream has eroded into upland margin which is a loess-mantled plain developed above fluviatile deposits of Illinoian age.

Grand Avenue Member (of Kope Formation)

Upper Ordovician: Southwestern Ohio.

J. P. Ford, Jan. 1966, Dissert. Abs., v. 26, no. 7, p. 3861. Member of Kope Formation. Thickness 11 feet.

J. P. Ford, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 918—936. Formal proposal of name. In upper part of Kope Formation. In approximately 11 feet of strata each terrigenous unit is no more than 2 feet thick, and limestone beds are more closely spaced than is typical of the Kope Formation. Base of unit is base of limestone over the highest underlying terrigenous rock more than 2.5 feet thick. Top of unit is top of limestone below overlying terrigenous rock in excess of 2.5 feet. The lithofacies of the Grand Avenue Member recurs in the next formation above the Kope. The Grand Avenue member forms a useful marker within the Kope but is in no way equivalent to the McMicken of Bassler (1906, U.S. Natl. Mus. Proc., v. 30).

Type section: Quarry opposite 2196 Grand Avenue, Cincinnati.

Grandfather Mountain Formation

Precambrian: Northwestern North Carolina and northeastern Tennessee.

Bruce Bryant, 1962, U.S. Geol. Survey Bull. 1121—D, p. D—6—D—8, pl. An interlayered and intertonguing sequence of metamorphosed arkose, siltstone, shale, and volcanic rock. Rocks tightly folded and lack marker horizons; thickness appears to be from 10,000 to 30,000 feet. Unconformably overlies Wilson Creek gneiss (new). Lower contact well exposed in many places on Grandfather Mountain; upper parts exposed on ridges northwest of Grandfather Mountain. Upper contact is the thrust fault on northwestern side of Grandfather Mountain window. Includes Montezuma member in upper part. Intruded in lower part by Linville metadiabase. Tentatively assigned late Precambrian age; no definite correlation can be made with either specific rock units of Ocoee series or Mount Rogers volcanic group.

Named for exposures on Grandfather Mountain.

†Grand Gorge Member (of Gilboa Formation)

Middle Devonian: Southeastern New York.

F. W. Fletcher, 1964, Pennsylvania Geol. Survey, 4th ser., Bull. G-39, p. 31 (fig. 4), 34—35. Name introduced to designate 85 feet of protoquartzite and fossiliferous, medium-dark-gray shales which immediately underlies Oneonta Formation in Schoharie Creek valley. Overlies Manorkill Member (new) of Gilboa. Wedges out south and west of Margaretville region.

F. W. Fletcher, 1967, New York State Geol. Assoc. Guidebook 39th Ann. Mtg., p. C7. Gilboa can be recognized along old cog-hill railway up to site of Catskill Mountain House (now North Lake State Park) by 1.5 feet of distinctive whitish-weathering siltstone. This siltstone unit was called Grand Gorge Member of Gilboa by Fletcher (1963) before correlation between Schoharie and Kaaterskill Creeks had been definitely established. Seems best, now, to recognize it as easterly-extending tongue to the Gilboa.

Type section: Exposed along Route New York 30, 1.8 miles northeast of Grand Gorge, Stamford quadrangle.

Grand Mesa Formation

Grand Mesa Glaciation

Pleistocene: Western Colorado.

W. E. Yeend, 1966, Dissert. Abs., v. 26, no. 9, p. 5375—5376. Quarternary geology of Grand Mesa area. Most dominant effects upon the topography have been made by three glaciations. Glacial, alluvial, and colluvial deposits associated with the three separate glaciations have been included in three newly named formations: Lands End, Grand Mesa, and Bonham Reservoir. Grand Mesa glaciation (Pinedale? Stade, late Wisconsin), distinctly younger than Lands End glaciation, left its effects throughout highland and lowland parts of area. Glaciers of this age flowed down all the major stream valleys draining north slopes of Grand Mesa and reached minimum elevation of 5,400 feet. About one-third of entire mapped area was covered with ice of the Grand Mesa glacial episode. A moderately thick, inter-till buried soil and two levels of outwash gravels at the lower elevations record withdrawal of ice into the highlands for a certain length of time followed by a readvance of ice again into the lowlands during Grand Mesa glaciation.

Grand Mesa is a basalt-capped plateau rising above 10,000 feet elevation. The mesa is about 20 miles east of junction of Gunnison and Colorado Rivers in the arid to semi-arid lands of western Colorado.

Grand Pitch Formation

Lower Cambrian(?): Northeastern Maine.

R. B. Neuman, 1962, Am. Jour. Sci., v. 260, no. 10, p. 794—797. Name proposed to replace Grand Falls Formation of Ruedemann and Smith (1935); name Grand Falls preoccupied. At type section consists of quartzite and slate, interbedded in varying proportions, and contains red slate with *Oldhamia smithi* Ruedemann. Almost continuous bedrock exposures line riverbanks for about 1,000 feet in vicinity of Grand Pitch. At steepest part of the falls the rock is light-greenish-gray fine-grained quartzite in massive beds from 6 inches to 4 feet thick, separated by thinner layers of light-greenish-gray and medium-gray slate, which here forms no more than 20 percent of the section. In adjacent exposures, both upstream and downstream, slate is more abundant and quartzite beds thinner. Geologic relations suggest formation may be as young as Early Ordovician but could be as old as late Precambrian.

Louis Pavlides and others, 1964, U.S. Geol. Survey Prof. Paper 501—C, p. C28—C38. Discussion of stratigraphic and tectonic features in northeastern Maine. Unconformities of both regional and local nature occur at many places in area. Oldest of these separate rocks of Grand Pitch Formation of Cambrian(?) age, presumably by angular discordance, from overlying Early or Middle Ordovician Shin Brook Formation. Silurian rocks overlie much of Grand Pitch, especially along northwest side of Weeksboro-Lunksoos Lake anticline. Grand Pitch is complexly folded and characterized by well-developed shear cleavage that has disrupted and offset complexly folded layers. This stype of deformation contrasts with that in less complexly deformed overlying younger rocks. Seems reasonable that Grand Pitch was affected by folding in Late Cambrian or Early Ordovician although angular unconformity between Grand Pitch and the volcanic rocks is not clearly exposed.

Type section: At Grand Pitch of East Branch of Penobscot River, Penobscot County.

Graniteville Soil

See **Little Cottonwood Formation** and **Draper Formation.**

Grant Lake Limestone

Grant Lake Member (of Ashlock Formation)

Upper Ordovician: Northeastern Kentucky.

J. H. Peck, 1966, U.S. Geol. Survey Bull. 1244—B, p. B14—B16. Chiefly irregularly bedded argillaceous limestone and minor interbedded shale. Limestone makes up 70 to 90 percent of the formation. Very fossiliferous. Thickness about 110 feet at type locality. Transitional into underlying Fairview Formation. Underlies Bull Fork Formation (new). Between Sherburne and Mount Sterling, Ky., lower part of Grant Lake grades laterally into interbedded limestone and shale of Calloway Creek limestone and limy mud of Tate Member of Ashlock Formation. Near Richmond, Ky., grades laterally into Tate Member, Gilbert Member, and nodular limy siltstone of Stingy Creek Member of Ashlock Formation.

G. C. Simmons, 1967, U.S. Geol. Survey Geol. Quad. Map GQ-583. In Richmond North Quadrangle, Grant Lake reduced to member rank and included in Ashlock Formation where it overlies Tate Member and underlies Terrill Member. In its type locality and southward to vicinity of Owingsville, Ky., it is recognized as unit of formational rank.

Type section: Measured in roadcuts along Kentucky Route 1449, beginning about 0.7 mile south of junction with Kentucky Route 10, Mason County. Base of section at E. 2,152100; N. 410,450 (10,000-foot grid based on Kentucky coordinate system, north zone). Named for Grant Lake, which is 2.8 miles west-northwest of Orangeburg, Mason County.

Grass Valley Shale Member (of Frontier Formation)

Upper Cretaceous: Northeastern Utah.

L. A. Hale, 1960, Wyoming Geol. Assoc. Guidebook 15th Ann. Field Conf., p. 136 (chart 1). Listed on correlation chart in column credited to Trexler (1955, unpub. thesis). Overlies Chalk Creek member (new); underlies Oyster Ridge sandstone member.

Coalville area.

Grassy Cove Member (of Pennington Formation)

Upper Mississippian: Northern Alabama.

J. W. Emerson, 1967, Dissert. Abs., v. 27, no. 11, sec. B, p. 3990—3991. Lower member of Pennington. Consists of alternating beds of fossil-fragmental and oolitic limestone, variegated claystone, and thin dolomites. Underlies Avis Member. Both members contain abundant foraminifera, especially genus *Millerella*.

Northern Alabama.

Grassy Flat Member (of Water Canyon Formation)

Lower Devonian: Northeastern Utah.

J. S. Williams and M. E. Taylor, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 38—53. Upper member of Water Canyon formation. Overlies Card member (new). Underlies Jefferson formation. Composed of sandy dolostone, sandstone, shale, and intraformational sandstone—dolostone and sandstone—limestone breccias. Marine. Thickness 200 to 500 feet.

Named for exposures in Logan Canyon section, in spur that separates Grassy Flat Canyon from Logan Canyon. Section measured 1.7 miles east of mouth of Logan Canyon, in NW¼ sec. 32, T. 12 N., R. 2 E., Salt Lake Base and Meridian.

Grassy Ridge Formation

Middle Triassic: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Spilitic flow rocks and volcaniclastic rocks that overlie older rocks with angular unconformity. Thicknesses are 3,000 to 4,000 feet in northeast part of mapped area. No rocks of Grassy Ridge are exposed in southwest part of area. Unconformably overlain by Doyle Creek Formation (new). Ladinian.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Grave Creek Flow (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho and eastern Oregon.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 28—29, fig. 18. Member of "Upper" Basalt of Columbia River Basalt [Group]. Thickness a little less than 250 feet at mouth of Grave Creek where it overlies basal flow of the "Upper" Basalt. Separated from overlying Center Creek Flow (new) by two unnamed flows totalling about 150 feet in thickness.

Named for exposures at mouth of Grave Creek, Idaho County, about 1,500 feet below level of Camas Prairie. Recognized southward to beyond area of study on Oregon side of Snake River.

Gravelly Flat Formation

Upper Jurassic and Lower Cretaceous: West-central California.

R. L. Rose and I. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24-25, p. 40 (strat. column), 41, geol. map. Name applied to thick sequence of predominantly fine-grained clastic sediments that crop out along southwestern side of Center Peak Ridge. Bulk of formation consists of dark-gray to greenish-gray silty mudstone with thin interbeds of feldspathic sandstone and gray argillaceous limestone. Thickness 2,400 feet. Presumably overlies Franciscan formation but base not exposed in this area. Disconformably underlies Center Peak conglomerate.

Well exposed near Gravelly Flat and to southeast along Waltham Canyon fault, east-central Priest Valley quadrangle.

Graveyard glacial stage

Pleistocene (Wisconsin): Eastern California.

W. C. Putnam, 1962, California Univ. Pub., Geol. Sci., v. 40, no. 3, p. 198. Birman (1957, unpub. thesis) divided Tahoe glacial stage into two parts, Tahoe (older) and Graveyard (younger).

R. P. Sharp and J. H. Birman, 1963, Geol. Soc. America Bull., v. 74, no. 8, p. 1079. Name Graveyard replaced by Tenaya glaciation.

Derivation of name not given. Area of study was in upper drainage of San Joaquin River.

Gray Hills Arkose (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 219, pl. 1. Glass and yellowish-gray arkosic sandstone at base of Gray Hills rhyolite (new). Contact with older Mount Belknap red rhyolites not exposed due to faulting. Exposed on eastern side of Gray Hills, Tushar uranium area, near Marysvale, Piute County.

Gray Hills Rhyolite (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 219, 227 (fig. 11), pl. 1. Medium-gray rhyolite. Contorted flow folding characteristic of thin laminae of unit. Isoclinal fold flows, overturned toward valley, rim the large (1,500 feet thick) rhyolite mass that forms the Gray Hills. Overlies Gray Hills arkose (new). In vicinity of Beaver Hill overlies Beaver Hill tuff (new).

Forms Gray Hills in Tushar uranium area, near Marysvale, Piute County.

Great Bridge Formation

Pleistocene, middle or upper: Northeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Beach-ridge sand inferred in east; lagoon clay in west. Maximum thickness 55 feet. Overlies North Landing Formation (new); underlies Norfolk Formation.

Great Bridge is in Norfolk County.

Green Canyon beds

Miocene, upper, or Pliocene, lower: Central Washington.

C. J. Smiley, 1963, California Univ. Pubs. Geol. Sci., v. 35, no. 3, p. 167. Mentioned in discussion of Ellensburg flora. Collections of fossil leaves made from these beds.

Green Canyon is on north side of Kittitas Valley.

Green Creek Complex

Precambrian: Southern Idaho.

R. L. Armstrong and F. A. Hills, 1967, Earth and Planetary Sci. Letters, v. 3, no. 2, p. 114—124. Albion and Raft River Ranges are composed of an older metamorphic complex, the Green Creek Complex, unconformably overlain by a section of metasediments, the Dove Creek Group. The Green Creek consists of porphyritic adamellite gneiss, mica schist, amphibolite, and quartzite. The 2.5 b.y. age of the Green Creek Complex extends to the west the area known to be underlain by older Precambrian rocks in North America.

Albion Range is northern third of a metamorphic complex which includes the Raft River and Grouse Creek Mountains of northwestern Utah.

Green Mountain Basalt

Pleistocene, upper: Central Oregon.

N. V. Peterson and E. A. Groh, 1964, Ore Bin, v. 26, no. 9, p. 164, 165, pl. 1. Green Mountain lavas form low shield some 10 to 12 miles in diameter. Lavas are of pahoehoe type. Where exposed in walls of Crack-in-the-Ground there are two or more flows with overall thickness of 70 feet. Tumuli and other flow-surface features are present. Older than four Craters basalt (new).

Green Mountain is just northwest of map area of Crack-in-the-Ground, Lake County.

Green Springs Diorite

Mississippian(?): Northern Virginia.

H. R. Hopkins, 1961, Dissert. Abs., v. 21, no. 7, p. 1912. During or immediately following major deformation of probable Mississippian age, Green Springs diorite and Ellisville granodiorite (new) were intruded into sedimentary rocks of area.

Western Louisa County.

Gresham Formation

Pleistocene, middle(?): Northwestern Oregon.

D. E. Trimble, 1963, U.S. Geol. Survey Bull. 1119, p. 10 (fig. 4), 52–56, pl. 1. Bouldery cobble gravel and mudflow deposits. Weathered to depth of about 35 feet, mostly saprolite (no red soil). Commonly along Sandy River and Clackamas River represent alluviation of valleys cut into Springwater formation (new). Older than Estacada formation (new). Mainly on basis of relative topographic position and degree of weathering the Gresham is of middle(?) Pleistocene age. Formation may correlate with Leffler gravels when mapping of intervening area is completed.

Named for town of Gresham, Clackamas County. Formation present on both sides of Sandy River and extends from eastern edge of mapped area to within about 1 mile of town of Troutdale. Deposits underlie town of Gresham and extend through Pleasant Valley to Sunnyside district, north of Clackamas River.

Grier Limestone Member (of Lexington Limestone)

Middle Ordovician: Central Kentucky.

E. R. Cressman, 1964, U.S. Geol. Survey Geol. Quad. Map GQ–303. Fossiliferous and phosphatic limestone 135 feet thick. Overlies Logana Member; underlies Brannon Limestone Member of Cynthiana Formation. Replaces names Jessamine and Benson Limestones, herein abandoned.

D. F. B. Black, E. R. Cressman, and W. C. MacQuown, Jr., 1965, U.S. Geol. Survey Bull. 1224–C, p. C12–C13, C17–C20. Includes Macedonia Bed and Cane Run Bed (both new). Overlies Logana Member; underlies Brannon Limestone Member. Term Cynthiana Formation abandoned in this report and Brannon reallocated to member status in Lexington Limestone (redefined).

Type section: Exposures along Shyrock Ferry Road from one-half to three-quarters mile south-southwest of Grier Creek Church in southern part of Tyrone quadrangle. Name derived from Grier Creek.

Grizzly Lake Rhyolite-Basalt Complex

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 403, pl. 1. Rhyolite-basalt mix-lavas are found at four localities. The largest, the Grizzly Lake rhyolite-basalt complex, is apparently a flow three-fourths of a square mile in area and 100 to 200 feet thick. Younger than Yellowstone tuff.

In vicinity of Obsidian Cliff, Yellowstone National Park.

Groesbeck Formation

Pleistocene: Northern Texas.

W. W. Dalquest, 1965, Jour. Paleontology, v. 39, no. 1, p. 63–79. Consists largely of sands and gravels capped with gypsiferous clay. Thickness 17 feet at type locality. Sediments are of Late Wisconsin age that accumulated in basin formed by solution of gypsum from underlying Blain [Blaine] Formation of the Lower Permian. Groesbeck Formation as well as Good Creek Formation (Dalquest, 1962) has been considered an outcrop of Seymour Formation (Cummins, 1893). Carbon–14 determinations date fauna 16,775 ± 565 years before present, correlating with Brady interstadial event.

Type locality: Locality mentioned by Cummins as the "Forks of Groesbeck Creek." Groesbeck Creek is small tributary of Red River, located near eastern side of Texas Panhandle, Hardeman County.

Grouse Canyon Member (of Belted Range Tuff)

Grouse Canyon Member (of Indian Trail Formation)

Grouse Canyon Member (of Oak Spring Formation)

Miocene: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—96—D—103. Member of Oak Spring formation. Overlies Tub Spring member (new); underlies Survey Butte member (new). Consists of two units. Lower, 0 to 400 feet, of medium-gray vitric tuff and greenish-yellow zeolitic tuff in beds 2 inches to 3 feet thick; thin beds composed of fine well-sorted thinly laminated pumice; lower contact erosional unconformity. Upper units, 0 to 175 feet, of reddish-brown, greenish-gray, and yellowish-gray densely welded tuff.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Reallocated to member status in Indian Trail Formation (new). Overlies Tub Spring Member. Tub Spring and Grouse Canyon are multiple-flow simple cooling units of rhyolitic welded and nonwelded ash-flow tuff and associated ash-fall tuff. These units wedge out southward from Oak Spring Butte area, whereas northward they thicken and become more densely welded.

K. A. Sargent, D. C. Noble, and E. B. Ekren, 1965, U.S. Geol. Survey Bull. 1224—A, p. A33, A36. Recent mapping has shown that Tub Spring and Grouse Canyon Members of Indian Trail Formation underlie large area north and west of Nevada Test Site. Indian Trail Formation is restricted to Test Site and north and west of Test Site the Tub Spring and Grouse Canyon are allocated to new formation herein named Belted Range Tuff.

Type locality: Grouse Canyon, Nye County. Extends from type locality northward to Indian Spring, southward to Big Butte, eastward to Oak Spring Butte and westward to Fortymile Canyon.

Grouse Mountain Basalt

Pliocene(?): Northwestern Colorado.

G. A. Isett, 1966, U.S. Geol. Survey Prof. Paper 550—B, p. B42—B46. Mostly a succession of massive to blocky lava flows that show scoriaceous tops and bottoms. Locally, thin layers of tuffaceous sedimentary rocks intercalated between the lavas. About 200 feet thick at Grouse Mountain, but elsewhere as much as 500 feet thick. At Grouse Mountain unconformably overlies Rabbit Ears Volcanics (new) or Middle Park Formation. Youngest extrusive rock in area and caps many upland surfaces north of Colorado River.

Type locality: In NE¼ sec. 18, T. 2 N., R. 78 W., at Grouse Mountain, Hot Sulphur Springs quadrangle, Grand County.

Grouse Ridge Formation

Pre-Upper Jurassic: Northern California.

P. W. Lipman, Sept. 1962, Dissert. Abs., v. 23, no. 3, p. 994. In southeastern Trinity Alps, rocks in central metamorphic belt of Klamath Mountains were folded, metamorphosed, and intruded by ultramafic and granitic plutons in a short interval of Late Jurassic time. Metasedimentary rocks previously included in Abrams Formation (Hershey, 1901) comprise two differing units of distinctive lithologies separated by metavolcanic Salmon Formation. Quartzites and phyllites lying structurally below Salmon Formation are named Stuart Fork Formation. Marbles, calc-schists, and associated rocks lying structurally above Salmon Formation are named Grouse Ridge Formation.

G. A. Davis and P. W. Lipman, 1962, Geol. Soc. America Bull., v. 73, no. 12, p. 1547—1552. A unit of diverse and distinctive lithology with maximum structural thickness (not stratigraphic) of about 10,000 feet in type area and to east. Lower contact of formation established at first siliceous or calcareous metasedimentary rocks above Salmon hornblende schists. To east formation is irregularly terminated by broad belt of pre-granitic ultra mafic rocks, so that original eastern extent is unknown. Lower third of type area sequence consists of alternating units of coarse-grained micaceous and feldspathic quartz schists, almandine-hornblende rocks of variable mineralogy. Impure quartz and silicate-bearing marbles and carbonate-bearing schists and gneisses predominate in upper two-thirds of sequecne. Term Abrams abandoned.

G. A. Davis, 1963, Geol. Soc. America Bull., v. 74, no. 3, p. 333 (footnote). On basis of metamorphism, a pre-Middle Devonian age for Salmon and Grouse Ridge formations is indicated. This suggestion is speculative.

R. G. Strand, 1964, Geologic map of California, Weed sheet, (1:250,000): California Div. Mines and Geology. Grouse Ridge Formation of Davis and Lipman (1962) mapped with pre-Silurian(?) metasedimentary rocks.

G. A. Davis and others, 1965, Geol. Soc. America Bull., v. 76, no. 8, p. 933—966, pl. 1. Mapped as pre-Upper Jurassic.

Named for well-exposed section on west side of Grouse Ridge in upper Coffee Creek area including parts of secs. 7, 8, 17, 18, T. 37 N., R. 9 W., southern Klamath Mountains.

Grove Church Shale or Formation

Upper Mississippian (Chesterian): Southern Illinois, southwestern Indiana, and northern Kentucky.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 44, 69, pl. 1. Dark-gray fossiliferous marine shale containing a few limestone beds that generally are thin but may be as much as 5 or even 8 feet thick. A thin red shale streak occurs about 40 feet above base in some areas. Thickness 16 feet at type section. Overlies Goreville Member of Kinkaid Formation. Youngest Chesterian unit in Illinois Basin. Unconformably overlain by Pennsylvanian sediments.

H. B. Willman and others, 1967, Geologic map of Illinois (1:500,000): Illinois Geol. Survey. Listed on map legend as Grove Church Shale.

Type section: Exposed in roadcut and nearby gullies to west of nearly abandoned roadway that climbs Caseyville escarpment about 0.3 mile northwest of Cedar Grove Church and 1¼ miles east of village of Lick Creek, west line of NE¼NW¼ sec. 31, T. 11 S., R. 2 E., Carbondale quadrangle, Johnson County, Ill.

Guadalupe Igneous Complex

Upper Jurassic: Southern California.

M. G. Best, 1963, Jour. Petrology, v. 4, no. 2, p. 223—259. One of several late Jurassic, mezozonal plutons in foothills of the Sierra Nevada.

Composed dominantly of gabbroic and granitic rocks. Name credited to Herkenham (1946, unpub. thesis).

O. E. Bowen, 1963, Sacramento Geol. Soc. Guidebook Ann. Field Trip, May 18—19. road log map 4. Guadeloupe [Guadalupe] Complex shown on generalized geologic map to accompany road log from Le Grand to El Portal. Upper Jurassic.

M. G. Best and E. L. P. Mercey, 1967, Am. Mineralogist, v. 52, nos. 3—4, p. 436—474. Detailed discussion of composition and crystallization of mafic minerals in Gudadlupe igneous complex.

In vicinity of Guadalupe Mountain, in western Mariposa County, about 25 miles northeast of Merced. Exposed over area of 60 square miles. Has elliptical outline with longest axis striking north-west parallel to strong regionally developed foliation in metamorphic country rocks.

Guadalupe Shale (in Trinity Group)

Lower Cretaceous: Southern Texas (subsurface).

J. S. Rives, 1962, South Texas Geol. Soc. Bull., v. 2, no. 14, p. 8, 10 (fig. 2). Name given to thin calcareous shale which separates Hosston sand from overlying Sligo formation on San Marcos Arch. Thickness 15 to 30 feet.

Typically displayed on electric log of Stanolind Oil and Gas Co. No. 1 Theodore F. Schmidt from 2,350 feet to 2,373 feet. Named for Guadalupe County.

Guaje Member (of Bandelier Tuff)

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 47—48, pl. 1. Composed of unconsolidated white rhyolitic lump pumice or lapilli tuff. Thickness 25 feet at type locality; 57 feet at hole 19.6.17.234 in Los Alamos Canyon. Unconformably underlies Otowi Member (new). Wedges out between underlying basaltic rock of Chino Mesa and overlying Otowi Member in area between White Rock and Totavi. Rests unconformably on all older rocks with which it is in contact. In northeastern part of area, overlies Puye Conglomerate or local patches of old alluvium. Overlies pyroxene and andesite unit of Tschicoma Formation in subsurface.

Type section (typical section): North side of hill on south side of Guaje Canyon in SE¼NW¼SE¼ sec. 4, T. 19 N., R. 7 E., Los Alamos area. Also well exposed in workings of White Eagle pumice mine on ridge north of Guaje Canyon. Exposed almost continuously along Puye Escarpment and in deep canyons in northeastern part of area.

Gunton Member (of Stony Mountain Formation)

Gunton Beds

Upper Ordovician: Manitoba and subsurface in Saskatchewan, Canada, and North Dakota.

V. J. Okulitch, 1943, Royal Soc. Canada Trans., 3d ser., v. 37, sec. 4, p. 60, 62—63. Consists of relatively heavy-bedded, dense, hard, massive dolomite, commonly buff with occasional bands of red or maroon. Thickness 15 to 19 feet. Overlies Penitentary member (new) and underlies Birse member (new).

Saskatchewan Geological Society, 1958, Report of the Lower Palaeozoic Names and Correlations Committee: Regina, Saskatchewan, Saskatchewan Geol. Soc., p. 8. Through subsurface of basin interior, Gunton beds comprise fossiliferous fragmental dolomitized limestone and dolomite series reaching maximum known thickness of 60 feet, overlain by 1 to 5 feet of anhydrite and a similar thickness of arenaceous dolomitic shale. Overlies Stoughton beds (new). At outcrop Gunton Beds equate with Gunton member as defined by Baillie (1952), Manitoba Mines Branch Pub. 51—6).

C. G. Carlson and W. P. Eastwood, 1962, North Dakota Geol. Survey Bull. 38, p. 6, 7. Described in subsurface in North Dakota where it is classified as lower member of Stony Mountain Formation. Overlies Stoughton Member; underlies Stonewall Formation.

Exposed at Stony Mountain, Gunton, the abandoned quarry west of Stony Mountain road, and the Fisher Branch-Hodgson region, Manitoba.

Gypsum Creek Quartz Monzonite

Post-Mississippian to Pre-Quaternary: Southeastern Alaska.

R. A. Loney, W. H. Condon, and J. T. Dutron, Jr., 1963, U.S. Geol. Survey Bull. 1108—C, p. C38—C40. Name applied to quartz monzonite in pluton at head of Gypsum Creek. Forms elongate west-northwestward-trending outcrop about 5½ miles long that averages three-fourths mile wide. Northern and western tributaries of creek cut largely into the quartz monzonite. Pluton occupies central part of Freshwater Bay syncline and is almost entirely surrounded at surface by limestone of upper part of Iyoukeen formation (new). Age can be determined no closer than post-Late Mississippian and pre-Quaternary.

M. A. Lanphere, R. A. Loney, and D. A. Brew, 1965, U.S. Geol. Survey Prof. Paper 525—B, p. B108. Potassium-argon ages of some plutonic rocks in Tenakee area. Ages measured on Gypsum Creek Quartz Monzonite provide additional evidence of Mesozoic plutonism on eastern Chichagof Island. Potassium-argon age of 103±5 m.y. for biotite and lead-alpha age of 150±20 m.y. for coexisting zircon differ by more than analytical uncertainty, but these ages indicate a probable Cretaceous age for Gypsum Creek Quartz Monzonite.

In Freshwater Bay area, Chicagof Island.

Hachita Formation (in Escarbrosa Group)

Mississippian (middle Osage through upper Meramec): Southeastern Arizona and southwestern New Mexico.

A. K. Armstrong, 1962, New Mexico Bur. Mines and Mineral Resources Mem. 8, p. 2 (fig. 1), 10—13, cross sections. A massive encrinite, 250 to 380 feet thick. Lower two-thirds is almost devoid of bedding and is composed of crinoid fragments to virtual exclusion of other organic remains. Upper third is darker gray, has persistent massive bedding, and is composed to large extent of crinoid remains, but also contains brachiopod and bryozoan remains. Thins to north and west from type section. Black Prince limestone should be considered member of Hachita. Overlies Keating formation (new); underlies Paradise formation.

Type section: S½ sec. 20, T. 26 S., R. 30 E., at south end of Blue Mountain, Chiricahua Mountains, Ariz. Forms persistent cliffs throughout area of exposure.

Hacienda Larga Tuff Member (of Cariblanco Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I—335. Indurated volcanic ash, mottled pale orange and olive gray. Bedding thick to massive and at type locality upper and lower contacts are sharp. Thickness about 60 m at type locality; probably more than 100 m near northern border of quadrangle. Occurs about middle of formation above La Guaba member and below Jobo Dulce limestone member (both new).

Type locality: Hacienda Larga, on U.S. Military Reservation, in southwestern part of Coamo quadrangle. Also crops out south of type locality, northward near crest of Cerro Cariblanco, in west-central part of quadrangle, in two places along Highway 14, just south of Cordillera Central, and near base of Cariblanco formation in vicinity of Quebrada Montería.

Hadley Gravel Member (of Baylis Formation)

Cretaceous: Western Illinois.

J. C. Frye, H. B. Willman, and H. D. Glass, 1964, Illinois Geol. Survey Circ. 364, p. 4, 8, 26, 28. Name applied to gravel and sand unit that commonly occurs at base of Baylis Formation (new). Thickness as much as 15 feet; generally less than 10 feet; 5 feet at type section. At some places represented by layer of pebbles only a few inches thick. Underlies Kiser Creek Member (new); overlies Pennsylvanian Abbott Formation.

Type section: Aberdeen School geologic section measured in creek bank, NW¼SW¼SE¼ sec. 31, T. 4 S., R. 4 W., Pike County. Named for town of Hadley 4 miles northwest.

Hager Rhyolite Porphyry

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1961, Dissert. Abs., v. 21, no. 11, p. 3421. Unconformably overlies McCaslin formation (new). Flowed out onto terrain of fairly high relief and is confined mainly to trough of McCaslin syncline.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), 5, 8. A variable rhyolite that occurs immediately north of Baldwin conglomerate (new) and south of McCaslin Mountain. To southwest the [Hager] rhyolite and Waupee series are cut off by a younger granite, the Belongia granite of Mancuso. Near High Falls dam the Hager is in contact with Peshtigo River Porphyry (new). Mancuso believed the rhyolite to be mainly an extrusive that issued from vents inside the quartzite-conglomerate arc and filled a topographic basin eroded in softer sediments. The Hager rhyolite occurs in several places outside the quartzite-conglomerate arc—notably to east of Thunder Mountain. Mancuso explains these occurrences as due to overflow from synclinal basin. It is possible that the rhyolite is intrusive.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. Mancuso (1957, 1960, unpub. theses) established following succession: Waupee Volcanics (oldest), Macaulay Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite, and High Falls Granite.

Haight Creek Member (Of Burlington Limestone)

Mississippian (Osage Series): Southeastern Iowa.

S. E. Harris, Jr., and M. C. Parker, 1964, Iowa Geol. Survey Rept. Inv. 1. Characterized by numerous chert layers and dominance of dolomite over limestone. Thickness 39 feet at type section. Overlies Dolbee Creek Member and underlies Cedar Fork Member (both new). Subsurface data.

Type section: In bluff on north bank of Haight Creek in NW cor. sec. 12, T. 71 N., R. 2 W., Des Moines County. Bluff is about 100 yards west of bridge over Haight Creek on Iowa Highway 99, about half a mile south of community of Kingston.

Half-Moon Hill Member (of Axemann Formation)

Lower Ordovician: Central Pennsylvania.

J. A. Lees, 1965, Dissert. Abs., v. 26, no. 2, p. 985. Upper member of formation in area. Characterized by predominance of calcilutite interbedded with dolomite. Thickness 150 feet. Overlies Rockview Member (new).

J. A. Lees, 1967, Pennsylvania Geol. Survey, 4th ser., Bull. G—52, p. 14—17, 47—48, map. Formal proposal of name. Upper member of Axemann. Overlies Rockview Member. Contact between the two members nowhere well exposed, but best estimate of thickness of the Half-Moon Hill, obtained near Axemann, is on the order of 150 feet. The limestone is dominantly an aphanitic dark-gray calcilutite which weathers light gray and is 1- to 2-foot bedded, though some beds are 0.5 foot thick. About half the dolomite is laminated and half mottled, and very little structureless dolomite is present. Chert occurs in the Half-Moon Hill at all sections, except the Slab Cabin Creek section. It occurs in middle of member and towards the base in part as thin, discontinuous beds 0.5 to 1 inch thick, but more generally as nodules commonly several inches in diameter, but ranging up to 1 foot in greatest dimension along bedding. Sparsely fossiliferous.

Type section: Located near Bellefonte, Centre County, Pa., about 10,000 feet east of long 77° 50′ W., and 3,500 feet south of lat 40° 55′ N., and about one-half mile southeast of village of Coleville. Named for exposures in road cut in side of Half-Moon Hill.

Halfpint Member (of Nopah Formation)

Upper Cambrian: Southeastern Nevada.

R. L. Christiansen and Harley Barnes, 1966, U.S. Geol. Survey Bull. 1244—A, p. A49—A52. Middle member of Nopah Formation (geographically extended into Nevada Test Site). Member consists of 715 feet of flaggy-splitting very thin bedded medium-gray limestone with partings of silty limestone or shale and common thin layers of chert. Underlies Smoky Member. Overlies Dunderberg Shale Member. The flaggy-splitting limestone above the Dunderberg at Eureka was assigned to the Catlin Member of the Windfall by Barnes and Byers (1961, U.S. Geol. Survey Prof. Paper 424—C). This is the flaggy limestone herein named Halfpint Member.

Type section: Measured by Barnes and Byers on Teapot Ridge in Halfpint Range.

Halleck Formation

Lower Permian: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C22—C23, pl. 1. A heterogeneous sequence of siltstone, sandstone, limestone, conglomerate, and basaltic volcanic rock. Dominant rock type in Saginaw Bay is dark-gray very calcareous siltstone that grades into silty limestone. Pillow lavas, pillow breccias, and epiclastic volcanic breccias of olivine-rich basalt occur near middle of unit southeast of Halleck Harbor. Approximately 700 feet thick on northeast shore of Saginaw Bay. In Saginaw Bay conformably overlies Saginaw Bay Formation (new) and is conformably overlain by Pybus Formation (Permian). Probably lateral equivalent of Cannery Formation. Early Permian.

Type locality: Tidal flats at Halleck Harbor. Reference section: Exposures on tidal flats on east side of Saginaw Bay south of abandoned cannery. Crops out on northeast shore of Saginaw Bay and on several of the Keku Islands.

Halloran Spring Formation

Tertiary: Southern California.

D. A. Warnke, 1966, Dissert. Abs., v. 26, no. 9, p. 5374. During Tertiary time, autoclastic friction breccias of andesite basalt composition intruded along faults in Halloran Complex. These intrusions were followed by deposition of coarse sedimentary breccias (rubble) and arkosic breccias (Halloran Spring Formation). At end of Tertiary (Pliocene?) basalt flows buried much of the ancient land surface near Halloran Spring.

Halloran Hills, central Mojave Desert.

Hallowell Granite

Paleozoic-Mesozoic: South-central Maine.

D. S. Barker, 1964, Am. Jour., Sci., v. 262, no. 5, p. 592—613. Name applied to granite in Hallowell pluton and in outlying bodies in the metasediments.

Pluton covers about 10 square miles in Augusta-Gardiner area.

Halls Gap Member (of Borden Formation)

Lower Mississippian: Southeastern Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224—F, p. F15—F18. At type locality includes beds previously assigned by Stockdale (1939, Geol. Soc. America Spec. Paper 22) to upper part of Brodhead Formation. Made up of resistant limy siltstone with minor shaly siltstone and silty limestone. Generally in obscure rough beds about a foot thick. Locally south of Halls Gap the beds are in broad sweeping lenses 2 to 20 feet thick and several hundred feet long. Maximum thickness about 100 feet a few miles southeast of Halls Gap. Thins northeastward and pinches out near Berea within Nada Member (new). Conformably overlain in much of area by Muldraugh Member. Between Halls Gap and Berea, overlain by Wildie Member. Full extent and stratigraphic relations of member not precisely known.

Type section: Measured up hill along U.S. Highway 27 at Halls Gap, Lincoln County, Halls Gap quadrangle), about 4.5 miles south of Stanford.

Halls Stream Grits (in Gile Mountain Formation)
Hall Stream Member (of Gile Mountain Formation)

Lower Devonian: Eastern Vermont.

C. G. Doll, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Mapped as Hall Stream member of Gile Mountain formation. Highly feldspathic grit, probably volcanic; feldspathic chlorite-ankerite schist and amphibolite.

P. B. Myers, Jr., 1964, Vermont Geol. Survey Bull. 27, p. 24, 25, 27, pl. 1. Name Halls Stream applied to grits that occur in lenses in Gile Mountain Formation in Averill area. Do not appear to be related to Sherbrooke grits, hence name Sherbbrooke not applicable in area. Halls Stream volcanics also used in report. Name credited to J. B. Thompson.

Well exposed along Halls Stream valley about 3½ miles north of Beecher Falls, Averill quadrangle.

Hamden Till, Glaciation

[Pleistocene]: Southern Connecticut.

R. F. Flint, 1961, Geol. Soc. America Bull., v. 72, no. 11, p. 1687–1691. Name Hamden till applied to the younger of two tills exposed in borrow pit at Lake Chamberlain. Till thickens from as little as 3 feet in upslope direction to as much as 20 feet downslope. Directly overlies Lake Chamberlian till (new). Figure 5 refers to Hamden glaciation. Age not stated.

Fred Pessl, Jr., 1966, U.S. Geol. Survey Prof. Paper 550–D, p. D89–D93. Upper part of Mashamoquet Brook till (new) may correlate with Lake Chamberlain and Hamden tills of Flint (1961).

Type locality: Town of Hamden, east of Bethany, northwest of New Haven.

Hamilton Canyon Formation (in White Pine Group)

Upper Mississippian: Eastern and southern Nevada.

R. L. Langenheim, Jr., 1962, Illinois Acad. Sci. Trans., v. 55, no. 2, p. 139 (fig. 2), 140 (fig. 3), 144. Uppermost formation in group. Overlies Chainman Shale; underlies Scotty Wash Quartzite or Diamond Peak Quartzite. Base of formation marked by soil and vegetation change at top of black fissile shale to open grassland with scattered outcrops of silty shale and fine-grained sandstone. Upper contact taken as base of lowest significant sandstone layer. Thickness as much as 1,690 feet.

Type section: Part of White Pine section measured along traverse starting at White Pine-Joana contact on north side of watergap through Joana Limestone in NE¼ sec. 31, T. 17 N., R. 58 E., Illipah quadrangle, White Pine County. Traverse proceeds eastward through cover to end of spur in Chainman Shale and continues roughly along crest of spur to base of Ely Limestone near Hamilton-Illipah Road.

Hamilton Island Limestone (in Hyd Group)

Upper Triassic: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241–C, p. C34–C35, pl. 1. Very thin bedded dark-gray aphanitic limestone. Black argillaceous laminae and thin to medium beds of dark-green calcarenite are subordinate. Thickness probably several hundred feet. Where exposed, it is so intensely and completely folded that thickness estimates are unreliable. Rests with apparent conformity on Burnt Island Conglomerate (new). Conformably overlain by Hound Island Volcanics (new). Coeval with Cornwallis Limestone (new). Appears to rest disconformably on Pybus Formation on northeast side of central part of Hamilton Island and on northeast side of Hamilton Bay. Late Triassic—predominantly Karnian. Youngest beds may be Norian.

Type locality: On northwest tip of Hamilton Island, 800 feet east-southeast of triangulation station Beth. Crops out on Hamilton Island, on north side of Hamilton Bay, and in northeastern Keku Islets.

Hammer Creek Formation (in Newark Group)

Triassic: Pennsylvania.

J. D. Glaesar, 1964, Pennsylvania Acad. Sci. Proc., v. 37, p. 179—188. A review of the lithostratigraphic elements which comprise the Newark Group in Newark-Gettysburg Basin brings out regional relationships between Brunswick and Gettysburg Formation and Brunswick and Lockatong Formations which can be understood more clearly via nomenclatural modifications. Coarse sediments exposed in the narrow neck of outcrop belt in Pennsylvania are herein named Hammer Creek Formation. The Hammer Creek is delimited laterally by two arbitrary cutoffs (one at Schuykill River, the other just northeast and parallel to Sesquehanna River). Base of formation is Stockton and New Oxford Formations. Top of unit is north margin of Newark-Gettysburg Basin. Formation is typified by coarse sandstones and conglomerates in which individual units pinch out laterally. Thickness at type section herein designated, 9,360 feet. Here, overlies New Oxford Formation. Newark Group.

Type section: Along Hammer Creek, Richmond (Pa.) 7½-minute quadrangle (SE¼ of Lebanon 15-minute quadrangle). Named for discontinuously exposed strata above New Oxford Formation along Hammer Creek.

Hammond Canyon Formation

Permian: Northern Nevada.

J. R. Coash, 1967, Nevada Bur. Mines Bull. 68, p. 5 (table 1), 12—14, pl. 1. Composed of thin-bedded limestones, interbedded with cherty limestones, and siltstones. Thickness 1,960 to about 2,500 feet. Overlies Sunflower Formation (new). Underlies Poorman Peak Formation (new). Age not definitely known. Tentatively assigned to Permian.

Named for Hammond Canyon in northwestern part of Mount Velma quadrangle, Elko County. Crops out along northeastern side of the canyon, on hills to the north and northwest, on the hill north of Fuzzie Spring, and on the hills west and south of Coleman Canyon.

Hanauer Formation

Upper Devonian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 8 (table 4). 59—61, pl. 1. Consists of dolomite and, in upper part, some limestone, both interbedded with calcareous quartzite. Thickness 481 feet at type section. Overlies Gilson dolomite (new); underlies Madison limestone equivalent.

Type section: On Hanauer Ridge in northeastern part of Dugway Range, Tooele County.

Hannacroix Member (of Kalkberg Formation)

Lower Devonian (Helderbergian): Eastern New York.

J. R. Dunn and L. V. Rickard, 1961, New York State Geol. Assoc. Guidebook 33d Ann. Mtg., p. C2, C4—C5, C9. Name applied to lower member of formation. Lower part of member, 11 to 15 feet thick, consists of bluish-gray chert-rich limestone. Upper part of member, 10 to 18 feet thick, consists of fine-grained fairly massive gray limestone with anastomosing argillaceous subbedding. Underlies Broncks Lake Member (new); overlies Coeymas Formation.

Named for occurrence on Hannacroix Creek, Albany County.

Hannold Hill Formation (in Tornillo Group)

Eocene, lower: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pls., figs., tables, road logs. Predominantly clay but contains conglomerate and channel sandstone deposits that are fossiliferous in places. Thickness about 835 feet. Uppermost formation in group. Overlies Black Peaks Formation (new); underlies Canoe Formation in Big Bend Park Group (both new).

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econo. Geology Pub. 6711, p. 102—107, pls. Formal proposal of name. Formation is mostly clay and contains less coarse clastic material than the Black Peaks Formation. Sandstone and channel conglomerates occur, and the vertebrate remains of the formation are from them. Most clay is gray and maroon. Hannold Hill is only Tertiary sequence containing lignite. Contains Exhibit Sandstone Member (new) 320 feet above base. Thickness 833 feet at type section. Underlies Canoe Formation. Vertebrates are lower Eocene (Wasatchian).

Type section: About three-fourths of a mile northeast of the abandoned rock crusher site on southern Tornillo Flat, Brewster County. Named from Hannold Hill on the Big Bend Park road in south-central Tornillo Flat.

Hans Grieve Formation

Pliocene-Pleistocene: West-central California.

D. B. Flynn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, p. 29. A Term used by Stanford Geological Survey (1956, unpub. rept.) to designate nonmarine Plio-Pleistocene beds in southeastern portion of San Benito-Waltham Canyon trough. Beds reach maximum thickness of 2,000 feet in Priest Valley.

R. L. Rose and I. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Ann. Spring Field Trip, p. 44. Unconformably overlying Etchegoin formation is sequence of strata herein informally designated Hans Grieve formation. Thickness 1,200 feet in east-central part of Priest Valley quadrangle.

Named for Hans Grieve Canyon in northwestern part of Preist Valley quadrangle.

Happy Camp Formation

Silurian: Northeastern Nevada.

J. W. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 4, p. 443 (fig. 2), 446—447, pl. 1. Name proposed for thin formation of limestone and bedded black chert which lies conformably above Hanson Creek formation and disconformably below Taylor Canyon formation (new); in some areas underlies Waterpipe Canyon Formation (new). Included in Burns Creek and Smith Creek sequences. Best section in Smith Creek sequence is in Thomas Jose Canyon. Here lower member is 108 feet of medium-light-gray calcislitite and calcilutite which weathers light gray; upper member is 65 feet of alternating thinly bedded black chert and gray calcisiltite in equal amounts. Best section of formation in Burns Creek sequence is type section. Lower member is 108 feet thick and upper member is 37 feet thick.

Type section: In bluffs of lower Mill Creek. Named for Happy Camp, a broad valley in Seetoya Mountains, east of Tuscarora, Elko County.

Happy Creek Volcanic Series

Happy Creek Group

Permian or older: Northwestern Nevada.

C. R. Willden, 1961, Dissert. Abs., v. 21, no. 9, p. 2677. Discussion of geology of Jackson Mountains. Oldest rocks in range are the Permian and older(?) volcanic rocks of Happy Creek volcanic series, which make up most of northern half of range. In a few places the Happy Creek volcanic series grades upward into undivided Permian and Triassic rocks, which consist of interbedded clastic sedimentary rocks and basic volcanic rocks, with some shaly and siliceous limestone. The Happy Creek also overlain by unnamed predominantly limestone unit of Triassic age. A phyllite and slate unit of probable Triassic age is in fault contact with the Permian and Triassic undivided rocks. At several localities the Happy Creek volcanic rocks are overlain by early Cretaceous King Lear formation or Tertiary Pansy Lee conglomerate, which are the two units of chief importance in dating the Cretaceous and early Tertiary orogenic events. Most extensive tectonic feature of Jackson Mountains is Deer Creek thrust which has brought Happy Creek volcanic series over King Lear and Pansy Lee formations.

Ronald Willden, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—116—C—120. Lower-plate rocks of Quinn River thrust in Kings River Range are part of mildly metamorphosed Happy Creek volcanic series of Permian or older age that is widely exposed in western Humboldt County. In Jackson Mountains the Happy Creek volcanic series is conformably overlain by sequence of interbedded graywacke, intermediate and mafic volcanic rocks, phyllite, pebble conglomerate, and some silty and sandy limestone. Permian fossils have beeen collected from this sequence. In Pine Forest Range, the Happy Creek is overlain by carbonate-clastic unit about 1,000 feet thick. Fossils found in lowermost limestone of this unit indicate an early Mesozoic age.

Ronald Willden, 1963, U.S. Geol. Survey Bull. 1141—D, p. D8—D11, pl. 1. Predominantly volcanics but graywackes present in places associated with tuffs. A tuff and breccia unit probably more than 1,500 feet thick present within formation along Happy Creek and on King Lear Peak. At both localities the tuff and breccia unit is part of upper plate of an extensive thrust, so that exact stratigraphic position is not known. Thickness unknown because base is not exposed and internal stratigraphy poorly known. Thickness of about 20,000 feet not unreasonable and is required by outcrop widths unless formation is tightly folded or much repeated by-faults. Grades upward into unnamed unit assigned a Permian and Triassic age. Underlies King Lear formation, or Pansy Lee conglomerate.

Ronald Willden, 1964, Nevada Bur. Mines Bull. 59, p. 34–36, 37 (fig. 3), pl. 1. Happy Creek Group is new formation consisting mainly of intermediate to basic volcanic rocks herein named for exposures along Happy Creek in Jackson Mountains. Happy Creek volcanic group is composed of massive aphanitic or porphyritic volcanic flows and flow-breccias, agglomerates, tuffs, and at a few localities, graywackes and volcanic debris sandstone.

J. D. Smith, 2d, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 236. Happy Creek volcanic series in Pine Forest Range, Humboldt County, includes Dyke Canyon member (new).

Named for exposures along Happy Creek in northern part of Jackson Mountains, Humboldt County. Also present in south end of Kings River Range and in Pine Thrust Range.

Happy Valley Quartz Monzonite

Jurassic: Southeastern Arizona.

C. H. Miles, 1966, Dissert. Abs., v. 26, no. 10, p. 5977. Term applied to exposures of granitic igneous rocks which form floor of Happy Valley, on east side of Rincon Mountains. Unit is light pink and medium to coarse grained. Weathers to low rolling terrain.

Lecheguilla Peak area is 30 miles due east of Tucson, and includes secs. 7, 8, 17, and 18, T. 14 S., R. 19 E., Cochise County.

Hardwood Mountain Formation

Upper Silurian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111–E, p. 156 (fig. 16), 170, 180–181. A hetrogeneous assemblage of fine- to medium-grained quartz- and feldspar-rich calcareous clastic rocks, with some impure limestone. Thickness as much as 3,000 feet, top deeply eroded. No complete, well-exposed uninterrupted section known. Overlies basement complex, relations not directly observed. Underlies Seboomook formation and Hobbstown formation (new).

Type area: One mile southwest of Hardwood Mountain, Hobbstown Township (Spencer quadrangle), Somerset County.

Harkless Formation

Lower Cambrian: East-central California and western Nevada.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 142, 143. Over much of area especially from type section northward and northwestward the Harkless is predominantly gray-green shale and thin-bedded to platy fine-grained quartzitic sandstone and siltstone. From type section southward to Waucoba Spring area formation contains massive vitreous quartzite (with *Scolithus*) interbedded in shale and quartzite becomes dominant. Locally contains thin beds of pisolitic limestone and archeocyathid limestone in basal portion. Thickness 2,000 feet. Overlies Poleta Formation (new); underlies Saline Valley Formation (new). Term Harkless sandstone was first used by Resser and Bridge (*in* Reeside, 1933, 16th Internat. Geol. Cong. U.S. Guidebook 29, pl. 1) and labeled Middle Cambrian. It appears that they included essentially what is here called Harkless except for its basal part, and that they followed Kirk (*in* Knopf, U.S. Geol. Survey Prof. Paper 110) who believed the beds to be Middle Cambrian. Harkless sandstone of Resser and Bridge was not described and its upper and lower limits not specified; it is not valid formation.

J. P. Albers and J. H. Stewart, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D24—D27. Geographically extended into Esmeralda County, Nev., where it is about 3,000 feet thick; overlies Poleta Formation and underlies Mule Spring Limestone.

J. H. Stewart, 1966, U.S. Geol. Survey Prof. Paper 550—C, p. C72. Correlation of Lower Cambrian and some Precambrian strata in southern Great Basin, California and Nevada. Harkless Formation (Nelson, 1962) consists of grayish-olive siltstone interlayered with fine- to coarse-grained quartzite tongue of Zabriskie Quartzite. The amount of quartzite tongues (tongues of Zabriskie) in Harkless and Saline Valley Formations decreases to north in White-Inyo Mountains area, and the Harkless and Saline Valley Formations may be almost entirely siltstone in northwest part of White-Inyo Mountains region.

Named for exposures on divide south of Harkless Flat in southern half of Waucoba Mountain quadrangle, Inyo Mountains.

Harrington Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 600, pl. 1. Very thin bedded gray to black argillaceous lutites and thin almost black cherts are abundant rock types; quartzose siltite and dark-gray limestone beds less common. Complexly folded. Maximum thickness about 450 feet. Overlies Mikes Creek Member (new); lower boundary, in valley three-quarters of mile north of Dorsey Creek-Jack Creek junction, is taken as base of the only volcanic unit; it is locally absent and is about 100 feet thick. Underlies Cap Winn Member (new).

Well exposed in hills along Jack Creek in Bull Run quadrangle, Elko County. Name taken from Harrington Creek, 2 miles west of above mentioned exposure.

Harrisonian Age

Miocene: Western North America.

R. W. Wilson, 1960, Kansas Univ. Paleont. Contr., Vertebrata, art. 7. p. 1—92. Harrisonian, Marslandian, Sheepcreekian, and Mascallian Ages named on chart showing suggested stratigraphic correlation of some North American and European fossil faunas. The Harrisonian is placed above the Whitneyan. The Harrisonian and Marslandian are equivalent to the Arikareean.

M. C. McKenna, 1965, Am. Mus. Novitates, no. 2228, 21 p. Wilson (1960) introduced without definition the time terms Harrisonian, Marslandian, Sheepcreekian, and Mascallian and redefined the Arikareean and Hemingfordian Land-Mammal Ages by moving the boundary between those two time units to include in the Arikareean "Quarry A" in northeastern [Martin Canyon area of Logan County] Colorado and certain related deposits. Wilson did not refer anything to the Arikaree (rock unit) but extended the Arikareean (a time unit) to apply to the younger sediments. However, Wilson's proposal is unacceptable because the geochron of the Marsland Formation (="Upper Harrison beds" of Peterson, 1906) is part of the original basis of the Hemingfordian Land-Mammal Age.

Harrison Formation is exposed in vicinity of Harrison, Sioux County, Nebr.

Harris Ranch Monzonite

Jurassic-Cretaceous: Southern Arizona.

P. E. Damon and others, 1965, Arizona Univ. Geochronology Labs. Ann. Prog. Rept. No. C00—689—50 to Research Div. U.S. Atom. Energy Comm., p. 29, 30 (table 16). A monzonite border phase of a granodioritic to quartz monzonitic pluton that intrudes a section of volcanic rocks mapped as Mesozoic on state geologic map. The age of the Harris Ranch lithology is not definitely established by this study. Samples of the whole rock, plagioclase, and orthoclase have been analyzed. Results indicate an age of 154 ± 25 m.y.

West side of Sierrita Mountains in Tascuela Canyon, Pima County. Samples collected in vicinity of old Harris Ranch homestead.

Harsin Ranch Formation (in Clover Creek Group)

Permian: Northeastern Oregon.

H. J. Prostka, 1962, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. GMS 1. Clover Creek Greenstone is to be raised to group rank and subdivided into two formations, Harsin Ranch and Tucker Creek of Permian and upper Triassic ages respectively. Names and classification credited to Koch and Bowen (written commun., 1962,).

Type locality and derivation of name not stated.

Hart Creek Fanglomerate

Pleistocene, middle: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. An alluvial fan covering southern shore of lake in which Montini Formation (new) was deposited.

Present in Oreana quadrangle in foothill country of Owyhee Mountains and southern margin of western Snake River Plain.

Hartington Till

Pleistocene, upper: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 42—43, 63—64. Yellowish-brown to olive-gray boulder clay in upper part grading to medium-dark gray in lower part. Silty to sandy and pebbly. Moderately calcareous throughout. Includes a 0.2-foot-thick sandy silt separation or block 14.7 feet below top. Thickness 20.8 feet at type locality. Overlies Sappa Formation; underlies Bignell Formation. Fluviatile deposits in periglacial region that are believed to be equivalent to Hartington Till are designated Peoria Formation.

Type locality: Ground Water Survey Test Hole A31—1—13ccc drilled near Tip-Top School, 2 miles north of Hartington (271 feet east of SW cor. sec. 13, T. 31 N., R. 1 E., Cedar County). Ground level elevation at test hold site, 1,534 feet.

Hartland Formation

[Devonian]: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Geology of Pittsfield quadrangle. Five formations tentatively described from region. From southeast to northwest they are: Vassalboro, Waterville, Dexter, and Hartland. No structural or bedding criteria have been found which would allow for determination of tops and bottoms of beds. Hence it is possible that these formations are merely repetitions of perhaps no more than two distinct rock units which would have formational status. Massive quartzites of Dexter, Hartland, and Ripley formations may represent one and the same unit through isoclinal folding. Indian Pond Limestone situated between the Dexter and Hartland formations as well as calcareous units of the Palmer Hill member and the Ripley formation may represent one and the same rock unit which may be repeated by folding.

Pittsfield quadrangle is within the northeastern portion of the New England Upland in Central Maine.

Hartsel Formation

Pliocene and Pleistocene: Central Colorado.

Efraim Lozano, 1967, Mountain Geologist, v. 4, no. 4, p. 119—126. Lower part of formation composed of gray, brown, and red feldspathic, tuffaceous conglomerates. Upper part consists of buff, brown feldspathic, tuffaceous medium- to coarse-grained sandstone. Thickness about 200 feet. Younger than Denver and Antero beds. No type section designated. Unit has been mapped as Maroon Formation, Garo Sandstone, and Morrison Formation.

Well exposed in E½ sec. 31, and W½ sec. 32. T. 11 S., R. 75 W., and W½ sec. 5, T. 12 S., R. 75 W., central South Park, Colo. Named for town of Hartsel.

Hatcher Member (of De Forest Formation)

Quaternary: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, and G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 5, p. 473—487. Yellowish-brown silt loam with abundant grayish-brown mottles; massive, calcareous. Thickness 3 to 28 feet. Disconformably overlies Watkins member (new). Underlies Mullenix member (new) in most parts of Thompson Creek, Fox Branch, and Turton Branches trenches. Crops out at surface as terrace 10 to 15 feet above younger alluvium in south side of Thompson Creek valley and in tributary stream valleys that flow from north to south. Deposition of member took place from 2020 B. P. to slightly more than 1800 B. P.

Type section: Thompson Creek, 100 yards east of country road between secs. 13 and 14, in SW¼ sec. 13, T. 80 N., R. 43 W., Harrison County. Named after Hatcher Branch where it is well exposed in trench of branch.

Hatfield Sandstone Member (of Mesaverde Formation)

Upper Cretaceous: South-central Wyoming.

L. A. Hale, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 131 (fig. 1), 132 (fig. 2), 134. A prominent white cliff-forming sandstone that marks boundary between upper coal-bearing facies of Mesaverde formation and underlying marine sequence of Espy tongue (new) of Steele shale. In Espy Ranch section, the sandstone is thin bedded to shaly at base, where it is gradational with Espy shale, and grades upward into thick-bedded to massive light-gray to white sandstones at top. The white cap is commonly overlain by lowest coaly zone of the Mesaverde and locally carries an oyster coquina. Thickness about 170 feet.

Typical exposure: On flanks of Hatfield anticline south of Rawlins, Carbon County.

Hawk Shale

Upper Jurassic (Tithonian) to Lower Cretaceous (Valanginian): Central California.

F. A. Schilling, Jr., 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Thickness 300 feet. In fault contact with the Franciscan. Underlies Panoche Group, probable unconformity.

Pacheco Pass quadrangle.

Hawks Nest Formation

Devonian: Southeastern New York.

F. W. Fletcher, 1962, New York State Geol. Assoc. Guidebook 34th Ann. Mtg., p. D—3, pl. 4. A section of gray sandstones and shales which, in southeastern New York, lies beneath the Oneonta Formation, is defined as the Hawks Nest Formation. This 800-foot sequence of strata is probably correlative with Unadilla Sandstone of Oneonta region. Name Delaware River Flags discarded and Oneonta redefined.

Named for exposures on high cliffs at Hawks Nest.

Hayden Canyon Formation

Permian: Eastern Nevada.

George McJannet, map ed., 1960, Intermountain Assoc. Petroleum Geologists Guidebook 11th Ann. Field Conf., map explanation, p. 2, 4. Named on map explanation of sedimentary rocks. Placed above Ely limestone and below "Rib Hill" formation. Sources of data credit Nahama (unpub. thesis) with mapping northeast quarter of Treasure Hill quadrangle, Nevada, the area where formation occurs.

H. J. Bissell, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 5, p. 587, 588. Nahama (1961, unpub. thesis) proposed name "Hayden Canyon Formation" for essentially what Steele (1960) had proposed Riepe Spring Limestone. Latter name is now applied by most stratigraphers in area. Nahama designated type locality and measured 480 feet of limestones above Ely Limestone and below Rib Hill Sandstone, assigning Wolfcampian age to sequence.

Type locality: Sec. 32, T. 16 N., R. 59 E., White Pine County.

Hayes Butte Basalt

Pliocene, upper: South-central Oregon.

E. R. Hampton, 1964, U.S. Geol. Survey Prof. Paper 383—B, p. B5 (fig. 4), B11—B12, pl. 1. Light to dark gray on fresh surfaces and reddish brown to dark-gray brown on weathered surfaces. Texture of rocks ranges from diktytaxitic lava and open frothy scoria to dense glassy ropy lava. Basalt flows range in thickness from about 10 to 30 feet. Thickness, measured from Hayes Butte, exceeds 1,300 feet. At most exposures unit occurs as one or two basalt flows, whose combined thickness does not exceed 100 feet. Number of flows and, thus, the thickness increases west of Hayes Butte. Unconformably overlies Fort Rock Formation (new) and older volcanic rocks. Unconformably underlies Peyerl Tuff and Paulina Basalt (both new) and, locally, some of younger units.

Type locality: Hayes Butte and its lava field to the south, in T. 27 S., R. 15 E., and northern T. 28 S., R. 15 E., Lake County.

Hayesville Till

Pleistocene (Wisconsin): Northeast-central Ohio.

G. W. White, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—72, C—73. Silty, sparingly to moderately pebbly with a few cobbles and boulders. Dark brown where oxidized and contrasts with light-yellow-brown or olive-brown color of older tills. Thickness 7 feet. At many places unconformably overlies sand and gravel or Navarre till (new). Where Navarre is missing, overlies Millbrook till (new). A deposit of Killbuck glacial lobe and correlated with Lavery till of Grand River lobe.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. Centerbury till (new), a deposit of Scioto glacial lobe, correlates with Hayesville till.

R. M. DeLong and G. W. White, 1963, Ohio Geol. Survey Bull. 61. p. 146—147. In western Stark County, Hayesville Till forms a thin and discontinuous mantle over Navarre Till in Lawrence Township (except northeast corner), and in Tuscarawas, southwestern Jackson, western Perry, and northwestern Bethlehem Townships. Commonly less than 10 feet thick, in many places less than 5 feet.

Crops out in roadcuts 1 mile south of Hayesville, Ashland County, for several miles along an east-west road, 2 miles north of Hayesville, and at crossroad 2½ miles south southeast of Hayesville. Also present in Stark, Medina, Wayne, and Richland Counties.

Haystack Creek Gneiss

Paleozoic(?): Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordilleran in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 112. In contrast to Shuksan Suite, the Skagit Metamorphic Suite contains a variety of metamorphosed intrusives. Metamorphosed acidic intrusives comprise predominantly trondhjemitic orthogneiss, including a larger elongate stock, the Marble Creek Orthogneiss (new), small bodies of leucotrondhjemitic orthogneiss, and thin sills or dikes of usually gneissose, trondhjemitic metaporphyries. A larger elongate stock of leucotrondhjemitic gneiss, Haystack Creek Gneiss (new), was intruded in a crystalline state during a fairly late stage of metamorphism. Another semicondordant leucotrondhjemite body, Alma Creek Leucotrondhjemite (new) was intruded near end of the metamorphism; it is igneous but shows incipient adjustment to the facies of the surrounding schist.

Type locality and derivation of name not stated. Haystack Mountain is in Skagit County.

Hazel Green Volcanics

Upper Cambrian: Southwestern Missouri (subsurface).

F. G. Snyder and P. E. Gerdemann, 1965, Am. Jour. Sci., v. 263, no. 6, p. 465—493. Discussion of explosive igneous activity along an Illinois-Missouri-Kansas axis. The volcanic episode is indicated in an unusual section of Lamotte sandstone in drill core. Section has normal stratigraphic sequence from Gasconade formation to lower part of the Lamotte. First appearance of volcanic material is 44 feet above base of Lamotte. [See Furnace Creek Volcanics.]

Occurs north of Hazel Green, Laclede County.

Hazens Notch Formation (in Camels Hump Group)

Cambrian(?) and Lower Cambrian: Vermont.

R. A. Cristman and D. T. Secor, Jr., 1961, Vermont Geol. Survey Bull. 15, p. 36—38, pl. 1. Name suggested for unit of graphitic rocks near top of group. At type locality, characterized by graphitic rhyollite and schist and interbedded dark-colored quartzite. Overlies Mount Abraham schist; underlies Pinney Hollow formation. Northward in Camels Hump quadrangle, Mount Abraham schist and Pinney Hollow formation die out and Hazens Notch overlies Underhill formation (new) and underlies Ottaqueche formation. Largest areal extent in Camels Hump quadrangle is on eastern side of Green Mountain anticlinorium where it forms outcrop belt about 3 miles wide. Cambrian. Name credited to Cady.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. As mapped includes Belvidere Mountain amphibolite member and three unnamed units of varying lithologies.

W. M. Cady, A. L. Albee, and J. F. Murphy, 1962, U.S. Geol. Survey Geol. Quad. Map GQ—164. In Lincoln Mountain quadrangle, underlies Pinney Hollow formation and overlies Mount Abraham scist and Underhill formation.

W. M. Cady, A. L. Albee, and A. H. Chidester, 1963, U.S. Geol. Survey Bull. 1122-B, p. B-11—B-13, pl. 1, table 1. Formal proposal of name. Chiefly interbedded carbonaceous and noncarbonaceous quartz-sericite-chlorite schist, which grades imperceptibly into less abundant gneiss of similar composition and quartzite. Amphibolite occurs as interbedded tabular bodies, mostly within the schist and gneiss. Characteristic section exposed along or near Highway 105—A across Green Mountains in towns of Troy and Jay. Lowest rocks in this section are at axis of Green Mountain anticlinorium in town of Jay, and uppermost are near highway from Troy to North Troy, 6 miles to east. Apparent thickness of exposed part of formation about 15,000 feet. Extends southward along strike into Camels Hump group in Hyde Park quadrangle where it makes up most of its unit. There it is composed of carbonaceous and noncarbonaceous quartz-sericite-albite-chlorite gneiss, and schist in which albite is porphyroblastic; and also carbonaceous schist and quartzite, which are interbedded with noncarbonaceous schist and dark massive quartzite. North of international boundary, rocks extend along strike into terrane chiefly of quartz-sericite-albite-chlorite schist and interbedded carbonaceous zones, greenstone, and quartzite variously referred to in Canada as Sutton schists, Sutton group, and schists of Caldwell group. Underlies Jay Peak formation. Base of section in area. Cambrian(?) and Lower Cambrian.

Type locality: Hazens Notch in eastern part of Jay Peak quadrangle.

Headlight Bed (in Red Lion Formation)

Upper Cambrian: Southwestern Montana.

W. C. Prinz, 1967, U.S. Geol. Survey Bull. 1237, p. 10 (table 1), 11. Uppermost 2 to 8 feet of the Red Lion is nearly pure marble. It is locally known as Headlight bed. It is similar to marble in the Hasmark Formation.

Present in Philipsburg district, Granite County.

Hebron Member (of Golden Valley Formation)

Paleocene, upper, to Eocene, lower: Western North Dakota.

L. J. Hickey, 1967, Dissert. Abs., v. 28, no. 2, sec. B, p. 742. Forms lower 20 to 40 feet of formation with Dickinson member (new) making up remainder. The Hebron is dominantly kaolinitic clays and silts. Upper part of member is usually a carbonaceous shale or silt capped by an extensive marker bed known as Alamo Bluff lignite or its lateral equivalent Taylor bed.

Williston Basin, western North Dakota.

Heimdal Drift

Pleistocene: East-central North Dakota.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44, p. 38—39. Consists of till of Heimdal end moraine and other associated drift that was deposited by Heimdal ice. Drifts of Heimdal and McHenry end moraines apparently deposited simultaneously.

Named for town of Heimdal in northern Wells County. Exposed over northwestern corner of Eddy County, northern part of Wells County, and southern and western parts of Benson County.

Helechal Tuff Member (of Robles Formation)

Upper Cretaceous (Cenomanian): East-central Puerto Rico.

Guillermo Otalora, 1961, Dissert. Abs., v. 22, no. 5, p. 1583. Uppermost member of formation. Overlies Lapa andesite member.

Guillermo Otalora, 1964, Am. Jour. Sci., v. 262, no. 6, p. 726—734. Discussion of zeolites and related minerals in Cretaceous rocks of east-central Puerto Rico. Uppermost member of Robles. Overlies Lapa Andesite Member. Contains rare analcime, abundant albite, chlorite, calcite, and quartz.

In Barranquitas quadrangle.

Helena Canyon Member (of Manitou Limestone)

Ordovician: Southeastern Colorado.

L. C. Gerhard, 1966, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 11, p. 2264. In Canon City area, Manitou Limestone divided into three members (ascending): Helena Canyon, cherty member, and massive member. Consists in most places of about 10 feet of massive pink dolomite weathering to brick red. Contains no chert and is easily separated from overlying chert beds. Basal contact is regolithic on Precambrian rocks, although the zone of weathering is very thin and the contact almost planar in some localities. A basal conglomerate of subangular to rounded cobble-size quartz fragments in a limestone matrix present in some places.

Type section: Exposed in Helena Canyon along the Shelf Road to Cripple Creek, sec. 22, T. 16 S., R. 70 W.

Hell Hole Conglomerate

Tertiary, middle or upper: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 8 (table), 97—100, pl. 1. Well-indurated buff conglomerate, locally strongly deformed, along northeast flank of Galiuro Mountains. Composed mainly of volcanic debris; includes few beds of tuff and ash. Total thickness not known, as upper limit could nowhere be determined closely. Maximum thickness about 2,000 feet. Unconformably overlies Galiuro Volcanics (new) and Horse Mountain Volcanics (new). In some places unconformity on Galiuro Volcanics is markedly angular.

Named for Hell Hole, in lower reaches of old Deer Creek, where more than 400 feet of conglomerate is well exposed. Belt of outcrop is 5 to 6 miles wide. Conglomerate underlies broad belt along east flank of Galiuro Mountains, extending from about a mile south of north edge of Klondyke quadrangle to about a mile southeast of Fourmile Canyon. About 50 square miles, or 20 percent of quadrangle, is underlain by this conglomerate.

Hells Bells Canyon Formation

Oligocene(?): Southeastern Nevada.

Abraham Dolgoff, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 878—885, pl. 1, app. Pahranagat area volcanic sequence consists of over 3,000 feet of widespread distinctive rhyodacitic ignimbrites interbedded with Miocene sediments and locally capped by basalts. Sequence divided into (ascending): Hells Bells Canyon Formation, Hiko Tuff, Alamo Range Formation, and Badger Valley Basalts. Entire section rests with angular unconformity on Paleozoic rocks. Hells Bells Canyon Formation is most varied of the groups in composition and thickness. Six lithologic subunits of unequal distribution and thickness recognized: conglomerate, basal ignimbrite, water-laid tuff, limestone, welded tuffs, and semiconsolidated tuffs. From thicknesses of 800 to 1,000 feet in west-central Pahranagat Range, formation decreases to 0 feet in central part of the range, 400 feet in canyons cutting east front of range, 0 to 100 feet along east side of Pahranagat Valley, less than 300 feet in northeastern Hiko Range, 1,000 feet or more in Pahroc Range. Entire Hells Bells Canyon section not present in any one place.

Type section: North-central part of T. 7 S., R. 60 E., about 5 miles northwest of Alamo, Lincoln County. Named for Hells Bells Canyon.

Helmer Claystone Bed (in Van Bibber Shale Member of South Platte Formation)

Cretaceous: Northeastern Colorado.

K. M. Waagé, 1961, U.S. Geol. Survey Bull. 1102, p. 27 (fig. 6), 31. Dove-colored claystone in upper part of member.

In Helmer mine, Douglas County.

Helpmejack Stade

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1983. Third of four stades in Siruk Glaciation (new). Preceded by Chebanika Stade and followed by Iniakuk Stade. During the stade, ice stagnated in lower Alatna Valley, and massive bodies of ice-contact stratified drift were deposited 8 to 15 miles south of Brooks Range.

Glaciation occurred in Alatna Valley which originates near north flank of the central Brooks Range and extends southeast through this mountain belt into the Koyukuk lowlands.

Helvetia Formation

Pliocene: Northwestern Oregon.

H. G. Schlicker and R. J. Deacon, 1967, Oregon Dept. Geology and Mineral Resources Bull. 60, p. 21—22. Reddish-brown, pebbly silty sand, sandy silt, and clayey silt. Exposed thickness about 25 feet in vicinity of Helvetia. Water-well logs show about 75 feet. Overlies Columbia River Basalt. Overlain by Willamette Silt. Subsurface data show the Helvetia may be overlain by Troutdale Formation.

Type locality: Just north of community of Helvetia in sec. 3, T. 1 N., R. 2 W., Tualatin Valley region.

Henderson Canyon Complex

Pre-middle Cretaceous: Southern California.

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, p. 722 (table 1), pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with the configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features on which correlations are based. Henderson Canyon complex is one of six complexes used in these correlations. Several plutons and sills also listed and mapped.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Hensley Member (of Lee Formation)

Pennsylvanian: Southeastern Kentucky.

K. J. Englund, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B30—B38. Name applied to nonresistant beds of the Lee that lie between top of Middlesboro Member (new) and base of Bee Rock Sandstone Member and have been referred to as sandstone and shale member D (Englund and others, 1963). Consists mostly of shale in lower, middle, and upper parts with very fine to medium-grained thin- to thick-bedded sandstones in between. Contains Tunnel coal bed near top. Thickness 320 to 400 feet. Basal contact conformable and placed where conglomeratic quartzose sandstone of Middlesboro Member is succeeded by shale and thin-bedded nonconglomeratic sandstone.

Type section: Exposed along Skyland Road and U.S. Highway 25E on northwest side of Cumberland Gap. Named from Hensley Flats, an upland area between crests of Brush and Cumberland Mountains.

Hepburns Mesa Basalt

Pleistocene(?): Southwestern Montana.

R. K. Ward and K. E. Wier, 1962, Michigan Acad. Sci., Arts, and Letters Papers, v. 47, p. 29—35. Name applied to basalt that caps mesa. Exposed thickness 80 feet. Average thickness about 30 feet. Overlies unnamed gravel. Post-Miocene and pre-Wisconsin.

Hepburn's Mesa is in Yellowstone River valley in Park County, Mont., about 20 miles north of north entrance to Yellowstone National Park.

Hewitt Drift, Till

Pleistocene: Eastern Minnesota.

H. E. Wright, Jr., 1964, Friends of the Pleistocene, Midwest Sec., [Guidebook] 15th Ann. Field Conf., p. 3, 0. Names applied to drift and till in Hewitt phase of Wadena lobe of Wisconsin glaciation.

Named from till exposed in drumlin on U.S. Highway 210, 1 mile east of Hewitt, Todd County.

Hickory Corners Limestone Member (of Reynales Limestone)

Silurian: Western New York, and Ontario, Canada.

W. J. Kilgour, 1963, Geol. Soc. America Bull., v. 74, no. 9, p. 1127—1142. Coarse to medium crystalline, argillaceous, highly siliceous, fossiliferous limestone. Thickness 9 feet at type locality; 4¼ feet at Niagara Gorge. At type locality overlies Neahga Shale and underlies Rockway Dolomite Member (new) of Irondequoit Formation. In Lockport area where both Neahga Shale and Thorold Sandstone are absent the Hickory Corners is in direct contact with Grimsby Sandstone. Beds equivalent to Hickory Corners have been recognized as far east as Genesee Gorge, but it is believed best to use names already in use in Genesee area when referring to this part of Reynales Formation. In this area the lower part includes a representative of Furnaceville Iron Ore with the part below the ore named Brewer Dock Limestone (Sanford, 1935). This name [Hickory Corners] should be used only where the Brewer Dock is separated from overlying limestone by the Furnaceville. Upper limit of Hickory Corners equivalent in Rochester area occurs within Fisher's (1960) Wallington and is drawn at base of a "crowded" *Pentamerus* layer 12 to 15 feet above the Furnaceville. Thus in Rochester area, Hickory Corners equivalent consists of the Brewer Dock, Furnaceville, and lower part of Wallington with upper contact marked by conglomerate in base of upper part of Wallington.

Type locality: On Budd Road, 1.4 miles west of Hickory Corners, Niagara County, N.Y.

Hico Shale (in Cotton Valley Group)

Upper Jurassic: Northern Louisiana (subsurface).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 149. Dark-gray shale wedge overlying and laterally equivalent to Terryville Sandstone (new). The five sandstone tongues of the Terryville pinch out within the Hico. Base of formation is progressively older to north. Top of formation is essentially a time-stratigraphic surface at base of Knowles Limestone (new). Grades northward into red beds of Schuler Formation. Occurs between depths of 8,130 and 9,330 feet in type well.

W. A. Thomas and C. J. Mann, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 178—182. Underlies Knowles Limestone. Consists mainly of dark-gray shale but contains a few thin beds of silty limestone, siltstone, and sandstone. Locally, thin beds of carbonaceous and pyritiferous sandstone and shale are common. Grades northward into redbeds of Schuler Formation. Toward south, thins pinches out between Knowles Limestone and underlying, regressive, massive Terryville Sandstone, which ascends in the section toward the south. Both upper and lower contacts of Hico are gradational.

Type well: Southwest Gas Producing Co., J. H. Peterson No. 1—V—10, NE¼NE¼, sec. 25, T. 20 N., R. 4 W., Lincoln Parish. Name derived from Hico Field.

High Falls Granite

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1961, Dissert. Abs., v. 21, no. 11, p. 3421. Youngest rocks in McCaslin district are the intrusive High Falls and Belongia (new) Granites. High Falls is in contact with McCaslin formation (new) in several places. A well-developed metamorphic aureole related to High Falls granite can be traced by progressive metamorphic changes in Hager (new), McCaslin, and Waupee (new) formations. Dominant structure in district is McCaslin syncline which trends approximately east-west. Trough opens to west and appears to close east but is disrupted by intrusive High Falls granite.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. Mancuso (1957, 1960, unpub. theses) established following succession: Waupee Volcanics (oldest), Macauley Granite, Baldwin Granite and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite, and High Falls Granite. Significant contribution of this study was demônstration of two distinct ages of granitic intrusion: the McCaslin Quartzite lies nonconformably on Macauley Granite and is intruded by High Falls Granite. Major structure recognized by Mancuso is syncline (outlined by quartzite) plunging to west, which was intruded to north and northeast by High Falls Granite and to south by Belongia Granite.

Highland Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies G. C. limestone member and underlies St. Joe limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

Hiko Tuff

Hiko Tuff Member (of Page Ranch Formation)

Miocene: Southeastern Nevada and western Utah.

Abraham Dolgoff, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 879 (fig. 1), 885—888, pl. 1, app. Dacitic crystal-vitric welded tuff, basal ash, pseudogranitic texture, bouldery outcrop pattern, largely one cooling unit. Thickness 450 to 1,000 feet; thickens to east and thins to southwest. Conformably overlies Hells Bells Canyon Formation (new); conformably underlies Alamo Range Formation (new); where former is absent, the tuff rests directly on Paleozoic rocks. Dolgoff (1960, unpub. thesis) originally designated Hiko Tuff as Curtis Canyon ignimbrite. Term "Curtis Canyon ignimbrite" now dropped in favor of Hiko Tuff (a name proposed by E. F. Cook, 1960, ms) because Cook has recognized Hiko Tuff as mappable unit in large parts of eastern Nevada and western Utah, outside of Pahranagat area.

E. F. Cook, 1965, Nevada, Bur. Mines Rept. 11, p. 27—28. Formal proposal of name. In Nevada, stratigraphic position of Kane Point Tuff Member of Page Ranch is occupied by unit here named Hiko Tuff. In type locality, Hiko Tuff is single, extraordinarily thick, crystal-vitric to crystal ignimbrite. Thickness of complete unit ranges from 213 to 1,135 feet; if correlation with Racer Canyon Tuff of Blank (1959, unpub. thesis) is correct, unit reaches 1,500 feet in Bull Valley district. In southeastern Nevada overlies Harmony Hills Tuff. Kane Wash Formation in its type section includes all rock units above the Hiko.

Type section: On east side of Hiko (or Hyco) Range about 6 miles south of U.S. Highway 93, in sec. 3, T. 5 S., R. 62 E., Lincoln County.

Hilgard Glaciation

Recent: Central California.

J. H. Birman, 1964, Geol. Soc. America Spec. Paper 75, p. 28 (table 5), 46—51, pl. 1. Hilgard glaciation recognized by recessional moraine arcs and short lateral moraines; scattered boulders on bare bedrock. Younger than Tioga glaciation and older than Recess Peak glaciation, Hilgard glaciation was short in time.

Type area: One and one-half miles downstream from Rock Creek Lake, Inyo County. Area of best development is in Rock Creek and upper Mono Creek near 9,000-foot elevation (main valleys). Mount Hilgard is near Sierra Crest in Fresno County.

Hillard Limestone

Lower Cambrian to Lower Ordovician: East-central Alaska.

E. E. Brabb, 1967, U.S. Geol. Survey Prof. Paper 559—A, p. A9—A15. A resistant fossiliferous limestone that forms crags and escarpments in Eagle River section. Characteristic lithology in type area is fine-grained pale-yellowish-brown limestone in beds a fraction of an inch to several feet thick. Limestone edgewise conglomerate common. Shale and limestone boulder conglomerate occur locally. Faults and incomplete exposures make it difficult to determine exact thickness of Hillard but formation seems to reach maximum thickness of about 500 feet in Hillard Peak area. About 400 feet thick along Tatonduk River. About 200 feet thick in vicinity of Adams Peak and Montauk Bluff, and about 100 feet thick along Hard Luck Creek. Overlies Adams Argillite (new). Underlies Road River Formation unconformably.

Type section: On cliffs about 1.6 miles east of Hillard Peak (a newly named mountain between McCann Hill and Yukon River) in NE¼ sec. 3, T. 1 N., R. 33 E., where top and 500-foot thick section of formation are exposed, but base concealed. Supplementary section: On cliff about 1.3 miles north-northeast of Hillard Peak where a 250-foot-thick section is exposed. Formation extends westward from Adams Peak Hillard Peak to Adams Peak area, and extends northward from Adams Peak in a continuous band to Tatonduk River and Montauk Bluff areas.

Hillside Sand

Pleistocene (Wisconsin): Southeastern Minnesota.

H. E. Wright and others, 1965, Internat. Assoc. Quaternary Research 7th Cong., Boulder, Colo., Guidebook Field Conf. C, Upper Mississippi Valley, p. 47 (fig. 6—3), 50 (fig. 6—6), 52. Medium to coarse pebbly sand and pebble gravel, reddish-brown. Underlies Twin Cities Formation (new). Overlies Decorah Shale.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2, (with text), p. 6 (table 2) 8—9. Formal proposal of name. Thickness 25 to 150 feet. Underlain by several types of bedrock and glacial deposits. Overlain by Twin Cities Formation. Contact with Twin Cities varies from sharp to gradational to interlayered. In some places as much as upper 20 feet of the Hillside Sand is highly contorted as if it had been largely plastic at time of deformation. Type section and type area stated. Occurs mostly in subsurface.

Type section: Cut on face of abandoned gravel pit on SW¼NE¼ sec. 18, T. 29 N., R. 23 W., New Brighton quadrangle. Type area: SW¼ of New Brighton quadrangle. Named for Hillside Cemetery in southwestern part of New Brighton quadrangle.

Hilton Creek Marble

Ordovician(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 17—18, pls. 1, 2, 5, 6. Fine-grained light-gray to dark-bluish-gray marble; scattered chert nodules, local beds of dark-gray siliceous hornfels; siliceous calc-hornfels intercalated with marble. Thickness about 1,500 feet at type locality. Lowest exposed formation in McGee Mountain block. Bounded by faults at both top and bottom except near southern end of outcrop where siliceous hornfels appears to lie above marble in normal depositional contact. Intruded by granitic rocks.

Type locality: Along south side of McGee Creek, Mount Morrison quadrangle, Sierra Nevada. Southernmost and largest segment of formation well exposed west of Hilton Creek.

Hindu Canyon Formation

Tertiary: Northwestern Arizona.

Robert Gray, 1964, Arizona Acad. Sci. Jour., v. 3, no. 1, p. 39—42. Consists of interbedded conglomerates, sandstones, and siltstones which interfinger with overlying Buck and Doe Conglomerate (new). Divided into three unnamed members: lower granitic conglomerate, middle limestone conglomerate, and upper siltstone. Lower member about 150 feet thick and upper member as much as 100 feet thick. [No thickness given for middle member.] Overlies Paleozoic limestone.

Type section: Hindu Canyon, secs. 20—25, T. 27 N., R. 12 W., Gila River and Salt River Principal Meridian. Hindu Canyon is a 9-mile long segment cut into the Hualapai Plateau.

Hines Tongue (of Reed Dolomite)

Hines Tongue (of Reed Formation)

Precambrian: East-central California.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 141. A north- and northwest-tapering tongue of quartzite, sandy dolomite, and calcareous sandstone that separates lower and upper unnamed members of Reed Formation south and southeast of type locality of the Reed. Thickness about 800 feet in Waucoba Spring quadrangle; about 50 feet in center of Blanco Mountain quadrangle. Cambrian or Precambrian.

The U.S. Geological Survey currently designates the age of the Hines Tongue of the Reed Dolomite as Precambrian on the basis of a study now in progress.

Named for exposures near Hines Road, Waucoba Mountain quadrangle.

Hinshaw Member (of Hilliard Shale)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 14, 15 (fig. 2). In outcrop area south of Frontier, the upper Hilliard consists of about 850 feet of lenticular sandstones and shales. Section is well-defined marine transitional sequence between homogeneous marine shales of Hilliard below and littoral marine Lazeart Sandstone above. Name Hinshaw is proposed for this member. Northward the Hinshaw changes facies to continental sediments of Adaville.

Typically exposed near Hinshaw Ranch in sec. 22, T. 16 N., R. 118 W., Uinta County.

Hirschdale olivine latite member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Stratigraphic and structural evidence demonstrate that Hirschdale olivine latite is youngest of Lousetown flows in Truckee area. It is younger than Polaris and Bald Mountain members (both new) because Prosser Creek alluvium overlies both of them. Also younger than Dry Lake flows (new) for fault truncates latter flows on west and does not offset Hirschdale farther north. Potassium-argon age determination of this flow gives 1.3 m.y. At least 20 flows recognized in area. Nine flows (or groups of flows) are named and given informal member status in Lousetown Formation.

Named for occurrence near settlement of Hirschdale, Truckee area, north of Lake Tahoe.

Hisle Gravel

Pliocene, lower: Southwestern South Dakota.

W. D. Sevon, 3d, 1961, Dissert. Abs., v. 22, no. 1, p. 231. An early Pliocene channel deposit which was laid down by rapidly moving stream which originated in Black Hills and flowed more or less southeastward across the state. Deposits range in size from sand to boulders.

Town of Hisle is in Washington County.

Hitchcock Volcanics

Triassic: West-central Massachusetts.

G. P. Brophy and others, 1967, New England Intercollegiate Geol. Conf., Guidebook 59th Ann. Mtg., Field Trip D, p. 62 (geol. map), 63, 68. Pyroclastic debris that pre-dates Holyoke Basalt flow.

Mount Hitchcock is near Amherst.

Hitchcock Lake Member (of Waterbury Gneiss)

Hitchcock Lake Member (of Hartland Formation)

Precambrian(?): Southwestern Connecticut.

C. E. Fritts, 1963, U.S. Geol. Survey Geol. Quad Map GQ—200. Composed mainly of feldspathic mica schist, paragneiss, and amphibolite. Probably overlies predominant paragneiss of Waterbury Gneiss stratigraphically, but contact between the two map units is gradational and difficult to map.

R. M. Gates and C. W. Martin, 1967, Connecticut Geol. and Nat. History Survey Quad. Rept. 22, p. 16—22, pl. 1. Reallocated to member status in Hartland Formation. A unit of variable thickness, probably not exceeding 2,000 feet, it crops out extensively in northern third of Waterbury quadrangle [this report]. Overlies unnamed unit I member of Hartland. Underlies The Straits Schist Member. Upper and lower boundaries of Hitchcock Lake Member are gradational and somewhat arbitrarily defined. Hitchcock Lake Member is a strikingly interlayered assemblage of (1) finely streaked, plagioclase-quartz granulites, (2) mica-streaked plagioclase quartz gneiss, and (3) massive gray friable mica-plagioclase quartz granulites. Cambrian or older.

Type locality: On eastern side of broad peninsula near center of Hitchcock Lake, Southington quadrangle.

Hite Cove Formation

Carboniferous: Central California.

O. E. Bowen, 1963, Sacramento Geol. Soc. Guidebook Ann. Field Trip, May 18—19, p. 27, 28, road log map 4. Predominantly metachert with lesser limestone and minor greenstone and mylonite. In fault contact with Briceburg Formation (new). May be equivalent to part of Calaveras Formation.

Hite Cove is in Mariposa County on south fork of Merced River.

Hobart Glaciation, Till

Pleistocene (pre-Wisconsin): Northern California.

P. W. Birkeland, 1964, Jour. Geology, v. 72, no. 6, p. 810—825. Oldest of four glaciations in Lake Tahoe region. Succeeded by Donner Lake glaciation (new). Followed Plio-Pleistocene deformation of Sierra Nevada and subsequent erosion of the valley to about present level. Hobart Till is highly weathered, as shown by depth of oxidation, high clay content, disintegrated granitic boulders, and weathering rinds on volcanic boulders. At type locality is overlain upslope by Tahoe Till. Soils and amount of subsequent erosion indicate that Hobart-Donner Lake interglacial was probably longest of the interglacials.

Type section of till: Ground moraine exposed in Highway 40 Freeway roadcut north end of Truckee, just west of Trout Creek overpass, in south-central part of sec. 10, T. 17 N., R. 16 E. Named for outcrops in roadcuts along Highway 89 west of Hobart Mills and Highway 40 Freeway north of Truckee.

Hobbstown Formation

Upper Silurian to Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16, 174—176, pl. 34. Main part of Hobbstown is mostly interbedded coarse-grained arkose and conglomerate with poorly rounded pebbles and cobbles. In type area includes lower conglomerate member not present elsewhere. Thickness as much as 1,500 feet. Lower conglomerate member as much as 200 feet thick. Overlies Hardwood Mountain formation (new) at some localities and basement complex at others; underlies Seboomook and Tarratine (new) formations. Late Silurian to Early Devonian.

Named from Hobbstown Township (northeast quarter of Spencer quadrangle) between Hardwood and Spencer Mountains.

Hodapp Member (of Calaveras Formation)

Mississippian(?) to Permian(?): Central northern California.

R. S. Creely, 1965, California Div. Mines and Geology Bull. 184, p. 13—14, pls. 1, 2. Proposed for succession of metamorphosed basic rocks in lower part of formation. Consists principally of schistose rocks derived from flows, tuff, and tuff-breccia. Characteristically light-grayish green or dark-bluish green. Thickness about 2,700 feet north of Nelson Bar; about 1,800 feet south of Nelson Bar; at least 1,500 feet in northernmost belt. Both underlain and overlain by slates of undifferentiated Calaveras.

Type locality: Along Hodapp Creek, in secs. 5, 6, T. 21 N., R. 4 E., and along respective canyons of the West Branch (both north and south of Nelson Bar) and Concow Creek, Oroville quadrangle, Butte County. Recognized in three separate belts which trend northwest across northeastern part of quadrangle. Two southernmost belts extend southeastward from beneath Tertiary strata near Nelson Bar and Lime Saddle. Third belt lies along lower part of Deadwood Creek and in hills to southeast.

Hodges Mafic Complex

Middle Paleozoic: Northwestern Connecticut.

R. M. Gates and N. I. Christensen, 1965, Connecticut Geol. Nat. History Survey Quad. Rept. 17, p. 18—30, pl. 1. Consists primarily of hornblende gabbro, a transition gabbro-amphibolite rock, and amphibolite with subordinate hornblendite and altered ultrabasic rock. Includes hornblende gabbro that has been considered part of Brookfield Diorite Gneiss (Gregory, 1906). Similar and probably related to younger mafic intrusives in Mount Prospect Complex (Cameron, 1951). Complex is an octopus-shaped mass, about 1¼ miles wide and 4½ miles long, with "head" occupying crest of a fold and "tentacles" extending into Hartland Formation.

Named for Hodges nickel prospect, West Torrington quadrangle.

Hogan Formation

Middle Pennsylvanian (Desmoinesian): Northeastern Nevada and western Utah.

G. B. Robinson, Jr., 1961, Brigham Young Univ. Geology Studies, v. 8, p. 98 (fig. 2), 101 (fig. 3), 103—104. Consists primarily of thin- to medium-bedded silty to quartzitic platy limestone, calcareous siltstone, calcareous shale, and argillaceous limestone. Interbedded with the sequence are a few siliceous cherty limestone, and fine-crystalline to medium-crystalline and coarse-textured bioclastic limestone beds. Thickness about 750 feet in central Pequop Mountains. Overlies Ely Limestone. Underlies Ferguson Mountain Formation. Steele (1960, Intermountain Assoc. Petroleum Geologists Guidebook 11th Ann. Field Conf.) referred all Pennsylvanian rocks below regional unconformity to Ely Limestone.

H. J. Bissell, 1962, Geol. Soc. America Bull., v. 73, no. 9, p. 1096. In northern part of Confusion Range in T. 14 S., R. 17 W., Juab County, Utah, the Wolfcampian age Ferguson Mountain Formation disconformably overlies Desmoinesian age Hogan Formation.

H. J. Bissell, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 5, p. 569, 573—585. Included in Ely Group. Many examples of stratigraphic studies of Hogan Formation cited to point up a lithologic sequence which can be demonstrated as a mappable entity and which contains diagnostic fusulinid faunas. Some areas are: Rib Hill, Moorman Ranch, Butte Mountains, Pequop Mountains, Gold Hill district, Confusion Range, Cherry Creek Range, Goshute Mountains, Leppy Range, and Conger Spur-Burbank Hills. Studies are incomplete and much detailed mapping as well as stratigraphic, paleontologic, and sedimentologic work must be done to relate formation to subajacent and superjacent strata in Great Basin area.

Type section: In sec. 34, T. 34 N., R. 65 E., Elko County, Nev. Name derived from a Western Pacific Railroad siding about 1 mile south of type section.

Hogan Volcanics

See Dearborn River Volcanics.

Hogan Mountain Rhyolite (in Van East Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, P. D. Procter, and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 40. From 20 to 30 percent of rock consists of salmon-red feldspar with glassy quartz phenocrysts.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83, 85. Included in Van East group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Hogan Mountain is in Iron County.

Hog Heaven Volcanics

Tertiary, upper, or Pleistocene, lower: Northwestern Montana.

W. D. Page, 1963, Montana Bur. Mines Bull. 36, p. 32—33. Consist of andesite and latite, andesitic tuff, and intrusive bodies of andesite, latite, quartz latite, and basalt. Thickness about 400 feet. Time of volcanic activity unknown, but probably late Tertiary or early Pleistocene, certainly pre-Wisconsin.

Named after Hog Heaven Hill east of Flathead mine, in Hog Heaven mining district, Kootenai-Flathead area.

Hog Island Granite

Pre-Pennsylvanian: Northern Maine.

W. H. Pinson, Jr., 1961, New York Acad. Sci. Annals., v. 91, art. 2, p. 375. Hog Island granite dated about 365 m.y.

Hog Island is in Attean quadrangle.

Holdout Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 9. Overlies Orlano Spring Member and underlies Quartz Mountain Basalt Member (both new).

Type section: SW¼SE¼ sec. 28, T. 24 S., R. 43 E., Malheur County.

Hole-in-the-wall Diatomite

Pliocene (Hemphillian): Southwestern Idaho.

J. F. Evernden, and others, 1964, Am. Jour. Sci., v. 262, no. 2, p. 183. Named in study of potassium-argon dates and Cenozoic mammalian chronology of North America. A thick accumulation of diatomite.

Locality: Stroud Claim, near Hagerman, southwestern Idaho, 400 ft N, 1200 ft W of SE cor. sec. 34, T. 3 S., R. 13 E., Davis Mountain County quadrangle, Gooding County.

Holiday Formation (in Ely Group)

Pennsylvanian (Desmoinesian): East-central Nevada.

B. O. Lane, 1962, Dissert. Abs., v. 23, no. 3, p. 993. Ely limestone raised to group rank and subdivided into two formations: Ely limestone (restricted) and Holiday formation. The Holiday consists of about 700 feet of silty limestones and contains persistent zones of *Chaetetes*. Formation overlain disconformably by chert pebble conglomerates at base of sequence of Lower Permian carbonates and sandstones.

Present in Illipah area.

Holly Hill Member (of Okefenokee Formation)

Miocene, post-late: Central South Carolina.

D. J. Colquhoun and D. A. Duncan, 1964, Southeastern Geology, v. 5, no. 3, p. 133—139. Occurs near base of formation, although lenses may be present at varying altitudes throughout the channel-like bodies. Two lithofacies commonly present. Conglomerates consisting of subangular to well-rounded, subspherical quartz pebbles with some sand are present immediately adjacent to Tertiary bedrock, but may occur as lenses and discontinuous beds anywhere within member. Major portion of member is moderately well-sorted to well-sorted orthoquartzitic, or subarkosic, sand. Thickness as much as 30 feet in central channel areas but laterally much thinner away from this area. Eutawville Member (new) is in upper part of formation.

D. J. Colquhoun and Donald A. Duncan, 1966, South Carolina Div. Geology Map Ms-12. Okefenokee Formation shown on map legend as upper Miocene-Pleistocene(?).

Named for town of Holly Hill in west-central part of Eutawville quadrangle.

Holter Sandstone Member (of Marias River Shale)

Holter Sandstone (in Colorado Group)

Upper Cretaceous: Central Montana.

S. L. Groff, 1963, Montana Bur. Mines and Geology Spec. Pub. 31 (chart 1). Shown on column 6 as member of Marias River Shale. Overlies Ferdig Shale Member and underlies Kevin Shale Member. Column 5 shows the Holter as a member of the Marias River and also as a formation in Colorado Group. In the group it occurs above an unnamed middle siliceous unit and below an upper black shale unit.

Type locality and derivation of name not stated.

Hombergian Stage

Upper Mississippian (Chesterian): Illinois.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 22, 70, pl. 1. Hombergian Stage proposed to include those rocks younger than Beech Creek Limestone and older than Tar Springs Sandstone. Name is derived from Homberg Group of Weller (1939). It is equivalent to rocks that Weller and Sutton (1940, Am. Assoc. Petroleum Geologists Bull., v. 24, no. 5) placed in Homberg Group in Kentucky and Indiana but differs in that it excludes the Cypress and Beech Creek Formations in Illinois. Unit consists of Fraileys Shale, Haney Limestone, Hardinsburg Sandstone, and Glen Dean Limestone and their equivalents. Middle stage of Chesterian; overlies Gasperian Stage; underlies Elviran Stage.

Named for Homberg Group which in turn is named for town of Homberg, sec. 4, T. 14 S., R. 6 E., Brownfield quadrangle, Pope County, Ill.

Home Gardens Quartz Monzonite Porphyry

Cretaceous(?): Southern California.

C. H. Gray, Jr., 1961, California Div. Mines Bull. 178, p. 17—18, pls. 1, 4. Light-gray porphyritic to porphyro-aphanitic biotite quartz monzonite. Includes pink micro pegmatite granite west of Home Gardens. Intrudes Cajalco quartz monzonite. Relations with Temescal Wash quartz latite porphyry and Corona hornblende granodiorite porphyry (new) obscure. Older than Trabuco formation. Name credited to Pampeyan (unpub. thesis).

Exposed in vicinity of Home Gardens, near Corona, Corona South quadrangle. Exposed for north-south distance of about 2 miles along Temescal Wash, west and northwest of Minnesota Mining and Manufacturing Co's. plant in Temescal Canyon.

Homeland Member (of Bone Valley Formation)

Pliocene to Recent: Central Florida.

S. R. Riggs, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 1998—1999. Hawthorn Group subdivided into Arcadia and Bone Valley Formations. Bone Valley further subdivided into Noralyn and Homeland Members (both new). Noralyn constitutes bulk of phosphorite section in Noralyn mine. Only locally does the Homeland form most of the phosphorite section. It disconformably overlies the Arcadia Formation or the Noralyn Member and occurs as sinuous and lenticular fluvial channel deposits. Contains abundant articulated terrestrial vertebrates and ranges from Pliocene to Recent in age. Unconformably overlying the Hawthorn Group and occasionally interbedded with the Homeland Member are unaltered and altered nonphosphatic sediments.

Occurs in Noralyn mine, in phosphate district of central Florida.

Homerian Stage

Miocene and Pliocene(?): Alaska.

J. A. Wolfe, D. M. Hopkins, and E. B. Leopold, 1966, U.S. Geol. Survey Prof. Paper 398—A, p. A17—A20. Three time-stratigraphic units can be recognized within Kenai Formation on basis of fossil leaf floras they contain. Homerian Stage is proposed as a provicinal time-stratigraphic unit that encompasses all plant-bearing strata in Alaska and in adjoining parts of the same ancient floristic province that are of same age as those parts of the Kenai Formation represented in the type section near Homer and in the reference section in valley of Chuitna River. Preceded by Seldovian Stage (new) and succeeded by Clamgulchian Stage (new).

Type section of stage is designated as the sequence of strata in the Kenai Formation approximately 2,000 feet thick that is exposed in coastal bluffs and in steep gullies and canyons along east shore of Cook Inlet and north shore of Kachemak Bay from Troublesome Gulch past the town of Homer to Fritz Creek.

Homestead Formation

Permian(?): Northeastern Oregon.

H. T. Stearns, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 225—226. Consists of metavolcanic rocks and tuffaceous metasedimentary rocks. Andesite, rhyolite, quartz latite dominate metavolcanic rocks. Thickness 5,000 feet or more. Belongs to Seven Devils Volcanics(?).

Oxbow area on Snake River near Homestead, about 70 miles northeast of Baker.

Honeycomb Basalt

Honey Comb Rhyolite

Tertiary: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 26—27, pl. 1. Honeycomb Basalt is older than Fumarole Butte Basalt (new). Earlier than Topaz Mountain Rhyolite and Topaz Mountain Tuff (both new). Rests with angular unconformity on Paleozoic sedimentary rocks in Confusion Range.

W. N. McAnulty and A. A. Levinson, 1964, Econ. Geology, v. 59, no. 5, p. 770. Caps Honey Comb Buttes. Exposed in bounding escarpments in thicknesses ranging from 50 to 150 feet. Youngest and least widespread volcanic unit in area. Existing remnants of formation probably rest on feeder vents through which parent lava reached surface. Similar in appearance to Topaz Mountain rhyolite in Thomas Range, 20 miles to east.

Forms conspicuous outcrops in Honeycomb [Honey Comb] Hills area. Exposures are almost continuous north of this area to Pony Express Station Monument on road east of Callao, Juab County.

Honey Creek Member (of Packsaddle Formation)

Precambrian: Central Texas.

R. V. McGehee, 1964, Dissert. Abs., v. 24, no. 7, p. 2870. Basal member of Packsaddle Formation. Underlies Sandy Creek Member (new).

Southeastern Llano uplift.

Hood Bay Formation

Devonian(?): Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 20—25, pl. 1. A sequence of dark-hued carbonaceous chert, siliceous argillite, graywacke, limestone, and minor altered basic volcanic rock. Lacks distinctive persistent members and has been isoclinally folded, so that measurement of accurate stratigraphic thickness is impossible. Thickness may be only a few thousand feet. Unconformably overlain by Permian Cannery Formation (new). To southwest, formation is buried unconformably by Tertiary Admiralty Island Volcanics (new). To northeast is in fault contact with Cannery and younger formations in complex manner along Pybus fault zone. Coeval with Gambier Bay Formation (new).

Typically exposed along the two rivers flowing westward into North Arm of Hood Bay, Admiralty Island.

Hoodoo beds

Eocene(?): Southwestern Montana.

R. L. Konizeski, 1965, Billings Geol. Soc. Guidebook 15th Ann. Field Conf., p. 12, 13, 15. An informal name applied to more than 600 feet of well-indurated bedded conglomerate and thin intercalated lenses of sandstones which crop out along Rock Creek. Most beds are flat-lying, but some near base of section are variously oriented with dips ranging from a few degrees to as much as 20 degrees. From Hoodoo sandstone lenses, Poulter (1957, unpub. thesis) collected four species of fossil plants. One species ranges throughout entire Tertiary, another is known only from Paleocene through Oligocene, other two are presently known only from Eocene. Dorf (*in* Poulter, 1957) states that the collection is early Tertiary probably Eocene. Csejtey (1962, unpub. thesis) provisionally described the beds as Miocene or Pliocene.

Crop out along Rock Creek beyond southwestern margins of Philipsburg Valley. The bluffs and chimneys, several hundred feet high along Rock Creek west of Philipsburg Valley, are known as "The Hoodoos."

Hoodoo Formation

Upper Cretaceous: Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 59—63, 180, 182; pt., 2 maps. In type area, consists almost entirely of black to dark-gray well-bedded siltstone and silty shale, with some claystone, clay shale, and small amounts of very fine grained sandstone. Thickness at least 2,000 feet and perhaps as much as 3,000 feet. Complete and undisturbed sequence of formation not found anywhere in Alaska Peninsula. Overlies Chignik Formation; underlies early Tertiary strata.

Type section: Exposures southeast of Hoodoo Mountain and along west side of Beaver Valley, Port Moller-Pavlof Bay area, Alaska Peninsula. Eastward from type area formation crops out almost continuously for 25 miles, nearly to Chicagof Peak, and is folded locally into series of complex warps.

Hoodoo Hills Mudstone

Upper Cretaceous (Turonian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Thickness 2,600 feet. Overlies Venado formation; underlies Guinda formation.

In Elk Creek-Fruto area, Glenn County.

Hope Member (of Cane Valley Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Basal member of Cane Valley. Thickness 70 feet. Underlies Robe Hill member (new).

J. T. Whetten, 1966, Geol. Sec. America Mem. 98, p. 185 (fig. 3), 199, pl. 1. Member at base of Cane Valley. Thickness 700 feet. Lower half of member contains about equal amounts of green fine-grained tuffaceous sandstone and black mudstone, whereas the upper half is entirely mudstone. Underlies Robe Hill Member.

Best exposed in Allandale gut (creek) half a mile north of Estate Hope.

Hopi Buttes Lava Flows

Pliocene, middle: Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 100. Incidental mention in report on geomorphology and age of volcanic rocks in northeastern Arizona.

B. E. Sabels, 1962, New Mexico Geol. Soc. Guidebook 13th Field Conf., p. 100—106. Discussion of Mogollon Rim volcanism and geochronology. Tuffs of Thirteen Mile Rock tuff from Thirteen Mile Rock Volcano are compared with tuff section in lower part of Bidahochi formation and Hopi Buttes tuff beds. Concluded that Thirteen Mile Rock Volcano was most likely source of tuff in Bidahochi formation. [Term Hopi Buttes tuff as used in this report may be informal name for White Cone member of Bidahochi, which contains claystone and volcanic rocks of the Hopi Buttes.]

Hopi Buttes are north and east of Holbrook, in Navajo County.

Hoppers Formation (in Livingston Group)

Upper Cretaceous: South-central Montana.

A. E. Roberts, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B86—B92. Consists largely of sandstone and interbedded claystone and siltstone. Generally massive to thin bedded, crossbedded, and poorly sorted. Thickness 965 feet at type section. Conformably overlies Billman Creek Formation (new); underlies Fort Union Formation.

Type section: Exposed near Hoppers Siding, Northern Pacific Railway in SW¼ sec. 7 and NW¼ sec. 18, T. 2 S., R. 9 E., Park County.

Horn Mountain Tuff Member (of Talkeetna Formation)

Lower Jurassic: Southern Alaska.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 18—20, 23 (fig. 2), pls. Bedded tuffs and tuffaceous feldspathic sandstone are dominant lithologic types. Porphyritic andesite lava flows are present locally. Minor constituents are volcanic breccia, agglomerate, greenstone, and argillite. Thickness 1,800 feet at type locality. Thickest measured section 2,850 feet. Overlies Portage Creek Agglomerate Member (new). Top of all sections is either an angular unconformity or a fault. Underlies Red Glacier Formation.

Type locality: Horn Mountain, after which member is named, from the shore of Chinitna Bay to the peak of Horn Mountain and north along the ridge to the contact with Portage Creek Agglomerate Member. Iniskin-Tuxedni region.

Horn Point Limestone

Horn Limestone

Pennsylvanian (Des Moines): Southern Utah.

H. D. Miser, 1924, U.S. Geol. Survey Bull. 751—D, p. 128. Description of section of Goodridge formation at Honaker Trail, San Juan River. Unit 36 of the section is "cherty drab fine-grained massive limestone" 11 feet thick. Forms top of the point known as The Horn, which overlooks the canyon.

S. A. Wengerd, 1955, Four Corners Geol. Soc. Guidebook Field Conf. [1] p. 74 (fig. 7, 8). Horn limestone shown near Honaker Trail in Goosenecks of San Juan River.

S. A. Wengerd and M. L. Matheny, 1958, Am. Assoc. Petroleum Geologists Bull. v. 42, no. 9, p. 2060—2061 (fig. 5), 2099. Horn Point limestone shown as overlying Paradox formation and underlying Honaker Trail formation (new).

S. A. Wengerd, 1962, *in* Pennsylvanian System in the United States—a symposium, Tulsa, Okla., Am. Assoc. Petroleum Geologists, p. 282—283 (fig. 11); 1963, Four Corners Geol. Soc. 4th Field Conf., p. 235—243. In Monument upwarp, based on surface mappability, top of Horn Point limestone is clearly mappable top of Paradox Formation. Thickness 47 feet.

L. C. Pray and J. L. Wray, 1963, Four Corners Geol. Soc. 4th Field Conf., p. 206, 207. Honaker Trail section described herein is about 120 feet thick and is located about halfway down from canyon rim. Top of persistent stratigraphic marker, the "Horn limestone," occurs near middle of section investigated. Literature is clear as to horizon termed "top of the Horn limestone" but is less clear as to lower limit. It is used here in sense of Wengerd (1962) who includes about 45 feet of section (Miser's rock unit numbers 36, 37, and 38). As so used the "Horn limestone" includes some noncarbonate rock units and coincides with full extent of sheer cliff normally present below top of the "Horn." Wengerd placed "Horn limestone" as top unit of Paradox Formation and defined Honaker Trail Formation as the 450 feet of strata immediately overlying the "Horn." By this usage the 120 feet of strata discussed herein include uppermost part of Paradox Formation and lowest part of Wengerd's Honaker Trail Formation.

Honaker Trail section is in San Juan Canyon in SW¼ sec. 29, NW¼ sec. 32, T. 41 S., R 18 E., San Juan County.

Horn Silver Andesite

Tertiary: Southwestern Utah.

Bronson Stringham, 1967, Utah Geol. and Mineralog. Survey Spec. Studies 16, p. 10, 11 (fig. 4), 13—15, pl. 2. A local unit lying between Needles Range and Isom Formations is most important extrusive rock in vicinity of Horn Silver mine and is herein named Horn Silver Andesite. Gray to purple groundmass, white plagioclase phenocrysts, and intraformational breccia. Thickness 200 to 2,000 feet. Distinctly a series of flow rocks. Although the Horn Silver Andesite occupies a relatively small proportion of southern part of area, it underlies entire area to north and east except where cut by intrusive rocks and breccia pipes.

Named for Horn Silver mine, Beaver County.

Horse Camp Formation

Mio-Pliocene(?): Eastern Nevada.

E. M. Moores, III, 1964, Dissert Abs., v. 24, no. 11, p. 4633. Thickness 10,000 feet. Consists of four unnamed members. Member 1, deposited disconformably upon volcanic surface of low relief, consists of as much as 2,000 feet of fluvial and lacustrine sediments. Unconformity between members 1 and 2 corresponds to folding and uplift of White Pine Range. Member 2, about 8,000 feet thick, consists of monolithic breccias that interfinger with complex sequence of travertine, lacustrine sediments, vitric tuff, and volcanic-rich clastic rocks. Member 3 consists of coarse clastic deposits and travertine. Member 4 is gradational into member 3 and consists of fluvial sandstone and conglomerate.

R. B. Scott, 1965, (abs.) Houston Geol. Soc. Bull., v. 8, no. 4, p. 23. Tertiary rocks in Grant Range in eastern Great Basin, Nev., consists of 5,000 to 15,000 feet of rhyolitic ignimbrite sheets, nonmarine sediments, and siliceous flows. Major named units are (ascending): Sheep Pass Formation, lacustrine limestone, middle to upper Eocene; Railroad Valley Rhyolite (new), 36 m.y.; Calloway Well Formation (new), ignimbrites; Stone Cabin Formation, ignimbrites; Windous Butte Formation, ignimbrites, 33 m.y.; Currant Tuff; Needles Range Formation, ignimbrites; Horse Camp Formation, tuffaceous fluvial and lacustrine sediments, Mio-Pliocene.

Occurs in Currant area, Nye County, about 55 miles west of Ely.

Horse Canyon Formation

Precambrian: Utah.

K. C. Condie, 1966, Jour. Geology, v. 74, pt. 1, p. 633. Late Precambrian rocks of northeastern Great Basin and adjacent areas occur as three distinct sedimentary-rock associations with quite different geographic distributions. These associations are designated as Subprovinces I, II, and III. Rocks of Subprovince II vary from virtually unmetamorphosed to moderately metamorphosed (amphibolite facies). They have maximum thickness of 5,500 feet in Wasatch Range and are known by such stratigraphic names as Big Cottonwood Series, Horse Canyon Formation, Sheeprock Series, and McCoy Creek Group. Name Horse Canyon credited to Bick (unpub. thesis).

Type locality and derivation of name not given. Bick's report discusses Deep Creek quadrangle.

Horse Creek Rhyolite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 72, 73, 75. Intrudes Wiggins formation. Appears to be somewhat teardrop in plan, about three-fourths to 1 mile long with maximum cross sectional width of about 1,000 feet. A yellowish-gray very fine grained felsite that has been locally stained along fracture zones.

Crops out on ridge between Horse Creek and Yellow Creek about 1 mile west of Mount Crosby, southern Absaroka Mountains.

Horse Hill Breccia

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 31, pl. 1. Consists of heterogeneous rhyolitic pyroclastic rocks of tuff, agglomerate, and tuff breccia. Probably overlies Timberlake Fanglomerate (new) and is unconformably overlain by Bluff Creek Formation and Young Ranch Tuff (both new). Thickness 0 to 150 feet.

Only exposure is in area south of Cowboy Creek and east of Horse Hill, Walnut Wells quadrangle, Hidalgo County.

Horse Mountain Volcanics

Upper (?) Cretaceous or Tertiary: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 47–56, pl. 1. Include a heterogeneous assemblage of lava, tuff, and agglomerate ranging in composition from andesite to rhyolite, as well as small amounts of conglomerate and breccia. Silicic rocks of rhyolitic to dacitic composition predominate over most of outcrop area but andesite is abundant at base of section in type locality and in general vicinity of Aravaipa and Williamson Canyon. Total thickness unknown, as upper limit is either present land surface or an angular unconformity with Hell Hole Conglomerate (new) or older alluvium. At type locality, measurement of section is complicated by faulting, highly contorted flow layering, and obscure bedding but likely at least 3,000 feet present, and thickness may be in excess of 4,000 feet. Base exposed in three general areas. South, west, and north of Aravaipa, the volcanics rest unconformably on Horquilla Limestone or, less commonly, on Escabrosa Limestone, Martin Formation, Bolsa Quartzite, Laurel Canyon Granodiorite (new), or Pinal Schist. Between Tule Spring and point on divide between Williamson Canyon and Arizona Gulch, the volcanic rocks unconformably overlie Escabrosa Limestone. Near Landsman Camp they overlie Horquilla Limestone. In tributary gulch of Williamson Canyon, in W½ sec. 30, T. 5 S., R. 20 E., they overlie various Paleozoic rocks. Between vicinity of Head Center mine, in Williamson Canyon, and north edge of quadrangle, the Horse Mountain Volcanics unconformably overlie Williamson Canyon Volcanics (new), except at one place where they overlie Horquilla Limestone. Along much of its outcrop in this area, base of the Horse Mountain is marked by distinctive red highly lenticular pebble and cobble conglomerate. Throughout entire southern two-thirds of outcrop area in Tps. 6 and 7 S., R. 20 E., base of Horse Mountain Volcanics is not exposed and rocks are in fault contact with Pinal Schist, Laurel Canyon Granodiorite, Bolsa Quartzite, Escabrosa Limestone, and Buford Canyon Formation (new). In principal outcrop area, between Lone Cedar Mesa and Waterfall Canyon, the volcanics are overlain by older alluvium. Along chain of outcrops, 2 to 3 miles southwest of this area, they are unconformably overlain by Hell Hole conglomerate on southwest and by older alluvium on northeast.

Type locality: Horse Mountain, Klondyke quadrangle. Makes nearly continuous belt of outcrops that extends along southwest side of Turnbull and Santa Teresa Mountains from northern boundary of quadrangle south-southeastward to Waterfall Canyon, a distance of about 10 miles. Maximum width of belt 2.5 miles. Named for Horse Mountain, 2 miles north of Aravaipa. About 9.7 square miles, or 4 percent of quadrangle, is underlain by this formation.

Horseshoe Shale Member (of Amsden Formation)

Upper Mississippian and Lower Pennsylvanian: Northwestern Wyoming.

W. W. Mallory, 1967, U.S. Geol. Survey Prof. Paper 554—g, p. G12—G14, pls. Typically red shale and siltstone. Widespread in northwestern Wyoming, and its striking color is useful criterion for identifying the Amsden Formation in outcrop and well cuttings. Where Darwin Sandstone Member is absent, Horseshoe Member rests directly on disconformity at top of Madison Limestone. A relatively tabular layer averaging 75 feet in thickness that was deposited on relatively flat surface. Locally thickness exceeds 100 feet. Underlies Ranchester Limestone Member (new). Late (Chester) Mississippian and Early (Morrow) Pennsylvanian.

Type section: In SE¼ sec. 33, T. 57 N., R. 87 W., on Amsden Creek 4 miles west of Dayton. Reference section: At Tensleep Canyon, west flank of Bighorn Mountains, Washakie County. Name taken from Horseshoe Mountain (sec. 27, T. 56, N., R. 87 W.) 7 miles southwest of Dayton.

Horseshoe Hills Member (of Three Forks Formation)

Devonian: Southwestern Montana.

J. L. Rau, 1962, Billings Geol. Soc. [Guidebook] 13th Ann. Field Conf., p. 53 (pl. 1), 54 (pls. 1, 2), 55 (pls. 4, 5), 57, 58. Middle member of formation. Overlies London Hills member (new); underlies Sappington sandstone member. In type section consists primarily of silty green fossiliferous shale which grades upward into basal beds of Sappington and downward into lower member. Lower part of member marked locally by limestone lentil which is about 6 feet thick in Logan section. In London Hills, a silty calcareous dark shale separates member from Sappington. Upper boundary difficult to pick if continual gradation occurs from greenish-yellow shale of upper part of middle member into argillaceous siltstones of basal Sappington. In most areas contact is clear because of color contrast between the dark-green shale and silty orange-weathering Sappington. Commonly one or two beds near top are thick-bedded gray fossiliferous irregularly fractured limestone which are as much as 21 feet thick in some areas. Thickness as much as 225 feet.

Type section: Devonian Ravine about one-half mile northeast of Logan, in SW¼SE¼ sec. 25, T. 2 N., R. 2 E., Gallatin County.

Horseshoe Mesa Member (of Redwall Limestone)

Mississippian: Northwestern Arizona.

J. W. Parker and J. W. Roberts, June 1963, Four Corners Geol. Soc. 4th Field Conf., p. 31, 45. Unit is thin bedded, consisting mostly of lutitic limestone containing some chert. Thickness 37 feet at type section. Uppermost member of formation. Overlies Mooney Falls Member (new). Name credited to McKee (unpub. ms.)

E. D. McKee, [Nov.] 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C21—C22. Formal proposal of name. At type section and in most of region, consists largely of aphanitic limestone; encrusting and sediment-binding algal structures common; relatively thin bedded. Thickness 38 feet (type section) to 125 feet in west. Uppermost member of formation; overlies Mooney Falls Member; underlies Supai Formation.

Type section: Horseshoe Mesa below Grandview Point on south side of Grand Canyon.

Horseshoe Mountain Member (of Bighorn Dolomite)

Ordovician: Wyoming.

P. W. Goodwin, 1964, Dissert. Abs., v. 25, no. 2, p. 1149. Bighorn Dolomite subdivided into (ascending) Lander Sandstone, massive Steamboat Point (new), thin-bedded blocky Leigh, and heterogeneous Horseshoe Mountain Members.

Big Horn Mountain and Black Hills areas.

Horseshoe Mountain Porphyritic Leuco Quartz Monzonite or unit

Mesozoic or Tertiary: Northern Washington.

M. J. Hibbard, 1965, Am. Jour. Sci., v. 263, no. 3, p. 245—261. Granite rocks along 49th parallel in Okanogan Range of northern Washington were first studied by Daly (1912, Canada Geol. Survey Mem. 39). A part of Daly's Okanogan Composite Batholith restudied for this report. It is here named Horseshoe Mountain Porphyritic Leuco Quartz Monzonite. This plutonic unit underlies 15 square miles and was emplaced in Cordilleran eugeosyncline in late Mesozoic or Tertiary. Alkali feldspar phenocrysts discussed in detail.

Horsetooth Member (of Muddy Sandstone)

Lower Cretaceous: Northeastern Colorado.

D. B. Mackenzie, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 2, p. 186—206. Upper unit of Muddy Sandstone. Consists of light-gray fine-grained well-sorted sandstone with locally abundant carbonized wood fragments. High-angle cross-stratification common. Thickness 1 to 40 feet. Tentatively interpreted as part of shoal-water delta (or possibly modified alluvial plain) assemblage, with central facies consisting mainly of channel sandstones, and southern and northern facies each consisting of channel sands redistributed and reworked by wave action. Overlies Fort Collins Member (new) with knife-edge contact. Underlies "Mowry."

Type section: In roadcut 0.15 mile east of south end of Spring Canyon Dam at center N½SE¼ sec. 32, T. 7 N., R. 69 W., Larimer County. Lower 13 feet exposed in roadcut, and upper 15 feet exposed on south side of draw about 800 feet northeast. Named for exposures at Horsetooth Reservoir.

Hoskin Lake Granite

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1962, (abs.) Lake Superior Geology Inst. 8th Ann. Mtg., May 10—12 (Michigan Coll. Mining and Technology), p. 5. Discussion of a Precambrian pluton near Pembine, Wis. Nine rock units mapped within some 350 square miles of the Precambrian granitic and metamorphic complex. Relative age relationships are suggested primarily from study of xenoliths, as follows (ascending): Quinnesec Formation, biotite gneiss, Marinette Quartz Diorite (new), Twleve Foot Falls Quartz Diorite (new), metagabbro sills, Hoskin Lake Granite, Newingham Granite, Amberg Granite (new), and diabase dikes.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. In Pembine-Amberg area, eight rock units younger than Quinnesec Formation are recognized and mapped. Five of these units are named. Hoskin Lake Granite is fifth in sequence (ascending). Younger than metagabbro sills and older than Newingham Granite (new). Name credited to Prinz (1958, unpub. thesis) who studied Niagara area and listed following igneous sequence: Quinnessec Formation (oldest), Marinette Quartz Diorite (new), Hoskin Lake Granite, gabbro sills, and diabase sills.

J. A. Cain, 1964, Michigan Acad. Sci., Arts, and Letters Papers, v. 49, p. 81—103. Described in Pembine area. The granite mass has sharp boundaries with Quinnesec Formation to north and east. Occurs in local and impersistent areas within biotite gneiss to west and Marinette Quartz Diorite to south.

W. C. Prinz, 1965, U.S. Geol. Survey Bull. 1224—A, A53—A55. Most of Hoslin Lake Granite is coarse grained and porphyritic, having large subhedral, white, gray, or flesh-colored microcline phenocrysts as long as 2½ inches. Phenocrysts are set in matrix of partially sericitized oligoclase, quartz, microcline, and biotite. Intrudes Marinette Quartz Diorite and Quinnesec Formation. Intruded by unmetamorphosed diabase dikes of Keweenawan age (late Precambrian). Age not known with certainty.

Named for Hoskin Lake which lies within the granite pluton in NE¼ sec. 23, T. 38 N., R. 19 E. Forms an arctuate intrusion of at least 20 square miles.

Hound Island Volcanics (in Hyd Group)

Upper Triassic: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C35—C43, pl. 1. Basaltic pillow breccia and pillow lava, andesitic volcanic breccia, and aquagene tuff. Some thin-bedded limestone present. Thickness ranges from several hundred feet on Kuiu Island to more than 2,000 feet on northwest Kupreanof Island near Cape Bendel. Conformably overlies Hamilton Island Limestone (new). Unconformable below Kootznahoo Formation. Upper Triassic.

Type locality: Shores of Hound Island, Keku Islets. Crop out over much of Keku Strait area.

Hovey Group

Hovey Formation

Ordovician or Silurian: Northeastern Maine.

Louis Pavlides, 1962, U.S. Geol. Survey Prof. Paper 362, p. 12—21, pl. 1. Divisible into two parts: lower part of slate and graywacke, which contains lenses of devitrified flow rocks (Saddleback Mountain member, new), and an upper part, chiefly slate, which contains several lenticular units of metavolcanic rock near base (Dunn Brook member, new, and volcanic breccia unit). Thickness more than 15,000 feet. In fault contact with Meduxnekeag formation (new); intruded by Spruce Top greenstone (new). Lower(?) Silurian and Lower Silurian.

Louis Pavlides, 1964, U.S. Geol. Survey Bull. 1194—B, p. B1—B6. Hovey Formation herein redefined as Hovey Group. Consists of conformable Nine Lake (new), Dunn Brook, and Maple Mountain (new) Formations that compose a eugeosynclinal suite of rocks about 22,000 feet thick. Term Saddleback Mountain Member abandoned.

Named for Hove Mountain, Maple and Hovey Mountains area, Aroostook County. Rocks of formation are generally exposed west of easternmost fault within mapped area and of the north-south fault that joins this major fault about 2 miles northeast of Maple Mountain.

Howard Mountain Member (of Littleton Formation)

Probably lapsus for Howard Pond Member (of Littleton Formation).

Howard Pond Member (of Littleton Formation)

Lower Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 45—47, pls. 1, 2. Consists of three units: Upper of interbedded rusty weathering quartz-mica schist and dark quartzites that contain some calc-silicate minerals; middle of very quartzose calc-silicate granulite and quartz-feldspar-biotite granulite, and lower similar to upper but poorly exposed. Estimated thickness 600 feet. Overlies Wilbur Mountain member (new).

Present on Howard Mountain in northwest corner of Bryant Pond quadrangle with small patches of lower unit present on summit and northeastern slopes of Wilbur Mountain. Upper unit best exposed in Rumford quadrangle at bridge just below outlet of Howard Pond.

HT Butte Bed (in Tongue River Formation)

HT Butte lignite bed (in Sentinel Butte Shale Member of Fort Union Formation)

Paleocene: North Dakota.

C. J. Hares, 1928, U.S. Geol. Survey Bull. 775, p. 44, 47 (fig. 1), 50, pls. HT Butte lignite bed is basal bed of Sentinel Butte shale. Average thickness 9 feet but in sec. 1, T. 138 N., R. 102 W., is over 16 feet thick.

C. F. Royse, Jr., 1967, North Dakota Geol. Survey Rept. Inv. 45, p. 5—7. Discussion of Tongue River-Sentinel Butte contact. A lignitic unit is present at contact in virtually all localities visited. With exception of Hares' (1928) term "HT Butte lignite", terms formerly or presently applied to this unit are not stratigraphic binomials. Recommended herein that terminology of Hares be exclusively retained and applied to this stratigraphic interval in North Dakota. As understood and applied in present report, name HT Butte bed applies to a carbonaceous zone in uppermost Tongue River Formation which may be represented by lignite, lignitic shale, or both, ranging in thickness from several inches to several tens of feet. Bed has great value in mapping. Should definite correlation be established with Roland coal bed of Sheridan field in Wyoming, term HT Butte should be superseded by Roland.

HT Butte is in Slope County.

Huachuca Quartz Monzonite

Jurassic(?): Southeastern Arizona.

P. T. Hayes, 1967, U.S. Geol. Survey Bull. 1254—A, p. A29. Most of formation consists of medium- to coarse-grained equigranular rock consisting of roughly equal portions of pink orthoclase, white plagioclase, and gray quartz. Most bounding contacts are faults, but locally it has definite intrusive relations with limestones of Permian age. In some areas overlain by conglomerate assigned to Glance Conglomerate of Bisbee Group of Early Cretaceous age. These geologic relations suggest probable Jurassic age.

Type area: Extensive exposures in southern part of Huachuca Mountains, Cochise County.

Hualpai granite

Precambrian: Northwestern Arizona.

G. W. Putman and C. W. Burnham, 1963, Geochim. et Cosmochim. Acta, v. 27, no. 1, p. 60. Name used to distinguish a rock unit in trace elements study. A coarse-grained biotite granite. Part of Cerbat complex. Name as used herein has no claim to priority.

Occurs in massive uniform outcrops in vicinity of Hualpai Park, forms Hualpai Peak, and extends for several miles southward in Hualpai Range.

Huasna Member (of Santa Margarita Formation)

Miocene, upper: Southern California.

C. A. Hall, Jr., 1962, California Univ. Pubs. Geol. Sci., v. 40, no. 2, p. 58 (fig. 7), 60 (table 2), 62, figs. 5, 6, map 1. Lowermost member of formation. Consists of white to gray-brown quartz arenite or arkosic wacke; siliceous clayey claystone facies in west. Underlies Phoenix member. Overlies Monterey formation.

C. H. Hall, Jr., and C. E. Corbato, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 562 (fig. 2), 572, pls. 1, 2. White to gray-brown quartz arenite or arkose wacke and in the west a siliceous shaly claystone facies. Thickness 1,300 feet. Underlies Phoenix Member. Overlies Monterey Formation. Upper Mohnian.

Type locality and derivation of name not stated. Texts refer to Huasna syncline and East and West Huasna faults. Huasna syncline lies between the East and West Huasna faults and 35 miles west of San Andreas fault, San Luis Obispo County.

Huckleberry Formation (in Belt Supergroup)

Precambrian: Northeastern Washington.

Ian Campbell and J. S. Loofbourow, Jr., 1962, U.S. Geol. Survey Bull. 1142—F, p. F—21——F—24, pl. 1. Formation contains two members, lower one designated the conglomerate member and the upper one the greenstone member. These extend from northern end of magnesite belt

[Stevens County] southward to vicinity of Deer Trail Monitor mine. South of this point (in sec. 24, T. 30 N., R. 37 E.) a thin sliver of conglomerate member extends nearly to Turk magnesite deposit. South of Turk deposit, neither member is present. Conglomerate member is about 1,500 feet thick. Estimated maximum thickness of greenstone member 3,000 feet. In northern part of area, the greenstone successively overlaps upper units of Deer Trail Group (Stensgar dolomite, slate and quartzite of Buffalo Hump formation) and the conglomerate member of the Huckleberry, thereby giving evidence of unconformity that separates Deer Trail group from Huckleberry formation. Bennett (1941) gave names Huckleberry conglomerate and Huckleberry greenstone to units herein referred to conglomerate member and greenstone member

The U.S. Geological Survey has discontinued the use of the term Belt Series and currently classifies the Belt as a supergroup.

Crops out on slopes of Huckleberry Mountain, Stevens County.

Huckleberry Mountain Formation (in Keechelus Volcanic Group)

Eocene, upper: Washington.

P. E. Hammond, 1964, Dissert. Abs., v. 24, no. 7, p. 2869. Thickness 2,200 to 11,000 feet. Overlies Enumclaw Formation. Volcanic rocks of Huckleberry Mountain and Enumclaw Formations grade eastward and northward into interstratified arkosic coal-bearing sedimentary and volcanic rocks of "Naches Formation." In Green River area, the Huckleberry Mountain unconformably underlies Eagle Gorge Andesite (new) of Keechelus Volcanic Group.

West-central Cascade Range.

Hueco Canyon Formation (in Hueco Group)

Lower Permian: Western Texas and eastern New Mexico.

T. E. Williams, 1963, Yale Univ. Peabody Mus. Nat. History Bull. 18, p. 12—20, fig. 1 (geol. map). At type locality, Hueco Canyon consists of basal conglomerate and redbed sequence (Powwow member) followed by about 600 feet of olive-gray medium- and thick-bedded limestones, with occasional very thick bedded units, the latter generally massive cliff formers. Thickness, excluding Powwow member, decreases from north to south from 635 feet at New Mexico-Texas State line to 470 feet in canyon north of Powwow Canyon. Everywhere overlain conformably by Cerro Alto Limestone (new). South of Powwow Canyon, formation overlies with marked angular unconformity all underlying rocks of Hueco Mountain from upper Magdalena to El Paso limestone. From Powwow Canyon northward to where range disappears in New Mexico, the Powwow is basal unit of formation.

Type section: In south side of Hueco Canyon in central part of Hueco Mountains Hudspeth County, Tex.

Huerfano Sand Member (of Gallup Sandstone)

Upper Cretaceous: Northwestern New Mexico (subsurface).

F. F. Sabins, Jr., 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 2, p. 198, 199 (fig. 5). Bisti stratigraphic trap consists of three individual bar sands called Marye, Huerfano, and Carson sands. Earlier writers have designated these sands by numerical or alphabetical "zones," but these systems do not conform with normal stratigraphic procedure nor with industry practice at Bisti. The Marye, Huerfano, and Carson sands are herein defined as individual members of Gallup Sandstone. The three bar sands are referred to collectively as "Bisti bar complex." The Huerfano Sand Member is the interval 5,470 to 5,490 in type well. The Huerfano sand bar is separated from overlying Marye sand bar by a thin Low SP interval and from underlying main Gallup Sandstone by 10 feet of Low SP facies. Not as widespread as Marye Sand.

Type well: Standard of Texas No. 9—1 Huerfano (SW¼SW¼ sec. 1, T. 24 N., R. 10 W.) Bisti field, San Juan County.

Humboldt clays

Quaternary: Northwestern Nevada.

Necip Güven and P. F. Kerr, 1965, Selected Great Basin playa clays: U.S. Air Force Cambridge Research Lab. Sci. Rept. 4, 35, p. Mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and Animas clays indicate that mica-type clay minerals illite, vermiculite, and montmorillonite are prominent in the playa crusts.

Humboldt Playa, the terminus of the Humboldt River, that meanders for 1,000 miles through an enclosed basin, is a smooth more or less moist, ancient saline-clay playa, considerably influenced by recent flooding.

Humboldt Valley Soil

See Lovelock Formation, Rye Patch Formation, and Lovelock-Humboldt Valley Stage.

Humbug Mountain Conglomerate

Upper Jurassic and Lower Cretaceous: Southwestern Oregon.

J. G. Koch, 1963, Dissert. Abs., v. 24, no. 4, p. 1572. Early Cretaceous in Klamath province is represented by one of thickest, coarsest, and most complete Lower Cretaceous (Valanginian) sequences known on West Coast. Sequence is herein subdivided into basal Humbug Mountain Conglomerate and gradationally overlying Rocky Point Formation (new).

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 30 (fig. 2b), 31 (fig. 3), 33 (fig. 4), 36, 45—48. Formal proposal of name. Myrtle Group of Imlay (1959, Am. Assoc. Petroleum Geologists Bull., v. 43, no. 12), whose type locality is along South Umpqua River near Days Creek, consists of Upper Jurassic Riddle Formation and Lower Cretaceous Days Creek Formation. Rocks of like age in Port Orford-Gold Beach area were designated by these names. Koch (1963) recognized essential lithologic differences and renamed the coast rocks (ascending) Otter Point Formation, Humbug Mountain Conglomerate, and Rocky Point Formation. Humbug Mountain, about 3,000 feet thick, contains near its top a graded fine conglomerate as well as subordinate zones of interstratified mudstone and graded sandstone, and is distinguished from the gradationally overlying Rocky Point Formation by thick, coarse, typically massive conglomerate. Decided unlike the inland, partly correlative, nonconglomeratic Days Creek Formation type section. At the fossiliferous type section, the Humbug Mountain consists of coarse to fine conglomerate, conglomeratic sandstone, sandstone and subordinate mudstone, which includes altered, plant debris.

R. H. Dott, Jr., 1966, Ore Bin, v. 28, no. 5, p. 85—97. Humbug Mountain Conglomerate, originally considered to be entirely of Early Cretaceous age, is now found to contain Late Jurassic (Portlandian) fossils in Barklow Mountain area.

Type section: On southwestern flank of Humbug Mountain, in SE¼ sec. 35, T. 33 S., R. 15 W., Port Orford quadrangle, southwestern Oregon coast. Representative section: On northeast side of Humbug Mountain, in SW¼ sec. 26, T. 33 S., R. 15 W.

Hunewill Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacramento Geol. Soc. Guidebook Ann. Field Trip June 18—19, p. 12, 13, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, Mount Biedman, and Silver Hill. The Hunewill consists, principally, of flows of hornblende andesite, minor flows or olivine basalt and biotite dacite, and layers of tuff-breccia.

Poorly exposed in Bodie quadrangle, but well exposed in Matterhorn Peak quadrangle immediately west. Mono Basin, Mono County.

Hunsaker Creek Formation

Middle Permian (Leonardian and Wordian): Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Consists of 8,000 to 10,000 feet of volcaniclastic rocks and minor volcanic flow rocks. Unconformably overlies Windy Ridge Formation (new). Interlayered with and partly underlies Kleinschmidt Volcanics (new). Leonardian and Wordian.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Hunter Creek Basalt

Miocene (Barstovian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 19—20. Felty, microcrystalline, intergranular, intersertal basalt. Thickness 3 to 400 feet; 150 feet at type locality. Contains one to several flows. Commonly rests on Dinner Creek Welded Ash-Flow Tuff (new); underlies Littlefield Rhyolite (new). Overlain, indirectly, by Butte Creek Volcanic Sandstone (new), which contains Barstovian fossils.

Type locality: On Hunter Creek in SW¼SW¼NW¼, sec. 26, T. 21 S., R. 39 E., Malheur County. Exposed extensively in Monument Peak, Malheur Gorge, and Harper Basin districts, usually as stone-striped slopes and domical hills.

Hunters Point Member (of De Chelly Sandstone)

Permian: Northeastern Arizona.

H. W. Pierce, 1964, Mus. Northern Arizona Bull. 40, p. 15—32. Name applied to lowermost member of De Chelly Sandstone. This is unit that McKee (1934, Am. Jour. Sci., 5th ser., v. 28, no. 165) and Read (1951, New Mexico Geol. Soc. Guidebook 2d Field Conf.), working in different areas, each refer to as the lower member of the De Chelly Sandstone. Thickness 238 feet at Hunters Point; grades southward into red strata of Supai Formation and is totally absent in Black Creek section. Underlies

Oak Springs Cliffs Member (new). Cross-stratification characteristics, channels, and ripple marks, suggest that these sandstones were largely water deposited.

H. W. Peirce, 1967, New Mexico Geol. Soc. Guidebook 18th Field Conf., p. 61. Discussion of Permian stratigraphy of Defiance Plateau, Ariz. Peirce stated (1964) that the development of channels and ripple marks and nature of cross-stratification in Hunters Point Member indicated an aqueous depositional environment, thus developing further the contrast between the lower and upper sandstones. This is of basic importance because Baars (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 2) correlates this unit at Hunters Point with entire De Chelly Sandstone at Canyon De Chelly, thus violating legitimate internal stratigraphic boundaries. Because of this correlation, he concluded that the position of his Yeso Formation (restricted) at Canyon De Chelly was in the "unconformity" at the top of the Permian section.

Forms prominent cliffs at Hunters Point, on Defiance Plateau, Apache County. Also well exposed at Bonito Canyon, Buell Park, Oak Springs Cliffs, and in parts of Canyon De Chelly.

Hunt Fork Shale (in Endicott Group)

Upper Devonian: Northern Alaska.

R. M. Chapman, R. L. Detterman, and M. D. Mangus, 1964, U.S. Geol. Survey Prof. Paper 303—F, p. 336—337, pl. 43. Predominantly shale, locally metamorphosed to slate, with minor amounts of interbedded hard sandstone and siltstone. Shale is gray brown to dark gray and weathers mottled dark yellow red. Not entirely exposed at any one locality. Thickness 3,185 feet at type section where rocks dip 6° to 15° S. Overlies unnamed Middle Devonian metasediments. Underlies Kanayut conglomerate. Structurally the Hunt Fork is in belt of complex folds and faults.

S. C. Porter, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 5, p. 955—960. Mapped and described in Anaktuvuk Pass, central Brooks Range, where it forms a northeast-trending outcrop belt one-fourth to 2 miles wide. Bulk of formation consists of soft dark-gray slate that has been intensely faulted and folded. Maximum stratigraphic thickness of 2,600 feet computed for section between Toyuk Mountain and Kollutuk Mountain. Grades into overlying Kanayut Conglomerate. Boundary drawn arbitrarily where dark-gray shale and siltstone pass upward into greenish-gray plant-bearing shale. Lower boundary is fault.

I. L. Tailleur, W. P. Brosgé, and H. N. Reiser, 1967, International Symposium on Devonian System, Calgary, 1967: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1354. Allocated to Endicott Group (new).

Type locality: About 25 miles east of Killik River at lat 68°18′ N., and long 153°20′ W., along Fire Creek, on east-flowing tributary of Okokmilaga River, central Brooks Range. Mapped as continuous belt from south end of Chandler Lake to Aniuk River. Over this distance of about 120 miles, unit ranges from 5 to 20 miles wide.

Hunton Limestone Megagroup

Silurian-Devonian: Central North America.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471–483. Hunton Limestone or Hunton Group of Oklahoma (Taff, 1902; Amsden, 1957) consists of Silurian and Devonian carbonates between Sylvan Shale (Cincinnatian) and shale or chert of Woodford Formation (Upper Devonian and Kinderhookian). Name Hunton Limestone Megagroup is herein applied to major body of Silurian and Devonian limestones and dolomites which, in central states, lies on clastic rocks ranging in age from Cincinnatian to early Niagaran and lies beneath clastic rocks ranging from late Middle Devonian to early Osagian. Panola Formation of central Kentucky is senior synonym of Hunton but is rejected because it has received little use, whereas Hunton is accepted for these rocks throughout Midcontinent region. The Hunton extends as useful megagroup into western part of Appalachian Basin, then frays out into geosynclinal facies on east. It retains its usefulness in some parts of the Cordillera. Where top Hunton unit is younger than Camden, it is overlain in conformity or near conformity by only slightly younger clastics of Knobs Megagroup (new). Megagroup is about 1,800 feet thick in southernmost Illinois and consists of an essentially uninterrupted sequence ranging in age from earliest Silurian to late Middle Devonian and early Upper Devonian. In western Illinois thins to featheredges of early Alexandrian strata and of late Middle Devonian strata and is entirely lacking in small areas. In northern Illinois, consists of a few hundred feet of beds, largely Silurian. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Huntzinger flow

See **Beverly Member** (of Ellensburg Formation).

Husted Alluvium

Holocene: Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 26–27, pl. 1. Silty alluvial deposits. Consists in large part of material derived from a humic soil developed in the past on all the unconsolidated materials of the region. In part consists of the soil itself, in place on these materials and mixed with detritus. Thickness 5 to 12 feet. Commonly forms the first terrace above modern flood plain. Top of terrace is 9 to 12 feet above stream level and has been overtopped by major floods. Younger than Monument Creek Alluvium (new).

Type locality: Husted, in Air Force Academy area, El Paso County. Present in nearly all stream valleys within Academy area.

Hutchins [Member] of Austin Chalk

Upper Cretaceous (Austinian): Texas.

E. A. Pessagno, Jr., 1967, Palaeontographic Americana, v. 5, no. 37, text fig. 2. "Hutchins" [member] of Austin Chalk listed on Upper Cretaceous correlation chart of western Gulf Coastal Plain and Caribbean areas. Listed above Bruceville [member] in Dallas area. Austinian Stage.

Type locality and derivation of name not stated.

Hyd Formation or Group

Upper Triassic: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull., 1178, p. 11 (table), 43—55, pl. 1. Name proposed for dark-colored argillite, chert, graywacke, limestone, and altered volcanic rocks that crop out in relatively thin discontinuous belt extending from north shore of Gambier Bay to southwest shore of Pybus Bay. Comprises four members. Basal breccia of white chert and red and green chert; white chert 0 to 30 feet thick and red and green chert 0 to 380 feet thick. Dark-brown medium-bedded limestone 0 to 500 feet thick. Thin-bedded grayish-black argillite and limestone 0 to 280 feet thick. Spilitic lavas, pillow types common, 0 to 500 feet thick. Disconformably overlies Pybus Dolomite (new); disconformably underlies Seymour Canal Formation (new).

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C28—C43, pl. 1. Rank raised to group in Keku Islets area, where it comprises Burnt Island Conglomerate, Cornwallis Limestone, Hamilton Island Limestone, and Hound Island Volcanics (all new). These new formations can be broadly correlated with basal breccia, limestone, argillite, and volcanic members, respectively of Hyd Formation of Pybus-Gambier area.

Named for triangulation station Hyd on northeast shore of Pybus Bay, Admiralty Island. The southeast shore of the peninsula at this traingulation station is type locality of argillite member of formation.

Idavada Volcanics

Pliocene, lower: Southwestern Idaho and northern Nevada.

C. P. Ross, 1962 (May), Idaho Bur. Mines and Geology Pamph. 125, p. 101. Incidental mention in discussion of stratified rocks in south-central Idaho. Inferred to be younger than Challis Volcanics.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1200—1201, pl. 1. Formal proposal of name. Name applied to various nonmineralized silicia volcanic rocks, chiefly welded ash flows but including some bedded vitric tuffs and lava flows. Conformably overlies Miocene rocks. Underlies Poison Creek Formation of Idaho Group (redefined). Along Goose Creek, the Idavada Volcanics are exposed in section more than 3,000 feet thick (Salt Lake and Payette(?) formations of Mapel and Hail, 1959, U.S. Geol. Survey Bull. 1055—H) which overlies gold-bearing rhyolite. Idavada Volcanics have been discussed by other writers under a variety of names all of which are herein abandoned: Mount Bennett Rhyolite (Russell, 1902), Shoshone Falls Andesite, and Pillar Falls Mudflow (Stearns, 1932, 1936, 1955, Stearns, Crandall, and Steward, 1938). Kirkham (1931, Jour. Geology, v. 39, no. 3) combined Idavada Volcanics with older rhyolite under name Owyhee Rhyolite. These two rock units are also combined on geologic map of Idaho, but most of outcrop mapped in western Snake River Plain consists of Idavada Volcanics. Lower Pliocene.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M14. Malde and Powers (1962) have applied name Idavada volcanics to unit that includes Cougar Point welded tuff (new) and Jenny Creek tuff (new) and possibly other rocks not represented in Jarbidge quadrangle, Nevada.

D. I. Axelrod, 1964, California Univ. Pub. Geol. Sci., v. 51, p. (table 1), 9—11. As defined by Malde and Powers (1962), the Idavada is sufficiently varied in lithology so that it seems desirable to recognize it as a group. In Goose Creek basin [this report], Idaho, includes (ascending) Beaverdam (new), Jenny Creek, and Cougar Point formations. Thickness about 3,100 feet. Overlies Jarbidge rhyolite; underlies Banbury formation. Miocene (Hemingfordian-Barstovian).

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 24, pl. 1. Geographically extended into Nevada where it is present in northern part of Rowland quadrangle, Elko County. The volcanics consist of lower pyroclastic beds and upper rhyolite flows with minor intercalated ash beds. The pyroclastics, up to 300 feet thick, consist of ash, tuff, tuffaceous sediments, and welded and vitric tuffs. The flows range in thickness from 10 to 50 feet and in many places overlap the pyroclastics and rest on older rocks. The Young America Gravel (new) lies between the late Miocene Jarbidge Rhyolite and the early Pliocene Idavada Volcanics.

Type locality: Escarpment parallel to Salmon Falls Creek, 10 miles northwest of Idavada, Twin Falls County Idaho. Name derived from Idavada, a place on the railroad near U.S. Highway 93, at Idaho-Nevada State line.

Idorwa Formation

Upper Jurassic: Oregon-Idaho.

R. F. Morrison, 1964, Dissert. Abs., v. 25, no. 3, p. 1847. Mudstone containing subordinate beds of pebble conglomerate and minor amounts of graywacke. Youngest sedimentary rock in area.

Exposed in Snake River Canyon between Cache Creek and Dug Bar, Oregon-Idaho boundary.

Ilyirak Gravel

Tertiary or Quaternary: Northwestern Alaska.

R. H. Campbell, 1967, U.S. Geol. Survey Prof. Paper 395, p. 55—56, pls. Oldest of unconsolidated deposits is probably the gravel that mantles the upper flanks on the southside of the Kukpuk River valley from its junction with Ipewik River west to drainage of Ilyirak Creek. Gravel covers a relatively continuous area between altitudes of about 150 feet and about 300 feet. Ranges in thickness from 0 to more than 20 feet observed in one streamcut where base was not exposed. Inferred that gravel is Yarmouth or older and may be as old as late Tertiary. Herein assign Tertiary or Quaternary age. Older than Saligvik Gravel (new).

Named from Ilyirak Creek, in vicinity of Chariot Site, Lisburne Peninsula.

Imnaha Formation

Upper Triassic: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert Abs., v. 28, no. 4, sec. B, p. 1585. Overlies Permian strata unconformably near Fish Lake in western part of area. Doyle Creek Formation (new) may interfinger with the Imnaha east of Fish Lake. Karnian.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Oregon. Part of Snake River Canyon included.

†Imo Formation

Lower Pennsylvanian: North-central Arkansas.

Mackenzie Gordon, Jr., 1964, U.S. Geol. Survey Prof. Paper 460, p. 34—38. Consists largely of grayish-black clay shale that is somewhat ferruginous in places and weathers dark gray or brown. Commonly a massive bed or two of fine-grained sandstone occurs near base, and some fossiliferous calcareous shale rarely containing scattered limestone lenticules occurs in lower one-third. At some localities there is bed of conglomerate, generally less than 1 foot thick, at base. Thickness 342 feet at type locality. Formation is in part a basinward facies of Cane Hill member of Hale formation. However, lower part of formation contains Mississippian fossils, some of them the same as those in upper shale member of Pitkin limestone, and because it lacks typical Morrow species, and because most of shale resembles the clay shale in several underlying Mississippian formations more than it does the siltstone and shaly fine sandstone of the Cane Hill member in Washington County, a separate name is proposed for the formation.

E. C. Glick, S. E. Frezon, and Mackenzie Gordon, Jr., 1965, U.S. Geol. Survey Bull. 1194—D, p. D1—D2. Name Imo Formation (Gordon, 1964) abandoned. Unit renamed Cane Hill Formation.

Type locality: In Sulphur Springs Hollow, a tributary of Bear Creek, in SE¼SE¼ sec. 3, and NW¼NW¼ sec. 11, T. 13 N., R. 17 W., Searcy County. Named for exposures near Imo.

Imuruk Volcanics

Pleistocene, lower(?) and middle: Alaska.

D. M. Hopkins, 1963, U.S. Geol. Survey Bull. 1141—C, p. C35, C49 (table), C50 (fig. 9), C54—C57, pl. 1. Name proposed for group of basaltic lava flows and associated agglomerate cones that have been exposed so long that in most places their surfaces have been thoroughly brecciated by frost action and mantled by layer of windblown silt 3 to 20 feet thick. At type locality, unweathered lava flows of Imuruk volcanics overlie deeply weathered lava flows of Kugruk volcanics (new), and a lava flow of Gosling volcanics (new) has invaded a canyon excavated into and below Imuruk volcanics.

Type locality: In canyon of Kugruk River, 3 miles below Imuruk Lake, Seward Peninsula. Imuruk Lake occupies vaguely defined graben whose bounding faults displace lava flows of Imuruk volcanics.

Inconsolable Granite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1528—1529. Medium-grained medium-gray rock. Intruded by Lamarck Granodiorite (new) and by quartz monzonite similar to Cathedral Peak Granite. Relations with Tinemaha Granodiorite (new) not determined.

Type locality: Inconsolable Range, east-central Sierra Nevada, near Bishop. Crops out in the Sierra-Nevada divide from Middle Palisade to Mount Agassiz and extends northward in Inconsolable Range to latitude of Chocolate Peak. Main mass is elongate in northwesterly direction and has outcrop area of a little more than 12½ square miles.

Indian Canyon Formation (in Park City Group)

Permian (Wordian): Northeastern Nevada and northwestern Utah.

K. A. Hodgkinson, 1961, Brigham Young Univ. Geology Studies, v. 8, p. 181—182, 190, 195. A sequence of cherty, sandy, and silty dolomites, dolomitic orthoquartzites, and dolomitic siltstones. Orthoquartzites and siltstones commonly weather red brown. Dolomite weathers light gray and bedded chert black. Thickness 710 feet at type locality. About 475 feet in Gold Hill district; 410 feet in Lipkey Range. Overlies Plympton Formation; underlies Gerster Formation. Steele (1960, Intermountain Assoc. Petroleum Geologists 11th Ann. Field Conf.) identified this sequence but referred it to Phosphoria Formation.

H. J. Bissell, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 5, p. 627—629. Type section remeasured. Thickness 625 feet. Overlies Plympton Formation; underlies Gerster Formation.

Type section: Indian Canyon, Pequop Mountains, sec. 21, T. 31 R. 65 E., Elko County, Nev.

Indian Hollow Rhyolite (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 216—217, 227 (fig. 11), pl. 1. Basal rhyolite of Mount Belknap east of Sevier River sequence. A dense moderate pink porphyritic flow. At Indian Hollow the rhyolite is moderately red porphyry. Toward west becomes progressively more gray than red. Thickness 1,000 feet. Underlies Indian Hollow tuff (new).

Occurs in Indian Hollow, Tushar uranium area, near Marysvale, Piute County.

Indian Hollow Tuff (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 217, pl. 1. A fragmental tuff with characteristic platy fracture parallel to bedding plane. Overlies Indian Hollow rhyolite (new). Thickens toward west and interfingers with Gold Mountain tuff (new). Intergrades into overlying Crescent Hills rhyolite (new). Contains lenses of Kimberly rhyolite (new).

Occurs in Indian Hollow, Tushar uranium area, near Marysvale, Piute County.

Indian Lakes Formation (in Lahontan Valley Group)

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—112—D—113. Consists of alluvium, colluvium, and some eolean sand and shallow-lake sediments, as much as 15 feet thick. Has three tongues. Lower intercalated between middle Lake Lahonan soil and lower tongue of Sehoo (new); middle intercalated between lower and middle tongues of Sehoo, to at least as low as 3,390 feet altitude; upper intercalated between middle and upper tongues of Sehoo, to at least as low as 3,900 feet. Overlies Wyemaha formation (new); underlies Turupah formation (new).

Type locality: Western part of Indian Lakes area, SE¼, T. 20 N., R. 29 E., and SW¼, T. 20 N., R. 30 E., Churchill County, where two ancient river-distributary channels are composed of alluvial sand of formation.

Indian Pond Limestone

Age not stated: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Occurs between Dexter (new) and Hartland Formations.

Report discusses geology of Pittsfield quadrangle.

Indian Trail Formation (in Oak Spring Group)

Miocene, upper, or Pliocene, lower: Southern Nevada.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Includes lowest three members described by Hinrichs and Orkild (1961) in former Oak Spring Formation, that is [unnamed member], Tub Spring, and Grouse Canyon. Underlies Piapi Canyon Formation (new). Age believed to be later Miocene or early Pliocene.

K. A. Sargent, D. C. Noble, E. B. Ekren, 1965, U.S. Geol. Survey Bull. 1224—A, p. A32, A33. Geographically restricted to eastern part of Nevada Test Site, that is east of long 116°15'. Outside test area, Tub Spring and Grouse Canyon Members assigned to Belted Range Tuff (new).

F. M. Byers, Jr., and Harley Barnes, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—577. Mapped in Paiute Ridge quadrangle, Nye and Lincoln Counties, where only Tub Spring Member is present.

Type locality: Indian Trail Wash on southeast flank of Oak Spring Butte, Nevada Test Site, Nye County.

Ingle Tuff Tongue (in Laycock Graywacke)

Upper Triassic(?): Northeastern Oregon.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548. Water-laid dark-gray feldspar-rich andesitic tuff and tuffaceous graywacke. Tuff grades into and interfingers with shale and graywacke in vicinity of Laycock Creek on the east and near Riley Creek Butte on the west. Thickness 3,000 feet on Ingle Mountain.

Named for outcrops in headwaters of Ingle Creek and on the east slopes of Ingle Mountain, Mount Vernon quadrangle, Grant County.

Iniakuk Stade

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1983. Last of a series of four stades in Siruk Glaciation (new). Preceded by Helpmejack Stade. Marked by narrow moraine belts along front of Brooks Range.

Present in Alatna Valley which originates on north flank of central Brooks Range and extends southeast through this mountain belt into Koyukuk lowlands.

Iowa Point Till

Pleistocene, lower: Northeastern Kansas and Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 25. Till of Late Nebraskan age has been penetrated in test drilling at several locations in southeastern Nebraska occurring below Afton Soil and resting upon Seward Formation. Stratigraphically documented outcrop in Nebraska has not been located. A locality in northeastern Kansas, reported by Frye and Leonard (1949, Kansas Geol. Survey Bull. 99) and classified as "Nebraskan till", is herein designated as type locality of the

Late Nebraskan till and the name Iowa Point Till is applied to the unit. Frye and Leonard gave thickness of 7 feet at the Iowa Point locality. Younger than Elk Creek Till (new) and older than Nickerson Till (new). Fullerton Formation is periglacial equivalent of the Iowa Point.

Type locality: In NE¼SE¼ sec. 6, T. 2 S., R. 20 E., Doniphan County, Kans., about 2 miles southeast of Iowa Point, Kans.

Irish Valley Member (of Catskill Formation)

Upper Devonian: Eastern Pennsylvania.

H. H. Arndt, G. W. Wood, Jr., and J. P. Trexler, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C32—C36. Name applied to lower varicolored sequence of intertonguing continental and marine facies of formation. Thickness about 2,000 feet at type section. In section north of Shamokin, underlies Buddys Run Member (new); north of Cressona, underlies Damascus Member. Conformably overlies Trimmers Rock Sandstone of Late Devonian age. Contact between them drawn at base of lowest red bed in section. Because of intertonguing, individual red beds wedge out along strike and base of Catskill becomes progressively younger westward.

J. L. Dyson, 1963, Pennsylvania Geol. Survey, 4th ser., Atlas A 137ab, p. 24—25, 48—54, pl. 1. Described in New Bloomfield quadrangle where it is 2,151 feet thick, and has about 30 percent red beds. Bulk of member consists of olive-gray fine-grained thin-bedded sandstone and siltstone. At Newport four sandstone units are more or less evenly spaced throughout member. They vary in thickness from 20 to 80 feet. Lowermost of these sandstones, locally called Kings Mill sandstone (Claypole, 1885), is 270 feet above base of member. Underlies Buddys Run Member.

J. L. Dyson, 1967, Pennsylvania Geol. Survey 4th ser., Topog. and Geol. Survey Atlas A—137 cd, p. 34—35, map. Described and mapped in southern New Bloomfield quadrangle where it is 2,151 feet thick at Newport and has about 30 percent red beds. Underlies Sherman Creek Member (new).

Type section: At mouth of Irish Valley on west side of Shanokin Creek, along Reading Railroad north of Shamokin, Northumberland County.

Iron Hill Formation

Silurian or Devonian: South-central Maine.

R. G. Doyle or Jeffrey Warner, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip B, p. 26 (table 1), 27, road log. A highly sulfidic "with minor graphite" pelite and quartzite. Weathers deep rust color. Excellent horizon marker. Thickness 200 and 500 feet. Present at Vassalboro volcanics boundary. Older than Coopers Mills Formation (new). Listed as an unpublished name used informally for convenience of discussion and reference.

Type locality and derivation of name not given. Stop 3 on road log is at outcrop of Iron Hill Formation, near Gardiner [Kennebec County].

Iron Mountain Formation (in Unicoi Group)

Precambrian or Cambrian: Southwestern Virginia.

T. J. Carrington, 1965, Dissert. Abs., v. 26, no. 2, p. 982. Lowest rock sequence in Unicoi Group. Consists of three distinct sedimentary rock sequences, each of which grades from very coarse grained at its base to very fine grained at its top. Underlies unnamed middle unit of group. Overlies Mount Rogers Group.

Mapped in four generally parallel outcrop belts in Unaka Mountain group in parts of Washington, Smyth, Wythe, and Grayson Counties.

Iron Mountain Rhyolite (in Specimen Mountain Volcanics Group)

Oligocene-Miocene: North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Specimen Mountain Volcanics of Wahlstrom (1944, Geol. Soc. America Bull., v. 44, no. 1) raised to group rank to include (ascending) Poudre Pass Rhyolite, Lulu Latite, and Iron Mountain Rhyolite (all new). Comprises the upper ash-flow rhyolites of Iron Mountain.

Caps ridges extending east and northeast of Iron Mountain. Mount Richthofen-Iron Mountain area is about 40 miles south of Wyoming border in north-central Colorado. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Irons Fork Mountain Formation (in Jackfork Group)

Mississippian: Southwestern Arkansas.

B. H. Walthall, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51 no. 4, p. 508, 509 (table 1). Morris (1964, unpub. thesis) divided Jackfork Group of frontal Ouachitas in western and central Arkansas into (ascending) Irons Fork Mountain and Brushy Knob Formations (both new). The Irons Fork Mountain was defined to include the lower sandstone beds and the overlying shale section of the Jackfork. This formation is correlative with the sandstone and shale beds of the Wildhorse Mountain Formation, including the Prairie Hollow Shale Member of the Ouachitas of Oklahoma. Overlies Chickasaw Creek Formation.

Type locality and derivation of name not given.

Isla Magueyes Member (of Parguera Limestone)

Upper Cretaceous: Puerto Rico.

C. C. Almy, Jr., 1965, (abs.) Houston Geol. Soc. Bull., v. 8, no. 3, p. 16. Composed of volcanic conglomerates in which a bioclastic component increases upwards to form a coarse-grained bioclastic limestone. Overlies Punta Papayo Member (new). Uppermost member of formation. Replaces Melones Limestone to east. Late Campanian-Early Maestrichtian.

Punta Melones - Ensenada area, southwestern part of island.

Island Falls Formation

Middle Silurian: Northern Maine.

A. M. Hussey, 2d, and others, 1967, Preliminary geologic map of Maine (1:500,000): Maine Geol. Survey. Named on map legend. Associated formations: Smyrna Mills and Allsbury.

Southern Aroostook County.

Isle Quartz Monzonite

Precambrian: East-central Minnesota.

S. S. Goldich and others, 1961, Minnesota Geol. Survey Bull. 41, p. 112—113. A light-gray coarse-grained biotite quartz monzonite. Considered part of Warman quartz monzonite intrusive by Wyoski (1949).

Quarried 5 miles south of village of Isle, Mille Lacs County.

Ismay Substage

Pennsylvanian (Desmoinesian): Utah, Arizona, Colorado, and New Mexico.

D. L. Baars, J. W. Parker, and John Chronic, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 3, p. 393—403. The units (ascending) Barker Creek, Akah, Desert Creek, and Ismay (formerly "pay zones") are herein called substages and used as formal time-stratigraphic units in Four Corners Stage (new). Useful fusulinids in the Ismay are *Fusulina haworthi* and *Fusulina weintzi*. Probably late Desmoinesian.

Interval for the four substages of the Four Corners Stage is in Shell No. 1 Hovenweep well, sec. 5, T. 40 S., R. 26 E., San Juan County, Utah.

Ivishak Member (of Sadlerochit Formation)

Lower Traiassic: Northern Alaska.

A. S. Keller, R. H. Morris, and R. L. Detterman, 1961, U.S. Geol. Survey Prof. Paper 303—D, p. 176 (fig. 27), 178—182, pls. 21, 23. Typically consists of two parts: a lower nonresistant shale and minor siltstone unit and an upper resistant siltstone, shale, and sandstone unit. Thickness 1,000 to 2,000 feet. Overlies Echooka member (new); underlies Shublik formation.

Type locality: On Flood Creek between lat 69° 02′40″ N. and lat 69°03′20″, where strata dip from 40° to 54° N., Shaviovik and Sagavanirktok Rivers region on north slope of Brooks Range. Named for Ivashak River.

Ivoryton Group

Ordovician: Southeastern Connecticut.

Lawrence Lundgren, Jr., 1966, Connecticut Geol. and Nat. Hist. Survey Quad. Rept. 19, p. 14—20, geol. map. Proposed to include Middletown Formation, Monson Gneiss, and New London Gneiss. No one section displays all three formations. Upper boundary placed at base of Brimfield (Partridge Formation in Massachusetts) or Tatnic Hill Formation. The lower boundary placed at contact between Mamacoke Formation and overlying New London or Monson Gneiss.

So named because all three formations and their mutual relationships are exemplified in exposures within a circle of 5-mile radius centered at Ivoryton in Essex quadrangle.

Ivy Formation

Upper Jurassic: Subsurface in Mississippi and Alabama.

K. A. Dickinson, 1963, Dissert. Abs., v. 24, no. 1, p. 248. A largely red clastic unit above Buckner Formation and below Schuler Formation. Locally contains white or gray sandstone and red shale. Thickness 0 along its updip edge to at least 1,578 feet in central Yazoo County, Miss. Equivalent to upper Haynesville and Bossier.

Type well and derivation of name not stated.

Ivy May Andesite

Tertiary: Southeastern Arizona.

J. E. Kinnison, 1959, Arizona Geol. Soc. Guidebook 2, p. 149 (fig. 28). Named on map legend where it is placed above Cat Mountain rhyolite and Safford formation and below Shorts Ranch andesite.

Michael Bikerman and P. E. Damon, 1966, Geol. Soc. America Bull., v. 77, no. 11, p. 1227, 1228 (fig. 2). Overlies Anklam formation (new). Underlies Shorts Ranch Andesite. Consists of dark porphyritic andesite.

Saginaw area, Tucson Mountains, Pima County.

Iyoukeen Formation

Mississippian: Southeastern Alaska.

R. A. Loney, W. H. Condon, and J. T. Dutro, Jr., 1963, U.S. Geol. Survey Bull. 1108—C, p. C7 (table 1), C32—C33, pl. 1. Divided into three unnamed members. Lower limestone, 200 to 600 feet thick, of dark-gray fossiliferous fine-grained thin-bedded limestone with a few dark-gray thin regular chert beds. Middle, 500 to 750 feet thick, of dark-gray to grayish-black sparsely fossiliferous shale with some graywacke and limestone. Upper, more than 3,000 feet thick, characterized by fossiliferous dark- and light-gray medium-bedded limestone with dark-gray thin irregular nodular chert lenses. Total exposed thickness decreases to northwest owing to erosion of southwestward-plunging Freshwater Bay syncline. Maximum exposed thickness probably less than 4,500 feet, total thickness cannot be measured at one locality. Underlies Kennel Creek formation (new) near lower part of Wukuklook Creek, both Freshwater Bay (new) and Cedar Cove (new) formations are missing; Kennel Creek limestone probably has been thrust to southwest and has overridden Cedar Cove formation, Freshwater Bay formation, and possibly, lower and middle member of the Iyoukeen. The Iyoukeen forms outcrop belt ranging in width from 2½ to 3½ miles and extending from Iyoukeen Cove northwestward to north edge of map area in vicinity of headwaters of Spasski Creek. Outcrop belt interrupted by Gypsum Creek quartz monzonite (new) and displaced by several faults.

Typically exposed on Iyoukeen Peninsula, northwest shore of Iyoukeen Cove, and inland to northwest on ridges drained by Gypsum and Seal Creeks, Freshwater Bay area on northeastern Chichagof Island.

Jack limestone

Triassic(?): South-central Alaska.

D. H. Richter, 1967, Alaska Div. Mines and Mineral Geol. Rept. 30, p. 3 (table), 9—10, fig. 2. Massive thick-bedded reef(?) limestone with minor thin-bedded limestone, limy siltstone, and sandstone. Fossiliferous. Thickness 0 to 600 feet. Overlies and locally interbedded with Slana basalt (new). Underlies Mentasta argillite (new). Definitive age assignment awaits further study of fossils. In this report, the Jack limestone is considered an informal name.

Named for Jack Creek. Slana-Mentasta Pass area covers a 30-mile long segment of Denali fault zone in eastern Alaska Range.

Jackass Butte Formation

Pliocene, upper, and Pleistocene, lower: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Consists of a lower member of flood plain deposits unconformably overlain by basalt tuff and basalt flows of a basalt member. Younger than Oreana Formation (new). Older than Otter Basalt (new) and Montini Formation (new). Formation included in Idaho Formation by Cope (1884) which name is herein abandoned.

Present in Oreana quadrangle in foothill country of Owyhee Mountains and southern margin of western Snake River Plain.

Jackhammer Formation

Oligocene(?) or Miocene, lower: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 84, pls. A discontinuous thin basal sedimentary and volcanic formation exposed only in Mud Hills. About 150 feet in maximum thickness; best exposed in Owl Canyon. Lower 30 to 100 feet composed of arkosic sandstone and siltstone. Upper part 5 to 20 feet of bedded white tuff overlain by 5 to 30 feet of vesicular basalt. Half a mile of Owl Canyon, formation composed of lens as thick as 50 feet of gray limestone; farther east, composed of granitic-boulder conglomerate. Unconformable on quartz monzonite. Overlain by Pickhandle Formation. Presumably Oligocene or early Miocene. Name credited to McCulloh (1952, unpub. thesis).

Type locality: At Jackhammer Gap, east of Mud Hills, Mohave Desert.

Jack Mountain Phyllite

Upper Jurassic(?) and Lower Cretaceous: Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 103, 115, pl. 7—1. The eastern metamorphic belt is separated from Skagit Gneiss (plus Gabriel Peak Orthogneiss) by the late-Middle and Late Cretaceous Ross Lake fault. This belt grades into nonmetamorphic formations on east. It includes Jack Mountain Phyllite which consists of Lower Cretaceous (of Late Jurassic?) strata and Elijah Ridge Schist (new).

Mapped in vicinity of Jack Mountain, Northern Cascades.

Jackson Flows

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 392—393, pl. 1. Jackson flows probably once covered a large part of Yellowstone Park, although their area of exposure is now small. Most abundant type of rhyolite is gray lithoidal rock with prominent white tablets of sanidine and oligoclase and with rounded grains of quartz. Thickness as much as 1,500 feet; base not exposed. Probably younger than Red Mountains rhyolite (new); older than Yellowstone tuff (new).

Well exposed in canyons of Madison, Lewis, and Snake Rivers. Maximum thickness exposed in north wall of Madison Canyon at Mount Jackson, Yellowstone National Park.

Jackson Bluff Formation

Miocene (Choctawhatchee Stage): Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 11) 115—116, 117 (fig. 14), 202—204, 229, pls. 2a, 2b, 2c. Name suggested for *Echphora* and *Cancellaria* faunizones. Thickness at type section about 9½ feet. Overlies Hawthorn Formation; underlies Pleistocene sand and soil zone. At Alum Bluff overlies Fort Preston formation (new); underlies Miccosukee formation (new). Choctawhatchee Stage.

C. W. Hendry, Jr., and C. R. Sproul, 1966, Florida Geol. Survey Bull. 47, p. 75—78, pl. 1. Formation includes all sediments of *Ecphora* and *Cancellaria* facies of Choctawhatchee Age that occur above the Alum Bluff Age Hawthorn Formation and beneath Miccoskuee Formation and younger deposits. Occurs only in western part of Leon County [this report]. Jackson Bluff sediments are clayey sands and sandy clays that are very macrofossiliferous. They are light gray to greenish gray and brown. Along eastern limits of Apalochicola Coastal Lowlands area there are about 12 to 15 inches of dark-gray, non-macrofossiliferous, finely sandy clay on top of the shell beds. Thickness ranges from featheredge near eastern limit to in excess of 10 feet at western edge of county.

Type section: At Jackson Bluff on Ochlockonee River in drainage ditch and face of road-metal borrow pit, Leon County.

Jacks Peak Formation (in Valmy Group)

Ordovician: Northeastern Nevada.

Michael Churkin, Jr., and Marshall Kay, Geol. Soc. America Bull., v. 78, no. 5, p. 651—668, pl. 1. Has two members: a dominantly chert lower member and a quartzite upper member. Basal part of type Jacks Peak consists of knobby medium-bedded black chert that either directly overlies McAfee Quartzite (new) or that has a 2-foot bed of dark-gray sandy claystone overlain by a 4-foot dark-gray sandy shale separating the knobby chert from the underlying McAfee. Upper part is a white fine-grained very thick bedded, massive quartzite like the pure parts of the McAfee. Lower chert member is 200 to 300 feet thick around Jacks Peak. Upper quartzite member is about 150 to 200 feet thick. Top of formation is the present erosion surface. Graptolites found in shale interbedded with lower chert member.

Typically exposed on Jacks Peak, Independence Range, Elko County.

James City Formation

Pliocene(?): Eastern North Carolina.

J. R. Du Bar and J. R. Solliday, 1963, Southeastern Geology, v. 4, no. 4, p. 213—233. Older deposits (Pliocene?) not originally included in Croatan Formation are herein named James City Formation. Comprised primarily of unconsolidated calcareous sandy clays and argillaceous sands. Nearly all units contain well-preserved abundant macro microfaunas. Greatest exposed thickness about 8 feet; base not exposed in type area. Lies disconformably below Flanner Beach Formation (new).

Type section: Right bank of Neuse River, 0.6 mile downstream from Fort Point Light and 1.3 miles east of center of James City, New Bern quadrangle, Craven County. All exposures occur on right bank of Neuse Estuary.

James Run Gneiss

Precambrian(?): Maryland.

D. L. Southwick and G. W. Fisher, 1967, Maryland Geol. Survey Rept. Inv. 6, p. 4—5. Consists of interlayered quartz amphibolite and biotite-quartz-plagioclase gneiss. Conformably overlies garnet schist that closely resembles part of Wissahickon Formation, which in turn overlies bedded microcline-mica gneiss that is much like part of Setters Formation. Sequence is separated from main belt of Glenarm metasedimentary rocks by broad belt of younger plutons, across which correlation is uncertain at best. Similarly, greenstones and schistose felsites of southern Cecil County (which have been called "Cecil volcanics" or "Cecil County volcanic complex" (Marshall, 1937, Maryland Geol. Survey, v. 13) are surrounded by younger intrusive rocks, and their stratigraphic relation to known formations of Glenarm Series is largely a matter of conjecture. Proposed that James Run Gneiss and the volcanic complex of Cecil County not be included formally in Glenarm Series at present time.

Named for James Run in southeastern Harford County.

Janum Formation

Miocene and Pliocene: Guam.

W. S. Cole, 1963, U.S. Geol. Survey Prof. Paper 403—E, p. E10. Report discusses Tertiary larger Foraminifera of Gaum. The Janum is placed in Tertiary largely on field evidence. The Janum may be either a deep-water facies of Barrigada Limestone (new), or a unit slightly younger than typical Barrigada.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A41—A44, pls. Formal proposal of name. A sequence of well-bedded globigerinid limestones ranging in thickness from 4 to 70 feet. At type section, herein designated, base of formation is not exposed, but Bonya limestone is thought to lie a very short distance below lowest part of the Janum exposed here [type section] because in other places where Janum is thinner, the Bonya immediately underlies the Janum. Unconformable contact with Mariana limestone. Probably equivalent to some or all of Barrigada formation.

Type section: On seacoast at Catalina Point, 1¼ miles southeast of Mount Santa Rose. Crops out a seven localities along northeast coast of Guam from Lujuna to Anao Point.

Janus Lava Flow

Recent: Central Arizona.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 8, 37. Lava flows classified into five groups or stages which are based on the stage of erosion which they exhibit. Janus lava flow listed as an example of a stage IV flow in which the true edge of the flow is visible and the surface of the flow is very rough and broken.

Source was Janus Crater.

Jarvis Ash Bed

Recent: Eastern Alaska.

R. D. Reger and others, 1964, Alaska Univ. Anthropol. Papers, v. 12, no. 2, p. 92—100. Name applied to ash bed in alluvial fan of Ruby Creek. Bed is conformable with crude stratification of underlying and overlying silt layers. Ash is cream colored when dry and light grey when wet. Thickness 1 to 3 centimeters. Near center of exposure, ash bed dips beneath tongue of gravel and is pinched off into isolated pods and lenses. Bed deposited between 2,000 and 4,000 years ago. Birch Creek Schist forms walls of Delta River valley in area.

Named for exposures at Jarvis Creek. In Delta River valley in vicinity of Yardang Flint Station, central Alaska Range.

Jatahmund Lake Glaciation

Pleistocene (Wisconsin): East-central Alaska.

A. T. Fernald, 1965, U.S. Geological Survey Prof. Paper 525—C, p. C120—C123. Morainal deposits define two major glaciations—the Black Hills of Illinoian age and the Jatahmund Lake of Wisconsin age—in upper Tanana River valley. Drift at type section for deposits of the Jatahmund is till that contains pebble- to boulder-sized fragments in matrix of sand and silt that is interbedded with poorly stratified gravel consisting of well-founded pebbles, cobbles, and boulders in a sandy matrix.

Type section for deposits: Bluff of gray drift along Nabesna River. Named for Jatahmund Lake, largest lake confined by end moraines on the piedmont.

Javelina Formation (in Tornillo Group)

Upper Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, road logs, pl. 1. Predominantly clay unit containing some lenticular masses of yellowish-gray, yellowish-brown, and dark-brown crossbedded sandstone. Contains fossil wood and dinosaur bones. Thickness 350 to 850 feet. Underlies Black Peaks Formation (new); overlies Aguja Formation. Locally underlies Canoe Formation (new), Burro Mesa Riebeckite Rhyolite, or Alamo Creek Basalt.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 88—96, pls. Formal proposal of name. Proposed for the Cretaceous part of original Tornillo Clay (herein redefined and rank raised to group). Nominally a clay unit containing some lenticular masses of yellowish-gray, yellowish brown, and dark-brown crossbedded sandstone. Clay mostly bentonitic and is varicolored in shades of maroon, dull gray, olive green, and dirty brown. Thickness 534 feet at type section. Gradationally overlies Aguja Formation. Unconformable below Alamo Creek Basalt.

Type section: Exposed between the Park [Big Bend Park] road and Tule Mountain, Brewster County. Name is from Javelina Creek in northeastern part of Tornillo Flat.

Jawbone Ridge biotite-augite latite

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Jawbone Ridge biotite-augite latite gave age of 9.0±.1 m.y.

Sample collected from Tuolumne quadrangle, 4210-foot elevation, 8300 feet N. 42° E., from southwest corner, sec. 19, T. 1 N., R. 18 E.

Jay granite

Age not stated: Southwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 113 (road log). Jay granite noted in exposure with Anasagunticook Formation (new).

Area of report is Buckfield and Dixfield quadrangles.

Jay Peak Formation (in Camels Hump Group)

Jay Peak Member (of Underhill Formation)

Lower Cambrian: North-central Vermont.

C. G. Doll, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Mapped as member of Underhill formation. Consists of pale, silver-green, quartz-sericite-chlorite-albite schist, locally quartzitic.

J. C. Dennis, 1961, New England Intercollegiate Geol. Conf. Guidebook 53d Ann. Mtg., sec. 6, table 1. Listed as formation in Camels Hump Group.

W. M. Cady, A. L. Albee, and A. H. Chidester, 1963, U.S. Geol. Survey Bull. 1122—B, p. B—13—B—15, pl. 1. Formal proposal of name. Consists of quartz-sericite-chlorite-albite schist, quartz-sericite-albite-chlorite quartzite, and a few beds of amphibolite. General absence of carbonaceous interbeds distinguishes these rocks from similar types in underlying Hazens Notch formation, with which Jay Peak intergrades, and younger Ottauquechee formation. Apparent thickness about 2,500 feet at Burnt Mountain in town of Montgomery. Thins to extinction to east and south.

Typical exposure: On Jay Peak in northwestern part of town of Westfield.

Jayuya Tuff

Lower Cretaceous: West-central Puerto Rico.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B5 (fig. 2), B7—B8. A sequence of pyroclastic volcanic rocks with some lava and fine-grained sedimentary rocks. Exposed at type locality are massive dark-green coarse-grained tuff and lapilli tuff with several lenses 5 to 10 m thick of greenish-gray laminated medium-bedded silicified mudstone and thin-bedded graded tuffaceous sandstone. Mafic volcanic rocks of the Jayuya Tuff occur along north and east sides of Utuado batholith, and formation is also present south of batholith in fault blocks between Hacienda Jauca and Hacienda El Banco. Lower part of Jayuya Tuff is cut out by Utuado batholith; upper contact appears to be conformable with Robles Formation. Rocks south of batholith are in fault contact with Robles on the north and west, are probably in fault contact with plutonic rocks on southwest, and are unconformably overlain by Eocene rocks on southeast. Massive pyroxene-rich tuff and lapilli tuff of Jayuya are at least 900 m thick at Cerro Morales, and feldspathic facies as much as 600 m thick where it is exposed 2 km northwest of Cerro Saliente. No fossils. Unconformably underlies Río Prieto Formation (new).

Type locality: On trail north from route 531 up the slope of Cerro Morales, from (132,730 m E.; 44,740 m N.) to (132,685 m E.; 45,190 m N.) Jayuya quadrangle. Named for exposures in Jayuya quadrangle north and west of town of Jayuya.

Jemez Springs Shale Member (of Madera Formation)

Upper Pennsylvanian: North-central New Mexico.

P. K. Sutherland and F. H. Harlow, 1967, Jour. Paleontology, v. 41, no. 5, p. 1065—1089. A shale interval 30 to 40 feet thick. Near top of the Madera. Base of member coincides with top of highest Pennsylvanian cliff-forming limestone layer in area and its top is within 4 to 7 feet of base of Abo red beds. Contains abundant brachiopods.

Type locality: Jemez State Monument, consisting primarily of ruins of an ancient church, on New Mexico State Highway 4, at north edge of village of Jemez Springs. Exposure of Jemez Springs Shale Member (type locality) is about 150 feet above level of church ruins and its nearest point of exposure to the ruins is on the hillside about 300 to 400 yards to the northeast.

Jenkins Peak Formation

Paleozoic: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12 (table 2). Table 2 is a stratigraphic section of Mountain City quadrangle by E. C. Stephens (1946, unpub. rept.). Jenkins Peak consists of conglomerate, quartzite, sandstone, limestone, schists, and slates. Overlies Rio Tinto Formation with angular unconformity. May correlate with Banner Formation.

Elko County.

Jenny Creek Tuff

Jenny Creek Formation (in Idavada Volcanics).

Pliocene: Northeastern Nevada and southwestern Idaho.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M13, pl. 1. White to pale-yellow or buff massive to well-bedded vitric tuffs, poorly consolidated. Locally includes thin layers of welded tuff. Type section includes one layer, about 3 feet thick, of dark-gray rhyolite welded tuff with crystals of quartz, sanidine, andesine, magnetite, apatite, and zircon. Thickness 60 to about 330 feet. Tuff is patchily distributed across full width of Jarbidge quadrangle and rests everywhere with depositional contact on Jarbidge rhyolite, Pole Creek dacite, or Slide Creek gravel (new). Locally intruded by Robinson Creek dacite and overlain by Cougar Point welded tuff (new). Malde and Powers (1962) applied name Idavada volcanics to unit that includes Cougar Point welded tuff and Jenny Creek tuff and possibly other rocks not represented in Jarbidge quadrangle.

D. I. Axelrod, 1964, California Univ. Pub. Geol. Sci., v. 51, p. 6 (table 1), 10—11. Middle formation in Idavada volcanics, herein recognized as group. Rests on Beaverdam formation (new) with slight angular unconformity in valley of Trapper Creek, but apparently is conformable with it in drainage of Beaverdam Creek to south. Grades upward into Cougar Point formation. Thickness about 600 feet in Trapper Creek area, Idaho [this report] Miocene (Barstovian).

Type locality: Just below mouth of Jenny Creek or Jack Creek, Jarbidge quadrangle, Elko County, Nev.

Jens Formation (in Colorado Group)

Upper Cretaceous: Central western Montana.

V. E. Gwinn, 1961, Dissert. Abs., v. 21, no. 8, p. 2247, 1961, Montana Bur. Mines and Geology Spec. Pub. 21 (geol. map 4), 1965, Billings Geol. Soc. Guidebook 15th Ann. Field Conf. p. 47—48. Defined as the thick series of shales and siltstones lying above Coberly formation (new) and below Carter Creek formation (new). Composed of about 1,000 feet of dark shale and siltstone, and minor thin-bedded silty siliceous mudstone east of Gough Creek; west of Gough Creek thickens to 1,500 feet at Hoover Creek with addition of volcanic-rich siliceous sandstone, siltstone, and silty mudstone in middle member. Medial sandstone tongue probably disappears eastward by facies changes into siltstone and shale.

Type section: East of Jens in NW¼ sec. 21 and NE¼ sec. 20, T. 10 N., R. 11 W., Powell County. Section displays maximum thickness and range of lithology. Name derived from village of Jens, 8 miles east of Drummond.

Jensen Member (of Chainman Formation)

Mississippian: Northern Utah and eastern Nevada.

C. A. Arnold and Walter Sadlick, 1962, Michigan Univ. Mus. Paleontology Contr., v. 17, no. 11, p. 249 (fig. 4), 250 (fig. 5), 251. Uppermost member of Chainman. Overlies Willow Spring member (new). Names will be formally introduced later.

H. J. Bissell, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48., no. 5, p. 569, 570, 571. Stratigraphers not in complete agreement regarding nomenclature of strata directly beneath Ely Limestone. Throughout large part of area is distinctive lithofacies of shale, sandstone, brown encrinal limestone, and calcarenite. Spivey (1954, Pacific Petroleum Geologist, v. 8, no. 7) applied name Illipah Sandstone to part of sequence, and present writer [Bissell] 1960, included most of lithofacies in Illipah Formation. Name Illipah never became official for above mentioned sequence of rocks, but has been used by Humphrey (1960) for rocks of Tertiary age in White Pine mining district. Steele (1960, Intermountain Assoc. Petroleum Geologists Guidebook 11th Ann. Field Conf.) proposed name "Illipah" be abandoned in favor of Scotty Wash Quartzite. Arnold and Sadlick (1962) used name "Jensen Member" of Chainman. In measured sections in present report "Jensen Member" of Chainman Shale is used for "Illipah Formation" of old reports. Both sections measured in White Pine County, Nev. Morrowan-Springeran Series.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978. Uppermost member of Chainman. Thickness about 450 feet. An alluvial coastal plain and neritic facies. Overlies Willow Gap Limestone Member (new).

Type locality and derivation of name not given.

Jewell Island Phyllite (in Casco Bay Group)

Siluro-Devonian: Southwestern Maine.

M. W. Bodine, Jr., 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., p. 60. Almost identical to Scarboro Phyllite. Lies above Spurwink Limestone, and without outcrops of the limestone for reference it is impossible to distinguish from the Scarboro. [This may or may not be same unit as Jewell Phyllite of Katz (1917, Washington Acad. Sci. Jour., v. 7).]

Jewell Phyllite is named for development on Jewell Island in Casco Bay, Cumberland County.

Jicarilla Monzonite

Permian: South-central New Mexico.

A. J. Budding, 1964, New Mexico Geol. Soc. Guidebook 15th Field Conf., p. 82, 84, 86. Common rock type is leucocratic gray to buff monzonite porphyry with varying amounts of quartz. Along northern and southern boundaries, monzonite is in contact with San Andres-Glorieta sequence. East of Jicarilla, Yeso Formation borders the intrusive. Crosscutting relationships between monzonite and overlying sediments are present along western boundary of pluton, and here contact cuts Bernal, Santa Rosa, and Chinle Formations.

Crops out in vicinity of village of Jicarilla, Lincoln County. Forms pluton of irregular shape, about 7 miles long in northwest direction and about 4 miles northeast.

Joaquin Miller Formation

Upper Cretaceous: West-central California.

J. E. Case, 1963, Dissert. Abs., v. 24, no. 3, p. 1135. Northeast of Chabot fault, 6,000 to 8,000 feet of Upper Cretaceous strata are exposed. These beds were referred to Chico Formation and Oakland Conglomerate Member by Lawson. These beds have been divided into (ascending) Joaquin Miller Formation (new), Oakland Conglomerate, Shephard Creek Formation (new), Redwood Canyon Formation (new), and variegated red and green shale. Joaquin Miller Formation is a sequence of sandstones and shales.

Report discusses geology of part of Berkeley and San Leandro Hills, in San Francisco Bay area.

Jobo Dulce Limestone Member (of Cariblanco Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I—335. Consists of medium-gray to greenish-gray medium- to thick-bedded and generally sandy or conglomeratic bioclastic limestone, with partings of shaly mudstone and siltstone. Thickness more than 50 m at type locality; thins westward and beyond Highway 14 is discontinuous. Occurs about 200 m below top of formation, above Hacienda Larga tuff member (new), and below Pío Juan limestone member (new).

Type locality: Along crest of Cerro Jobo Dulce at eastern border of Coamo quadrangle. Caps several hills between type locality and Highway 14, where about 2.5 km north of bridge over Río Cuyon, it is exposed in roadcut. Present as lenticular body on hill, 1 km west of Highway 14.

Jobos Formation

Eocene(?): Puerto Rico.

A. E. Nelson, 1967, U.S. Geol. Survey Misc. Geol. Inv. Map I—480. A thick sequence of massively bedded volcanic breccia and associated rocks. Estimated thickness 1,700 m. Lower contact placed at base of lowermost massively bedded volcanic breccia that overlies relatively thin bedded volcanic sandstone and siltstone at top of Yunes Formation. This contact appears to be conformable, but locally it may be disconformable. Overlain with angular unconformity by limestone of Oligocene age. Most exposures are in valley of Río Grande de Arecibo, but inliers, probably exhumed buried hills, are present in area of Oligocene limestone. Probably Eocene. Map bracket shows upper Paleocene to middle Eocene and younger (?).

Type section: About 3 km north-northeast of Quebrada Jobos on the east side of the Río Grande de Arecibo at coordinates 127,720—56,880, Utuado quadrangle.

John Mansville Formation

Pliocene: West-central California.

G. R. Case, 1967, Fossil shark and fish remains of North America: New York, Grafco Press, p. 18 (fig. 98). Clupied fish skeleton from John Mansville formation shown in figure.

Collected from near Lompoc, Calif.

Johns Creek Flow (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 30—31, fig. 18. Member of "Upper" Basalt of Columbia River Basalt [Group]. Separated from underlying Center Creek Flow (new) by two unnamed flows about 180 feet thick. May be correlative to Maggie Creek Flow (new) east of Camas Prairie.

Named from exposures about 900 feet below the Camas Prairie at confluence of Johns Creek and Rock Creek, 1 mile northwest of Tolo Lake. Well exposed in adjoining canyons and traceable for many miles along Snake and Salmon Rivers.

Johns Creek Member (of Middlesex Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Overlies Montour Member (new); underlies Sawmill Creek Member. Consists of gray shales, siltstones, and black shales (rare).

Type section: In Johns Creek, 2 miles west of Watkins Glen, Schuyler County (elevation, 990 to 1,090 feet). Traced southeastward to Chenango Forks, 39 miles southeast of Ithaca.

Jollo Formation

Jollo Conglomerate

Lower Cretaceous: Western California.

N. L. Taliaferro, 1943, Am. Assoc. Petroleum Geologists Bull., v. 27, no. 2, p. 199 (fig. 7). Conglomerate and sandstone, equivalent to lower Shasta.

C. A. Hall, Jr., and C. E. Corbato, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 562 (fig. 2), 564—565, pls. 1, 2. Name "Jollo conglomerate" first used by Taliaferro (1943) for conglomerate and sandstone in eastern part of Nipomo quadrangle that he considered to be of Early Cretaceous age. Name Jollo Formation used herein as local stratigraphic name for rocks of Early Cretaceous age in Jollo Creek area. Formation consists of olive-gray to dark-greenish-gray or black mudstone, siltstone, and shale interbedded with reddish-brown or locally greenish-brown fine- to coarse-grained arkosic wacke or lithic wacke. Thickness about 3,000 feet in Nipomo quadrangle. Disconformably overlies Franciscan group. Unconformably overlain by Upper Cretaceous Carrie Creek Formation (new).

Occurs in Jollo Creek area, secs. 29, 30, T. 12 N., R. 32 W., Nipomo quadrangle, San Luis Obispo County, southern Coast Ranges.

Jonah Limestone (in Austin Group)
Janah Formation (in Austin division)

Cretaceous (Gulf Series): Central Texas.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Bros., p. 353. According to Durham (1957, unpub. thesis) the type Austin sequence (in vicinity of Austin) includes (ascending) Atco chalk, Bruceville chalk-marl, Vinson chalk, Jonah limestone, Dessau chalk, Burditt chalk marl, and Big House chalk.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121–1123. Formation in lower part of Austin Group. Overlies Atco formation; underlies Schwertner member (new) of Dessau formation. Name credited to Durham (1957).

Keith Young, 1962, Geol. Soc. America Guidebook Houston Mtg., p. 99 (table 2), 103 (table 3). Listed on tables as formation in Austin division, Gulf series. Above Atco formation and below Vinson formation.

Keith Young, 1965, Texas Univ. Bur. Econ. Geology Circ. 65–3, p. 3 (table 2). As shown on table, Jonah underlies Sprinkle Formation (new).

Occurs in type section of Austin Group at Austin.

Jonathan Creek Formation (in Maxville Group)

Middle and Upper Mississippian: East-central Ohio.

J. W. Scatterday, 1964, Dissert. Abs., v. 24, no. 11, p. 4635. Middle formation of group. Overlies Dillon Falls Formation (new); underlies Bluerock Creek Formation (new). Lower and middle members (informal) are equated with all or some part of pre-Golconda Chester; beds about 10 to 20 feet above base of upper member (informal) are correlated with Haney Limestone of Kentucky, presumably equivalent to upper formation of Golconda Group of standard Mississippian, and lower 10 feet are believed to be equivalent to lower formation of the Golconda, the Beech Creek Limestone.

Jones Ridge Limestone

Lower Cambrian to Middle or Upper Ordovician: East-central Alaska, and western Yukon, Canada.

E. E. Brabb, 1967, U.S. Geol. Survey Prof. Paper 559–A, p. A15–A19 Provisionally divided into two unnamed members. Lower 2,000 feet of lower member consists primarily of very light gray massive limestone and dolomite. Thickness of lower member 2,940 feet. Lower member may range in age from Early Cambrian to Early Ordovician. No fossils of Middle Cambrian and middle Late Cambrian (Franconian) age were found, but the part of the section where the fossils would occur has not been carefully examined. Upper member consists of about 60 feet of pale-yellowish-brown medium- to coarse-grained thickly bedded bioclastic limestone. Fossils indicate upper member is either Middle or Late Ordovician. Fossils and stratigraphic sequence indicate that lower member of Jones Ridge is correlative with Funnel Creek Limestone, Adams Argillite, and Hillard Limestone (all new). Formation overlies Tindir Group and underlies unnamed chert, shale, and limestone.

Type section: Central part of sec. 3, T. 3 N., R. 33 E., where base of formation is exposed, then across crest of Jones Ridge to northwest part of section 10, at an altitude of about 3,300 feet. Top of formation is at base of a 60-foot largely covered interval. Formation exposed in spectacular cliffs and jagged peaks from Jones Ridge to Squaw Mountain. Extends into a small area in Yukon, Canada.

Joppa Member (of Ste. Genevieve Limestone and Aux Vases Sandstone)

Mississippian (Valmeyeran): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 5 (table 1), 6 (fig. 2), 10, pl. 1. Uppermost member of Ste. Genevieve in Hardin County. Consists of oolitic limestone and fine-grained limestone characterized by numerous shale partings or thin shale beds. Is chief fluorspar horizon. Thickness about 30 feet. Member is largely limestone in Hardin County,is dominantly clastic some 20 or 30 miles to north and west, and is nearly all sandstone and shale still further to the north and west where it may be considered a member of Aux Vases Sandstone. Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 28—29, 71, pl. 1. Name formally proposed in this report for shale, sandstone, and limestone of Genevievian age that lie upon limestone assigned to Karnak Member of Ste. Genevieve Limestone and beneath clastic rocks assigned to Rosiclare Member of Aux Vases Sandstone. Joppa is assigned to the Ste. Genevieve wherever presence of a prominent limestone bed at its top makes this practical, but to Aux Vases Sandstone wherever absence or thinness of the limestone bed makes separation of Joppa from Aux Vases impractical. In most of southeastern Illinois the Joppa has been called "Aux Vases lime" and is unit between "Indiana Ste. Genevieve top" and the "Illinois Ste. Genevieve top." It is in this region that the Joppa is most useful and is considered member of Ste. Genevieve. At type section is represented by 32 feet of shale, only partially exposed, containing thin sandy layers near base and beds of hematitic, oolitic limestone up to a foot or so thick in upper part. Type section lies upon that of Karnak Limestone Member and beneath 19 feet of poorly exposed sandstone and shale of Aux Vases (Rosiclare Member), which in turn is overlain by about 4 feet of Levias.

Type section: Exposures on hillslope and in road ditch north of secondary road leading to Belknap, about 300 feet east of Illinois Highway 37, and one-half mile east of railroad track at Joppa Junction, in SW¼SW¼ sec. 32, T. 13 S., R. 2 E., Dongola quadrangle, Johnson County.

Jordan Limestone Member (of Bingham Mine Formation)

Pennsylvanian (Missourian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 8, 9, pl. 5. Lowermost member of formation. In middle Canyon, the Jordan has 195 feet of black and dark-gray fine-grained argillaceous and silty thin-bedded to platty fossiliferous limestone with abundant black nodular chert overlain by 113 feet of light-brown to dark-gray fine-grained sandy crossbedded limestone at top. Underlies Lark limestone member (new); overlies Butterfield formation (new) with Sub Jordan limestone member (new) at top. Jordan and Commercial (new) limestones occur on both sides of Bingham stock. On west side of Bingham mining district these units are known as Highland Boy and Yampa limestones. Units and names described herein are those used by

Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

L. A. Hansen, 1961, Utah Geol. Soc. Guidebook 16, p. 77, fig. 14 (strat. column). Highland Boy limestone is also known as Jordan or Brooklyn limestone.

Bingham Mining district northern Oquirrh Mountains.

Jordanville Member (of Herkimer Formation)

Middle Silurian: East-central New York.

D. H. Zenger, 1966, Geol. Soc. America Bull., v. 77, no. 10, p. 1159—1166. Stratigraphic usage of "Herkimer Sandstone", uppermost unit of Clinton, has been inconsistent. In this revision, the Herkimer is considered a formation with a western and eastern facies, each of which is called a member. The Joslin Hill Member represents western facies and the Jordanville the eastern facies. The Jordanville consists of light-gray to brownish-gray orthoquartzite, in lower part, generally lighter gray in upper part. Thickness 45 feet at type section where the resistant orthoquartzite creates an impressive 40-foot waterfall. Overlies Willowvale Shale and underlies Vernon Shale on west and Brayman Shale on east.

Type section: Along main branch of Flat Creek immediately north of northwest-southeast paved road and an artificial lake 2.5 miles northwest of Jordanville. Name taken from village in northwest part of Richfield Springs quadrangle.

Jory Member (of Havallah Formation)

Middle Pennsylvanian and Lower Permian: North-central Nevada.

R. J. Roberts, 1964, U.S. Geol. Survey Prof. Paper 459—A, p. A45—A46, pl. 4. Name applied to lowest unit of formation. Consists of sandstone and pebbly sandstone and interbedded minor amounts of conglomerate, shale, and chert. Thickness 1,272 feet at type section. Underlies Trenton Canyon Member (new); overlies Pumpernickel Formation.

Type section: On west side of Willow Creek, Antler Peak quadrangle, Pershing County. Named from nearby Jory Ranch.

Jose Formation (in El Paso Group)

Canadian (Demingian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. An oolite younger than Victorio formation (new) and older than Mud Springs Mountain formation (new). Canadian treated as system in this report.

Type section: Northern end of Cooks Range. Named for Jose mining district.

Joshua Rock Gneiss Member (of New London Gneiss)

Joshua Rock Gneiss Member (of New London? granite gneiss)

Ordovician(?) or older: South-central Connecticut.

Lawrence Lundgren, Jr., 1963, Connecticut Geol. and Nat. History Survey Quad. Rept. 13, p. 16, 18, pl. 1. In Selden Neck dome, Plainfield formation is separated from Monson gneiss by sequence of granite gneisses tentatively correlated with New London granite gneiss. This sequence of granite gneisses includes a distinctive aegerine-augite granite gneiss here named Joshua Rock gneiss. It is regarded as a member of the sequence. Age of rock sequence from Plainfield formation to Hebron formation ranges from Cambrian(?) or even Precambrian to Ordovician or possibly Silurian.

Richard Goldsmith, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—609. Joshua Rock Gneiss Member of New London Gneiss mapped in Montville quadrangle, New London County. In lower part of formation. Ordovician(?) or older.

Exposed in quarry at Joshua Rock, Deep Rock quadrangle.

Joslin Hill Member (of Herkimer Formation)

Middle Silurian: East-central New York.

D. H. Zenger, 1966, Geol. Soc. America Bull., v. 77, no. 10, p. 1159—1166. Stratigraphic usage of "Herkimer Sandstone", uppermost unit of Clinton unit, has been inconsistent. In this revision, the Herkimer is considered a formation with western and eastern facies, each of which is called a member. The Joslin Hill Member, consisting of shale, dolostone, sandstone, and hematite beds, represents Herkimer Formation in western part of outcrop belt and Jordanville Member the eastern part. Thickness of Joslin Hill 65 feet at type section. Overlies Willowvale Shale and underlies Ilion Member of Lockport Formation.

Type section: Along south branch of Moyer Creek about 1.3 miles east-northeast of Parker Corners in the S 1/9 of Utica quadrangle. Name taken from the hill immediately east of the creek, along whose north slope are other out crops of the member.

Judd Hollow Tongue (of Carmel Formation)

Middle and Upper Jurassic: Southeastern Utah and northeastern Arizona.

D. A. Phoenix, 1963, U.S. Geol. Survey Bull. 1137, p. 33, 63, 66—67, 69, pl. 2. Name applied to horizontally bedded sandstone in lower part of Carmel. Crossbedded sandstone correlative with upper part of Navajo sandstone is herein named Thousand Pockets tongue. Consists of dark- to red-brown fine- to medium-grained limy sandstone and siltstone in horizontal beds 2 to 6 feet thick. Thickness 32 feet at type section; 20 feet on Cedar Mountain; 168 feet at Lick Wash close to its junction with main mass of Carmel. Conformably underlies Thousand Pockets tongue.

J. C. Wright and D. D. Dickey, 1963, U.S. Geol. Survey Prof. Paper 450—E, p. E66. Limestone of lower part of Carmel Formation passes southeastward beneath Thousand Pockets Tongue of Navajo to form Judd Hollow Tongue of Carmel. Thickness 100 to 200 feet on west side of Paria Valley; 50 to 100 feet on east side of valley. Pinches out near head of Judd Hollow on Paria Plateau. From west to east the limestone thins, grades from relatively pure carbonate to argillaceous limestone, and from gray to reddish gray. Interbedded red siltstone and sandstone increase eastward. Uppermost bed of limestone, which is ripple marked and oolitic near East Kaibab monocline, grades to ripple-marked limey siltstone that may be traced a little east of Judd Hollow.

Type section: North side of Judd Hollow in NW¼ sec. 31, T. 43 S., R. 2 E., Kane County, Utah.

Judith Fancy Formation (in Mount Eagle Group)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. A unit of tuffaceous sedimentary rocks with exposed thickness of 15,000 feet including Clairmont, Blue Mountain, and Recovery Hill members (all new). Overlies Cane Valley formation (new) in west and Caledonia formation (new) in east. Campanian, possibly Early Maestrichtian to Santonian.

J. T. Whetten, 1965, (abs.) Geol. Soc. America Spec. Paper 82, p. 221. Discussion of wairakite from St. Croix. Wairakite has been identified in thin unit of very fine grained impure limestone from lower part of marine Judith Fancy Formation at type locality.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 184—187, 200—201, pl. 1. Composed of tuffaceous rocks about 15,000 feet thick. Present over wide area of western and central St. Croix. Contact with underlying Springfield and Caledonia Formations conformable, but contact with Tertiary rocks of coastal plain is angular unconformity. Two exposures of Judith Fancy are separated by Tertiary sedimentary rocks of coastal plain which partly conceal large normal faults trending approximately parallel to Butzberg fault, which cuts Judith Fancy Formation in East End Range. Faulting has moved Judith Fancy-Caldeonia contact south in fault block. Formation undifferentiated in many areas but Clairmont and Blue Mountain Members can be separated and mapped in Northside Range and Recovery Hill Member in East End Range. In some areas underlies Jealousy Formation.

Type locality: St. Croix, Virgin Islands. Named from Estate Judith Fancy.

Judy Gap Series

Lower Silurian: Northeastern West Virginia.

Ping-fan Chen, 1964, West Virginia Geol. and Econ. Survey Educational Ser., p. 1—18. Discussion of nomenclature of Lower Paleozoic stratigraphy in northeastern West Virginia. Lower limit of the Silurian in West Virginia depends on age of the Juniata and Oswego. Since the assignment of both of them to the Silurian, present author would set Silurian-Ordovician boundary between Martinsburg Shale and Oswego Sandstone. In Judy Gap, Pendleton County, W. Va., Lower Silurian clastic deposits consist of 115 feet of Tuscarora white and pinkish-white sandstone, 906 feet of Juniata red shale and sandstone, and 179 feet of Oswego gray sandstone and shale. No hiatus is present above Tuscarora or below Oswego. Term Judy Gap Series is selected to replace the "Medina", "Albion", or "Alexandrian" for Lower Silurian Series because Judy Gap section is best section to be found in the Appalachians.

Julian Rocks Formation

Upper Cretaceous (Cenomanian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Principally sandstone conglomerate. Thickness 5,000 feet. Overlies Aspilche formation (new); underlies Clark Valley mudstone (new).

In Elk Creek-Fruto area, Glenn County.

Jump Creek Rhyolite

Miocene, upper: Southeastern Oregon.

L. R. Kittleman, Jr., 1962, Dissert. Abs., v. 22, no. 12, pt. 1, p. 4321. As much as 500 feet of mostly extrusive grayish-red rhyolite. Overlies Sucker Creek formation (new); unconformably underlies Owyhee basalt.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 7—8. Formal proposal of name. Grayish-red to gray porphyritic rhyolite. Thickness 100 to as much as 800 feet. Chronologic relations of Jump Creek are ambiguous. In type area overlies Sucker Creek Formation, but its relation to the Owyhee Basalt, which also overlies Sucker Creek Formation is unknown. On western Snake River Plain the Jump Creek appears to underlie Poison Creek Formation, but at nearby localities the rhyolite overlies strata also assigned to the Poison Creek. May be lateral equivalent to part of Idavada Volcanics of Malde and Powers (1962). Rocks of Jump Creek Rhyolite were named Owyhee Rhyolite by Kirkham (1931). Term "Owyhee" preoccupied by name "Owyhee Basalt."

Type area: Near origins of Jump Creek, in secs. 4, 5, 8, 9, T. 1 N., R. 5 W., and secs. 27, 28, 33, 34, T., N., R. 5 W., Boise Meridian, Owyhee County, Idaho. Widely exposed in Owyhee Reservoir district Oregon, which is between fault system of Steens Mountain on west, and faults of Snake River Plain on east.

Juniper Flat alluvium member (of Lousetown Formation)

Pleistocene: Eastern California.

P. W. Birkeland, 1962, Sacramento Geol. Soc. Guidebook Ann. Field Trip, June 9—10, p. 61, fig. 2 (map). Informal term applied to alluvium that was laid down as fan deposit on latite flows by Juniper Creek about the same time as Prosser Creek alluvium (new) was deposited.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Consists of interfingering lenses of silt, sand, and gravel, with some 1-foot boulders. Maximum known thickness about 80 feet. Overlies andesite bedrock and Hirschdale olivine latite (new).

Covers much of Juniper Flat, Truckee area, north of Lake Tahoe.

Juntura Formation

Miocene, upper, through Pliocene: Southeastern Oregon.

J. A. Shotwell and others, 1963, Am. Philos. Soc. Trans., v. 53, pt. 1, p. 23 (map 5), 25—28, 32 (fig. 7). A diverse unit consisting mostly of diatomaceous beds. Made up of three members, though not all are present in any one section. Lower member, as exposed north of Scab Mountain consists predominantly of fine-grained unconsolidated ash. Middle member, typically exposed at Juniper Hill, consists of diatomite and associated porcelaneous and opaline rocks. Upper tuffaceous beds are best exposed to south and west of Pete Mountain. Thickness about 1,250 feet. North of Scab Mountain about 400 feet of tuffaceous and agglomeratic beds capped by flow of palagonite are present but base is not exposed. To south of Pete Mountain, upper tuffaceous beds are 400 feet thick. Disconformably overlies basement complex. Unconformably underlies Drewsey formation (new).

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 22—23. Overlies Tims Peak Basalt (new) and underlies Drewsey Formation.

Named from town of Juntura, Malheur County. Most extensive occurrence is in eastern part of Juntura Basin with lesser exposures along valley of Stinkingwater Creek.

Justiss Tongue (of Terryville Sandstone)

Justiss Sand (in Schuler Formation)

Upper Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. The Justiss as originally defined (Martin and others, 1954, Louisiana Geol. Survey Bull. 29) included Ardis sand and sandstone beds above and below the Ardis (as shown in well 6, plate 1 of this report). Because both the Ardis and the upper sandstone bed of the Justiss (original) are regionally extensive, it is proposed herein that name Justiss (restricted) be reserved for the upper sandstone bed of the original Justiss. Occurs at depth of 8,864 feet to 8,910 feet in type well.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 143—152. Rank reduced to tongue in Terryville Sandstone (new). Includes blanket sandstones "E", Justiss, and Burgess-Simmons. Type section designated where it occurs at depth 9,100 to 9,430 feet. Occurs below McFearin Tongue.

Type well (sand): Ohio Oil Co. No. 1 Pardee, sec. 1, T. 21 N., R. 10 W., Cotton Valley field. Reference well (sand): C. V. Operators Comm. Ohio-Gleason No. 6, sec. 28, T. 21 N., R. 10 W., Webster Parish.

Type section (tongue): California Co. Colvin No. 1, SE¼NW¼ sec. 14, T. 19 N., R. 4 W., Knowles Field, Lincoln Parish, La.

Kadletz Volcanics (in Challis Volcanic Group)

Miocene, lower(?): East-central Idaho.

A. L. Anderson, 1961, Idaho Bur. Mines and Geology Pamph. 124, p. 52—53, pl. 1. Challis volcanic formation redefined and given group status and subdivided into three units of formational rank (ascending): Cheney, Yearian, and Kadletz Volcanics. Kadletz is chiefly basaltic. Least widespread of the three formations. Represented as isolated caps resting unconformably on Cheney and Yearian.

Named for Kadletz Creek in Baker (Goldstone Mountain) quadrangle.

Kahoka Till

Pleistocene (Kansan?): Northeastern Missouri.

J. E. Stone, 1961, Dissert. Abs., v. 21, no. 10, p. 3061. Oldest of three stratigraphic units recognized in area. Underlies Clark silt (new).

G. E. Heim, Jr., 1964, Dissert. Abs., v. 24, no. 9, p. 3688. Following Pleistocene units present in Hannibal-Canton area: alluvium, Peoria(?) loess, terraces, Oakwood gravels (new), La Grange gravels (new), Clear Creek silt (new), Dover clay (new), Kahoka till, and pro-Kahoka sands and gravels. Kahoka till is only till recognized from surface studies. Tentatively assigned to Kansan.

Kahoka is in Clark County.

Kamp Ranch Limestone Member (of Eagle Ford Formation)

Upper Cretaceous: Northeastern Texas.

G. H. Norton, 1965, *in* The Geology of Dallas County—a symposium: Dallas, Tex., Dallas Geol. Soc., p. 77–79. Flaggy detrital limestone in upper part of formation. Thickness 3¼ feet at type locality. Overlies Britton member; underlies Arcadia Park member (restricted). Name credited to R. M. Meier (1964, unpub. thesis).

Type locality: Exposures along unnamed tributary of Bedford Branch of Mountain Creek on Kamp Ranch property, just north of Britton-Midlothian road in northwestern Ellis County, about 1½ miles east and 2 miles south of southwestern corner of Dallas County.

Kana-a Lava Flow

Recent: East-central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 10, 33–34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary when basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Bonito and Kana-a flows from Sunset Crater are examples of stage V in which the true edge is visible. Kana-a flow is deeply buried.

C. A. Hodges, 1962, Plateau, v. 35, no. 1, p. 15–36. Associated with Sunset Crater are two lava flows—Bonito and Kana-a. Kana-a flow consists of single unit which had its source at or near the vent now obscured by Sunset Crater. Lava is aa, resembling Bonito flow in both morphology and petrology. Increases in thickness toward northeast, approaching about 20 feet near its termination. Partially concurrent with ash fall of primary Bonito. Younger than S. P. flow. Birth of Sunset Crater about A.D. 1064.

D. A. Breternitz, 1967, Plateau, v. 40, no. 2, p. 72–75. Suggested date of A.D. 1066–67 for eruption of Sunset Crater.

Sunset Crater is in west-central part of San Francisco volcanic field, 16 miles north of Flagstaff and 4 miles east of U.S. Highway 89, Coconino County.

Kane Wash Formation

Miocene: Southeastern Nevada.

Abraham Dolgoff, 1963, Geol. Soc. America Bull., v. 74, no. 7, p. 892. Name used by E. F. Cook (1961, unpub. ms.). Part of Kane Wash is equivalent to Alamo Range Formation.

R. L. Armstrong, 1963, Intermountain Assoc. Petroleum Geologists Guidebook 12th Ann. Field Conf., 78. On basis of potassium-argon dating, Kane Wash Formation which overlies Hiko Tuff in southeastern Nevada, is Pliocene.

E. F. Cook, 1965, Nevada Bur. Mines Rept. 11, p. 8 (fig. 4), 29–30. Formal proposal of name. In type section includes all rock units above

Hiko Tuff. Comprises at least eight members. Crops out extensively in Meadow Valley Mountains and in Delamar Range on both sides of Kane Springs Wash, a northeast-trending fault trough. Thickness as much as 1,435 feet. Miocene.

Type section: Delamar Range, approximately in sec. 5, T., 9 S., R. 63 E., Lincoln County.

Kannally Member (of San Manuel Formation)

Tertiary, middle(?): Southeastern Arizona.

L. A. Heindl, 1963, U.S. Geol. Survey Bull. 1141—E, p. E18—E20, pl. 1. Consists of alluvial deposits characterized by boulders of gray quartz monzonite. Includes two areas of breccia deposits. Member strikes generally northwest and dips to northeast. Where it overlies gray quartz monzonite of San Catalina Mountains, unit dips from 15° to 20° NE., these dips steepen to 45° near San Manuel fault. Apparent thickness excessive because of faulting; true thickness estimated between 3,000 and 5,000 feet. Overlies Cloudburst formation and Precambrian quartz monzonite; disconformably underlies Tucson Wash member (new).

Named for exposures in vicinity of Kannally Wash, Pinal County. Member constitutes main part of tilted alluvial deposits, younger than Cloudburst, generally south and west of Red Hill.

Karnak Member (of Ste. Genevieve Limestone)

Mississippian (Valmeyeran): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 5 (table 1), 6 (fig. 2), 10, pl. 1. Oolitic limestone 30 feet thick. Underlies Joppa Member (new); overlies Spar Mountain Sandstone Member. Difficult to recognize where Spar Mountain is thin or absent. Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 28, 29, 71, pl. 1. Name formally proposed in this report for relatively pure persistent limestone unit in Ste. Genevieve Limestone of Genevievian age. Commonly 10 to 35 feet thick. It overlies sandstone, siltstone, shale, or impure limestone assigned to Spar Mountain Member. At type section the top 16 feet of an estimated 20 to 25 feet of crossbedded oolitic limestone is exposed in cuts on Illinois Highway 37. Lower beds inadequately exposed in hill slope southeast of junction of highway with gravel road to Belknap. About 300 feet east of junction, top of Karnak lies 51 feet beneath base of Levias Limestone Member of Renault and directly beneath type section of Joppa Member.

Type section: SW¼SW¼SW¼ sec 32, T. 13 S., R. 2 E., and NW¼NW¼NW¼ sec. 5, T. 14 S., R. 2 E., Dongola quadrangle, Johnson County. Exposures are 4 miles northwest of Karnak.

Katak Glaciation

Holocene: Alaska.

G. W. Holmes and C. R. Lewis, 1965, U.S. Geol. Survey Bull. 1201—B, p. B18—B19, B20 (table 3), pl. 1. Distinct moraines lie in front of nearly all the present glaciers in Mount Chamberlin area; most flow from flanks of Mount Chamberlin. Moraines are small compared to moraines of Peters Glaciation; they record only minor Recent advances of alpine ice. The advances are named Katak Glaciation.

Named for creek between Hulahula River and Mount Chamberlin, Brooks Range.

Katlian Group

Permian and Triassic: Southeastern Alaska.

R. A. Loney and others, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—388 (with separate text). Composed of intensely foliated fine-grained cataclastic phyllite, greenschist, and semischist through which are scattered sheared lenses, ranging in length from a few inches to several tens of feet, composed of thinly interbedded white-weathering radiolarian metachert and reddish-brown-weathering greenstone. Comprises the more deformed lithic equivalents of Goon Dip Greenstone, Whitestripe Marble, Pinnacle Peak Phyllite, and Waterfall Greenstone (all new). Lower contact not observed. Upper contact with Kelp Bay Group complicated by deformation but appears to be transitional.

Type locality: Mount Katlian, about 9 miles northeast of Sitka, Baranof Island.

Kavanaugh Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Kavanaugh sand occurs at depth of 10,316 to 10,322 feet in type well.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Kavanaugh blanket sand included in Cadeville Tongue (new) of Terryville Sandstone (new).

Type well: Arkansas-Louisiana Gas Co., No. 1 Kavanaugh, sec. 22, T. 17 N., R. 3 W., Clay field, Lincoln Parish.

Keamoku lava flows

[Holocene]: Hawaii.

D. W. Peterson, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—667. Chiefly aa lava. In northern part of area [Kilauea Crater quadrangle] locally grades into rather rough and uneven pahoehoe. Lobes distinguished from each other by location and by consistent superposition relations. Lava locally overlain by thin discontinuous ash deposits that probably represent uppermost beds of Keanakakoi Formation of Wentworth (1938, Hawaiian Volcano Observatory Spec. Rept. 3).

Issued from vents along northeast rift zone of Mauna Loa 5 miles northwest of Kilauea Crater quadrangle.

Keating Formation (in Escabrosa Group)

Mississippian (Osage): Southeastern Arizona and southwestern New Mexico.

A. K. Armstrong, 1961, Dissert. Abs., v. 21, no. 9, p. 2672. Basal formation in Escabrosa group.

A. K. Armstrong, 1962, New Mexico Bur. Mines Mineral Resources Mem. 8, p. 2 (fig. 1), 5—10, cross sections. Formal proposal of name. A sequence of calcilutites and encrinites 350 to 590 feet thick. Thickest section is in Big Hatchet Mountains, N. Mex. Thins to west in Chiricahua, north in Peloncillo Mountains, and east in Klondike Hills as result of original deposition. About 360 feet thick in Tombstone Hills, Ariz., and 395 feet in Klondike Hills, N. Mex. From Chiricahua Mountains eastward divisible into two members herein termed A and B. Member A rests with paraconformity on Upper Devonian strata. Underlies Hachita formation (new). Fauna of member A indicates age which transgresses Kinderhook-Osage boundary.

Type section: On southeast side of Blue Mountain, sec. 20, T. 26 S., R. 30 E., Cochise County, Ariz.

Keg Mountain Ignimbrites

Tertiary, upper: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 24—25, pl. 1. Name applied to ignimbrite units which crop out in places around margins of Thomas and Keg Ranges. Ignimbrite unit, made up of welded tuffs and associated thick flows in eastern part of Keg Mountains, has exposed thickness of 1,000 feet and base not exposed. Thickness as much as 300 feet in Thomas Range. Base of series exposed only in Thomas Range where ignimbrites rest with angular unconformity on steeply dipping Paleozoic sedimentary rocks.

Named for exposures in Keg Mountains, western Juab County.

Keg Spring Andesite, Latite

Tertiary, lower: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 26, pl. 1. Intermediate rocks of unit are mostly porphyritic andesites and latites which occur as flows and pyroclastic beds. Maximum thickness about 300 feet on west side of Keg Range. Unconformably overlies Keg Mountain Ignimbrites (new).

Named for occurrence at Keg Spring which is about 1 mile northwest of Keg Pass, Juab County.

Keiths Dome quartz monzonite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Keiths Dome quartz monzonite shown on map in report on contact metamorphic reactions and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Kekiktuk Conglomerate (in Endicott Group)

Upper(?) Devonian or Mississippian: Northeastern Alaska.

W. P. Brosgé and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2174, 2177 (fig. 2), 2183, 2185, 2186, 2195. Predominantly conglomerate and gray coarse-grained quartzitic sandstone. Thickness 0 to more than 400 feet; commonly less than 300 feet; at type section 295 feet. May in part thin and disappear by grading laterally into basal sandstone beds of Kayak(?) Shale. Unconformably overlies Neruokpuk Formation at many places. The Kekiktuk is probably basal conglomerate of overlapping Mississippian sequence; may become progressively younger northeastward. Lithologically similar to Kanayit Conglomerate and occupies similar place in sequence of formations but

Kanayut is not known to have unconformity at base. If the two conglomerates are the same, they may be inferred to overlap progressively on an Upper Devonian unconformity in northeast part of area.

I. L. Tailleur, W. P. Brosgé, and H. N. Reiser, 1967, International Symposium on the Devonian System, Calgary, 1967: Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1354. Allocated to Endicott Group (new). The Kekiktuk is a widely though discontinuously distributed unit in northeast Brooks Range. It is a thin (0 to 100 m) unit deposited in a paralic environment and lies discomformably on the Neruokpuk Formation and gradationally below the Lower(?) and Upper Mississippian Kayak(?) Shale. Assigned to Late(?) Devonian or Mississippian in part because it appears to transgress time. It may be entirely Mississippian.

Type section: On Whistler Creek (69°19′ N., 145°09′ W.), 3½ miles above mouth of Whistler Creek near Lake Peters. Widespread in area north of Brooks Range divide and east of Canning River. Named for stream that drains Lake Peters.

Keku Volcanics

Upper Triassic: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C26—C28, pl. 1. Sequence of felsic and mafic volcanic rock and intercalated clastic rock that crops out on Cornwallis Peninsula and on a few of the Keku Islets. Unit lenticular. Dominantly altered felsic flow rock and flow breccia. Subordinate rock types include mafic flow rock and flow breccia, volcanic wacke, and volcanic conglomerate. Maximum thickness probably over 1,000 feet, yet thins abruptly to north and east and is absent in northeastern Keku Islets. Interpreted to overlie Pybus Formation unconformably. Contact not exposed but scattered poor outcrops on forest-covered southwest slope of the Cornwallis Peninsula suggest that there may be an extensive chert and limestone-clast conglomerate at base of formation. Conformably overlain by Cornwallis Limestone (new). Late Triassic, probably mostly early Karnian, although uppermost beds extend into the late Karnian.

Type locality: Shoreline 3 to 3½ miles east of Cornwallis Point, Kuiu Island.

Keller Creek Shale (in Aldrich Mountains Group)

Lower Jurassic: Northeastern Oregon.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Misc. Geol. Inv. Map I—447. Lower 2,000 to 2,500 feet of formation consists of massive to well-bedded coarse- to fine-grained tuffaceous graywacke, in which there are lenses of pebbly conglomerate, subordinate amounts of shale, and a few thin ashy beds. In middle and upper parts of formation, gray to black shale interbedded with graywacke and siltstone in beds a few inches thick is dominant; massive coarse- to fine-grained graywacke 500 to 1,000 feet thick occurs near top of formation. Thickness about 5,000 feet at type locality. Elsewhere, formation consists mostly of medium-bedded shale and siltstone. Essentially conformable with underlying Murderers Creek Graywacke (new). Marked angular unconformity separates the Keller Creek from overlying Lower Jurassic rocks.

Type locality: Headwaters of Keller Creek. Named for Keller Creek in northwest corner of Logdell quadrangle.

Kellyland Formation

Silurian(?): Northeastern Maine.

D. M. Larrabee, 1963, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—269. Interbedded sericitic pale-gray metasiltstone, arenaceous metasiltstone, argillaceous metasandstone and quartzite, and thin beds of darker gray slate. Thickness not known because of isoclinal folding and lack of continuous outcrop; probably exceeds 1,000 feet. Stratigraphic equivalent of at least part of Pale Argillite Division of Charlotte Group in New Brunswick (Alcock, 1946, Canada Geol. Survey Paper 46—3). Relationship to Silurian Daggett Ridge Formation (new) not stated.

D. M. Larrabee, 1964, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—282. Mapped in Wabassus Lake quadrangle, Washington County. Underlies Wabassus Quartz Monzonite (new).

D. M. Larrabee, C. W. Spencer, and D. J. P. Swift, 1965, U.S. Geol. Survey Bull. 1201—E, p. E11—E13, pl. 1. Described in Grand Lake area. Geologists who have studied Charlotte Group of Alcock (1946) have recognized need for subdivision of group beyond present Pale and Dark Argillite Divisions. To accomplish this, rocks exposed along St. Croix River between Vanceboro and Kellyland, Maine, have been named Kellyland and Silurian(?) age assigned to them. East of river these rocks had been mapped as Pale Argillite Division (Alcock, 1946) of Ordovician or earlier age. Relative ages of the Pale and Dark Argillites have long been questioned but present writers agree with Alcock in believing that Pale Argillite is younger than Dark Argillite, chiefly because it has been less folded and has been regionally metamorphosed to a lower grade. Kellyland considered to underlie Daggett Ridge of Silurian age on basis of obscure structure relations in eastern part of area, and to overlie the Dark Argillite on basis of considerable stratigraphic evidence of graded bedding and crossbedding. Age of Kellyland (Pale Argillite Division of Charlotte Group) still in doubt. Believed to be Silurian but might be Ordovician.

Named for Kellyland Village at Grand Falls, St. Croix River, Kellyland quadrangle.

Kelp Bay Group

Triassic or Jurassic: Southeastern Alaska.

H. C. Berg and D. W. Hinckley, 1963, U.S. Geol. Survey Bull. 1141—0, p. 010—012, pl. 1. Composed of a variety of predominantly fine-grained thin- to medium-bedded rocks. Present in about equal quantities are: fissile quartzose greenschist and phyllite; graywacke, slate, and sheared conglomerate; calcareous and quartzose slate that contains lenses of metachert and volcanic rock; and granular-appearing, moderately platy siliceous greenschist that commonly contains layers and lenses of jasper or is interbedded with slate or agillite. Overlies Nakwasina Group (new); underlies Sitka Group (new). Triassic(?).

R. A. Loney and others, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—388 (with separate text). Extended into Chichagof Island. Overlies Katlian Group (new). On basis of fossil evidence, considered to be of Triassic or Jurassic age. Sitka Group renamed Sitka Graywacke in this report.

Type area: Exposures along shores of Kelp Bay, northern Baranof Island. Forms parts of Krestof Island and most of northeast half of Partofshikof Island.

Kelsey Creek Gabbro

Triassic: Northern California.

W. P. Pratt, 1965, Dissert. Abs., v. 25, no. 7, p. 4048. Hornblende gabbro. Intrudes metamorphic rocks of area.

Northeastern part of Scott Bar quadrangle, Marble Mountains area, Siskiyou County.

Kempsville Formation

Pleistocene, upper: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Beach sand, gravel, clay, and shells. Maximum thickness 15 feet. Overlies Diamond Springs Formation (new); underlies Londonbridge Formation (new). Radiocarbon age about 40,000 years.

Kempsville is in Princess Anne County.

Kemuk Glaciation

Kemuk Drift

Pleistocene: Southwestern Alaska.

S. C. Porter, 1967, Arctic, v. 20, no. 4, p. 227—246. Present investigation disclosed that glacier ice had invaded Chagvan Bay area from east and had pushed north into lower part of Salmon River valley. Four drift sheets recognized, from oldest to youngest: Kemuk, Clara Creek, Chagvan, and Unaluk. Kemuk drift sheet which lies buried beneath younger drift is known only from a single deep bore hole. Kemuk consists of 32 feet of (ascending) gravel and sand, slightly oxidized; stony till; reddish silt; and reddish sand. Kemuk Drift not seen beyond limit of Clara Creek Drift which may mean that Kemuk ice reached no farther north in the lower Salmon River valley than did the ice of Clara Creek Glaciation. That much or all of the central part of the valley was glaciated during Kemuk Glaciation remains distinct possibility, however, even though convincing evidence for this was not found. Strong oxidation of Kemuk Drift suggests a long period of chemical weathering preceding deposition of overlying drift sheet. Total depth of weathering not known because Kemuk Drift is separated from Clara Creek Drift by an erosional unconformity, above which an unknown thickness of weathered Kemuk sediments was removed by advancing ice.

Bore hole is at crest of a hill half a mile north of Happy Creek. Chagvan Bay area comprises approximately 75 square miles along southeast side of Kuskokwim Bay and includes most of land between Chagvan and Goodnews Bays.

Kennebec Formation

Middle Ordovician: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 183, pl. 34. Massive felsite and rhyolite tuff. Thickness unknown but probably a few hundred to a thousand feet. Basal relations and relations to Cambrian or Ordovician rocks unknown. Contains *Valcourea* of Middle Ordovician age.

Type locality: Quarter of a mile northeast of Somerset Junction (Brassua Lake quadrangle) on northwest side of west branch of Kennebec River.

Kennel Creek Limestone

Middle Devonian: Southeastern Alaska.

R. A. Loney, W. H. Condon, and J. T. Dutro, Jr., 1963, U.S. Geol. Survey Bull. 1108—C, p. C8 (table 1), C13—C17, pl. 1. Consists of dark- and light-gray fossiliferous limestone, thick-bedded near base and thin-bedded near top. *Amphipora* and *Pycinodesma* in middle half. Thickness 2,200 to 5,000 feet. Underlies Cedar Cove formation (new); overlies unnamed Silurian(?) or Devonian(?) argillite and graywacke sequence. Type section terminated at base by fault. In lower part of Wukuklook Creek overlies Iyoukeen formation (new), apparently having been thrust to southwest where it has overridden Cedar Cove and Freshwater Bay formations (new) and possibly lower and middle members of Iyoukeen formation.

Type section: Near Kennel Creek, Freshwater Bay area, Chichagof Island. Exposed on both limbs of Freshwater Bay syncline.

Kensal Drift

Kensal-Oakes Drift

Pleistocene: East-central North Dakota.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44, p. 34—35. Consists of till of the Kensal end moraine and other associated drift that was deposited by the Kensal ice. Locally overlies Grace City drift (new). The lithology of the two drifts do not differ enough to distinguish any stratigraphic unconformity. Inferred geologic history is main basis for distinguishing Kensal from other drifts. McHenry end moraine overlaps Kensal drift truncating older washboard moraines and is therefore younger.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, p. 28—34. Kensal-Oakes is most widespread drift sheet in Barnes County. Term Oakes moraine has been applied to the part of the drift sheet in south-central North Dakota and name Kensal moraine applied in central part of State. Barnes County is located midway between the two type areas and name Kensal-Oakes is applicable. Glacial till is principal constituent of Kensal-Oakes drift. Drift has average thickness of less than 50 feet, except in end moraine areas where it is generally less than 100 feet thick. Younger than Buchanan drift (new). Also younger than Eldridge drift.

Named for town of Kensal, 2 miles south of Foster County line in Stutsman County. Drift of Kensal phase covers eastern third of Foster County, northeastern part of Stutsman County, and parts of Griggs and Barnes Counties.

Kenwood Formation

Upper Devonian: Eastern Wisconsin.

Ira Edwards and Gilbert Raasch, 1922, Milwaukee Public Mus. Yearbook, v. 1, p. 88—93. Consists of three shaly members (ascending) brown shales, blue shales, and black shales. Average thickness 55 feet. Overlies Milwaukee formation (Hamilton). Underlies Pleistocene deposits. Age determined from position in section and fossil content as lower Upper Devonian.

Lawrence Martin, 1932, Wisconsin Geol. and Nat. History Survey Bull. 36, p. 6 (fig. 2). Kenwood formation shown on geologic column as Mississippian. Thickness 0 to 55 feet. Overlies Milwaukee formation. Underlies glacial drift.

F. T. Thwaites, 1949, Michigan Acad. Sci., Arts, and Letters Papers, v. 33, p. 249. Kenwood formation at Milwaukee, known only from fossils collected from dump of a tunnel believed to be Mississippian. [This annotation was placed under Kenwood Sandstone, a Lower Mississippian formation with type locality in Kentucky, in U.S. Geol. Survey Bull. 1200.]

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Devonian strata crop out at only one place in Wisconsin and are otherwise known only from drill cuttings. They were examined by Raash (1935, Kansas Geol. Soc. 9th Ann. Field Conf. Guidebook 9) who assigned them a Middle Devonian age. The overlying shale formation known as Kenwood was assigned an Upper Devonian age by Edwards and Raash. Although it was subsequently assigned to the Mississippian (Cooper *in* Weller and others, 1948, Mississippian correlation chart), recent studies by Schumacher (1967, unpub. thesis) support work of Edwards and Raash for an Upper Devonian age. The Kenwood is youngest Paleozoic formation in Wisconsin.

Typical exposures occur in Kenwood section of city of Milwaukee. Penetrated in excavation of North Point Intake Tunnel and Linwood Avenue Tunnel on shore of Lake Michigan.

Kern Basin Formation (in Idaho Group)

Pliocene, lower: Eastern Oregon.

R. E. Corcoran and others, 1962, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. GMS 2. Tuffaceous sandstone and siltstone with bedded tuffs, ash deposits, and massive tuff breccias; conglomerate beds common in basal part of section. Thickness about 750 feet at type locality. Underlies Grassy Mountain Basalt. Basal formation of Idaho Group. Unconformable above Deer Butte Formation.

Type locality: Kern Basin, sec. 1, T. 22 S., R. 44 E., Mitchell Butte quadrangle.

Kesswick Formation

Precambrian and Lower Cambrian to Lower Ordovician: Northern Virignia.

H. R. Hopkins, 1961, Dissert. Abs., v. 21, no. 7, p. 1911. Five units in mapped area are (ascending): Lynchburg formation, Catoctin greenstone, Rivanna formation (new), Keswick formation, and Boyd Tavern formation (new). The sedimentary rocks were deposited in eugeosynclinal environment. Sequence of deposition broken by Precambrian-Cambrian unconformity and Middle Cambrian unconformity.

Western Louisa County.

Ketcherside Tuff (in Van East Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 29. Volcanic ash beds. Near north end of outcrop a basal conglomerate of the Bonneterre rests on the Precambrian pyroclastics. A shear zone near center of exposure displaces the tuff.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 81, 83. Included in Van East group (new). Name credited to Tolman and Robertson (in preparation).

Outcrop shown in SE¼SW¼SE¼ sec. 11, T. 33 N., R. 3 E., Iron County. Ketcherside Mountain and Ketcherside Gap are in Iron County.

Kettle Creek Alluvium

Pleistocene: Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 23—24, pl. 1. Oldest alluvium of three terraces in area. Consists of unconsolidated olive-gray and yellowish-brown medium to coarse sand. Poorly stratified. Individual beds generally less than a foot thick. Appears to be mostly a remnant of reworked sand from Pine Valley Gravel (new) after part or most of the Pine Valley Gravel was stripped off by erosion in Wisconsin time. Thickness 3 to 15 feet. Older than Monument Creek Alluvium (new). Top of alluvium is 10 to 12 feet below top of Pine Valley Gravel. Early Wisconsin.

Type locality: In NW¼NW¼ sec. 6, T. 13 S., R. 66 W., in Air Force Academy area, El Paso County. Crops out only along Monument Creek, Black Squirrel Creek, and Kettle Creek.

Keyes Lake quartzite member (of Michigamme Slate)

Precambrian: Northeastern Wisconsin.

T. H. Nilsen, 1964, Lake Superior Geology Inst., 10th Ann. Mtg., May 6—9 (Ishpeming, Mich.) p. 23—25. Pine River (new) and Keyes Lake units are informally designated members of Michigamme Slate in Baraga Group of Animikie Series of middle Precambrian. They crop out in separate fault blocks as resistant northwest-southeast-trending ridges in northeastern Florence County. Because they occur as steeply dipping homoclines, it is impossible to judge their original extent; also the lateral boundaries are generally vague due to lack of outcrop. They appear to be anomalous local lenticular quartz-rich bodies within the more typical Michigamme slates graywackes and basic volcanics. The Keyes Lake consists of horizontally stratified quartzites, profusely cross-stratified quartzites, and finer quartzose phyllites that can be traced for variable distances parallel to the strike. Outcrop width narrows from 3,000 feet to 250 feet in the southeast, and the abundant cross-stratification has inclinations up to 65 degrees. Unit is bounded on the north by a major fault and grades laterally into iron-rich rocks of Little Commonwealth area to the southeast.

T. H. Nilsen. 1965, Jour. Sed. Petrology, v. 35, no. 4, p. 805—817. An informally named member of the Michigamme. Consists of parallel-stratified quartzite, profusely cross-stratified quartzites, and finer quartzose slates that can be traced parallel to the strike for different distances. Outcrop width narrows from 3,000 feet in center to 250 feet in the southeast.

Crops out as a vertically dipping, northwest-southeast striking homocline about 2 miles southwest of Florence, Florence County.

Keyhole Leucogranite

Tertiary, middle and late: Southeastern Nevada.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2491. Four intrusive stocks of middle to late Tertiary age, but younger than the volcanic rocks, intrude foliated basement rocks and volcanics. These are named Nelson quartz monzonite, Nob Hill and Aztec granodiorites, and Keyhole leucogranite. Nelson and Keyhole intrusives appear to be structurally controlled.

Eldorado mining district, Clark County.

Keys Valley Marl Member (of Walnut Formation)

Cretaceous: South-central Texas.

C. H. Moore, 1962, (abs.) *in* Contributions to geology of South Texas: San Antonio, South Texas Geol. Soc., p. 116. Walnut formation divided into (ascending) Bull Creek, Bee Cave, Cedar Park, Whitestone (new), and Keys Valley marl members and an unnamed upper marl.

C. H. Moore, Jr., 1964, Texas Univ. Bur. Econ. Geology Rept. Inv. 52, p. 4 (fig. 2), 9 (fig. 4), 11—15, pls. 16, 17, 19. Formal proposal of name. A marl and nodular unit with average thickness of 35 feet in intermediate area. Normally overlies Cedar Park Member (emended); underlies unnamed marl member and (or) Comanche Peak Limestone. In southern area pinches out at crest of Whitestone Member and is not present south of Williamson County.

Type locality: Three-tenths mile west of Keys Valley Church on Ranch Road 1670, 6 miles southwest of Belton, Bell County. Section is in roadcut 20 feet north of bridge over Lampasas River on Union Grove-Belton Road.

Kidd Quartzite Conglomerate lithosome (in Beaverhead Formation)

Paleocene: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—67. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Kidd Quartzite Conglomerate lithosome consists mostly of Precambrian Belt (maroon and green) clasts. Thickness of lithosome not known.

Mapped in vicinity of Kidd, Mont.

Kidderville Formation

Lower Devonian: Northern New Hampshire.

N. L. Hatch, Jr., 1963, New Hampshire Div. Econ. Devel. Bull. 1, p. 7 (fig. 2), 19—27, pl. 1. Comprises variety of rocks of both sedimentary and volcanic origin. Within Dixville quadrangle [this report] divided into two members that are distinguished by their different proportions of various rocks. Eastern or felsic volcanic member present only along northern half of belt. Western or mafic volcanic member extends full length of belt. Outcrop width of formation ranges from 3½ miles in northeast to less than 1 mile in southwest corner of quadrangle. Formation apparently pinches out completely a few miles to southwest. Bedding dips between 70 and 90 degrees. Rocks considerably folded. Outcrop width of felsic member on west side Keyser Mountain about 2,000 feet; this suggests thickness of about 1,500 feet for member. North of Diamond Ponds, outcrop width of mafic member is 5,000 feet; this suggests that mafic member, which is nearly vertical in this area, is 4,000 to 5,000 feet thick. Estimated maximum thickness of formation about 6,000 feet. Overlies Dixville formation; underlies Waits River formation. Lower Devonian.

Named for village of Kidderville in middle of outcrop belt in Dixville quadrangle. Well exposed both east and west of village along Mohawk River.

Kiger Shale Member (of Cloud Chief Formation)

Kiger Shale Member (of Whitehorse Formation)

Upper Permian: Southwestern Kansas and northern Oklahoma.

H. G. O'Connor, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 10, p. 1873–1877. Whitehorse Formation as heretofore recognized in Kansas consists of three members: Marlow Sandstone, at base, Relay Creek Dolomite, and at top an unnamed member. Norton (1939, Am. Assoc. Petroleum Geologists Bull., v. 23, no. 12) divided Whitehorse beds above Relay Creek Member into an "even-bedded member" about 100 feet thick overlain by an "upper shale member" about 38 feet thick. Name Kiger Shale Member is herein applied to Norton's "upper shale member." Name as used in this report is used in restricted sense for only a part of Cragin's (1896) original Kiger division.

R. O. Fay, 1965, Oklahoma Geol. Survey Bull. 106, p. 74–76. Name Kiger division was first used by Cragin for beds above Blaine Formation (Cave Creek). It is here restricted to shale member between top of Moccasin creek Bed (new) and base of Day Creek Dolomite, as redefined by O'Connor (1963), but here placed in Cloud Chief Formation. At type section, herein designated, the Kiger is 31 feet thick and consists of red-brown shale, with interbedded greenish-gray siltstones and sandstones in upper half, overlain by Day Creek Dolomite.

Type section (Fay): In SE¼SE¼ sec. 8, T. 28 N., R. 18 W., Woods County, Okla. Name derived from Kiger Creek, Clark County, Kans.

Kilauea flow

Recent: Hawaii Island, Hawaii.

J. G. Moore and W. U. Ault, 1965, Pacific Sci., v. 19, no. 1, p. 3–9. Discussion of historic littoral cones in Hawaii. Three historical littoral cone localities are: Sand Hills, produced by the 1840 Kilauea flow; Puu Hou, produced by the 1868 Mauna Loa flow; and the cone produced by the 1919 Mauna Loa flow.

On the coast 5 miles northwest of Cape Kumukahi, the east cape of the island.

Kilauea Iki lava

Recent: Hawaii Island, Hawaii.

G. A. Macdonald and Takashi Katsura, 1961, Pacific Sci., v. 15, no. 3, p. 361–369. Lava that accumulated in Kilauea Iki crater during eruption that lasted from November 14 to December 20, 1959.

Kilauea Iki is a pit crater immediately adjacent to the east edge of Kilauea caldera.

Kilby facies (of Bacons Castle Formation)

Pliocene and (or) Pleistocene, lower:(?): Southeastern Virginia.

N. K. Coch, 1965, U.S. Office Naval Research, Geography Branch Tech. Rept. 6, p. 36–38. Name applied to coarse-grained facies of Bacons Castle Formation (new). Occurs near base of formation and generally underlies Cross Creek facies (new). Maximum and average thicknesses for

Kilby facies are 20 feet and 8 feet, respectively. Composed of clayey sand, pebble gravel, and cobble gravel. Name Kilby Formation (Moore, 1956, Virginia Acad. Sci., Geology sec., Field Trip Guidebook) rejected in this report and term Bacons Castle formation applied to the lower unit and Elberon Formation to the upper unit. Name Kilby retained for facies of Bacon Formation.

Type section: Sunken Meadow Beach on State Road 609, Surry County.

Killey Stade

Pleistocene: Southern Alaska.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1). Naptowne Glaciation includes (ascending) Moosehorn, Killey, Skilak, and Tanya Stades.

Karlstrom, (1960, 1964) used term Killey advance. However, terms advance and readvance are not accepted as part of formal stratigraphic nomenclature.

Name derived from Killey River, which flows across the second morainal belt, Kenai lowland, Cook Inlet area.

Kiln Diatomite

See 111 [one hundred eleven] Ranch Beds.

Kilpatrick Lentil (in Cockfield Formation)

Tertiary: North-central Louisiana.

C. O. Durham, Jr., 1964, Louisiana Geol. Survey Geol. Bull. 41, p. 18—26. A glauconite lentil in lower sand of the Cockfield. Name credited to Jones (1962, unpub. thesis, pl. 3).

Type locality and derivation of name not given.

Kimballian Age

Pliocene, upper: Western North America.

C. B. Schultz and T. M. Stout, 1961, Nebraska Univ. State Mus. Spec. Pub. 2, p. 9 (fig. 3). Shown on correlation chart above the Hemphillian and below the Blancan. Includes Kimball Formation and Oshkosh, Cambridge, and Dalton local faunas.

Kimball Formation is exposed 2 miles south of Kimball in Kimball County, Nebr.

Kimberly Rhyolite (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 228, pl. 1. Lenses of Kimberly rhyolite appear within Indian Hollow tuff (new) and then within Staley Pasture tuff (new), as former grades into the gray western counterpart. The Kimberly thickens from 10-foot lenses in Beaver Creek to extensive exposures in Kimberly mining area north of Mount Belknap.

Kimberly mining is north of Mount Belknap, Tushar uranium area, near Marysvale, Piute County.

Kingfisher Creek Gypsum Bed (in Blaine Formation)

Permian (Guadalupean): West-central Oklahoma.

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, p. 33 (fig. 8), 36—38, 201, pl. 1. Name Alabaster Gypsum used by Buckstaff (1931) for thin gypsum bed in shale unit between Medicine Lodge Gypsum below and Nescatunga Gypsum above. No type locality was designated. This gypsum is here named Kingfisher Creek Gypsum Bed. About 2½ feet thick at type section and 1 to 3 feet from central Blaine County to northwestern Canadian County. In southern Blaine County, the Kingfisher Creek Gypsum is 15 feet above top of Medicine Lodge Gypsum and 16 feet below base of Magpie Dolomite. In northern Blaine County the Kingfisher Creek is 7 feet above top of the Medicine Lodge and 9 feet below base of the Magpie. The Kingfisher Creek Gypsum bed is conformable with beds above and below.

Type section: On State Highway 33 and outcrops just north and south of the road, especially in SE¼SE¼ sec. 19, T. 16 N., R. 10 W., Blaine County. This is included in type section of the Blaine Formation. Named for Kingfisher Creek which has its headwaters in eastern Blaine County.

Kings Lake Formation or Limestone (in Galena Group)

Middle Ordovician (Champlainian): Eastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 110—111, 112, 236. Differentiated by Herbert (1949, unpub. thesis), as member of Decorah Formation, the Kings Lake is classified here as formation overlying the Spechts Ferry and underlying the Guttenberg. Subdivided into Mincke and Tyson Members (both new). Commonly 5 to 10 feet thick; maximum thickness 15 feet; thins to northeast in subsurface.

H. B. Willman and others, 1967, Geologic map of Illinois (1:500,000): Illinois Geol. Geol. Survey. Listed on map legend as Kings Lake Limestone.

Type section: Exposure at top of Mississippi River bluff, 1.6 miles north of Foley, Lincoln County, Mo., about 500 feet north of road junction at Kings Lake, SE SE NE 26, 5 ON-2E, Hardin quadrangle.

Kino Formation

Tertiary, lower: Southern Arizona.

J. E. Kinnison, 1966, *in* Geology of the porphyry copper deposits of southwestern North America: Tucson, Ariz., Univ. of Arizona Press, p. 283, 284, 285 (fig. 5). Two units that consist of unsorted siltstone and volcanic pebble conglomerate are present in the Mission ore body. These rocks are hard and uniformly textured and are referred to as argillite or conglomerate for purposes of mine mapping. The oldest, the Papago Formation, consists dominantly of argillite, and the younger Kino Formation, which consists dominantly of conglomerate, lies beneath a preore thrust fault. Early Tertiary on basis of district and regional geologic mapping.

Present at Mission mine, a recently developed open pit near Tucson.

Kintyre Formation

Pleistocene: Northeastern Montana.

R. B. Colton, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—362, Map I—363, Map I—367. Mapped in Richland, Roosevelt, and McCone Counties. Buff to brown clay, silt, and sand. Bedding planes folded and faulted. Thickness up to 150 feet.

F. S. Jensen and H. D. Varnes, 1964, U.S. Geol. Survey Prof. Paper 414—F, p. F33—F34, pl. 1. Formal proposal of name. Composed of fluviolacustrine sediments that were in large part deposited on stagnant ice in old Missouri River trench. Thickness 0 to more than 70 feet; 20 to 70 feet in most areas. Rests directly on ground moraine in most places, but on Bearpaw shale in some areas south of Missouri River. Generally is the surface formation, but in some areas is overlain by outwash terrace, gravels, alluvium, and alluvial-colluvial deposits, or patches of silt and clay deposited in intermittent ponds.

Named for exsposures near Kintyre, a siding on Great Northern Railway, about 5 miles west of town of Frazer. Town of Kintyre is in Valley County.

Kiokee Series

Paleozoic(?): Georgia.

V. J. Hurst and others, 1966, Mineral Resources of the central Savannah River area: Georgia Univ. Geology Dept., v. 1, p. 52—53. Crickmay (1952, Georgia Geol. Survey Bull. 58) outlined Kiokee metamorphic belt and equated it with a part of the Carolina gneiss. McLemore (1965) [Compiler unable to locate this reference.] studied Kiokee belt in greater detail. Principal, and probably oldest, unit of the series is a granitic biotite gneiss. Alternating biotite-rich and quartzo-feldspathic layers form pronounced color banding. Kiokee gneisses, with associated granitic and ultrabasic intrusives, underlie most of Columbia County from Keg Creek southward to Richmond County. In extreme southeast corner Kiokee rocks are in contact with Little River Series; southward both the Kiokee and Little River are overlapped by Tuscaloosa sediments. The Kiokee gneisses extend westward from Columbia County, across central McDuffie, and into central Warren County with little change.

Savannah River area.

Kione Sand or Formation

Upper Cretaceous: Northeastern California (subsurface and surface).

H. R. Johnson, 1943, California Div. Mines Bull. 118, pt. 3, p. 611, 613 (fig. 271). "Kione" sand listed on stratigraphic columns of Marysville (Sutter) Buttes gas field. The "Kione" appears opposite the Ione formation of other workers. Upper Cretaceous. Sequence of events at Marysville Buttes discussed and reference made to interpretation given by Williams (1929, California Univ. Dept. Geol. Sci. Bull., v. 18, no. 5). Williams confused the white sand found in Cretaceous of Marysville Buttes with the true Ione of the Eocene. [Johnson does not use term Kione in his text.]

J. N. Thomson, 1962, San Joaquin Geol. Soc. Selected Papers, v. 1, p. 27—35. Kione Formation is Upper Cretaceous unit with maximum thickness of 2,200 feet of alternating sands and shales. Formation is trough-shaped in gross form and is truncated by younger formations on north, west, and east sides. Disappears to south by shaling out at base into Forbes Formation. Underlies Sacramento Shale or Capay Shale. Has been confused with Eocene Ione Formation. Name Kione is reportedly a contraction of K (for Cretaceous) and Ione. Name was quickly accepted and used in core description. Although naming of unit would be considered inadequate under present rules of Code of Stratigraphic Nomenclature, name has been widely used and should be retained on that basis. In northern two-thirds of Sacramento Valley generally occurs at depths from 1,500 to 4,500 feet. Fairly typical log is from Mobil "Llano Seco" in sec. 33, T. 20 N., R. 1 W.

J. L. Burnett and C. W. Jennings, 1962, Geologic map of California, Chico Sheet (1:250,000): California Div. Mines and Geology. Mapped with Upper Cretaceous marine sedimentary rocks. Consists of white quartzose sandstone.

Typical log: Mobil "Llano Seco" 1 in sec. 33, T. 20 N., R. 1 W. More or less typical log: Honolulu "Honolulu-Humble-Wild Goose" No. 1 in sec. 17, T. 17 N., R. 1 E., Sacramento Valley.

Kirkham Hollow Volcanics

Pliocene, middle, or younger: Eastern Idaho.

M. H. Staatz and H. R. Albee, 1966, U.S. Geol. Survey Bull. 1205, p. 77—83, pl. 1. Largely welded tuff but includes interlayered flows. Volcanic breccia present locally. Within Garns quadrangle [this report], Kirkham Hollow Volcanics was deposited on eroded surface carved on older rocks ranging from Mississippian to Late Cretaceous. On south side of Limekiln Canyon, overlies Mission Canyon Limestone (Mississippian); to northwest end of Thousand Springs Valley, along Packsaddle Creek, and north of North Twin Creek, overlies Frontier Formation of Late Cretaceous age. About 2½ miles southwest of quadrangle, unconformably overlies unit termed younger conglomerate. Underlies unnamed basalt. No fossils. Middle Pliocene or younger.

Type area: Along drainage of Canyon Dreek. Named for exposures along both sides of Kirkham Hollow in northwestern part of Garns quadrangle. Volcanics encircle northwest end of Snake River Range and are present in places along South Fork and Henry's Fork of Snake River and along Teton River.

Kiser Creek Member (of Baylis Formation)

Cretaceous: Western Illinois.

J. C. Frye, H. B. Willman, and H. D. Glass, 1963, Illinois Geol. Survey Circ. 364, p. 4, 10, 26 (geologic sections). Consists of tan, massive sand and clay with lenses and zones of dark-gray sandy clay and gray clayey sand. Thickness 20 feet at type section. Overlies Hadley Gravel Member (new). Underlies Pleistocene deposits (Roxanna Silt in some areas).

Type section: Aberdeen School geologic section measured in creek bank, NW¼SW¼SE¼ sec. 31, T. 4 S., R. 4 W., Pike County. Named for East Branch of Kiser Creek.

Kisimilok Formation

Lower Cretaceous: Northwestern Alaska.

R. H. Campbell, 1965, U.S. Geol. Survey Bull. 1194—A, p. A22, A28—A29, 1967, U.S. Geol. Survey Prof. Paper 395, p27—28, pls. Dominant rock type is massive to thinly laminated medium-dark gray to dark-gray mudstone. Zone containing interbedded sandstone, possibly as much as 2,000 feet thick, present at base of formation. It is overlain by 3,000 feet or more of mudstone with a few thick sandstone interbeds. Contact with underlying Telavirak Formation (new) apparently conformable but for much of length is faulted. Underlies Fortress Mountain(?) Formation. Assigned Early Cretaceous age on basis of pelecypod fauna.

Type locality: Exposures in vicinity of Kisimilok Creek. Exposed in low hills along coast line from point 1 mile west of mouth of Kisimilok Creek to east edge of map area, in vicinity of Chariot Test Site, near Cape Thompson.

Kiska Harbor Formation

Tertiary, upper, or Pleistocene, lower: Southern Alaska.

R. R. Coats and others, 1961, U.S. Geol. Survey Bull. 1028—R, p. 571—573, pl. 71. Consists of subaerial lava flows, autoclastic breccias, pyroclastic rocks, and water-laid pumiceous sand and conglomerate. Lava flows predominate in north and water-laid beds in south. Unconformable on Vega Bay formation (new) on south, and to north covered by rocks of Kiska Volcano and alluvium. On Little Kiska, the Kiska Harbor formation lies in a depositional contact unconformably on north-sloping surface eroded on steeply dipping beds of Vega Bay formation. On Kiska Island contact between the two formations is probably a fault.

Type section (pyroclastic facies): Bluff north of Trout Lagoon at head of Kiska Harbor. Type section (lava flow facies): In Sredri Point. Formation occupies about 30 square miles in north-central part of Kiska Island, Aleutian Islands.

Kiss Creek Formation (in Colorado Group)

Upper Cretaceous: Central western Montana.

V. E. Gwinn 1961, Dissert. Abs., v. 21, no. 8, p. 2247, T. A. Mutch, 1961, Dissert. Abs., v. 21, no. 8, p. 2250. Uppermost formation of Colorado group. Overlies Jens formation (new).

Flint Creek Range and Drummond area.

Kitt Peak sphene-bearing granite

Oligocene-Miocene: Southeastern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 70 (table 2). Listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Age 27±0.9 m.y.

Quinlan Mountains, Pima County.

Klamath Mountain Complex

Pre-Tertiary: Northern California and southwestern Oregon.

M. A. Murphy, G. L. Peterson, and P. U. Rhodda, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 4, p. 497, 499. Consists of igneous and metamorphic rocks. In Ono and Chanchelulla Peak quadrangles, California, underlies Budden Canyon Formation (new).

M. A. Kays and J. L. Bruemmer, 1964, Ore Bin, v. 26, no. 3, p. 43—52. Report of gravity study of Klamath Mountain complex, Galice quadrangle. Area includes Dothan and Galice Formations.

Kleinschmidt Volcanics

Middle Permian: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Comprise a sequence about 2,000 to 3,000 feet thick. Interlayered with and in part overlie Hunsaker Creek Formation (new).

Mapped area lies between Wallow Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River canyon is included.

Klinker Till

Pleistocene: Northwestern Washington.

J. H. Mackin, D. R. Mullineaux, and W. J. Stark, 1950, Washington Univ. (Seattle), Trend in Engineering, v. 2, no. 4, p. 19—21. Thickness ranges from 15 feet at type locality to about 80 feet in Abrahamson pit at West Brandon Street and West Marginal Way. Overlies different members of Duwamish formation (new). Possible that Lawton sediments [formation] were deposited during recession of glacier that deposited Klinker till.

Type locality: In workings of Klinker Sand and Gravel Company above West Marginal Way, Seattle.

Knippa basalt

Age not stated: Southern Texas.

W. C. Maurer, 1965, America Inst. Mining, Metall. and Petroleum Eng. Soc. Petroleum Eng., Trans., v. 234, p. 174, 176. Mentioned in report on shear failure of rock under compression.

Quarried near Knippa, Uvalde County.

Knobs Megagroup

Devonian-Mississippian: Central United States.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Name proposed for the body of Devonian and Mississippian clastic rocks of central states, overlying Hunton Limestone Megagroup (new) and underlying main assemblage of limestones of Mississippian age. In Illinois Basin, phrase "top of Devonian" in practice means top of Hunton carbonate sequence despite awareness that larger part of overlying New Albany Shale Group is also Devonian. Megagroup names, Hunton and Knobs, are needed to avoid this dual usage of term Devonian. The Knobs is overlain in general conformity by carbonates of Mammoth Cave Limestone Megagroup (new). Boundary is generally older to west, and younger to east. There is one major step or arbitrary vertical cutoff in this surface and several minor steps. Major step is from base of Chouteau (Rockford) Limestone of Late Kinderhookian age to top of western edge of Borden Group of Osagian age. In Illinois, this cutoff runs diagonally southwestward from flank of LaSalle anticlinal belt west of Urbana to point about 30 miles south of Springfield, then southward to Mississippi River and Ste. Genevieve fault zone near Chester. Limestone tongues of Chouteau and lenses in the Coldwater extend far east of arbitrary line, and shale tongues of Fern Glen and Warsaw extend westward. In Ohio and West Virginia, the Knobs-Mammoth Cave boundary rises well into Meramecan, and toward west in Iowa it drops to about base of Kinderhookian. Thickness 400 to 1,000 feet in eastern Illinois; 30 to 300 feet in western Illinois. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Named for "The Knobs" a narrow band of highly dissected terrain developed on late Devonian and early Mississippian shales that partially surrounds Bluegrass region, and lies in front of Highland Rim, Muldraugh, or Knobstone Escarpment of Kentucky and Indiana.

Knowles Limestone (in Cotton Valley Group)

Upper Jurassic: Northern Louisiana (subsurface).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p 145—148. Name applied to upper 300 to 400 feet of Cotton Valley Group. Characterized by alteration of argillaceous limestones and gray shales. Occurs between subsurface depths 8,240 and 8,550 feet in type well. Overlies Hico Shale (new) and Terryville Sandstone (new). Grades northward into Schuler Formation near Louisiana-Arkansas line.

W. A. Thomas and C. J. Mann, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 178—182. In Louisiana the upper 300 to 400 feet (91 to 122 m) of Cotton Valley Group, the Knowles Limestone, consists of alternating, regionally persistent units of dark-gray argillaceous limestone and gray shale. Thin lenses of sandstone occur within, and locally supplant, some of the limestone units. Formation grades northward into red shale and sandstone. Basal part of formation is gradational with underlying formations, and is overlain conformably by Cretaceous Hosston Formation. Overlies Hico Shale.

Type section: The California Co., T. C. Colvin No. 1, SE¼NW¼ sec. 14, T. 19N., R. 4W., Lincoln Parish. Name derived from Knowles Field.

Knox Clastic Group (in Montevallo Supergroup)

Cambrian: Cincinnati Arch Province.

W. L. Calvert, 1962, Ohio Geol. Survey Rept. Inv. 45, p. 1, 21, 25 (table 2), 45 (table 3). Proposed for clastic unit between Shady Dolomite below and Knox Dolomite Supergroup above. This sedimentary unit, which comprises the lower two units of Safford's (1869) original Knox Group, is composed of Rome Formation and Conasauga Shale. Overlies Chilhowee Group. Underlies Lee Valley Group (new).

W. L. Calvert, 1962, Ohio Geol. Survey Rept. Inv. 47, p. 9 (fig. 2). Knox Clastic Group included in Montevallo Supergroup.

W. L. Calvert, 1963, Ohio Geol. Survey Rept. Inv. 48, p. 7. Name Knox Clastic Group dropped. Replaced by name Oostanaula Group. [Spencer's 1893 (Georgia Geol. Survey, Paleozoic group) abandoned term Oostanaula Shale revived and rank raised to group.]

Knox Dolomite Megagroup

Cambrian and Ordovician: Central North America.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Term Knox Group of eastern Tennessee has been used in Illinois Basin literature for major light-gray crystalline dolomite of late Cambrian and early Ordovician age. Knox has been used in this area particularly in places where formations are difficult to differentiate. Proposed herein to extend name to areas where formations are more readily separated, and to modify name to Knox Dolomite Megagroup, because unit contains such valid groups as Prairie du Chien in Illinois, the Elvins in Missouri, and Blue Creek Canyon in Oklahoma.

Arbuckle in Oklahoma, Kansas, and Arkansas is synonymous with Knox, and name Ellenberger is sometimes used in similar manner in Texas, Oklahoma, and New Mexico. Knox is valid unit in much of Appalachian area as well as in the interior. In Appalachians it is typically underlain by Nolichucky Shale of earliest Croixan age which separates the Knox from Middle or Lower Cambrian carbonate sequences. Potsdam and Knox Megagroups are generally separated by one or more formations of intermediate character, but in some areas they are in direct contact. In parts of southern Wisconsin and small area of adjoining Illinois, St. Lawrence (Potosi) Dolomite at base of Knox rests on Arcadia Sandstone or on Franconia Formation so sandy that it can be considered part of Potsdam [Megagroup]. In most of northern Illinois 500 to 1,000 feet of Eau Claire, Galesville, Ironton, and Franconia Formations of late Dresbachian to earliest Trempealeauan age are of varied lithologic character and are not included in either Knox or Potsdam Megagroups. In east-central Illinois, base of Knox drops to base of Franconia, and in southeastern Illinois, southern Indiana, and Kentucky, it lies on top of Eau Claire. In southwestern Illinois, the Eau Claire is equivalent to Bonneterre Dolomite, and base of Knox is at base of Bonneterre, where it rests directly on the Potsdam represented by La Motte Sandstone. Knox Megagroup is truncated by St. Peter Sandstone or equivalent sandy strata in Simpson Group in most of midwest. There are unresolved problems involving upper boundary of Knox, as in northwestern Virginia where parts of Blackford Limestone are lithologically similar to Knox but other parts have Ottawa [Megagroup] lithology and clearly lie above the Knox. Similar problem involves Everton strata in southeastern part of Ozarks. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Knox Lake Till

Pleistocene: Northeastern Ohio.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. Knox Lake till, a deposit of Scioto glacial lobe, correlates with Millbrook till, a deposit of Killbuck glacial lobe. Older than Mount Liberty till (new).

Report discusses glacial geology of Richland County.

Kobuk Glaciation

Pleistocene (pre-Wisconsin): Norhtwestern Alaska.

A. T. Fernald, 1964, U.S. Geol. Survey Bull. 1181—K, p. K6—K9, pl. 1. Earliest episode of glaciation represented by mappable deposits in area. Deposits compose a complex of till and outwash gravel and sand. Was preceded by an earlier glaciation that overrode the valley and reached many miles to east and west. Followed by Ambler Glaciation (new). Maximum extent of ice of Kobuk Glaciation not known.

Named after extensive exposures in central Kobuk River valley.

Koger Limestone Lentil (in Fayetteville Formation)

Mississippian (Chesterian): Northwestern Arkansas.

J. D. Taylor, 1964, Arkansas Acad. Sci. Proc., v. 18, p. 64—65. Marine dark-gray hard dense finely crystalline fossiliferous limestone. Thickness

6 to 14 inches. At type locality lies 40 feet above Wedington Member and about 50 feet below base of Pitkin Formation.

Type locality: Two miles northwest of Elkins, Washington County, and 2 miles east of Koger Branch of Middle Fork of White River near center of north boundary of sec. 3, T. 15 N., R. 29 W. Reference section: On South Mountain (Baxter Mountain) south of Fayetteville in NE¼, sec. 28, T. 16 N., R. 30 W., on Country Club road.

Kogruk Formation (in Lisburne Group)

Lower and Upper Mississippian: Northern Alaska.

E. G. Sable and J. T. Dutro, Jr., 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 5, p. 592. Composed of thick-bedded fine- to coarse-grained gray limestone with minor beds and lenses of chert. Thickness about 520 feet at type section; contact with overlying Tupik formation (new) may be faulted; other sections, 5 miles west and 12 miles southwest, are 1,500 and 1,400 feet, respectively. Overlies Utukok formation (new). Fossil assemblages indicate both Early and Late Mississippian age.

Type section: On Tupik Mountain, in mountain-top outcrops adjoining and south of Utukok-type section, De Long Mountains. Named for Kogruk Creek, the west-flowing headwater tributary of Utokok River.

Kokoruda Ranch Complex

Upper Cretaceous and Tertiary: West-central Montana.

H. W. Smedes, 1966, U.S. Geol. Survey Prof. Paper 510, p. 62–64, pl. 1. Boulder batholith was emplaced at close of a main orogenic episode, in at least four major stages, probably during very late Cretaceous and Paleocene time. Earliest stage involved intrusion of mafic rocks, mostly gabbro, syenogabbro, diorite, syenodiorite, monzonite, and related rocks. These are now preserved principally in northern part of area where they are a component of a large mass called Kokoruda Ranch complex, which lies between layered host rocks to north and northeast, and quartz monzonite of main intrusive stage of batholith to the south. The second, or intermediate, intrusive stage of the batholith involved less calcic magma that produced granodiorite and related rocks. These occur as a component of Kokoruda Ranch complex, where they cut early mafic rocks, and as the Antelope Creek stock. Granodiorite in the Kokoruda Ranch complex is coextensive with Unionville Granodiorite (Knopf, 1957, Am. Jour. Sci., v. 255, no. 2) to the west. Contacts of Kokoruda Ranch complex with Elkhorn Mountains Volcanics are steep and clearly discordant. The intrusive appears to have been emplaced into the volcanic rocks and the middle unit of the Colorado Formation along preexisting north- or north-northeast-trending faults. Along north boundary, complex cuts Kootenai and Morrison Formations. West of map area, contact cuts down section and is close to the top of the Mission Canyon Limestone. Rocks of complex are cut by three plugs of augite-bearing quartz monzonite and by dikes of coarse- to fine-grained quartzmonzonite, all probably part of Butte Quartz Monzonite.

Named from the George C. Kokoruda Ranch which lies within it in sec. 28, T. 9 N., R. 2 W., northern Elkhorn Mountains. Jefferson and Broadwater Counties.

Kolob Latite

Tertiary, lower: Southwestern Utah.

Paul Averitt, 1962, U.S. Geol. Survey Prof. Paper 389, p. 30—31, pl. 1. A porphyritic quartz latite. Evidently the lower part of an early and more extensive lava flow, or series of flows, that originated east of and higher than present outcrop. On Kolob Terrace on west side of Urie Creek, the latite lies below a thick flow of younger basalt, which forms extensive lava plateau.

Named for occurrence on Kolob Terrace on west side of Urie Creek near center sec. 17, T. 37 S., R. 10 W., Cedar Mountain quadrangle, Iron County.

Kootznahoo Formation

Paleocene through Miocene: Southeastern Alaska.

E. H. Lathram and others, 1965, U.S. Geol. Survey Bull. 1181—R, p. R9 (table 1), R28—R31, pl. 1. Composed of about 5,000 feet of conglomerate, sandstone, siltstone, shale, and coal. Conglomerate with lithic sandstone matrix constitutes most of exposures northwest of Kootznahoo Inlet and Mitchell Bay. Southwest of these areas, sandstone, siltstone, and shale predominate. At Little Pybus Bay, comprises coarse-grained lithic sandstone and conglomerate. Formation believed to be wedge shaped, thickest area occurring southeast of Kootznahoo Inlet. Thickness about 2,000 feet at Little Pybus Bay; thins northward and disappears south of Cannery Cove. Lies with angular unconformity on Gambier Bay Formation at south end of Kanalku Bay and on Seymour Canal Formation (of Stephens Passage Group, new) at Little Pybus Bay. In Kootznahoo Inlet, unconformably overlies plutonic rocks. In type area, upper surface erosional, no younger bedded rocks occur. In Little Pybus Bay area, conformably underlies Admiralty Island Volcanics. On basis of fossil evidence, formation as mapped in this report is considered Paleocene through Miocene.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C47—C48. Rests unconformably on Hound Island Volcanics (new) and on Cannery Formation, but contact with Seymour Canal Formation obscured by gabbro intrusion. Thickness probably more than 1,500 feet. Area of report is Keku Islets and neighboring parts of Kuiu and Kupreanof Islands.

Named for Kootznahoo Inlet, along which typical exposures occur. Mainly occupies lowland bounded by Favorite Bay, Kanalku Bay, Davis Creek, and Mitchell Bay on west, southeast, and east, and low foothills northwest of Kootznahoo Inlet and Mitchell Bay. Also mapped from Little Pybus Bay to Cannery Cove.

Kope Formation

Upper Ordovician: Ohio, Indiana, and Kentucky.

M. P. Weiss and W. C. Sweet, 1964, Science, v. 145, no. 3638, p. 1296—1302. Proposed that the medium-bedded shales and limestones of lower formation in Maysville area, which lie beneath distinctly thinner bedded more calcareous Fairmount and McMillan equivalents above thin- to medium-bedded shaly limestones of Point Pleasant formation be included in Kope formation. Unit consists of interbedded, highly fossiliferous gray limestones and shales. No continuous section of formation is known. Composite thickness 73.5 meters.

G. D. Brown, Jr., and J. A. Lineback, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 5, p. 1018—1020. Geographically extended into Indiana where it underlies Dillsboro Formation (new). Kope includes rocks that were loosely embraced by Orton's (1873, Ohio Geol. Survey Rept., v. 1, pt. 1) original term Eden Shales. In places the Kope is not entirely of classical Eden age.

J. P. Ford, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 924—928. In Hamilton County, Ohio, formation subdivided to include Grand Avenue Member (new) in upper part and Wesselman Tongue (new). Intertongues with Fairview Formation.

F. A. Schilling, Jr., and J. H. Peck, 1967, U.S. Geol. Survey Geol. Quad Map GQ—588. Geographically extended into Orangeburg quadrangle, northeastern Kentucky, where it is about 60 feet thick and base is not exposed. Consists of about 70 percent shale. Underlies Fairview Formation.

Name taken from Kope Hollow, north of Levanna, Ohio, and largely on Russellville 7.5-minute quadrangle in Brown County, Ohio.

Kougarok Gravel

Tertiary, middle(?) and upper, and Pleistocene, lower(?): Alaska.

D. M. Hopkins, 1963, U.S. Geol. Survey Bull. 1141—C, p. C29—C34, pl. 1. Consists of basal gravel member locally more than 187 feet thick, a thin middle member composed of peaty lignite, and upper gravel member 3 to 60 feet thick. Middle member contains pollen and wood flora consisting of mixture of coniferous and deciduous trees. Upper member contains poplar and either spruce or larch wood and may be early Pleistocene in age. Gravel thins abruptly northward up Noxapaga River from Turner Creek; thinning due to wedging out of lower and middle members and to rise in level of bedrock floor beneath the formation. Upper member rests directly on weathered flow of Kugruk volcanics in terrace remnants between Grouse and Andesite Creeks.

Type locality: Exposures along and near lower course of Kougarok River. Also well-exposed in drainage basin of Quartz Creek, a tributary of lower Kougarok River. Gravel sheet occupies belt, 18 miles along and 1 to 4 miles wide, extending along northwest margin of Kuzitrin Flats from Bunker Hill to valley of Noxapaga River, Imuruk Lake area, Seward Peninsula.

Koyukuk Glaciation

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1983. Ice extended south from Brooks Range into lower Alatna Valley during at least three Pleistocene glaciations. During Koyukuk Glaciation, oldest known advance, coalescing glaciers formed a piedmont ice sheet that covered most of Koyukuk lowlands. Followed by Alatna Glaciation (new).

Alatna Valley originates near north flank of central Brooks Range and extends southeast through this mountain belt into Koyukuk lowlands.

Kress Member (of St. Peter Sandstone)

Middle Ordovician (Champlainian): Northern Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13, 35, 45. In many places is a coarse basal conglomerate consisting largely of rubblelike deposit of irregular blocks of chert with a matrix of clay, sand, or chert. In many areas a red argillaceous unit is present at base of St. Peter Formation. This unit reaches maximum thickness of 170 feet in well at Rochelle, Ogle County, Ill. One or more layers of bentonite occur in red clay or white sandstone just above base of formation in Ogle County. Elsewhere the Kress consists of well-bedded deposits of red and green shales, generally containing thin beds of sandstone. Clay and shale phase of the Kress is locally exposed in Split Rock section, particularly along Pecumsaugan Creek, where it is 10 feet thick. Irregular in distribution; appears to be present at least locally throughout area of St. Peter Sandstone but is more common and thicker in some areas than others. Appears to be thickest, locally exceeding 100 feet, immediately north of north-facing pre-St. Peter escarpment of Prairie du Chien dolomites that extends from central part of Chicago slightly north of west across northern Illinois. Underlies Tonti Member (new). Kress Member is the basal shaly and conglomeratic zone of St. Peter Sandstone referred to in many Illinois, Iowa, Minnesota, Missouri, and Wisconsin reports. Name credited to T. C. Buschbach (in press).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 50 (fig. 17), 51—52. Formal proposal of name. Type well designated. Basal member of St. Peter. Underlies unnamed member of St. Peter in area of this report [northeastern Illinois]. Occurs at depths of 940 to 1,004 feet in type well.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Name Readstown Member (new) used in Wisconsin in preference to name Kress.

Type well: Elgin, Joliet, and Eastern Railroad No. 1 (reference well 48), a cable tool well in NW¼NE¼SE¼ sec. 32, T. 40 N., R. 9 E., DuPage County. Named for Kress Creek, northwest of West Chicago, DuPage County. The creek flows southward in sections 6, 7, and 8, T. 39 N., R. 9 E. The headwaters of the creek are about 1½ miles southwest of type well.

Kroenke Granodiorite

Precambrian: Central Colorado.

Fred Barker and M. R. Brock, 1965, U.S. Geol. Survey Bull. 1224—A, p. A26. Consists of quartz diorite, granodiorite, and quartz monzonite in a sharply discordant body that underlies much of drainage areas of Pine Creek, North Cottonwood Creek, and the uppermost reaches of Texas Creek, and a small pluton in Ptarmigan Creek drainage area. Intrudes Denny Creek Granodiorite Gneiss (new). Younger than Browns Pass Quartz Monzonite (new).

Type area: Exposures west of Kroenke Lake, Mount Harvard quadrangle, Gunnison and Chaffee quadrangles.

Kugruk Volcanics

Tertiary, upper, and Pleistocene, lower(?): Alaska.

D. M. Hopkins, 1963, U.S. Geol. Survey Bull. 1141—C, p. C48—C54, pl. 1. Name proposed for group of volcanic rocks in Imuruk Lake area that are characterized by thick weathered zone unlike weathered zones formed in similar rocks under present climate. Some rocks lacking this characteristic weathering profile are assigned to the Kugruk volcanics, because they are much more dissected than rocks assigned to next younger formation, Imuruk volcanics (new). Kugruk volcanics range in composition from olivine basalt to pilotaxitic andesite. Where best exposed in cliffed east wall near head of canyon of Kugruk River, 3 miles east of Imuruk Lake, the volcanics consist of (1) basal basaltic lava flow, about 20 feet thick, containing sparse olivine phenocrysts but free of inclusions and recognizable xenocrypts; and (2) olivine-basalt lava flow, 40 feet thick, containing large angular xenocrysts of orthoclase and lustrous opacite and inclusions of granitic rock and dunite. Conformable contact with overlying Imuruk volcanics. Base of cliff obscured by olivine-rich basalt flow of Gosling volcanics (new).

Type locality: In canyon of Kugruk River, 3 miles east of Imuruk Lake, Seward Peninsula.

Kugururok Formation

Upper Devonian: Northern Alaska.

E. G. Sable and J. T. Dutro, Jr., 1961, Am. Assoc. Petroleum Geologist Bull., v. 35, no. 5, p. 585—589. Formation in type section is largely dolomite and limestone with shaly to conglomeratic clastic rocks in lower part; three informal lithologic members can be recognized. Lower, dominantly clastic (shale with interbedded sandstone, granule conglomerate, siltstone, and limestone) about 380 feet thick; middle, about 610 feet, of calcarenite with some conglomeratic limestone, sparse chert lenses, and dolomitic(?) sandstone; upper, 380 feet, light-colored laminated to crossbedded dolomite. Thickness about 1,370 feet at type section; some areas probably exceed 2,000 feet. Formation occurs in thrust plate and overlies Mississippian(?) carbonate rocks and dark shales of unknown age. Type section unconformably overlain by dark shales of probable Jurassic or Early Cretaceous age.

Type section: North side of Mont Bastille, De Long Mountains. Named from exposures on Kugururok River.

Kuiu Limestone

Upper Silurian: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C11—C12, pl. 1. A massive limestone that forms the prominent cliffs on the south-west shore of Saginaw Bay and that crops out on a few islets and reefs in Keku Islets. Characteristic and dominant type of the Kuiu is brownish-gray dense styolitic limestone. Lenses of polymict conglomerate occur sporadically throughout formation. Thickness probably about 2,500 feet on southwest side of Saginaw Bay. Contacts of the Kuiu either are faults or are of equivocal nature. Exact stratigraphic relations uncertain. Distribution of the Silurian formations suggests that the Kuiu overlies Bay of Pillars Formation (new) and underlies the red arkose unit and the volcanic graywacke of argillite of Saginaw Bay.

Type locality: Shoreline of Kuiu Island, just west of entrance of Saginaw Bay.

Kulshan Glaciomarine Drift

Pleistocene, upper: Northwestern Washington.

D. J. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1472—1475, pl. 3. Consists of massive blue-gray unsorted and unstratified till-like sediments. Coarser fraction consists of pebbles, cobbles, and a few boulders covered by younger deposits over most of lowland but crops out near beach level at cliffs along Bellingham Bay. Younger than Vashon drift. Underlies Deming sand (new) along Nooksack River near Cedarville.

Occurs in Northern Puget Lowland.

La Barge Member (of Wasatch Formation)

Eocene, lower: Southwestern Wyoming.

S. S. Oriel, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2161—2173. Name applied to upper part of main body of Wasatch Formation. Heterogeneous unit that includes mudstone, siltstone, sandstone, conglomerate, marlstone, and limestone. Brightly colored mudstone dominant and forms extensive thick bands that are mainly various shades of red, purple, and orange but also green, yellow, tan, brown, and gray. Thickness several hundred feet near La Barge. Overlies Chappo Member (new) with angular unconformity; where Chappo is overlapped, gently dipping La Barge rests on steeply dipping Paleozoic and Mesozoic strata. Upper contact is base of Fontenelle Tongue of Green River Formation. Member is of Lysite(?) and Lost Cabin, or middle(?) and late early Eocene age. Names Almy and Knight not applicable in this area.

Type area: Along north side of La Barge Creek, a tributary of Green River; extends eastward from center of SE¼NE¼ sec. 17, T. 26 N., R. 113 W., to bluffs along east side of Green River. Type section: Incompletely exposed sequence 1 mile southeast of town of La Barge in river bluffs along middle of north line of sec. 8, T. 26 N., R. 112 W., Lincoln County.

La Belle Clay Member (of Tamiami Formation)

Miocene, upper: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 116, 213. Lowest unit of formation in Caloosahatchee area. Consists of greenish-gray, blue-gray, and olive-green clays. Underlies Alva clay member (new). Laterally merges into unnamed quartz sand.

La Belle is in Hendry County.

Labyrinth Canyon Member (of Thirsty Canyon Tuff)

Pliocene: Southeastern Nevada.

D. C. Noble and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D24—D27. Lower 5 to 20 feet composed of slightly to moderately welded light-gray or light-brown vitric ash-flow tuff containing about 20 percent white pumice fragments. Basal vitric zone sharply overlain by pink to bluish-gray devitrified tuff. Maximum thickness about 50 feet. Overlies Gold Flat Member (new). Uppermost named member of formation; underlies unnamed member.

Type locality: In headward part of Labyrinth Canyon (lat 37°17′ N., long 116°41′ W.) Nye County. Crops out west, north, and east of Black Mountain.

La Casita Stage

La Casita Formation or Group

Upper Jurassic (Sabinas Series): Gulf Coastal Province.

R. W. Imlay, 1936, Geol. Soc. America Bull., v. 47, no. 7, p. 1110. Formation includes shales, sandstones, and intercalated limestone beds lying between La Gloria formation and Taraises formation. Thickness about 200 feet.

W. E. Humphrey, 1956, Notes on the geology of northeast Mexico: Corpus Christi Geol. Soc., 41 p. La Casita group is upper division of Sabinas series. Zuloaga is lower group.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 287, 292—296. La Casita used herein as provincal stage for youngest known Late Jurassic in coastal province to include rocks which can be equated in any reasonable way to typical La Casita and La Caja sequences. Locally La Casita strata disconformably or unconformably overlie Zuloagan beds. Zuloagan used as stage name for lower part of Sabinas series.

Type locality (formation): Cañon de La Casita, which is about 10 miles south of General Cepeda and about 30 miles southwest of Saltillo, Coahuila Peninsula, Mexico.

Ladd Creek Mudflow

Recent: Northwestern Oregon.

D. C. Birch, 1963, Oregon Country Geol. Soc. Newsletter, v. 29, no. 4, p. 27. Name given to mudflow that issued from toe of Ladd glacier on Mount Hood and swept down Ladd Creek. Thickness about 15 to 20 feet at mouth of Ladd Creek Canyon; may be 5 to 8 feet where spread out over existing alluvial fans.

La Follette Member (of Monteagle Limestone)

Mississippian: Central Tennessee.

R. G. Stearns, 1963, Tennessee Div. Geology Inf. Circ. 11, p. 5 (table). Green-gray shale, 7 feet thick. In upper part of Monteagle.

Measured section is at type section of Monteagle in Marion County. Derivation of name not given.

La Garita Quartz Latite

Oligocene: Southwestern Colorado.

T. A. Steven and J. C. Ratté, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D54—D63. Name proposed for part of assemblage of rocks formerly included in Alboroto Rhyolite by Larsen and Cross (1956, U.S. Geol. Survey Prof. Paper 258). Consists largely of identical densely welded ash-flow tuffs that are equivalent to former Outlet Tunnel and Phoenix Park Quartz Latites of Emmons and Larsen (1923). Rocks that accumulated before Bachelor Mountain Rhyolite and before cauldron subsidence are herein called Outlet Tunnel Member, and those that accumulated concurrently with and after Bachelor Mountain Rhyolite and after cauldron subsidence are called Phoenix Park Member. Emmons and Larsen believed that bulk of these rocks along upper East Willow Creek and La Garita Mountain belonged to their Phoenix Park unit, but present study has shown that they formed before cauldron subsidence and belong to redefined Outlet Tunnel Member. Middle or upper Tertiary.

T. A. Steven, H. H. Mehnert, and J. D. Obradovich, 1967, U.S. Geol. Survey Prof. Paper 575—D, p. D47—D55. Age of volcanic activity in San Juan Mountains, Colo. Potassium-argon age determination on La Garita Quartz Latite, Outlet Tunnel Member 27.8 ± 1.3 m.y.

Type area: La Garita Mountain, northeast of Creede, Mineral County. Forms bulk of La Garita Mountain. Well exposed along upper canyon of East Willow Creek.

Lago Garzas Formation

Upper Cretaceous: West-central Puerto Rico.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B22—B24. Highly amygdaloidal purple lava and associated volcanic rocks. Formation consists of basal member predominantly of mudstone and volcanic sandstone, a middle member of tuff, and an upper member of lava. The three members intertongue or interfinger with each other in central part of exposure area. Minimum thickness of 1,700 m of formation measured near Lago Garzas. Lava member restricted to graben between Garzas and Ciénaga faults. All contacts of formation are faults. The Lago Garzas outcrop is part of broad band of rocks that are exposed from Ponce to west coast of Puerto Rico near Aguada. Hubbard (1923) called these rocks "Rio Blanco Series", and term has been used by several workers. Suggested that term "Rio Blanco" be abandoned in favor of Lago Garzas, Anon, or other names as appropriate to the specific areas.

Type locality: At (122,300 m E. ; 33,980 m N.), at kilometer post 5.0 on route 518 on east side of Cerro El Gigante. Named for exposures in vicinity of Lago Garzas and eastward from the lake along route 518. Exposed in graben between Garzas and Cienaga faults, in a horst south of the San Patricio fault and in the south-central part, and in a fault block on route 10 along the Cerrillos fault.

La Grange Gravels

See Kahoka Till.

La Guaba Lava Member (of Cariblanco Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I—335. Fine grained, dark-greenish gray to olive gray, very amydaloidal, and usually pillowed. Thickness 0 to about 50 m. Base about 100 m. above base of formation.

Type locality: Near La Guaba, at junction of Quebrada Algarrobo and Río Cuyón, in northwestern part of Coamo quadrangle. Crops out on Cordillera Central north of type locality and north slope of Las Piedras Chiquitas just south of La Guaba.

Laguna Latite

Eocene, middle: North-central Utah.

C. T. Hardy, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 61. Northern part of Long Ridge is almost entirely underlain by volcanic breccia or agglomerate, with a few included flows. This unit was mapped by Muessig (1951, unpub. thesis) as Laguna Latite. In East Tintic district, west of Long Ridge, it is now called Laguna Springs Latite.

Laguna Springs Latite

Eocene, middle: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 125—126, pl. 2. Latite effusives, which disconformably overlie Packard quartz latite, are named Laguna Springs latite. Subdivided on basis of rock type into basal tuff, lower flow series, intermediate tuff and agglomerate, an upper flow series, and a thick and extensive agglomerate.

C. T. Hardy, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 51 (table), 61. Laguna Springs Latite, in Long Ridge, is represented by the agglomerate member which is 500 to 1,000 feet thick. According to Muessig (1951) who called the unit Laguna Latite, the volcanic breccia of Laguna Springs Latite grades southward into volcanic conglomerate of Goldens Ranch Formation.

Type locality: Near Laguna Springs in lower part of canyon of Pinyon Creek, in W½NW¼ sec. 25, T. 9 S., R. 2 W., East Tintic Mountains.

Lahontan Valley Group

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—111——D—114. Consists of lacustrine sediments deposited in Lake Lahonton and interfingering and immediately overlying subaerial sediments. Divided into five formations on basis of lithologic differences due to two major alternations from mainly deep-lake to subaerial and shallow-lake sediments (ascending): Eetza, Wyemaha, Sehoo, Indian Lakes, and Turupah (all new). Overlies Paiute formation (new); underlies Fallon formation (new).

Type area: Lahontan Valley, in southern Carson Desert, near Fallon, Churchill County.

Laib Group or Formation

Lower Cambrian: British Columbia, Canada.

H. W. Little, 1950, Canada Geol. Survey Paper 50—19, p. 15—18. Group consists of thick assemblage of argillaceous quartzites, argillaceous schist, phyllite, and minor limestone. Overlies Reno formation and underlies Nelway formation. Almost equivalent to Maitlen phyllite of Metaline quadrangle, Washington, but excludes basal quartzite member of that formation.

J. T. Fyles and C. G. Hewlett, 1959, British Columbia Dept. Mines Bull. 41, p. 23—27. Rank reduced to formation. Includes (ascending) Truman, Reeves and Emerald members.

Named for Laib Creek north of Salmo-map-area.

Lake Alta tuff

Miocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 20 (table 2), 37. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon ages: (sanidine) 22.6 ± 0.5 m.y. and (plagioclase) 28.1 m.y. Sanidine date considered more reliable. Overlies basement rock; underlies andesite mudflow breccia. Indicated age Miocene.

Lake Alta is in SE¼ sec. 35, T. 16 N., R. 10 E., Placer County.

Lake Chamberlain Till, Glaciation

[Pleistocene]: Southern Connecticut.

R. F. Flint, 1961, Geol. Soc. America Bull., v. 72, no. 11, p. 1687–1691. Name Lake Chamberlain till applied to the older of two tills exposed in borrow pit at Lake Chamberlain. Exposed thickness 12 to 20 feet. Underlies Hamden till (new); overlies bedrock (Orange phyllite). Figure 3 refers to Lake Chamberlain glaciation. Age not stated.

Fred Pessl, Jr., 1966, U.S. Geol. Survey Prof. Paper 550–D, p. D89–D93. Upper part of Mashamoquet Brook till (new) may correlate with Lake Chamberlain and Hamden tills of Flint (1961).

Type locality: Lake Chamberlain, a reservoir in valley of Sargent River in Bethany, 1.9 miles south-southeast of Bethany, northwest of New Haven.

Lake Dorothy Hornfels

Pennsylvanian and (or) Permian(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 26, pls. 1, 2. Dense yellowish-gray to grayish-black thinly layered quartz-plagioclase-pyroxene hornfels; siliceous hornfels locally present near south boundary of quadrangle. Cut by diorite intrusion south of Constance Lake. About 1,000 feet thick north of Lake Genevieve, where it appears least disturbed structurally. Contact with underlying Mildred Lake hornfels (new) commonly gradational over several tens of feet. Underlies Bloody Mountain formation (new).

Type locality: Immediately east of Dorothy Lake, Mount Morrison quadrangle, Sierra Nevada. Discontinuously exposed from north end of ridge separating Laurel and Sherwin Creeks southeastward about 8½ miles to Big McGee Lake, about 1 mile south of quadrangle boundary in Mount Abbot quadrangle

Lake Escarpment Glaciation

Pleistocene (late Cary): Western New York.

E. H. Muller, 1963, New York State Mus. Bull. 392, p. 47–48. Name applied to glaciation in Chautauqua County to time represented by group of moraines termed Lake Escarpment Morainic System by Leverett (1902, U.S. Geol. Survey Mon. 41). Leverett named moraine ridges in succession from oldest to youngest (south to north) the Euclid, Painesville, Ashtabula, and Girard. For purposes of present report the Gowanda moraine in northeastern part of Chautauqua County is associated with above named moraines. Physiographic implications of term Lake Escarpment Morainic System are appropriate in Chautauqua County, but eastward the association of the moraines with the escarpment becomes invalid. Shepps and others (1959, Pennsylvania Geol. Survey Bull. G-32) adopted name Ashtabula Moraine for the group of moraines, redefining a term initially applied by Leverett to a single moraine ridge. Leverett's terminology is here retained for Chautauqua County in preference to that adopted in Pennsylvania and Ohio.

Group of moraines occur along the escarpment of north margin of Appalachian Plateaus in Chautauqua County.

Lake Milan Silt, Sand

Pleistocene: Western Illinois.

R. W. Edmund and R. C. Anderson, 1967, Tri-State Geol. Guidebook 31st Ann. Field Conf., Oct. 14—15, p. 18, 25, 35, 39. At Milan quarry, the overburden consists of Illinoian till, Sangamonian accretion gley, Lake Milan sand, and Wisconsin till. Also mentions Lake Milan terrace (silt and clay).

Area of report is vicinity of Rock Island, Ill. Glacial Lake Milan was formed when ice from the Lake Michigan lobe blocked the ancient Mississippi Valley at the "big bend" of the Illinois River at Hennepin.

Lake Nancy Limestone

See 111 [one hundred eleven] Ranch Beds.

Lake Thatcher Formation (in Gentile Valley Group)

Pleistocene, upper: Southeastern Idaho.

R. C. Bright, 1964, Dissert. Abs., v. 25, no. 4, p. 2440. Consists of unconsolidated fine clastics, marl, and lesser amounts of gravel in deltas and beach deposits. Contains peat and organic beds and at least three strata of volcanic ash. Partly interbedded with Gem Volcanics (new). Radiocarbon analyses of mollusk shells show formation is 27,000 to 33,700 years old.

Site of the present Oneida Narrows was at one time a divide separating Cache Valley (arm of Lake Bonneville) from ancestral Thatcher Basin, the latter draining northward to Bear River.

Lakewood Formation

Pleistocene: Southern California.

California Department Water Resources, 1961, California Dept. Water Resources, Southern Dist., Bull. 104, p. 54, 56—64, table 1, pls. Marine and continental gravel, sand, sandy silt, and clay with shale pebbles. Thickness about 340 feet in typical section in well at Lakewood. Unconformably overlies San Pedro, Pico, Repetto, and Puente formations. Includes what has been termed "terrace deposits," "Palos Verdes sand," and "unnamed upper Pleistocene deposits." Basal part of formation in Cheviot Hills area of Beverly Hills was called Medill sand by Rodda (1957). Other names used for upper Pleistocene deposits or parts of these deposits include Sunny Hills formation (Hoskins, 1954, unpub. thesis) and San Dimas formation (Eckis, 1928).

Named for occurrence at Lakewood, Los Angeles County. Extends beneath most of coastal plain of the County.

Lamarck Granodiorite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1532—1533. Homogeneous in both composition and texture except in thin southeastern part of mass, which is more felsic and somewhat porphyritic. Younger than Inconsolable and Tinemaha Granodiorites (both new) and older than granodiorite of Cartridge Pass, Tungsten Hills Quartz Monzonite (new), and quartz monzonite similar to Cathedral Peak Granite.

Type locality: Cirques east of Mount Lamarck, east-central Sierra Nevada, near Bishop. Named after Mount Lamarck. Two masses crop out along west and southwest sides of mapped area. Larger, Mount Lamarck mass, underlies about 54 square miles within southwestern part of area; smaller, Chickenfoot Lake mass, underlies about 3 square miles in northwestern part of area.

Lambert Shale

Oligocene and (or) Miocene: West-central California.

T. W. Dibblee, Jr., 1966, California Div. Mines and Geology Map Sheet 8. Marine shale conformable on Vaqueros Sandstone, or San Lorenzo Formation where Vaqueros Sandstone is absent. Overlain by Monterey Shale in area southwest of Pilarcitos fault. Thickness at type section about 4,800 feet. Lower 2,750 feet from base of formation to upper tongue of Mindego Basalt composed of moderately to indistinctly bedded, gray spheroidally weathering clay shale and siltstone, commonly with calcareous concretions. Upper part above tongue of Mindego similar but includes more semisiliceous shale and much dark-brown hard semisiliceous mudstone that weathers chalky white. Has been mapped as part of Monterey Shale, as parts of San Lorenzo and Vaqueros Formations, as Sandholdt Formation, and as part of Mindego Formation by various workers.

Type section: Exposed from top of Vaqueros Sandstone (in NW¼ sec. 33, T. 7 S., R. 3 W.) in Lambert Creek southwest down Lambert and Peters Creek to base of Monterey Shale (in NW¼ sec. 33, T. 7 S., R. 3 W.) in Peters Creek. Named after Lambert Creek, Palo Alto quadrangle.

Lambs Chapel Dolomite (in Beekmantown Group)

Ordovician: Virginia.

W. L. Calvert, 1962, Ohio Geol. Survey Rept. Inv. 45, p. 25 (table 2), 33—34, 45 (table 3). Proposed to substitute name Lambs Chapel Dolomite for rock-stratigraphic unit heretofore called "Longview-Kingsport-Mascot Dolomite, undifferentiated." Consists of strata above top of upper argillaceous member of Chepultepec Dolomite and below top of Knox Dolomite Supergroup (Knox unconformity). Thickness 915 feet at type section. Base of unit conformable to and transitional with underlying Chepultepec. Lambs Chapel Dolomite is truncated northward in subsurface until it appears to be absent before No. 1 Adams well in Lewis County, Ky., is reached. Unit probably not present in subsurface of Ohio.

Type section: Lambs Chapel, 1 mile north-northwest of mouth of Hardy Creek, Lee County, Va. Section at this locality was described by Miller and Fuller (1954, Virginia Geol. Survey Bull. 71).

Lamine River Conglomerate physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 21—22. A chert phosphate and limestone conglomerate physiofacies. Thickness 0 to 29 feet. Interfingers with, underlies and overlies Shiel Clay Facies. Overlies and underlies Little Shaver Creek Laminated Limestone Facies. Overlies, underlies, and interfingers with Smithton Limestone Facies. Overlies and underlies Little Splice Creek Brecciated Limestone Facies.

Underlies Clifton City Intraclastic Limestone Facies (to northwest of Lupus, along Missouri River, the Clifton City grades into Little Shaver Creek which grades into the Mineola). Grades laterally into Smithton and Little Splice Creek Facies. Overlies, underlies, and interfingers with Mineola Facies of Callaway Limestone Facies. Underlies and interfingers with Sandy Hook Facies of Callaway Lithofacies of the Cedar City. Overlain by *Siphonodella* Beds of Bachelor Formation and by Chouteau and Burlington Formations of Mississippian age. Overlain by Lupus Sandstone Facies of Callaway Lithofacies. Underlain by Cotter-Jefferson City, St. Peter, and Kimmswick Formations of Ordovician age.

Best developed in Pettis and Cooper Counties along Lamine River, for which it is named, and its tributaries.

Lamoine Group

Ordovician-Silurian: Eastern Maine.

J. D. McGregor, 1965, Dissert. Abs., v. 25, no. 11, p. 6539. The Ordovician-Silurian Ellsworth Schist is divisible into two groups, the Lamoine (older) and Egypt (new). The Lamoine is about 25,000 feet thick and characterized by nonporphyoblastic quartzofeldspathic schist. Overlies Charlotte Group.

Ellsworth quadrangle, southeastern coastal region.

Lands End Formation

Lands End Glaciation

Pleistocene: Western Colorado.

W. E. Yeend, 1966, Dissert. Abs., v. 26, no. 9, p. 5375—5376. Quaternary geology of Grand Mesa area. Most dominant effects upon the topography have been made by three glaciations. Glacial, alluvial, and colluvial deposits associated with the three separate glaciations have been included in three newly named formations: Lands End, Grand Mesa, and Bonham Reservoir. Oldest glacial period, Lands End Glaciation (Bull Lake(?) Stade, middle Wisconsin) covered entire present surface of Grand Mesa and flowed into lowlands probably to minimum elevation of 6,000 feet. Two levels of outwash terraces in the lowlands record a fluctuation of the ice front.

Grand Mesa is a basalt-capped plateau rising above 10,000 feet elevation. The mesa is about 20 miles east of junction of Gunnison and Colorado Rivers in the arid to semiarid lands of Western Colorado.

Landslide Creek Granodiorite

Mesozoic: Eastern Alaska.

A. W. Rose, 1966, Alaska Div. Mines and Minerals Geol. Rept. 20, p. 10, 15. Granodiorite is medium grained, leucocratic, and light gray to buff. In western part of main body, the granodiorite is cut by numerous dikes ranging from diorite to quartz diorite and by a few diabase or gabbro dikes. Southwest contact with dacite and is intrusive and irregular. At northwest corner, granodiorite appears to intrude a metadiorite and meta-volcanic unit.

Occupies about 2 square miles between East MacLaren Glacier and headwaters of Landslide Creek, Mount Hayes quadrangle.

Lane Mountain Andesite

Pliocene(?): Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 91, pls. Andesite extruded onto eroded surface of quartz monzonite. Rock is gray to brown, massive, and porphyritic; composed of phenocrysts making up 25 to 50 percent of rock. Composed of one or more flows totaling about 480 feet thick. Field relations in Calico Mountains beyond east border of mapped area indicate that andesite lies unconformably on Barstow Formation and is therefore younger presumably of Pliocene age. Name credited to McCulloh (unpub. thesis).

Type locality: Lane Mountain in Lane Mountain quadrangle 15 miles east-southeast of Opal Mountain. Covers about 2 square miles to form slightly domes nearly flat topped butte about 7 miles southeast of Opal Mountain, San Bernardino County.

La Pasada Formation

Pennsylvanian (Morrowan-Desmoinesian): North-central New Mexico.

J. P. Miller, Arthur Montgomery, and P. K. Sutherland, 1963, New Mexico Bur. Mines Mineral Resources Mem. 11, p. 20 (fig. 6), 30—33, 36—60, pl. 1. Primarily a cyclic carbonate-rock unit which includes a variety of rock types. Thickness 973 feet at type section where it overlies Mississippian Tererro Formation and underlies Alamitos Formation (new). Approximate southern equivalent of Flechado Formation (new).

Type section: Dalton Bluff on west side of Pecos River, 6.6 miles north of junction of State Highway 63 and alternate U.S. Highway 84—85 at town of Pecos, San Miguel County. Name taken from small Spanish settlement of Upper La Pasada near foot of Dalton Bluff just south of Dalton Campground. Entire formation present at Dalton Bluffs.

La Porte Tuff

Oligocene: Northern California.

G. B. Dalrymple, July 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 14, 15, 16, 20, 22, 24, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Plagioclase from La Porte leaf-bearing tuff gives date of 32.3 m.y. Lovejoy and Ingalls Formations can be no older than 23.8 m.y. and no younger than 22.2 m.y. Therefore, the Lovejoy basalt could not underlie La Porte Tuff [flora] as was believed by Durrell (1959, California Univ. Pubs. Geol. Sci., v. 34).

J. F. Evernden and G. T. James, Oct. 1964, Am. Jour. Sci., v. 2623, no. 8, p. 967. Discussion of potassium-argon dates and the Tertiary floras of North America. Referred to as La Porte Tuff and La Porte leaf-bearing dacite tuff. Plants in tuff have long been considered to be of Late Eocene age (Potbury, 1937, MacGinitie, 1941). This was one of prime pieces of evidences for "Eocene auriferous gravels" in the Sierra Nevada. Age according to K/A date: Late Chadronian (Oligocene).

Potbury, (1935, Carnegie Inst. Washington Pub. 534) discussed the La Porte flora but did not use formal term La Porte Tuff.

Locality of sample (Dalrymple): 2,000 feet S 16° W from NE cor. sec. 8, T. 21, N., R. 9 E., in Upper Dutch Diggings, Downieville quadrangle. La Porte flora (Potbury) occurs on west flank of the Sierra Nevada, 15 miles northwest of La Porte, Plumas County. Town of La Porte is near west edge of Downieville quadrangle. One mile north and a little west of town in northeast quarter of sec. 8, T. 21 N., R. 9 E., in the Upper Dutch Diggings is the tuff bed in which occurs the La Porte flora. The leaf-bearing bed is at top of cliff on west side of the diggings.

La Porte City Chert

Devonian: Central Iowa (subsurface).

M. C. Parker, 1967, Iowa Geol. Survey Rept. Inv. 4, 12 p. A white to dark-gray chert with limestone occurring near eastern and western limits. Yellowish-orange to light-gray fine- to medium-crystalline dolomite present in some areas. Thickness 25 to 145 feet; average thickness 50 feet. Underlies various members of Wapsipinicon Formation. Overlies Silurian Niagaran Series.

Type section: In La Porte City town well, NE/C SW¼ sec. 25, T. 87 N., R. 12 W., Blackhawk County. Well was drilled in 1948 to depth of 250 feet. Land surface elevation 815 feet. Top of La Porte City occurs at depth of 95 feet, the base at 150 feet. Reference section: Brandon town well, NW¼SW¼ sec. 27, T. 87 N., R. 10 W., Buchanan County. Well was drilled in 1955 to depth of 405 feet. Land surface elevation 838 feet. Top of La Porte City occurs at depth of 180 feet, base at depth of 230 feet.

La Revés Sandstone Member (of Pozas Formation)

Upper Cretaceous: Puerto Rico.

R. P. Briggs and P. A. Gelabert, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I-336. Consists principally of thin-bedded sandstone, but calcirudite and limestone conglomerate are common. Thin lenses of limestone present throughout member. Thickness 30 to as much as 250 m (100 to 800 ft). Overlies Botijas limestone member (new).

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 9. Member of Pozas Formation. Marine sandstone and some limestone. Characterized at many localities by presence of welded tuff and fine breccia with reddish to purplish colors. In fault contact with Yunes Formation (new). Believed to be Maestrichtian. Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

See **Revés Member** (of Pozas Formation)

Type locality: Series of outcrops on and near road between barrio Barrancas and barrio Botijas in drainage of Quebrada La [El] Revés just east of village of Botijas, Barranquitas quadrangle. Name modified to Revés. Classified as member of Pozas Formation.

Lark Limestone Member (of Bingham Mine Formation)

Pennsylvanian: Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), pl. 5. Overlies Jordan limestone member and underlies Commercial limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

Lasoya Creek Member (of Sabinetown Formation)

Eocene: Eastern Texas.

W. A. Atlee and others, 1967, Soc. Econ. Paleontologists and Mineralogists, Gulf Coast Section, Guidebook Field Trip Sept. 30—Oct. 1, p. 29 (chart). Lasoya Creek conglomerate member listed on chart showing general stratigraphy of Wilcox group at central Texas outcrop. Thickness 50 to 100 feet. Occurs above Calvert Bluff Member of Rockdale Formation. A name of local usage.

Field trip covers parts of Milam, Burleson, and Brazos Counties.

Las Vegas Formation

Pleistocene: Southeastern Nevada.

C. R. Longwell and others, 1965, Nevada Bur. Mines Bull. 62, p. 50—53, pl. 1. Name given to distinctive light-colored deposits of clay and silt prominently exposed in large areas along Las Vegas Valley. Much of deposit is in thin horizontal layers, which at many localities contain abundant shells of snails and other mollusks. Many of these shells represent open-water forms, others represent forms that live in wet ground. Nature of the water-laid sediments and the associated evidence of abundant life indicate that when the deposits were formed the climate of southern Nevada was much more humid than present climate.

Type section: Along Las Vegas Wash east of Tule Springs, in NE¼ of T. 19 S., R. 60 E., Clark County. Exposed from vicinity of Las Vegas to a point several miles west of Indian Springs.

Laurel Canyon Granodiorite

Precambrian: Southeastern Arizona.

F. S. Simons, 1964, U.S. Geol. Survey Prof. Paper 461, p. 9 (table), 13—19, pl. 1. A coarse-grained porphyritic biotite granodiorite. Varies in appearance from place to place but commonly it is gray or pinkish-gray characterized by large phenocrysts of pink potassium feldspar. Intrudes Pinal Schist; is overlain unconformably by Bolsa Quartzite and older alluvium. Intruded by diabase and Santa Teresa Granite (new). Contacts with all other formations—Horse Mountain Volcanics (new) and pre-Cretaceous sedimentary rocks other than Bolsa Quartzite—are faults. Probably older than Apache Group and presumably is of early Precambrian age.

Named for exposures along Laurel Canyon at south end of outcrop area, Klondyke quadrangle. Crops out from point half a mile north of Grand Reef mine to a mile northeast of Landsman Camp. Underlies about 10 square miles or 4 percent of quadrangle.

Lava Butte Flow

See Lava Cast Forest Flow.

Lava Cascade Flow

See Lava Cast Forest Flow.

Lava Cast Forest Flow

Recent: Western Oregon.

R. L. Nichols and C. E. Stearns, 1965, Oregon Dept. Geology and Mineral Industries Bull. 57, p. 8 (map), 9. Discussion of Recent lava flows of Northwest Rift Zone, Newberry Volcano. At least eight separate basaltic flows have been erupted from this zone. These flows are not mantled by pumice ejected during caldera collapse of Mount Mazama, now site of Crater Lake, hence are assumed to be post-Mazama in age. Named flows are Lava Cast Forest, Forest Road, Mokst Butte, Lava Cascade, North Summit, Twin Vent, and Lava Butte. Lava Cast Forest and Forest Road Flows are probably same age and oldest of the flows. Charcoal from tree mold in Lava Cast Forest Flow gave date of 6150±210 B.P. Mokst Butte Flow is next in sequence. Lava Cascade and North Summit Flows appear to be coeval. Twin Vent Flow believed to represent latest volcanism along the rift zone.

Rift zone runs about N. 30° W. from East Lake in Newberry Crater down slope of Newberry Volcano, Deschutes County.

Lava Lake Flow

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 126. Rests upon lava from central group of cinder cones and overlain by flow from Little Nash Crater.

Vicinity of Lava Lake, Sand Mountain Lava Field, Three Fingered Jack and North Sister area.

Lava Mountains Andesite

Pliocene, upper: Southern California.

G. I. Smith, 1964, U.S. Geol. Survey Prof. Paper 457, p. 5 (fig. 2), 32—40, pls. 1, 2. Consists of porphyritic plagioclase andesite. Occurs in tabular flows, 200 to 600 feet thick, and as mounds and domes formed above areas of upwelling lava. Typically forms caps of rolling or flat-topped hills, cropping out to form soft or boulder-strewn areas on the top and blocky cliffs along the edges. Unconformably overlies Almond Mountain Volcanics (new) and older rocks (Bedrock Spring Formation, new). Overlain by a few patches of gravel. Fine Quaternary rock units are inferred to be younger on basis of indirect evidence. Probably very late Pliocene but may be in part Pleistocene. Formation is approximately equivalent to Hulin's (1925) "Red Mountain Andesite."

Type locality: On southeast side of Dome Mountain, in sec. E8—m [NW¼SW¼ sec. 8, T. 29 S., R. 42 E.]. In Lava Mountains, San Bernardino County.

Lavansville limestone (in Glenshaw Formation)

Pennsylvanian: Southwestern Pennsylvania.

N. K. Flint, 1965, Pennsylvania Geol. Survey, 4th ser., County Rept., C56A, p. 74 (fig. 30), 81 pl. 1. Informal name applied to fresh-water limestone lying below Ames horizon at top of Glenshaw Formation (new). Gray on fresh surface; weathers light gray to buff.

Lavansville is in Somerset County.

Lavender Quartz Porphyry

Jurassic: Southeastern Arizona.

D. G. Bryant, 1964, Dissert. Abs., v. 25, no. 3, p. 1841. Intrusion of igneous rocks and associated hydrothermal activity in Warren (Bisbee) mining district occurred late in Jurassic period, not after Lower

Cretaceous as commonly cited. Intrusion of Escabrosa Ridge porphyries (new), Lavender, and underground feldspar-quartz porphyries occurred in fourth stage of activity. Juniper Flat granite and Sacramento quartz porphyry (new) were intruded in first stage.

Bisbee mining district, Cochise County.

Lawnes Creek Formation

Post-Miocene: Southeastern Virginia.

J. E. Sanders and others, 1962, Preliminary report on the geology of southeastern Virginia and adjacent coast and continental shelf, with remarks on sediment sampling techniques using vibro-drilling methods: New Haven, Conn., Yale Univ., Dept. Geology, p. 25 (fig. 15), 26, 28. Tentative designation for one of sandy alluvial fills in James River valley. Consists of much oxidized unfossiliferous gravel, sand, and silt. Fine-grained layers are parallel bedded, but sands are cross laminated. Resembles Oceana Ridge sand (new) but stratigraphic relationships not known at present.

Limited to narrow strip between Lawnes Creek and James River, Surry County.

Lawton Clay Member (of Vashon Drift)

Lawton Formation

Pleistocene: Northwestern Washington.

J. H. Mackin, D. R. Mullineaux, and W. J. Stark, 1950, Washington Univ. (Seattle), Trend in Engineering, v. 2, no. 4, p. 19—21. Formation consists of clay phase, with interbeds of sand in lower part, that grades upward at 150 to 160 feet into coarse sand that forms upper part of unit. Thickness at least 250 feet south of West Point with base below sea level. Most extensive of major depositional units predating last glacial stage. Lawton sediments may have been deposited during recession of glacier that deposited Klinker till (new), thus repeating Beacon-Duwamish relationship. Underlies Vashon till. Type locality is in sea cliffs in Fort Lawton area, just south of West Point, Seattle area.

D. R. Mullineaux, H. H. Waldron, and Meyer Rubin, 1965, U.S. Geol. Survey Bull. 1194—O, p. O1-O6. Lawton Formation as originally described was divided into a lower clay "phase" and an upper sand "phase." Clay "phase" can be subdivided into two distinct conformable units. Resulting sequence includes: lower unit of interbedded clay, silt, and sand about 70 feet thick; a middle unit of clay and silt about 80 feet thick; and an upper unit of sand more than 100 feet thick. Term "Lawton Formation" redefined. Name Lawton restricted to middle unit of glaciolacustrine clay and silt and is here designated Lawton Clay Member of Vashon Drift. Sand phase is termed Esperance Sand Member of Vashon Drift.

Type section (member): Sea cliff exposures on southwest side of Fort Lawton, sec. 16, T. 25 N., R. 3 E., western side of Seattle. Type locality (formation): Sea cliffs in Fort Lawton area, just south of West Point, Seattle area.

Lawyer Creek Interbed (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 26—27, fig. 18. In "Upper" Basalt of Columbia River Basalt [Group]. Underlies Lolo Creek Flow (new) and is present nearly everywhere that base of Lolo Creek is exposed. Overlies Sweetwater Creek Interbeds (new). Thickness up to 30 feet. East of Doumecq Plateau underlies White Bird Lake Beds (new). Lolo Creek Flow missing in this area.

Named from exposures along rims of Lawyer Creek and tributary canyons, Lewis County, Clearwater Embayment.

Laycock Graywacke (in Aldrich Mountains Group)

Upper Triassic(?): Northeastern Oregon.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Misc. Geol. Inv. Map I—447. Lower part of formation consists of coarse- to medium-grained graywacke and black shale. Upper part more shaly and tuffaceous, and grades westward into tuff and feldspathic graywacke. Thickest known section, from Laycock Creek eastward beyond Hanscombe Mountain, estimated to be 11,000 feet. Base of formation faulted off in Laycock Creek. To west, formation grades downward lithologically into Fields Creek Formation with increasingly stronger folding. Conformable with overlying Murderers Creek Graywacke (new). Upper Triassic(?).

C. E. Brown and T. P. Thayer, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—548. Mapped in Mount Vernon quadrangle. Includes Ingle Tuff Tongue (new). Underlies Murderers Creek Graywacke and overlies Fields Creek Formation.

Named for Laycock Creek in southeast quarter of Mount Vernon quadrangle, Grant County.

Leader Mountain Granodioritic Gneiss

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert Abs., v. 25, no. 12, pt. 1, p. 7205. Term used to designate rocks formed from metamorphism of Reed (Red) Creek Quartz Dioritic Orthogneiss.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Lead Gulch Formation

Upper Cambrian: Eastern California.

D. C. Ross, 1963, U.S. Geol. Survey Prof. Paper 475—B, B74—B76. Comprises limestone, siltstone, dolomite, chert, and shale interlayered in a regular-bedded sequence in which beds are most commonly ½ to 2 inches thick, but locally as thick as 5 inches. Thinly lamenated siltstone that weathers out in relief in bright orange and red tints and blue-gray to medium-gray limestone are dominant lithologies. Distinctive fissile olive-brown to dark-green shale, or its metamorphic equivalent, occupies as much as 20 feet at very base of some sections. Thickness at type section 280 feet. Overlies Bonanza King Formation; underlies Tamarack Canyon Formation (new). Considered to be approximately equivalent of unnamed basal unit of Nopah Formation in Hazzard's (1937, California Jour. Mines and Geology, v. 33) type area.

D. C. Ross, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—612. Described and mapped in Waucoba Wash quadrangle. Measured section, 440 feet thick, consists of four unnamed units. Lower unit, 55 feet thick, consists of medium-gray shale; unit 2, 10 feet thick, is coarsely crystalline white to gray marble; unit 3, 105 feet thick, similar to unit 4 except that ½- to 2-inch black chert layers that weather desert-varnished blackish red to dusky brown are dominant over reddish-brown siltstone layers; unit 4, 270 feet thick, consists of medium-gray limestone in ½- to 2-inch layers interbedded with light-brown to grayish-brown siltstone layers: chert nodules and thin layers subordinate. Base of section is about 2,500 feet S. 30° W. from SE cor. sec. 15, T. 12 S., R. 37 E. Overlies Bonanza King Dolomite. Underlies Tamarack Canyon Dolomite. [Text lists the Lead Gulch Formation with units of Mazourka Group. This is in error according to map bracket which includes only Al Rose and Badger Flat formations in Mazourka Group.]

Type section: On a spur along east wall of Mazourka Canyon, 7,500 feet S. 85°E., from SE cor. sec. 36, T. 11 S., R. 35 E., Inyo County. Named for exposures in Lead Gulch, a tributary of Mazourka Canyon. Formation extends as thin, relatively continuous, though faulted and folded belt from about latitude of Independence north to edge of Independence quadrangle. Belt of outcrop continues north into Waucoba Mountain quadrangle for about 1 mile, where it is cut out by Mesozoic granitic rocks and overlapped by Cenozoic basalt.

Leakesville Formation

Triassic: South-central Virginia.

C. T. Meyertons, 1963, Virginia Div. Mineral Resources Rept. Inv. 6, p. 5—27, 51—52, pl. 1. Predominantly red and black claystones, shales, siltstones, sandstones, and a few conglomerates. Includes Cow Branch and Cascade Station members (both new). Thickness 1,179 feet at type section. Intertongues with Dry Fork formation (new). Disconformably underlies Cedar Forest formation (new).

Type section: Along State Road 856, from 0.2 mile south of State Road 622 to 0.2 mile north of Virginia State line, near Leakesville Junction, Pittsylvania County.

Leakin Park Gneiss

Lower to Middle Paleozoic: Southern Maryland.

C. A. Hopson, 1964, *in* The geology of Howard and Montgomery Counties: Maryland Geol. Survey, p. 29 (fig. 12). Named on legend of geologic map of gneiss domes in Howard and Baltimore Counties.

Mapped in Baltimore County.

Leavitt Creek tuff

Oligocene, upper, or Miocene, lower: Northern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 20, 22, 34, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 29.5 ± 0.6 m.y.

Leavitt Creek is in sec. 7, T. 5 N., R. 22 E., Mono County.

Lebanon Diorite

Permian(?) or later: Southwestern Maine.

A. M. Hussey, 2d, 1962, Maine Geol. Survey Spec. Geol. Studies Ser. No. 4, p. 42, 53, pl. 1. A relatively simple diorite with no appreciable lamination or layering. In one exposure fresh diorite is overlain by about 15 feet of weathered diorite and this in turn by about 3 feet of glacial drift. Occurs in general area with Cape Neddick, Tatnic, Alfred, and Agamenticus complexes.

Crops out in an irregularly shaped body in northwestern end of Lebanon Township.

Le Conte Gneiss

Pre-Devonian: Northwestern Washington

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Le Conte gneiss consists of Marblemount meta-quartz diorite, metagabbro, subordinate schistose horn-blendite, and trondhjemitic gneiss. Grades eastward into Magic Mountain gneiss (new). Maybe correlative with pre-Devonian crystalline basement complex (Yellow Aster unit).

Area south of Cascade Pass, northern Cascade Mountains.

Leeds Creek Member (of Twin Creek Limestone)

Upper Jurassic: Southwestern Wyoming, southeastern Idaho, and northeastern Utah.

R. W. Imlay, 1967, U.S. Geol. Survey Prof. Paper 540, p. 45—50, pls. Most conspicuous and thickest member of the Twin Creek. Thickness 260 to 1,600 feet. Consists mainly of soft dense light-gray shaly limestone that commonly weathers into lighter colored splintery fragments and in some places to chunky fragments. At wide intervals contains hard thin beds of fossiliferous limestone. Gradational into overlying Giraffe Member (new). Overlies Watton Canyon Member (new). Has been called member F by Imlay (1950, Wyoming Geol. Assoc. Guidebook 5th Ann. Field Conf.).

Type section: North side of Leeds Creek Canyon in SW¼ sec. 30, T. 23 N., R. 118 W., and SE¼ sec. 25, T. 23 N., R. 119 W., Lincoln County, Wyo.

Leetonia Limestone

Pennsylvanian: Eastern Ohio.

G. H. Denton and others, 1961, Geol. Soc. America Guidebook for Field Trips, Cincinnati Mtg., p. 148 (fig. 5), 149. Near Salem, Ohio, rocks are mostly of Allegheny age and best outcrops are in ravines along Middle Fork of Little Beaver Creek. Brookwood Hollow is one of these ravines and exposes beds from Clarion(?) to Lower Freeport sandstone. Most significant members are between Lower and Middle Kittanning coals. In this interval three limestones are exposed: marine Columbiana (formerly Hamden) consisting of thin nodular limestone associated with fossiliferous shale above the Lower Kittanning coal; nonmarine lenticular Hamden limestone interbedded with Oak Hill underclay; and nonmarine Leetonia (formerly Salem) in a ledge at base of Middle Kittanning underclay. Until recently only two limestones, Hamden and Salem, were recognized in this interval. Term "Hamden" had been applied to both the marine limestone and shale over the Lower Kittanning coal and to the nonmarine limestone and ironstone associated with Oak Hill underclay. Type Hamden is nonmarine, hence name Columbiana has been proposed for the marine member. Name Leetonia proposed to replace name Salem in this interval. Type Salem is about 3 miles southeast of Salem. Its name was a poor selection and not intended for continued use. Occurs between Strasburg coal below and Middle Kittanning coal above. Stratigraphically above Hamden limestone. Thickness about 5 feet.

R. M. DeLong and G. W. White, 1963, Ohio Geol. Survey Bull. 61, p. 71, pl. 1. Leetonia Limestone was formerly designated Salem Limestone by Stout and Lamborn (1924, Ohio Geol. Survey Bull. 28), but term "Salem" was preoccupied. Sturgeon and others proposed in paper read before Ohio Academy of Science that name "Leetonia" would be a more appropriate designation for this unit. Name was selected because Orton (1884, Ohio Geol. Survey vol. 5) described a section with this limestone in it at Leetonia but did not name the limestone. Stout and Lamborn's type section for their Salem is only a few miles from Leetonia. Name "Leetonia" like name "Columbiana" has been given informal usage by interested geologists and is accepted here in accordance with a publication by Sturgeon and DeLong (in press). Member described at its type locality as bluish gray, hard and dense, blocky in form, siliceous and ferruginous, and in places changes into a calcareous sandstone and in other places into iron ore. In Sandy Township of Stark County [this report] there occurs at this position a nodular zone that may represent this stratum.

M. T. Sturgeon and R. M. DeLong, 1964, Ohio Jour. Sci., v. 64, no. 1, p. 41—43. Revision of stratigraphic names between Lower and Middle Kittanning coals. Hamden, Leetonia, Columbiana, and Tuscarawas (new). Leetonia replaces term Salem. Occurs above Red Kidney ironstone and below Middle Kittanning coal. Type section noted. May be correlative to Snow Fork ironstone.

Type section (Stout and Lamborn): Along abandoned Y. & O. Railroad at deserted mine of Salem Mining Co. in NW¼ sec. 3, Salem Township, Columbiana County. Named for town of Leetonia, Columbiana County.

Lee Valley Group (in Knox Dolomite Supergroup)

Upper Cambrian: Tennessee and Ohio.

W. L. Calvert, 1962, Ohio Geol. Survey Rept. Inv. 45, p. 24—26. Proposed as formal name for that part of Knox Dolomite Supergroup which is distinct from Beekmantown Group. Lee Valley Group defined as that body of generally pure, partly oolitic, partly cherty dolomite and some limestone which composes Maynardville Limestone and Copper Ridge Dolomite Formations. Underlies Chepultepec Dolomite of Beekmantown Group; overlies Knox Clastic Group.

W. L. Calvert, 1963, Ohio Geol. Survey Rept. Inv. 48, p. 6 (table 1), 7. Underlies Beekmantown Group; overlies Oostanaula Group which name replaces Knox Clastic Group.

Type locality: Northward along State Route 66, beginning about 2.4 miles north of Lee Valley Post Office, Hawkins County, Tenn. Units 69 through 162 of this section published by Rodgers and Kent (1948, Tennessee Geol. Survey Bull. 55) describe beds which constitute Lee Valley Group. Name taken from Lee Valley Post Office.

Lehman Ridge Gravel

Pleistocene (Wisconsin): Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 20, pls. 1, 6. Composed of reddish-brown fragments of Pikes Peak

Granite ranging in size from silt to boulders 20 feet in diameter. Pebbles of quartz and feldspar ¼ to 1 inch in diameter probably make up bulk of the gravel. Oldest and highest pediment in area. Remnants lie about 380 feet above adjacent modern streams. Thickness generally more than 25 feet and in several places appears to exceed 50 feet. May exceed 65 feet locally. Older than Douglass Mesa Gravel (new). Nebraskan or Aftonion.

Type locality: Lehman Ridge, Air Force Academy area, El Paso County. Also crops out on ridge north of Jack Valley and on highest pediment remnants north of Pine Valley.

Leidy Adamellite

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 143—144. A fine-grained rock. Surrounded by older rocks: on south by Cabin Granodiorite (new), on east and west by sedimentary rocks, and to north by a complex of granitic rocks contaminated by numerous inclusions. The four adamellites—Leidy, Sage Hen, Cottonwood, and McAfee—in area correspond to Boundary Granite.

R. G. Strand, 1967, Geologic map of California, Mariposa sheet (1:250,000): California Div. Mines and Geology. Mapped in White Mountains with Mesozoic granitic rocks.

Underlies approximately 3 square miles of Mount Barcroft quadrangle. Inyo batholith.

Leopard Skin marker bed (in Fish Haven Dolomite)

Upper Ordovician: Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 58, 60. A marker bed at top of Fish Haven dolomite. A massive ledge-forming unit consisting of medium- to dark-gray granular rock mottled with irregular light- to medium-gray patches of coarser grained dolomite. Thickness about 96 feet. Occurs about 248 feet above base of formation. Serves as marker to help distinguish Fish Haven from overlying Bluebell dolomite.

In East Tintic Mountains area.

Leslie Gulch Ash-Flow Tuff Member (of Sucker Creek Formation)

Miocene, upper: Southeastern Oregon.

L. R. Kittleman, Jr., 1962, Dissert. Abs., v. 22, no. 12, pt. 1, p. 4321. Ash-flow tuff as much as 1,000 feet thick.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 6. Formal proposal of name. A thick, extensive rhyolitic ash-flow tuff near top of formation in southern part of Owyhee Reservoir district. Member is lenticular. Attains thickness of at least 1,000 feet. Gradational with sedimentary strata of formation at its base locally. Overlain by Sucker Creek Formation, Jump Creek Rhyolite, or Deer Butte Formation.

Named for typical exposures near Leslie Gulch in secs. 10, 11, 13, 14, 24, T. 26 S., R. 44 E., and secs. 16, 17, 19, 20, T. 26 S., R. 45 E., Malheur County.

Levings Member (of McNairy Formation)

Cretaceous (Gulfian): Southern Illinois.

W. A. Pryor and C. A. Ross, 1962, Illinois Geol. Survey Circ. 332, p. 3 (fig. 2), 19—20. Lignitic silt and clay in upper part of formation. Thickness 0 to 70 feet.

Type locality: Along creek in NW¼SW¼ sec. 18, T. 15 S., R. 2 E., Pulaski County, 1½ miles southeast of village of Levings.

Lexington Till

Pleistocene (Wisconsin): Eastern Massachusetts.

J. G. Ogden, 3d 1963, Am. Jour. Sci., v. 261, no. 4, p. 346 (fig. 1). Named on map legend.

Present on Martha's Vineyard.

Lightning Creek Schist (in Riggins Group)

Paleozoic or Mesozoic: Western Idaho.

C. P. Ross, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 63, 64. Thickness about 8,000 feet. Exposed along Salmon River. Name credited to Warren Hamilton (in press).

Warren Hamilton, 1963, U.S. Geol. Survey Prof. Paper 436, p. 16—27, pl. 1. Formal proposal of name. Metamorphosed lava, tuff, and agglomerate; now greenschist. Thickness 8,000 feet on northeast limb of Riggins syncline. At type section overlies Fiddle Creek Schist (new); above are ultramafic rocks, and next above, the Squaw Creek Schist (new). Formation is mappable southeastward to area about 4 miles east of Riggins, where its metamorphic grade is higher than in type section. South of Salmon River contacts drawn are questionable, as high-grade rocks of Lightning Creek and Squaw Creek Schists are similar in appearance. Greenschist phase is exposed also on southwest limb of Riggins syncline, along Rapid River and nearby part of Little Salmon River. There it is in part in direct contact with overlying Squaw Creek Schist and in part separated from it by ultramafic rocks. East of Riggins, Berg Creek Amphibolite (new) lies between the Lightning Creek and Squaw Creek Schists.

Type section: Exposures along Salmon River north of Riggins, from 0.1 to 1.7 miles north of Goff Bridge, Riggins quadrangle. Named for Lightning Creek whose lower course is on the formation.

Lily Creek Formation

Pleistocene, lower(?) and middle: Western Washington.

D. R. Crandell, 1963, U.S. Geol. Survey Prof. Paper 388—A, p. A9 (table 4), A17—A22, pl. 1. Defined as interbedded stream gravel and mudflows principally of Mount Rainier provenance, probably ranging in age from early to middle Pleistocene. Mudflows make up bulk of formation. Maximum thickness about 273 feet. Youngest deposit that underlies the Lily Creek is bedrock of late Eocene age. Nowhere in contact with drift of Orting age, stratigraphic relation of these two formations inferred from other evidence. Inferred to be correlative with Alderton and Puyallup formations. Underlies Wingate Hill drift (new).

Typically exposed along logging road in NE¼ sec. 8, T. 18 N., R. 6 E., 1 mile southwest of Carbonado, Lake Tapps quadrangle, Pierce and King

Counties. Name taken from Lily Creek, a minor tributary of Carbon River, adjacent to which the formation is typically exposed.

Lima Formation (in Beaverhead Group)

Lima Limestone Conglomerate lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene(?): Southwestern Montana.

M. D. Wilson, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2787—2788. Late Cretaceous and Paleocene(?) sediments in area separated into two laterally equivalent units of formation rank (informally defined), Lima and Monida. Formations are placed in Beaverhead group (term Beaverhead informally raised to group status). The Lima is predominantly a conglomeratic succession. In area between Snowline and Monida, the Lima is subdivided into a series of sandstone and conglomerate members.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Lima Limestone Conglomerate lithosome 6,000 feet. Consists predominantly of Madison Limestone clasts.

Lima is in Beaverhead County.

Liman Substage

Pleistocene (Illinoian): Western Illinois.

J. C. Frye, H. B. Willman, and H. D. Glass, 1964, Illinois Geol. Survey Circ. 364, p. 16, 19. Liman Substage defined as encompassing time span represented by Petersburg Silt, Mendon Till (new), and other Illinoian deposits stratigraphically below deposits of Jacksonville moraine. Term Payson Substage abandoned.

Name derived from Liman Township, Adams County.

Lincoln Creek Formation

Eocene, upper, to Miocene, lower: Northwestern Washington.

W. W. Rau, 1966, Washington [State] Div. Mines and Geology Bull. 53, p. 13—17, pls. Report on Satsop River area. Overlying rocks of late Eocene age with apparent conformity, and in some places lapping unconformably onto Crescent Formation, is thick sequence of tuffaceous mudstone, siltstone, and sandstone. These rocks are assigned to Lincoln Creek Formation as defined by Beikman and Rau (in press). Rocks that are called Lincoln Creek Formation are regarded as part of what was originally named Lincoln Formation (Weaver, 1912, Washington Geol. Survey Bull. 15). Term Lincoln is several times preempted and name Lincoln Creek formation is proposed to replace name Lincoln Formation. In area of this report, formation attains thickness of over 9,000 feet. On basis of Foraminifera, formation in area of this report ranges in age from latest Eocene to late Oligocene. Underlies Astoria(?) Formation.

H. M. Beikman, W. W. Rau, and H. C. Wagner, 1967, U.S. Geol. Survey Bull. 1244—I, p. 14 p. Formal proposal of name. Formation consists of 2,000 to 9,000 feet of tuffaceous siltstone and fine- grained sandstone, predominantly Oligocene in age. Crops out within or underlies about 1,500 square miles in Grays Harbor basin. Thickness of formation increases from east to west and from south to north. Along east edge of basin the Lincoln Creek consists mainly of a basaltic sandstone member with interbeds of pyroclastic rocks. This member is about 1,500 feet thick in area east of Chehalis but thins to south and west. In eastern part of area overlies Skookumchuck Formation. In areas of pre-Oligocene relief, the Lincoln Creek overlaps older sedimentary rocks and locally rests unconformably on volcanic rocks of Crescent Formation of early(?) and middle Eocene age. Overlain by Astoria(?) Formation. Type section and four reference sections given. Molluscan and foraminiferal collections indicate formation ranges in age form late Eocene to early Miocene.

Type section: rocks exposed along Chehalis River from Galvin to Helsing Junction, Lewis and Thurston Counties. Typical exposure in south half of T. 15 N., R. 3 W., along State Road 1N, which is parallel to and north of Lincoln Creek. Named from Lincoln Creek, Lewis County. Reference sections: Canyon River; along Highway 9 in vicinity of Porter; Pe Ell-Doty; and Willapa River.

Lindavista Formation

Pleistocene, upper: Southern California.

Original reference (terrace materials): M. A. Hanna, 1926, California Univ. Pub., Dept. Geol. Sci. Bull., v. 16, no. 7, p. 187—246.

E. D. Milow and D. B. Ennis, 1961, Geol. Soc. America, Cordilleran Sec., 57th Ann. Mtg., Guidebook for Field Trips San Diego County, p. 24—30. Term Lindavista terrace materials of Hanna (1926) revised to relieve physiographic connotation, fit observed relationships, and as closely as possible, the original concept. Hanna in his discussion and map showed his principal meaning of unit to be the covering of sedimentaries over the surface of the "Linda Vista terrace," typically developed near Lindavista Railroad siding, and draping over the edges. He arbitrarily split off his "younger terrace materials" at 200-foot contour. Subsequent to this work, several underlying units of Pleistocene rocks were recognized and separated as Sweitzer formation and Bay Point formation (Hertlein, 1929, Hertlein and Grant, 1939, 1944), and the unnamed Pleistocene sandstones commonly forming "beach or dune ridges" (this paper). Lindavista formation is reserved for youngest Pleistocene unit of area overlying much of present topography as terrace deposits, slope veneer, and valley fill and includes the "younger terrace materials" of Hanna. Formation consists of light-gray to reddish-tan sandstone, silty sandstone, siltstone, conglomeratic sandstone, and conglomerate. Poorly indurated. Thickness 10 to 100 feet. Overlies Bay Point Formation.

Lindavista Railroad siding, San Diego County.

Lipan Hills Sandstone (of Whitsett Formation)

Eocene: South-central Texas.

J. D. Horne, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 277—283. Name applied to the prominent sandstone overlying Conquista clay member of McElroy formation mapped in Karnes County area as Stones Switch by Eargle (1959). Consists of series of gray to light-gray-brown massive to obscurely bedded, moderately to well-indurated, fine to very fine grained sandstone and silty sandstone with common to abundant *Ophiomorpha* borings especially in the massive sections. Thickness about 7 feet at type locality; about 15 feet at type section of the Conquista. Underlies Dubose member of Whitsett.

Type locality: In roadcut on U.S. Highway 281 about 3.6 miles south of town of Campbellton, Lipan Hills area of southeastern Atascosa County.

Lipozoic Era

Lipozoic: North America.

W. L. Calvert, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 2, p. 171—172. Interval between end of Grenville deposition (about 1,000 m.y.) and beginning of Cambrian deposition (about 550 m.y.), represented by the Ocoee, most of Chilhowee, the Grand Canyon, Belt, and Windemere Groups of rocks, and by extensive period of erosion preceding Cambrian time, is equivalent to a geologic era. Name Lipozoic proposed for this part of geologic time. Lipozoic means missing life. The clastic rocks which remain to represent this era were deposited in environment unsuitable for preservation of fossils.

Lippincott Gravel

Pleistocene: Southwestern Ohio.

R. P. Goldthwaite, leader, 1955, Pleistocene chronology of southwestern Ohio: Guidebook 5th Bienn. Pleistocene Field Conf., Sept. 6—13, p. 66. Cemented gravel 1 to 3 feet thick; sand and gravel beds about 12 feet thick. Underlies calcareous till that is part of East Liberty moraine.

Near Lippincott, Champaign County.

Liscom Creek Member (of Fall River Formation)

Lower Cretaceous: Subsurface in Montana, South Dakota, and Wyoming.

D. W. Bolyard and A. A. McGregor, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, No. 10, p. 2221—2244. Fall River Formation subdivided into (ascending) Liscom Creek, Morton, and Coyote Creek Members (all new). Regionally, these members exhibit geometric characteristics of roof shingles. Whereas total formation maintains relatively uniform thickness, each member, or single, is sheetlike body which reaches maximum thickness where the other two are either relatively thin or absent. Coyote Creek Member is at top of formation in Wyoming but pinches out northward in Montana, and Morton becomes upper limit of formation farther north. In type well, the Liscom Creek consists of massive buff fine- to medium-grained sandstone overlying Lakota Formation and underlying Morton Member, between depths of 5,612 and 5,708 feet. The Coyote Creek Member is a marine shale facies in this well.

Type well: Carter Oil. Co. No. 1 Liscom Creek in center of SW¼SW¼ sec. 15, T. 1 N., R. 45 E., Custer County, Mont.

Little Beggar flows

Holocene: Hawaii.

D. W. Peterson, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—667. An informal term applied to flows that were product of 1882 to 1885 eruptions of Kilauea.

Central and eastern parts of Kilauea caldera. Hornito known as "Little Beggar" formed March 3, 1884, continued in activity for several years, and was well-known landmark until buried by 1954 lava.

Little Black Peak Lava Flow

Recent: South-central New Mexico.

C. T. Smith, 1964, New Mexico Geol. Soc. Guidebook 15th Field Conf., p. 92, 96, 97. Greenish-gray to black on fresh surface and weathers reddish brown to grayish black. Nearly overlaps Broken Back flows.

In southwest corner of Little Black Peak quadrangle, Socorro and Lincoln Counties. Flow apparently derived from Little Black Peak cone. Occupies more than 17 square miles and extends many miles to south.

Little Captina Limestone Member (of Monongahela Formation)

Upper Pennsylvanian: East-central Ohio, Pennsylvania, and West Virginia.

H. L. Berryhill, Jr., 1963, U.S. Geol. Survey Prof. Paper 380, p. 39. Member is part of Uniontown limestone member of Stout (1929, West Virginia Acad. Sci. Proc., v. 3) and is upper part of unit which he later called Arnoldsburg limestone member (1931, Illinois Geol. Survey Bull. 60). Stout's Uniontown limestone member included, in addition to limestone, a very persistent sandstone, siltstone, and shale unit that he later named "Arnoldsburg sandstone member" (1953, Ohio Geol. Survey Open File Rept.) In his 1953 report, Stout restricted Uniontown limestone member to interval between "Arnoldsburg sandstone member" and Uniontown coal bed and included all limestone beds between this sandstone and "Fulton green shale" in Arnoldsburg limestone member. The "Arnoldsburg sandstone" of Stout is herein named McKeefrey siltstone member and name Little Captina is applied to the limestone beds between McKeefrey siltstone member and Arnoldsburg sandstone member as used in this report. Thickness 6 to 14 feet. Commonly consists of 3 to 6 beds of limestone that are separated by shaly clay partings, but in some places shaly clay and mudstone make up more than half of unit. In type area Little Captina is 17 feet below Uniontown coal bed and is 10 feet thick.

Type area: Outcrops north of mouth of Little Captina Creek in eastern York Township, Belmont County, Ohio, along State Highway 7 west of Ohio River.

Little Cottonwood Formation (in Lake Bonneville Group)

Pleistocene: Northern Utah.

R. B. Morrison, 1965, U.S. Geol. Survey Prof. Paper 477, p. 14—25, pl. 1. Oldest unit in group. Composed of lacustrine sediments—mainly gravel, sand, silt, and clay. Thickness about 125 feet at type section. Comprises (ascending) Alpine, Bonneville, and Provo Members. Separated from overlying Draper Formation by a mature soil, local alluvium, and a pronounced disconformity. Younger than Dimple Dell Soil and older than Graniteville Soil.

R. B. Morrison, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C114—C115. Bonneville Formation as used in this report [southern Promontory Point] is identical with combined Bonneville and Provo Members of Little Cottonwood Formation in eastern Jordan Valley by Morrison (1965).

Type locality: Series of exposures in western bluff of Dry Creek 0.7 mile southwest of Granite Latter Day Saints Church, NW¼NW¼ sec. 14, T. 3 S., R. 1 E., Salt Lake County. Named after Little Cottonwood Creek, along whose course it is well exposed west of Wasatch Boulevard, Salt Lake City.

Little Creek Formation

Pleistocene(?): Southeastern Idaho.

W. J. Carr and D. E. Trimble, 1963, U.S. Geol. Survey Bull. 1121—G, p. G19,G21, pl. 1. Massacre volcanics of Stearns and others (1938, U.S. Geol. Survey Water-Supply Paper 774), Stearns and Isotoff (1956, Geol. Soc. America Bull., v. 67, no. 1) includes at least two groups of volcanic groups separated by an unconformity. Older and more widespread of these groups is here distinguished from Massacre volcanics and named Little Creek formation. (According to interpretation used herein Massacre volcanics do not occur in American Falls quadrangle, this report). Formation consists of upper basalt member and lower tuff member. Thickness 20 to 50 feet thick. Unconformably overlies Walcott tuff; unconformably underlies Raft formation.

Type locality (tuff member): N½ sec. 6, T. 8 S., R. 31 E., and SW¼ sec. 31, T. 7 S., R. 31 E., near mouth of Ferry Hollow and in south bluff of Snake River Basalt member. At American Falls. Named from exposures along Little Creek in Rockland quadrangle.

Little Elm Tongue (of Templeton Member of Woodbine Formation)

Upper Cretaceous: Northeastern Texas.

G. H. Norton, 1965, *in* The Geology of Dallas County—a symposium: Dallas, Tex., Dallas Geol. Soc., p. 61—62. Mostly dark shale. Thickness as much as 20 feet. Younger than Six Flags limestone (new) on Timber Creek. Older than bentonitic submember of Britton member of Eagle Ford.

Type locality: Along shores of Garza-Little Elm Reservoir near settlement of Little Elm where highway crosses drowned arm of Little Elm Creek. Alternate type localities: On Timber Creek on highway south Lewisville; on Prairie Creek at cemetery in northeastern edge of Lewisville.

Littlefield Rhyolite

Miocene, upper: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 15. Flaggy grayish-red or dark-gray multiple-flow porphyritic rhyolite with about 70 percent silica content. Conspicuously flow foliated. Thickness about 500 feet. In Crowley district overlies unnamed igneous complex. Overlain, probably unconformably, by Butte Creek Volcanic Sandstone (new) which contains Barstovian (late Miocene) mammalian fossils. Underlies Drip Spring Formation (new) in Harper Basin district. Overlies Hunter Creek Basalt (new) in Monument Peak, Malheur Gorge, and Harper Basin districts. Has been dissected and faulted, probably in late Miocene time, and forms basins of deposition for later rocks.

Named for exposures at Littlefield Ranch, in sec. 35, T. 23 S., R. 40 E., Malheur County.

Little Flat Formation (in Chesterfield Range Group)

Upper Mississippian: Southeastern Idaho.

J. T. Dutro, Jr., and W. J. Sando, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 11, p. 1963—1986. Comprises 965 feet of dominantly terrigenous strata underlying Monroe Canyon Limestone (new). Lower 126 feet is siltstone member; overlying 551 feet is sandstone member; upper 288 feet is sandy limestone member. Overlies Lodgepole Limestone.

Type section: On southwest-trending spur in NW¼ sec. 29, T. 7S., R. 40 E., Bannock County. Named for Little Flat Canyon.

Little Moose Mountain Series

[Precambrian]: Northeastern New York.

Dirk de Waard, 1963, (abs.) Geol. Soc. America Spec. Paper 73, p. 138. In Indian Lake quadrangle, metasedimentary Little Moose Mountain Series is underlain by basement complex of dome-shaped Snowy Mountain tectonic unit. Lower part of Little Moose Mountain Series consists of marble-bearing zone which extends as narrow synclinal keel between two basement units.

Little Moose Mountain is in northern Hamilton County.

Little River Formation

Silurian: Eastern Maine.

Olcott Gates, 1961, Maine Geol. Survey Quad. Mapping Series No. 1, p. 9—23, pl. 1. Diverse group of volcanic and sedimentary rocks herein named Little River formation does not constitute formation according to established practices of stratigraphy. No top or bottom can be defined; thickness is unknown; no stratigraphic succession applicable to formation as whole can be recognized; no particular exposure or groups of exposures sufficiently representative of all rocks included in formation to permit designation of type section. Formation essentially consists of blocks of dominantly volcanic rocks, many of which are marine, surrounded and isolated from each other by interlacing dikes, sills, and plugs of diabase. Three principal rock types: (1) basaltic lavas and pillow lavas, agglomerate, and tuff; (2) coarse tuffaceous breccias made up of many different lithologies—mainly basaltic; and (3) bedded tuff and argillite with minor amounts of conglomerate, sandstone, shale, and limestone. Appears to be same age or nearly so as Quoddy Shale and may represent rather abrupt facies change from shales and mudstones to volcanics. Stratigraphic relations of Little River to Edmunds and Pembroke formations unknown because geologic evidence is buried beneath glacial deposits. Map legend implies that Little River is older than Pembroke and Edmunds.

Mapped in Cutler and Moose River quadrangles, Washington County. Little River is in southwestern part of map area.

Little Shaver Creek Laminated Limestone physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 24—26. Little Shaver Creek Laminated Limestone Physiofacies consists of light to dark, tannish-gray or grayish-tan to pinkish-gray to tan fine grained, dense or sublithographic, thin-bedded or massive, laminated clastic limestone.

Maximum thickness about 9½ feet in Ralls County; 3½ feet in Pettis and Cooper Counties. Stratigraphically equivalent to Mineola, Sandy Hook, and Calwood facies of Callaway lithofacies of Cedar City Formation.

Type area: CenterN¼S¼NW sec. 35, T. 46 N., R. 20 W., Pettis County, in draw just east of county road. Crops out in Pettis, Cooper, Morgan, Saline, Moniteau, Cole, Boone, Callaway, and Ralls Counties. Named for Little Shaver Creek.

Little Splice Creek Brecciated Limestone physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 26—27. Little Splice Creek Brecciated Limestone Physiofacies is light- to medium-grayish tan or tannish gray, light gray to white, pinkish tan or light- to dark-bluish tan, and in some places, dark-tannish gray. It is a dense to sublithographic brecciated limestone somewhat arenaceous especially toward base, with chert and chalcedony-filled vugs; calcite-filled vugs, veins, and vermicules; clay partings and lenses. Thickness 0 to 8 feet. For most part stratigraphically younger than the Lamine River and Shiel Facies; stratigraphically equivalent to Smithton, Little Shaver Creek, Sandy Hook, and Mineola Facies and contains fossils which are also present in Callaway Lithofacies.

Named for Little Splice Creek in Moniteau County. This creek empties into Missouri River less than 0.25 mile northwest of NW¼SE¼SE¼SE¼ sec. 9, T. 47 N., R. 14 W. Also occurs in Pettis, Cooper, Cole, Boone, and Callaway Counties.

Little Stone Gap Member (of Hinton Formation)

Upper Mississippian: Southwestern Virginia.

R. L. Miller, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B39—B42. Name applied to limestone or calcareous shale unit in upper part of Hinton Formation. Thickness about 44½ feet at type section. Overlies unnamed middle red member. Underlies Princeton Sandstone. Was called Avis Limestone by Reger (1926) but name Avisis preoccupied.

Type section: Along county road from Norton to High Knob, Wise County. Section begins at 2,950 feet elevation at first sharp curve of hairpin-turn complex, proceeds up small quarry face and through woods to top of hairpin-turn complex, and ends with exposures in small ditch and low roadcut along southeast stretch of road at top of turn complex. Named for exposures at Little Stone Gap, near Norton.

Little Valley Quartz Diorite

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. Leucocratic quartz diorite made up largely of quartz and plagioclase layers. Name credited to D. L. Schmidt (1958, U.S. Geol. Survey open-file rept.).

Exposed in Long Valley district, Boise Basin.

Llaves Member (of San Jose Formation)

Eocene, lower: Northwestern New Mexico.

E. H. Baltz, 1963, Dissert. Abs., v. 23, no. 7, p. 2490. San Jose formation consists of mappable facies named Cuba Mesa, Regina, Llaves, and Tapicitos members.

E. H. Baltz, 1967, U.S. Geol. Survey Prof. Paper 552, p. 50—52, pls. Formal proposal of name. Mainly massive beds of arkosic conglomeratic sandstone that also contains thin beds of red and variegated shale and shaly sandstone. Thickness about 1,300 feet at type section. Lower part of member grades southward into Regina Member but persistent medial sandstone part rests on the Regina in much of north-central part of area. Upper part above the persistent medial sandstone wedges out southwestward and westward into Tapicitos Member.

Type section (lower part): Measured on eastward-projecting spur of ridge southwest of Spring Canyon in N½ sec. 18, T. 25 N., R. 1 E. Type section (upper part): On ridge on northern side of Canoncito de las Yeguas east of Pasture Canyon, from SW¼ sec. 4, T. 25 N., R. 1 W., to center sec. 33, T. 26 N., R. 1 W. Name derived from Llaves Post Office.

Llewellyn Formation

Middle and Upper Pennsylvanian: Eastern Pennsylvania.

G. H. Wood, Jr., J. P. Trexler, and H. H. Arndt, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C39, C41—C42. Name applied to strata heretofore informally termed "post-Pottsville rocks." Composed of gray- and brown-hued beds of conglomeratic sandstone, quartzose sandstone, subgraywacke, and siltstone with lesser amounts of conglomerate, shale, and anthracite. Estimated maximum thickness about 3,500 feet. Contact with underlying Pottsville is at base of shale bed that underlies Buck Mountain coal bed. Late Pennsylvanian based on floral zonation.

The U.S. Geological Survey currently designates the age of the Llewellyn Formation as Middle and Upper Pennsylvanian on the basis of a study now in progress.

Named for town of Llewellyn, Schuylkill County, about 5 miles west of Pottsville.

Lockwood Clay

Lockwood Clay (in Caliente Formation)

Miocene-Pliocene: Southern California.

B. H. Rogers and C. W. Chesterman, 1957, California Div. Mines Bull. 176, p. 522. Mentioned in report on expansible shale. Exposures are in area about 4 square miles in Frazier Park, Ventura County. Miocene.

G. T. James, 1963, California Univ. Pub. Geol. Sci., v. 45, p. 7, 23, fig. 2. A discontinuous dark-brown clay bed near middle of Caliente Formation. Thickness about 150 feet.

M. F. Carman, Jr., 1964, California Div. Mines and Geology Spec. Rept. 81, p. 43—44, pls. 1, 5. Lockwood clay was named by Gazin (1930, unpub. rept.). Unit as here presented is identical with his. A dark-red-brown to brownish-gray montmorillonitic clay with local white bentonite at base, and intercalated thin white to gray fine-grained laminated biotitic sandstone lenses. Thickness 0 to 275 feet. Unconformable on Caliente beds in

Dry Canyon; bears complex relations to these beds on western edge of Lockwood Valley area where beds reveal local reworking of both units and local unconformity with overlying beds of Quatal Formation. Contact relations indicate that clay is more closely related in time to deposition of Quatal than Caliente Formation. It is taken to be essentially same age as lower parts of the Quatal which is determined as Blancan. Plate 1 shows age Miocene-Pliocene.

Type locality: In eastern part of Lockwood Valley (G.40, IX.03; Mount Pinos quadrangle, NE¼ sec. 30, T. 8 N., R. 20 W.), Ventura County.

Lodi Limestone (in Genesee Group)

Upper Devonian: Southern New York.

J. M. Clarke *in* D. F. Lincoln, 1895, New York State Mus. 48th Ann. Rept., v. 2, p. 100—101 [1897]. A name applied to an irregular concretionary and impure calcareous stratum at Lodi Falls. Occupies well-defined position at top of Genesee shales. Fauna of at Lodi Falls. Occupies well-defined position at top of Genesee shales. Fauna of this Lodi limestone discussed briefly.

L. V. Rickard, 1964, New York State Mus. and Sci. Service Geol. Survey Map and Chart Ser.: No. 4. Lodi limestone in Genesee group shown on correlation chart. Overlies Geneseo shale. Interfingers with part of Penn Yan shale. Name credited to Clarke (1897).

Occurs in Lodi Glen on east side of Seneca Lake.

Logan Gulch Member (of Three Forks Formation)

Upper Devonian: Montana and Wyoming.

C. A. Sandberg, 1965, U.S. Geol. Survey Bull. 1194—N, p. N8 (fig. 3), N10—N12. Name applied to lower evaporitic nonfossiliferous part of Three Forks Formation. Underlies Trident Member (new); overlies Jefferson Formation. At Logan, Mont., where it is 111 feet thick, consists of yellowish-gray and grayish-red argillaceous limestone breccia and shale breccia; interbedded in basal 12 feet with dolomitic shale and siltstone and silty dolomite and capped by an 8- to 22-foot lenticular bed of brownish-gray limestone and limestone breccia. Section at Logan is characteristic of member in Bridger Range and areas to west and north. Changes facies across northern Gallatin Range and its lithologic character is somewhat different but still recognizable as evaporitic in Beartooth Mountains. Subsurface name Potlatch proposed by Sandberg and Hammond (1958) is herein abandoned in favor of Logan Gulch Member. Member is lithologically and stratigraphically identical with outcropping Potlatch Member and equivalent to most of carbonate Three Forks Formation, as used in southwestern Montana by McMannis (1962). Recommended herein that this usage be discarded in favor of Logan Gulch. Rau (1962) proposed another name [London Hills] for lower part of outcropping Three Forks Formation. However the member [Logan Hills] crosses lower boundary of Three Forks at Logan and several other localities and cannot be considered an equivalent of Logan Gulch Member.

C. A. Sandberg and Gilbert Klapper, 1967, U.S. Geol. Survey Bull. 1251—B, p. B12—B21. East of limit of Sappington Member of the Three Forks, the Cottonwood Canyon Member (new) of Madison Limestone (or

Lodgepole Limestone) rest unconformably on Trident and Logan Gulch Members of the Three Forks in descending order. The weakly resistant Trident Member, which is largely greenish-gray calcareous shale, is truncated in a belt 10 to 50 miles wide. It extends only about 25 miles into Yellowstone Park. Farther east, the Logan Gulch, which comprises silty dolomite, dolomitic siltstone, and evaporite-solution breccia in Wyoming, is truncated in a belt 65 miles wide. It underlies the Cottonwood Canyon Member at Meridian Ridge in north west corner of Yellowstone Park and is the only member of the three Forks that is widespread in western Wyoming. Eastern limit of the Logan Gulch lies along west side of Bighorn Basin. The contact with the Cottonwood Canyon is well exposed at Clarks Fork Canyon reference section on east side of Beartooth Mountains where the Logan Gulch is only 15 feet thick close to its wedge edge.

Type section: Included in type section of Three Forks, as given by Sandberg (1962), in gulch and on bluffs at north side of Gallatin River, northeast of Logan, in S½S¼ sec. 25, T. 2 N., R. 2 E., Gallatin County, Mont. Named for exposures in Logal Gulch, near Logan.

Logan Quarry Coal Member (of Staunton Formation)

Pennsylvanian: Indiana.

Rainer Zangerl and E. S. Richardson, Jr., 1963, Fieldiana: Geology Memoirs, v. 4, p. 25 (table 2), 29, 30, measured sections. A coal lying beneath the Logan Quarry shale (new) has been called Staunton A coal (Friedman 1960, Indiana Geol. Survey Prog. Rept. 23) but it is not certain that this is a single, continuously developed coal. For convenience in correlation with area of this report, it is herein called Logan Quarry coal member. At Logan Quarry it is a poor coal of drifted sticks, varying in thickness from 2¾ to 6 inches. At Garrard Quarry, about 6 inches of poor coal lies at base of section, probably equivalent of Logan Quarry coal. Beneath Logan Quarry coal at Logan and Garrard Quarries in thin black clay; at Logan Quarry it contains marine invertebrates. This lies upon the underclay and may represent a reworked underclay with organic matter worked into it. Overlies Holland limestone.

Type locality: Logan quarry in Reserve Township, Parke County, NE¼SW¼ sec. 9, T. 16 N., R. 8 W., 1¾ mile east of West Union, near head of one of hollows draining into Sugar Creek Quarry; named for P. H. Logan of Indianapolis who granted permission to work on his property.

Logan Quarry Limestone Member (of Staunton Formation)

Pennsylvanian: Indiana.

Rainer Zangerl and E. S. Richardson, Jr., 1963, Fieldiana: Geology Memoirs 4, p. 25 (table 2), 29 measured sections. At type locality includes bed of impure dark-gray carbonaceous, argillaceous limestone 8 to 10 inches thick, containing brachipods, crinoid fragments, and other typical marine invertebrates. Beneath limestone is 2-foot bed of dark-blue-gray unevenly bedded clay shale lying upon sheety shale of Logan Quarry shale member (new). At other localities the limestone may be represented by two thin beds with drab shale between, or may die out laterally by change of facies to calcareous shale. Both the limestone and the interpolated (if any) and subjaceant shale are included in this member. Top is defined, at least provisionally, as top of highest limestone bed.

Type locality: Logan quarry in Reserve Township, Parke County, NE¼SW¼ sec. 9, T. 16 N., R. 8 W., 1¾ miles east of West Union, near head of one of hollows draining into Sugar Creek Quarry; named for P. H. Logan of Indianapolis who granted permission to work on his property.

Logan Quarry Shale Member (of Staunton Formation)

Pennsylvanian: Indiana.

Rainer Zangerl and E. S. Richardson, 1963, Fieldiana: Geology Memoris., v. 4, p. 25 (table 2), 28—29, 30, 33—95 (sections). Proposed as a unit of Staunton. Lies upon one of hitherto unnamed local coals of Staunton, about 50 feet below Coal IIIA in Barren Creek section (of present report). Consists of alternating hard black sheety shale and soft dark-gray sheety shale. At type locality, these shales lie upon a poor coal about 4 inches thick; here and elsewhere they contain fossils of Mecca fauna. Top is taken as highest of the sheety shales, gray at type locality; above this is usually a poorly bedded blue-gray shale containing marine vertebrate fauna, which is herein included in Logan Quarry limestone member. In type section contains succession of beds identified by letters F through K (I not used). Level G is very persistent from one exposure to another. Beneath the shale is coal referred to in this report as Logan Quarry coal member. Friedman (1960, Ind. Geol. Survey Prog. Rept. 23) referred to this coal as "Staunton A" coal. Above the shale is limestone referred to as Logan Quarry limestone member.

Type locality: Logan quarry in Reserve Township, Parke County, NE¼SW¼ sec. 9, T. 16 N., R. 8 W., 1¾ miles east of West Union, near head of one of hollows draining into Sugar Creek Quarry; named for P. H. Logan of Indianapolis who granted permission to work on his property.

Lolo Creek Flow (in Columbia River Basalt)

Miocene: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 27—28, fig. 18. Member of "Upper" Basalt of Columbia River Basalt [Group]. Where best exposed, about 2 miles south of Cavendish, at least 25 feet of the colonnade is preserved. Higher in olivine and lower in pyroxene that underlying flows of "Upper" Basalt, hence may represent a late variant of "Yakima type" basalt described by Waters (1961, Am. Jour. Sci., v. 259, no. 8). Typically underlain by Lawyer Creek Interbeds (new). Stratigraphically above Grave Creek, Center Creek, Johns Creek, and Maggie Creek Flows (all new). Middle Cenozoic.

Jane Gray and L. R. Kittleman, Am. Jour. Sci., v. 264, no. 4, p. 257—291. Geochronometry of Columbia River Basalt and associated floras of eastern Washington and western Idaho. At least 19 flows and associated interbeds, in Clearwater Embayment, with a maximum thickness of 2,800 feet are assigned to the Upper Basalt Member of Columbia River Basalt by Bond (1963). Nine stratigraphic units named as members; one of these, Whiskey Creek Member, provided one radiometric age for Upper Basalt. Clearwater Embayment is capped over much of area by Lolo Creek Flow. Radiometric date of 19.5 m.y. was secured for Lolo Creek Flow. A replicate sample from Lolo Creek Flow was dated at Rice University as 23 + 2.0 m.y. For several reasons it is believed that date of

23 + 2.0 m.y. for Lolo Creek is too great. Radiometric ages for Lolo Creek Flow of 19.5 m.y. and for Rock Creek Flow, in Lower Basalt, of 21.3 m.y. give inclusive dates for all floras from sedimentary interbeds found in the Upper Basalt or above Rock Creek Member of Lower Basalt. The intervening flow of Whiskey Creek Interbed gives date of 19.5 m.y.; thus floras from sedimentary units above the Whiskey Creek Member and below the Lolo Creek Flow are, practically speaking, contemporaneous.

Named for exposures along Lolo Creek, Clearwater County. Isolated patches present on Doumecq Plateau between Salmon and Snake Rivers.

Loma Blanca facies (of Santa Fe Group)

Tertiary: Central New Mexico.

G. C. Evans, 1963, New Mexico Geol. Soc. Guidebook 14th Field Conf., p. 210, figs. 1 and 2. Santa Fe Group along lower Rio Salado includes two facies. Older is called Loma Blanca Facies and the younger which rests on the Loma Blanca, is referred to as upper facies of Santa Fe Group. The Loma Blanca is gray-white sand except for occasional small yellow-weathering sandstone lenses. In vicinity of Arroyo Tio Lino, Loma Blanca sands are partially capped by gravels that form steep slopes.

Loma Blanca is in southwestern part of Rio Salada area in Socorro County.

Lombard Dolomite Member (of Eau Claire Formation)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 27 (fig. 9), 32. Name proposed for unit overlying Elmhurst Sandstone Member (new). Consists chiefly of grayish-brown partly sandy dolomite with interbedded weak greenish shale. Thickness 100 to 150 feet; thins to about 50 feet in McHenry County. Occurs between 1,535 and 1,640 feet in type well. Underlies Proviso Siltstone Member (new).

Type well: Layne-Western The Wonder Co. No. 11, sec. 10, T. 39 N., R. 11 E., Du Page County. Named for city of Lombard, 2 miles west of type well.

Lompico Sandstone

Miocene, middle: Western California.

J. C. Clark, 1966, Dissert. Abs., v. 27, no. 4, sec. B, p. 1184. In area the two younger sequences are products of two separate and succesive marine cycles of sedimentation. Older cycle was a middle Miocene (Relizian-Luisian) event that produced a widely transgressive basal sandstone unit herein defined and named Lompico Sandstone, and an overlying organic mudstone unit, the Monterey Formation.

Felton-Santa Cruz area, west of San Andreas fault in Santa Cruz County.

Londonbridge Formation

Pleistocene, upper: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Dune sand and beach sand with shells in east; lagoon clay in east. Maximum thickness 35 feet. Overlies Kempsville Formation (new); underlies Sandbridge Formation (new).

Londonbridge is in northeastern Princess Anne County.

London Hills Member (of Three Forks Formation)

Devonian: Southwestern Montana.

J. R. Rau, 1962, Billings Geol. Soc. [Guidebook] 13th Ann. Field Conf., p. 53—57. Proposed for beds lying between Horseshoe Hills member (new) above and Jefferson dolomite below. Where well exposed in Devonian Ravine, member consists predominantly of ledge-forming gray dolomitic and limestone breccia in upper part; yellow-orange and red-weathering thin-bedded siltstones and shales in middle; and light-gray, pale yellow-weathering calcarenites at base. Top is delimited by beds of yellow to orange silty limestone south of Jefferson River between Willow Creek and Antelope Creek. Where base is covered, the highest breccia zones in lower member should be considered top of the London Hills member. Thickness about 30 to about 130 feet. Name used in preference to Potlatch member.

Type section: Devonian Ravine, about one-half mile northeast of Logan in SW¼SE¼ sec. 25, T. 2 N., R. 2 E., Gallatin County. Named for London Hills.

Lone Rock Formation (in Tunnel City Group)

Upper Cambrian (Franconian): Wisconsin.

M. E. Ostrom, 1966, Wisconsin Geol. and Nat. History Survey Inf. Circ. 6 (also Michigan Basin Geol. Soc. Ann. Field Conf. May 21—22), p. 7 (fig. 2), 8 (fig. 3), 27, 64—69. Green sands, shales, and shaly sandstones above Wonewoc Formation (new) and below St. Lawrence Formation are grouped together as single formation and assigned name Lone Rock. Occurs above Mazomanie (herein given formation rank). In some areas the Mazomanie occurs as a wedge in Lone Rock Formation. Lone Rock includes (ascending) Birkmose, Tomah, and Reno Members.

Named for exposures in roadcut on Highway 137 south of village of Lone Rock and in south bluff of Wisconsin River in Iowa County.

Lone Tree Gulch Ash

Eocene (Chadronian): Central Wyoming.

J. F. Evernden and others, 1964, Am. Jour. Sci. v. 262, no. 2, p. 185, 190. Study of potassium-argon dates and Cenozoic mammalian chronology of North America. Four beds sampled, B, F, G, and J. Ash B, early Chadronian; Ash F, and Ash G, middle Chadronian; and Ash J, late Chadronian.

Locality: Section started in about side of cen. SE¼ sec. 23, T. 31 N., R. 83 W., Natrona County.

Longford Member (of Kiowa Formation)

Lower Cretaceous: North-central Kansas.

P. C. Franks, 1967, Dissert. Abs., v. 28, no. 3, sec. B, p. 940. Along eastern fringes of its outcrop area, Kiowa Formation contains diagnostic sequence of siltstone underlain by heterogeneous assemblage of red-mottled and carbonaceous gray to black mudstone and siltstone. The mudstone contains variable amounts of montmorillonite and kaolite. The siltstone and underlying assemblage are designated the Longford Member of the Kiowa. Part of Longford Member is thought to have been deposited on the landward side of a shifting shoreline.

Type locality and derivation of name not stated.

Long Lake Drift

Pleistocene (Wisconsin): North Dakota.

Lee Clayton, 1962, North Dakota Geol. Survey Bull. 37, p. 61—62. Defined as morphostratigraphic unit consisting of till of Long Lake end moraine plus other associated drift that originated from same glacial ice. Older than Burnstad Drift.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull 44 (County Ground Water Studies 5) pt. 1, p. 56. After deposition of Napoleon drift, the ice margin probably receded to the Missouri Couteau and conceivably remained there until about 12,000 years ago when the Long Lake and Burnstad drifts were deposited.

Type area: Secs. 4 through 9, T. 136 N., R. 73 W., in northwest corner Logan County, 10 miles southeast of Long Lake.

Lookout Mountain Formation

Pre-Tertiary: Central Washington.

M. L. Stout, 1964, Geol. Soc. America Bull., v. 75, no. 4, p. 320—322, pl. 1. A complex of metasedimentary and quartz dioritic rocks. Lithologically similar to Tonga formation (Yeats, 1958) in northern Cascades. No fossils found, and age of original rocks not known. Age of youngest regional synkinematic metamorphism is pre-Middle Jurassic, so original rocks are probably pre-Jurassic.

Type area: On southwestern flank of Lookout Mountain, south-central Cascade Mountains.

Lookout Peak Tonalite

Jurassic-Cretaceous: Eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend of Markleeville quadrangle.

J. B. Koenig, 1963, Geologic map of California, Walker Lake sheet (1:250,000): California Div. Mines. Jurassic-Cretaceous. Name credited to Parker (1961, unpub. thesis).

Lookout Peak is in Alpine County.

Los Laureles Sandstone Member (of Monterey Formation)

Miocene, middle: Western California.

O. E. Bowen, 1965, *in* Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Name proposed for lowermost member of Monterey in type area. Characteristically a medium- to fine-grained buff-weathering sandstone with lesser siltstone and clay shale, particularly near base of overlying Aguajito Shale Member (new). Thickness about 200 feet. At base of type section the Los Laureles lies on Sur Series and granodiorite basement rocks, and its top is gradational with overlying Aguajito Shale Member. The Los Laureles is an onlapping unit that gets progressively younger eastward as it engulfs a former granite ridge. Type section is unit 5 and part of unit 4 of Galliher (1931, Micropaleontology Bull., v. 2, no. 4). Along Los Laureles Grade road beds are transitional between sandstone and opaline shale and contain fauna characteristic of lower Mohnian stage. Farther west, and west of type section, uppermost beds contain Luisian microfauna. Name credited to Cassell (1949, unpub. thesis).

Type locality: Parts of secs. 16, 17, 19, 20, T. 16 S., R. ½ E., (projected) in northwest corner of Spanish grant Rancho Corral de Tierra and extending into Rancho Los Laureles. Type section: On east boundary of Monterey quadrangle 800 feet east of B.M. 1364. It begins at point 4,510 feet S. 15° E. of B.M. 1364 and continues north 2,430 feet to the first continuous opaline shale beds encountered. Named for exposures along Los Laureles Grade road.

Los Negros Formation (in Río Orocovis Group)

Los Negros Member (of Río Orocovis Formation)

Upper Cretaceous: Puerto Rico.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 61, pl. 1. Mainly clinopyroxene-rich tuff and breccia; minor flow rock. Uppermost member of formation. Overlies Avispa Member (new).

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C10—C11. Rank raised to formation in Río Orocovis Group. Consists predominantly of numerous layers of massive crystal-lithic basaltic tuff but includes some basalt flow breccia and lapilli tuff. Includes several unnamed members and small lenses of basalt and andesite similar to those of Perchas and Avispa Formations respectively. Thickness as much as 1,000m in Corozal quadrangle [this report]; 1,800 m in Naranjito quadrangle. Overlies Avispa Formation in most of Corozal quadrangle. In southeastern part of quadrangle overlies Perchas Formation. Type area and type locality designated.

Type area: Along Río Los Negros and the Camion Del Blanco road between coordinate 51,680 and 53,710. Type locality: In Río Los Negros valley between coordinate 51,800 and 52,140. Also well exposed along Route 814 from 200 m west of the bridge over Río Quadiana to 500 m east of the bridge.

Lost Creek Gneiss

Precambrian: Central Texas.

V. E. Barnes and D. A. Schofield, 1964, Texas Univ. Bur. Econ. Geology Rept. Inv. 53, p. 3—4, pls. 1, 2. A metasedimentary gneiss distinct from underlying Valley Spring Gneiss. Grades upward through a sequence of alternating beds of augen gneiss and schist to Packsaddle Schist. Named by P. C. Ragland (unpub. thesis).

Named for exposures along Lost Creek, McCulloch County.

Lost Mine Rhyolite Member (of South Rim Formation)

Lost Mine Peak Rhyolite Member (of South Rim Formation)

Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 24, road logs. South Rim Formation (new) subdivided into (ascending) Wasp Spring Flow Breccia Member (new), Lost Mine Rhyolite Member, and Burro Mesa Riebeckite Rhyolite Member. In the Basin of Chisos Mountains, Lost Mine Peak Rhyolite Member forms caprock on Toll Peak and about two-thirds of the lower caprock on Casa Grande Peak; westward pinches out in eastern high slope of Emory Peak. Thickness about 800 feet at Casa Grande Peak.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 140—141, pls. Formal proposal of name Lost Mine Rhyolite

Member. Mostly a reddish rhyolite porphyry but parts are nonporphyritic, and some are glassy and have complex flow banding. Present outcrop pattern, thickness of the flow units, complexity of the flow structures, and distribution of the rocks suggest that source was in central Chisos Mountains but vent has not been found. Overlies Wasp Spring Flow Breccia Member. Underlies Burro Mesa Riebeckite Rhyolite Member.

Named from Lost Mine Peak whose top is capped by the lava that also occurs on Crown Mountain, the high mesa between the South Rim and Emory Peak, and on an unnamed peak about 2 miles southwest of Emory Peak. Big Bend National Park, Brewster County.

Lost River Member (of Fish Haven Dolomite)

Middle(?) or Upper Ordovician: Central Idaho.

Michael Churkin, Jr., 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 5, p. 577. A relatively nonresistant sandy and argillaceous unit about 287 feet thick at base of Fish Haven. Overlies Kinnikinic Quartzite.

Named for exposures in Lost River Range. Measured section on west side of Bear Canyon above Little Lost River valley, SE¼ sec. 6, T. 11 N., R. 26 E., Custer County.

Los Tularcitos Member (of Chamisal Formation)

Miocene, middle: Western California.

O. E. Bowen, 1965, *in* Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petrloeum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Upper member of Chamisal Formation. Thickness at type section 400 feet. Thickens to southeast and may be at least 1,100 feet thick. Known to underlie at least 100 square miles and is more or less continuously exposed over 40 square miles. As used here, the Los Tularcitos Member is predominantly a marine assemblage although it is intertongued to some extend with underlying Robinson Canyon Member (new) and locally includes lenses of land-laid red beds. Although beds at least in part equivalent to Robinson Canyon Member have been referred to in some private oil company reports as "Tularcitos Formation" present author believes that the pre-Monterey Miocene sequence on Rancho Los Tularcitos is much more extensively marine than nonmarine, particularly along Chupines Creek, and that the name Los Tularcitos Member should be adopted for the marine portion of the sequence and Robinson Canyon Member for underlying nonmarine part of sequence. Member consists chiefly of medium to coarse-grained dark-yellowish-brown arkosic sandstone, but there is considerable variation in grain size, sorting, and color. No microfossils found but enough megafossils are scattered throughout stratigraphic thickness to establish its stratigraphic position. At type locality, member grades downward into Robinson Canyon Member and upward into Los Laureles Member (new) of Monterey Formation. In some areas lies directly on granitic basement. In some areas underlies Santa Margarita Formation. Present writer does not agree with some workers that Los Tularcitos is equivalent to Los Laureles Sandstone and states reasons.

Type section: Exposed along Robinson Canyon between Carmel Valley and Chamisal Ridge. Named for extensive exposures on Los Tularcitos Spanish land grant in township 17 S., Rs. 2 and 3 E. Rancho Los

Tularcitos lies 6 to 10 miles east of type section. Also well exposed in drainage of Corral de Tierra north of Rancho Los Tularcitos, along south side of Carmel Valley west of Robinson Canyon and on north wall of San Jose Creek Canyon to the west of type section.

Lotta Creek Tuff Member (of Franciscan Formation)

Upper Jurassic: Central California.

M. E. Maddock, 1964, California Div. Mines and Geology Map Sheet 3. White crystalithic tuff and interbedded dark-green siliceous shale at headwaters of Lotta Creek. About 900 feet of strata exposed between lower fault contact with Del Puerto Keratophyre Member and upper conformable contact with Knoxville(?) Formation. Though contact is faulted at exposures, regional structural relationships indicate that Lotta Creek rocks directly overlie those of the Del Puerto.

Well exposed along headwaters of Lotta Creek in sec. 21, T. 6 S., R. 6 E., Stanislaus County.

Louark Group

Upper Jurassic: Subsurface in Gulf Coast Province.

T. H. Philpott, 1952, Am. Assoc. Petroleum Geologists Bull., v. 36, no. 7, p. 1315 (fig. 14). Louark group shown on diagrammatic section of Louisiana and Arkansas. Includes Smackover formation. Occurs above the Morehouse and below Cotton Valley.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 278 (fig. 6.1), 287, 288. As shown on generalized geologic column the group comprises Haynesville, Smackover, and Norphlet formations. Occurs above Louann salt and below the Cotton Valley. In Zuloaga stage of Sabinas series. [A poorly defined unit.]

Loup Loup Granodiorite

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert Abs., v. 25, no. 12, pt. 1, p. 7205. Most of rocks underlying thesis area were formed under conditions of regional metamorphism and plutonism. After period of regional metamorphism, magmas ranging from periodotitic to granitic intruded the metamorphic rocks. Resulting igneous bodies have been mapped as Loup Loup Granodiorite, Pogue Mountain Quartz Monzonite, and Darling Lake Anorthositic Gabbro.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Lousetown flows (in Lousetown Formation)

Plio-Pleistocene: Northwestern California and western Nevada.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Discussion of Pleistocene vulcanism and deformation of Truckee area, north of Lake Tahoe, Calif. Pleistocene latite and basalt flows crop out along the upper Truckee Canyon, located immediately downstream from Lake Tahoe, and throughout Truckee Basin, an intermontane basin at north end of the canyon. The flows postdate the major Pliocene-Pleistocene deformation of the Sierra Nevada and appear to predate oldest recognized glaciation in this part of the Sierra Nevada.

They are correlated with Lousetown Formation of western Nevada. For clarity in presentation, the flows or groups of flows and associated alluvial deposits are treated as members. This member usage is intended to be informal. Named units are: Dry Lake flows, Fir Crags gravel, Tahoe City olivine latites (flow), Big Chief basalt, Prosser Creek alluvium, Hirschdale flow, Juniper Flat alluvium, Alder Hill basalts, Boca Ridge flows, Polaris olivine latite, and Bald Mountain flow or olivine latite. Hirschdale olivine latite is youngest of Lousetown flows in Truckee area. Term Lousetown lavas also used in Truckee area.

G. A. Thompson and D. E. White, 1964, U.S. Geol. Survey Prof. Paper 458—A, p. A17—A19, Discussion of Steamboat Springs area, Washoe County, Nev. Term Lousetown flows used interchangeably with Lousetown Formation.

D. F. Heinrichs, 1967, Jour. Geophysic. Research, v. 72, no. 12, p. 3277—3294. Discussion of paleomagnetism of Plio-Pleistocene Lousetown formation, Virginia City, Nev. In Virginia Range the Lousetown flows form two thick sections at Lousetown Creek and Clark Mountain. To west, in Carson Range and Truckee basin, the flows cover broad erosional surfaces and generally are single flows with limited areal extent. For most part the flows are flat lying or have several degrees of dip. Although the major Cenozoic deformation occurred before eruption of the Lousetown flows, the Lousetown formation has several hundred feet of structural relief. In Carson Range the Lousetown flows lie on post-mature erosion surface cut on Truckee and pre-Truckee formations. As Truckee formation is Pliocene in age, the Lousetown formation must be Pliocene or younger. As evidenced by degree of erosional dissection, the Carson Range flows are older than late Pleistocene. On basis of its magnetic direction alone this flow is tentatively correlated with the Clark Mountain flows. Clark Mountain flows cannot be definitely assigned to a given polarity epoch on the basis of available geologic controls. The Clark Mountain flows are overlain by Mustang andesite, which is considerably less eroded and deformed than Lousetown formation. Although considerable time appears to have elapsed, the time interval between the formations cannot be determined precisely. The Mustang andesite has a Brunhes normal polarity at Clark Mountain, and the Clark Mountain Lousetown flows appear to be either early Matuyama (≈2.4 m.y.) or late Gilbert (≈3.4 m.y.), depending on the magnitude of this time interval. In contrast to the relatively young ages of most of the Lousetown formation, flow 2 at Lousetown Creek has been dated at 6.8 m.y. Thus although the Lousetown flows are petrographically similar, the type section of the Lousetown formation is significantly older than the remainder of the Lousetown flows. Text also mentions Truckee basin flows and Lousetown Creek flows. [Inasmuch as this report does not follow the Stratigraphic Code relative to capitalization of formally named units, for example, Lousetown Formation, it is not possible to determine which, if any, of the flows mentioned the author intended should have formal status.]

Type locality of the Lousetown Formation is in the area east of Lousetown Creek, about 6 miles north of Virginia City, Nev.

Lousetown Creek flows

See Lousetown flows.

Lovel Shale

Upper Cretaceous (Santonian): West-central California.

E. V. Tamesis, 1967, Dissert. Abs., v. 28, no. 1, sec. B., p. 237. Eight stratigraphic units ranging from Early to Late Cretaceous are recognized in area. In descending [ascending?] order these are: Badger Shale, Risco Formation, Johnson Peak Formation, Catskin Formation (new), Lovel Shale (new), Redman Sandstone, Willow Spring Mudstone (new), and Moreno Formation. Unconformities exist between Campanian Redman and Maastrichtian Willow Spring Mudstone, Redman and Santonian Lovel Shale, and the Lovel and Cenomanian-Coniacian Catskin Formation.

Area of report is Avenal Ridge-Reef Ridge area of Southern Diablo Range, 200 miles southeast of San Francisco, in Fresno and King Counties.

Lovelock Formation

Pleistocene: Western Nevada.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 7—11. Subaerial sediments of pre-Lake Lahontan Quaternary age are divided into two formations, Lovelock (oldest) and Paiute. At type locality consists of poorly sorted silty to sandy and pebbly alluvium intercalated with at least six weathering profiles that together represent the Humboldt Valley Soil. In this low-lying situation the exposed Lovelock represents only the older lacustral interval; however, by definition the formation also includes subaerial deposits correlative with at least the preceding main lacustral interval, that is, with older pre-Lake Lahontan lacustrine unit. Thickness as much as 50 feet at type locality where it underlies Rye Patch Formation (new).

Type locality: Valley of Humboldt River for a mile below Rye Patch Dam. Named for Lovelock, Pershing County, about 22 miles south of type locality.

Lovelock-Humboldt Valley Stage

Pleistocene: Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. [For explanation see Sehoo-Toyeh Stage.] Lovelock-Humboldt Valley is oldest stage named in area. Followed by Rye Patch-Cocoon Stage.

Type area: Bluffs along Humboldt River near Rye Patch Dam, Pershing County, Nev.

Love Ridge Quartz Monzonite

Devonian: Eastern Maine.

D. M. Larrabee, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—358. Light-gray fine-grained biotitic quartz monzonite. Believed to be of Devonian age because it has not been regionally metamorphosed, intrudes rocks of Silurian(?) age, and has relationships similar to other intrusive granites considered Devonian in general area. Pocamoonshine Gabbro-Diorite (new) and Wabassus Quartz Monzonite are mapped as Devonian in area.

D. M. Larrabee, C. W. Spencer, and D. J. P. Swift, 1965, U.S. Geol. Survey Bull. 1201—E, p. E21, pl. 1. Shown on map legend above Chiputneticook Quartz Monzonite and below Wabassus Quartz Monzonite. Devonian.

Type locality: Exposures on southeast side of Love Ridge, between Pug Lake and North Beaverdam Lake in Big Lake quadrangle, Washington County.

Lovers Lane Breccia

Upper Cretaceous and Tertiary, lower: Southwestern New Mexico.

A. W. Rose and W. W. Baltosser, 1966, *in* Geology of the porphyry copper deposits of southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 211. Several breccias are present near copper deposit at Santa Rita. Whim Hill Breccia is at north end of Santa Rita stock and Lovers Lane Breccia lies west and northwest of the ore body and has a northwest elongation. The brecciated rock consists mainly of the Colorado and Beartooth Formations along with some late diorite porphyry.

The Santa Rita copper deposit is at town of Santa Rita in southwestern New Mexico.

Lower Eagle Meadow Rhyolite Tuff

Miocene, lower: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci. v. 47, p. 4—5 (table 1) 20, 22, 37. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon ages: (biotite) 26.1 ± 0.5 m.y.; (sanidine) 23.3 ± 0.5 m.y. Sanidine date considered most reliable. Refers to Slemmons (1951, unpub. thesis).

In Dardanelles Cone quadrangle in sec. 1, T. 5 N., R. 19 E.

Lowery Spring Member (of Chinle Formation)

Upper Triassic: Northern Arizona.

J. P. Akers, 1961, (abs.) Arizona Geol. Soc. Digest, v. 4, p. 175. Composed of sandstone and mudstone. Overlies Shinarump member and underlies Petrified Forest member. Pinches out toward northwest and not present in Utah.

In Paris Plateau area.

Lowland Creek Volcanics

Eocene, lower: Southwestern Montana.

H. W. Smedes, 1962, Jour. Geology, v. 70, no. 3, p. 255—267. A sequence of quartz latitic volcanic rocks. Comprises six major units: basal unit of conglomerate and sedimentary rocks, 500 feet; welded tuff, 3,000 feet; breccia, 600 feet; lower lava, 400 feet; vitrophyre, 300 feet; upper lava, 1,000 feet. Upper Oligocene on basis of facts that volcanics contain a flora which also occurs in upper Oligocene beds near Missoula and that there is regional unconformity between the volcanics and the overlying lower Miocene deposits.

H. W. Smedes and H. H. Thomas, 1965, Jour. Geology, v. 73, no. 3, p. 508—509. Potassium-argon date determinations of 48 and 50 m.y. for biotite rocks in Lowland Creek Volcanics agree with previous K-Ar age of 49 m.y. for biotite of dike rock correlated with lavas of upper part of the volcanics. These determinations establish age of volcanics as early Eocene rather than late Oligocene.

A. A. Wanek and C. S. V. Barclay, 1966, U.S. Geo. Survey Bull, 1222—B, p. B12—B13, pls. 1, 2. Mapped and described in Anaconda quadrangle, Deer Lodge County. Have aggregate thickness in excess of 4,000 feet and consist predominantly of intercalated beds of volcanic breccia, quartz latite flows, ash-flow tuff, welded tuff, and sedimentary strata. Divided into three members which correlate generally with units described by Smedes (1962). Basal member, locally as much as 400 feet thick, consists of massive- to thick-bedded grayish-brown cross laminated arkose, lenticular conglomerate beds that contain abundant volcanic pebbles, and gray to buff tuffaceous siltstone and claystone beds. Ash-flow tuff member, 0 to about 3,000 feet thick, is composed chiefly of massive light-gray ash-flow tuff and gray, buff, and grayish-red quartz latite flows that are interlayered with gray lapilli tuff, some welded tuff, and a few beds of greenish-gray conglomerate. Volcanic and red bed member, 0 to about 600 feet thick, consists chiefly of massive gray to reddish-brown quartz latite flows, thick-bedded buff conglomerate, sandstone, and thin coaly shale beds. Unconformably overlies Colorado Shale. Underlies unnamed Miocene(?) and Pliocene gravels. Type locality stated.

Type locality (Wanek and Barklay, 1966): Lowland Creek in Elk Park quaerangle northeast of Butte, Jefferson County. Rocks are distributed over 600 square miles in Jefferson, Silver Bow, Deer Lodge, and Powell Counties.

Luce Gravel

Pliocene: Southern Indiana.

L. L. Ray, 1965, U.S. Geol. Survey Prof. Paper 488, p. 17—20, p. 1. Noncalcareous and oxidized, medium to coarse, compact to poorly consolidated sand with thin clayey layers and some scattered gravel; intercalated lenses and stringers of gravel form transitional zones between the compact sand and gravel layers. Sand is grayish white through pale yellow and brilliant orange to deep crimson. Tentatively referred to "Lafayette division of the Neocene" by Veatch (1897, Indiana Acad. Sci. Proc.).

Named for occurrence near Enterprise, Luce Township. Good exposures occur where section-line roads cut through the valley wall and at small gravel pits along the valley wall.

Lucy (Lucey) Siltstone Member (of Bloomsberg Red Beds)

Silurian: Central Pennsylvania.

F. M. Swartz, 1955, Pennsylvania Geologists Guidebook 21st Ann. Field Conf., p. SI—14, SI—26. Lucy (Lucey) siltstone member, 20 feet thick, near middle of the Bloomsburg. The Lucy (Lucey) siltstone member is a westward tongue from the thicker and coarser sandstones of the Bloomsburg red beds of sections along Blue Mountain at and to the northeast of Susquehanna Gap near Harrisburg, and which in turn appear to integrade in northwestern New Jersey with much or all of the red Greenpond conglomerate.

Area of field trip is in Bellefonte, Tyrone, Huntingdon, Mount Union and Centre Hall quadrangles.

Ludden Brook Formation (in Woodstock Group)

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 106—107, figs. 1, 2, road log. Composed of fine-grained to medium-grained biotitic-feldspathic sandstone, with pods, beds, and stringers of calc-silicate. Considered a southwestward extension of "sandstone facies" of Woodstock Group. Occurs between Anasagunticook Formation (new) and Thompson Mountain Formation. Listed as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not given. Area of report is Buckfield and Fixfield quadrangles.

Ludlow Spur Till

Pleistocene: Southwestern Ohio.

R. P. Goldthwaite, leader, 1955, Pleistocene chronology of southwestern Ohio: Guidebook 5th Bienn. Pleistocene Field Conf., Sept. 6—13, p. 63. Till belongs to Scioto lobe material. May be early or late Wisconsin.

Lulu Latite (in Specimen Mountain Volcanics Group)

Oligocene-Miocene: North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Specimen Mountain Volcanics of Wahlstrom (1944, Geol. Soc. America Bull., v. 44, no. 1) raised to group rank to include (ascending) Poudre Pass Rhyolite, Lulu Latite, and Iron Mountain Rhyolite (all new). Comprises the quartz latite of Lulu and Specimen Mountains. Associated with ash-fall rhyolite units. On Lulu Mountain, quartz latite is found near top of ash-fall sequence with no evidence of having been displaced from its original stratigraphic position. Same material occupies a similar position on Specimen Mountain, but here Wahlstrom has inferred a fault-contact relationship with both overlying and underlying strata.

Present on Lulu and Specimen Mountains in Mount Richthofen- Iron Mountain area located 40 miles south of Wyoming border in northcentral Colorado. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Lupus Sandstone physiofacies (of Callaway lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Callaway lithofacies of Cedar City formation (new) divided into four physiofacies: Lupus sandstone, Mineola crinoidal or arenaceous limestone, Sandy Hook dolomitic limestone or dolomite, and Calwood limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 35—37. Lithologically, the Lupus Sandstone Physiofacies is a quartz sandstone, white, light gray, weathering to medium grayish tan, yellowish white, light to medium brown, yellowish brown, reddish brown, or green; fine to medium grained, calcareous, in part dolomitic friable to fairly well cemented, with most of quartz sand being well rounded and in part frosted. Thickness as much as 17.5 feet. Interfingers with other Callaway facies which contain Middle Devonian fossils. Overlies Ordovician formations—Jefferson City, St. Peter, Kimmswick, or Maquoketa. Facies is lenticular and occurs at various horizons in the Cedar City.

Type section: SW¼SW¼SE¼ sec. 4, T. 47, N., R. 14 W., about two-tenths of a mile northwest of Lupus, Moniteau County, along Missouri River bluffs and Missouri Pacific Railroad, just northwest of Big Splice Creek (Columbia quadrangle).

Luverne Drift

Pleistocene: Southeastern North Dakota.

D. A. Block, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1979. Uppermost Wisconsinan drift in area [Barnes County]. Unit consists of a long straight end moraine, its attendant outwash on the west, and sloping ground moraine to east edge of county. Historical interpretation places all Barnes County surface deposits of late Wisconsinan subsequent to emplacement of ice that formed Streeter moraine and dead-ice features of Burnstad drift on the Coteau du Missouri.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, pt. 1, p. 35—41. Approximately 520 square miles of eastern Barnes County covered by Luverne drift. Luverne drift consists primarily of till. Average thickness of Luverne deposits probably exceeds 50 feet and may be more than 100 feet beneath the end moraine. Younger than Cooperstown drift.

Type area: Vicinity of Luverne, a small village in sec. 32, T. 144 N., R. 57 W., southwestern Steel County. End moraine traveses Barnes County from north to south in R. 57 W. and locally extends into R. 58 W. Width of moraine ranges from less than 1 mile to more than 5 miles, but in most places it is slightly more than 2 miles.

Mabton interbed (in Priest Rapids Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 25. A sedimentary interbed 75 feet thick in the Priest Rapids Basalt Member (new). Name credited to Laval (1956, unpub. thesis).

W. N. Laval, 1966, *in* Fourth Ann. Engineering Geology and Soils Engineering Symposium Moscow, Idaho, p. 95. In eastern part of Toppenish Ridge and Horse Heaven Hills, the Priest Rapids Member is as much as 700 feet thick and includes the Basal flows, the Mabton interbed, and the Upper (Umatilla and Sillusi) flows. South of Mabton, the sedimentary Mabton interbed is about 75 feet thick and consists of tuff and tuffaceous silts and sands. Farther east the Mabton is as much as 100 feet thick and contains quartzose micaceous sand. The Mabton may be the stratigraphic equivalent of Mackin's Quincy diatomite.

Mabton is in southeastern Yakima County.

McAfee Adamellite

Jurassic or Cretaceous: Eastern California and western Nevada.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 141—143. A complex of three different facies—Aiken, Central, and Garden (all new). Contacts with Cabin and Barcroft Granodiorites (both new) and Cottonwood Porphyritic Adamellite (new) show the McAfee to be the younger. Corresponds to part of Boundary Peak Granite.

R. G. Strand, 1967, Geologic map of California, Mariposa sheet (1:250,000): California Div. Mines and Geology. Mapped with Mesozoic granitic rocks in White Mountains.

The McAfee, including all three facies, underlies about 61 square miles in Mount Barcroft quadrangle and extends beyond the north, east, and south borders of the quadrangle. Inyo batholith.

McAfee Quartzite (in Valmy Group)

Ordovician: Northeastern Nevada.

Michael Churkin, Jr., and Marshall Kay, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 651—668, pl. 1, Quartzite beds from 10 feet to more than 100 feet thick alternating with thinner beds of graptolitic shale and siltstone. Thickness 1,387 feet exposed at eastern slope of McAfee Peak. Overlies Snow Canyon Formation (new). Underlies Jacks Peak Formation (new). Abundant graptolites.

Type section: Extending along crest of Independence Range from McAfee Peak to Jacks Peak. Named for McAfee Peak, Independence Range, Elko County. Highest parts of northern Independence Range are dominated by the quartzites of the McAfee.

McCall Migmatite

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. Derived from pre-Cretaceous metamorphic rock by addition of silicic material, a leucocratic quartz diorite. Name credited to D. L. Schmidt (1958, U.S. Geol. Survey open-file rept.).

Exposed on east flank of West Mountain and along McCall-New Meadows Highway, Long Valley district, Boise Basin.

McCann Hill Chert

Middle and Upper Devonian: East-central Alaska and Yukon, Canada.

Michael Churkin, Jr., and E. E. Brabb, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 2, p. 172—185. Name applied to a 200- to 800-foot-thick sequence of thinly bedded and laminated light-gray to black chert and siliceous shale, with a few interbeds of siltstone and chert grit, and a limestone and shale member at its base. Disconformably overlies Road River Formation. Conformably overlain by Nation River Formation.

Type section: Along creek about one-half mile east of bench mark 4085 except for uppermost 100 feet which is exposed on ridge crest extending north from bench mark. Traced without interruption from Canadian border near McCann Hill (boundary monument 105) to Montauk Bluff on Yukon River. Extends eastward into Ogilvie Mountains of Canada.

McCaslin Formation or Quartzite

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1961, Dissert. Abs., v. 21, no. 11, p. 3421. Formation unconformably overlies Waupee series (new). Composed of a basal conglomerate which grades upward into clean quartzite. Maximum thickness about 5,000 feet. Unconformably underlies Hager rhyolite porphyry (new). In contact with younger High Falls granite (new) in several areas. McCaslin formation furnishes structural framework for regional [McCaslin] syncline. Middle Precambrian or Huronian but exact position in Huronian not clear.

W. F. Read and L. W. Weis, 1962, Tri State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), 5,8. Presumably same as Thunder Mountain quartzite (new).

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. Mancuso (1957, 1960, unpub. theses) established following succession: Waupee Volcanics, Macauley Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite and High Falls Granite. Significant contribution of this study was demonstration of two distinct ages of granitic intrusion: McCaslin Quartzite lies nonconformably on Macauley Granite and is intruded by High Falls Granite.

Macauley Granite Gneiss

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), road log. Gray gneissic granite cutting Waupee volcanics. Name credited to Mancuso (unpub. thesis).

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 11. Mancuso (1957, 1960, unpub. theses) established following sequence in McCaslin district: Waupee Volcanics (oldest), Macauley Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite and High Falls Granite. A significant contribution of this study was demonstration of two distinct ages of granitic intrusion: McCaslin Quartzite lies nonconformably on Macauley Granite and is intruded by High Falls Granite.

McClure Mountain Complex

Cambrian: South-central Colorado.

R. L. Parker and F. A. Hildebrand, 1963, U.S. Geol. Survey Prof. Paper 450—E, p. E8—E10. Name McClure Mountain complex applied to an intrusive alkalic complex in northern Wet Mountains. Genetically related to Gem Park complex (new). Both complexes intrude gneissic granite and other metamorphic rocks of Precambrian age. Both complexes are cut by carbonatite dikes, some of which contain niobium, rare earths, and thorium. Principal rocks comprising both intrusives are: pyroxene-olivine-plagioclase rocks, biotite-hornblende syenite, mafic nepheline-bearing rocks, nepheline syenite, and fenite. Nepheline syenite, most abundant rock type in McClure Mountain complex, forms core of complex and intrudes biotite-hornblende syenite. Alkalic rocks in the McClure Mountain complex are probably of late Precambrian age.

D. R. Shawe and R. L. Parker, 1967, U.S. Geol. Survey Bull. 1251—A, p. A1—A28., pl. 1. Formal proposal of name. The complex, originally shown as Precambrian in age, is now considered to be Cambrian or Precambrian.

The U. S. Geological Survey currently designates the age of the McClure Mountain Complex as Cambrian on the basis of a study now in progress.

Type area: Encompasses about 20 square miles in vicinity of McClure Mountain about 13 miles north of Westcliffe, in northern Wet Mountains, Fremont County. Roughly circular in plan.

McCourt Sandstone or Tongue (of Rock Springs Formation)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 104—105, pl. 1. Upper part white to light gray; lower part buff. Thickness 105 feet at type locality. Overlain by sequence of carbonaceous beds 25 feet thick; underlain by about 88 feet of gray and black shales of Coulson tongue (new).

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Field Conf., p. 17, pl. 4. As shown on pl. 4 underlies Gottsche Member of Rock Springs Formation.

Type locality: Sec. 7, T. 14 N., R. 103 W., Sweetwater County. Named from old McCourt Ranch near Salt Wells Creek.

McCoy Creek Group

Precambrian: Northeastern Nevada and western Utah.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 289—344. A thick succession of quartzose and argillaceous metasediments. Overlain concordantly but with sharp boundary by Lower Cambrian Prospect Mountain Quartzite (restricted). Lower part contains minor marble, and in Deep Creek Range, Utah, tillitic schists. Base not exposed. Upper 3,600 feet of group exposed in Southern Snake Range; six formations recognized (ascending): Willard Creek Quartzite, Strawberry Creek Formation, Shingle Creek Conglomerate, Osceola Argillite, and Stella Lake Quartzite (all new). In Schell Creek Mountains, 8,800 feet of group exposed; eight formations recognized and designated as units A through H. At least upper 4,300 feet are equivalent to formations exposed in Southern Snake Range. In Trout Creek area of southeastern Deep Creek Range about 8,800 feet of metasediments are exposed which represents lower part of group and are believed to include strata older than any exposed in McCoy Creek area. Seven formations designated as Trout Creek Unit 1 through 7, and several subdivisions recognized. Lower Part includes some marble and three units of tillitic schists totalling about 1,350 feet. Group also exposed between southern end of Cherry Creek Mountains and northern Egan Range as well as in Egan Range north of Ely.

L. A. Woodward, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 3, p. 310—316. Recommended that term Goshute Canyon Formation (Bick, 1959) be abandoned and that rocks be referred to as units D, E, F, and G of McCoy Creek Group as defined in type section by Misch and Hazzard (1962).

Named for McCoy Creek in Schell Creek Mountains, Nev.

McCrary Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface)

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. McCrary sand occurs at depth of 8,912 to 8,924 feet in type well.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). McCrary blanket sand included in McFearin Tongue (new) of Terryville Sandstone (new).

Type well: California Co., No. 1 McCrary (B—31), sec. 14, T. 19 N., R. 4 W., Knowles field, Lincoln Parish.

Macedonia Bed (in Grier Limestone Member of Lexington Limestone)

Middle Ordovician: Central Kentucky.

D. F. B. Black, E. R. Cressman, and W. C. MacQuown, Jr., 1965, U.S. Geol. Survey Bull. 1224—C, p. C19—C20. A distinctive unit of interbedded tabular argillaceous micrograined limestone and shale as much as 15 feet thick and 60 to 65 feet above base of the Grier.

Type section: In roadcuts on southside of east-bound lane along Interstate Highway 64 on east side of Kentucky River in reference section of Lexington Limestone in Frankfort East quadrangle, Franklin County. Present in Franklin, Woodford, and western Fayette and Jessamine Counties. Named from Macedonia Church in northwestern Woodford County 2 miles south of type section.

McFearin Tongue (of Terryville Sandstone)

Upper Jurassic: Northern Louisiana (subsurface).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 148, 150. Fourth in sequence (descending) of five tongues of the Terryville (new). Underlies Vaughn Tongue (new) and overlies Justiss Tongue (new). Occurs at depth of 9,440 to 9,590 feet in type well. Includes blanket sandstones, Price, McCrary, McFearin-Davis, and Bolinger.

Type well: Arkansas-Louisiana Gas Co., Lewis No. 1, NW¼NW¼ sec. 27, T. 19 N., R. 4 W., Lincoln Parish.

McFearin-Davis Sand (in Schuler Formation)

See Davis Sand (in Schuler Formation) and McFearin Tongue (of Terryville Sandstone).

McGee Creek Granite

Age not stated: Eastern California.

E. M. P. Lovejoy, 1964, Arizona Geol. Soc. Digest, v. 7, p. 165, 168. Mentioned in study of late Neogene faulting at McGee Mountain. Underlies McGee [Mountain] basalt. The granite supplied most of the debris for moraines in McGee Creek Canyon.

Occurs on McGee Mountain, Mono County.

McGee Mountain Basalt

Pleistocene: Eastern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380 (table 1), 387. Listed with units from which samples were collected for potassium-argon age determinations. Underlies type McGee Till. Age determination 2.6 m.y.

E. M. P. Lovejoy, 1964, Arizona Geol. Soc. Digest, v. 7, p. 165, 168. Overlies McGee Creek granite (new).

Present on McGee Mountain, on east side of Sierra Nevada near Mono Lake.

McGregor Gneiss

Tertiary: Northwestern Washington.

J. B. Adams, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Skagit gneiss in area has been subdivided in three mappable units, McGregor gneiss, Rainbow Lake schist, and War Creek gneiss, which strike approximately N. 30 W. and dip vertically or steeply to northeast.

Area of report is Stehekin-Twisp Pass, Northern Cascades.

McHenry Drift

Pleistocene: East-central North Dakota.

J. P. Bluemle, 1965, North Dakota Geol. Survey Bull. 44, p. 24, 42—44. Consists of till of McHenry moraine and other associated drift that was deposited from the McHenry ice. Includes extensive area of buried lake sediments in eastern Eddy County. Associated with and underlying the drift is a sequence of lake deposits in eastern Eddy County and western Nelson County. Neither its lateral extent nor its thickness are accurately known. Relationships to Heimdal drift (new) are obscure but the two drifts were probably deposited at about the same time. Younger than Grace City drift (new).

Named for town of McHenry in northeastern Foster County. Exposed over eastern third of Eddy County, northeastern corner of Foster County, northwestern Griggs County, southwestern Nelson County, and southeastern Benson County.

McHenry Valley Substage

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 260—261. McHenry Valley Substage of Cassadaga Stage proposed as time-stratigraphic name for strata between and including older Alfred Station Coquinite (new) and younger Cuba Formation.

Named from exposures along McHenry Valley in Almond and Alfred Townships, Allegany County.

McKay beds

Pliocene: Northeastern Oregon.

G. M. Hogenson, 1964, U.S. Geol. Survey Water-Supply Paper 1620, p. 24—26, pl. 1. A deposit of fanglomerate gravel that underlies Pendleton plains in vicinity of McKay Reservoir. Referred to informally as McKay beds. Composed of basaltic pebble and cobble conglomerate having silt-filled interstices. Many siltstone and sandstone lenses some of which are several hundred feet long and as much as 40 feet thick. Overlies Columbia River basalt and underlies loess of Quaternary age.

R. C. Newcomb, 1966, U.S. Geol. Survey Prof. Paper 550—D, p. D62, D63. The apparent continuation eastward of the sedimentary facies of Dalles Formation may necessitate some restriction of that name or a revision of the present names Arlington Lake beds, Arlington beds, lower Shutler Formation, and Pliocene fanglomerate, as well as a definition of "McKay beds."

In Umatilla River Basin, in vicinity of McKay Reservoir, Umatilla County.

McKay biotite-augite latite

[Pliocene]: Eastern California.

G. G. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 36. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 9.2 ± .2 m.y.

Locality: Blue Mountain quadrangle.

McKeefrey Siltstone Member (of Monongahela Formation)

Upper Pennsylvanian: East-central Ohio, Pennsylvania, and West Virginia.

H. L. Berryhill, Jr., 1963, U.S. Geol. Survey Prof. Paper 380, p. 39—40. In past, entire sequence between Arnoldsburg sandstone member and Uniontown coal bed has been designated as "Uniontown limestone." The "Uniontown limestone" included a sandstone-siltstone-shale unit 5 to 30 feet thick. This unit is herein named McKeefrey siltstone member. In Belmont County, top of the McKeefrey lies from 6 inches to as much as 15 feet below Uniontown coal bed and is separated from it in most places by Uniontown limestone member and by underclay of coal bed. Where limestone is absent, sandstone member is separated from coal by thin underclay, but locally this clay is absent and the sandstone member is overlain by the coal. Overlies Little Captina limestone member (new).

Named for outcrop on west side of Ohio River in high west bank of State Highway 7 in east-central sec. 3, York Township, Belmont County, Ohio, at a point one-half mile S. 30° W. of McKeefrey, W. Va.

McKelligon Formation (in El Paso Group)

Canadian (Jeffersonian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Includes Pistol Range member (new). Overlies Snake Hills formation (new). Underlies Scenic Drive formation (new). Comprises entire Jeffersonian. Canadian treated as a system in this report.

Named from McKelligon Canyon at southern end of Franklin Mountains, at northeast edge of El Paso.

McKenney Ponds Limestone Member (of Tarratine Formation)

Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 159, 168—169, pl. 34. Predominantly limestone with calcareous arkose, conglomerate, slate, and dark sandstone; base arkosic. Occurs near base of formation. Thickness as much as 200 feet in McKenney Ponds area, thinner elsewhere. In places rests on basement complex and in others on undifferentiated volcanic rocks of Silurian or Ordovician age.

Type section: At northeast end of McKenney Ponds, Upper Enchanted Township (Pierce Pond quadrangle).

McKim Limestone Member (of Rico Formation)

Permian: Southeastern Utah.

S. A. Wengerd, 1950, Photogramm. Eng., v. 16, no. 5, p. 775. A limestone, 3 to 20 feet thick, at top of the Rico. Lies just below base of Halgaito member of Cutler.

R. B. O'Sullivan, 1965, U.S. Geol. Survey Bull. 1186, p. 24—25. A local name applied to a persistent limestone near top of Rico Formation.

Forms top on west side of Raplee Ridge and in area of Mexican Hat, San Juan County.

Macklyn Member (of Chetco Formation)

Jurassic: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4221. Member of Chetco Formation (new). Gradational with Winchuck Member (new). Macklyn considered older but evidence not convincing. Contains numerous volcanic rocks, bedded radiolarian cherts, and coarse conglomerates, some with pre-Nevadan granitic boulders. Older than Middle Portlandian.

Report discusses west-central Klamath province in southwestern Oregon and northwestern California. Macklyn Cove is in Curry County, Oreg.

McKnight Formation (in Atascosa Group)

Cretaceous (Comanche): Southern Texas and northern Mexico (subsurface and surface).

J. A. Winter, 1961, Gulf Coast Assoc. Geol. Soc. Trans., v. 11, p. 15—23, 1962, *in* Contributions to the geology of South Texas, San Antonio, South Texas Geol. Soc., p. 87—98. A black shale or shaly siliceous limestone with anhydrite nodules and veinlets and thin chert beds. Overlies Edwards "B" and underlies Pryor member (new) of Georgetown formation and Edwards "A". Formation pinches out in eastern part of Zavala and Dimmit Counties and also pinches out close to the reef trend in northern Webb County. Northern limit lies in Uvalde and Kinney Counties and southern tip of Val Verde County. Name was first used by Hedwig Kniker in report of Producers of Maryland Oil Co., but was never defined in publication. Imlay (1945, Am. Assoc. Petroleum Geologists Bull., v. 29, no. 10) assigned the beds to the Kiamichi. Name McKnight is preferable to name Kiamichi for the sequence of black shaly limestone in Maverick basin because of lithologic difference and deposition in a different basin from the Kiamichi. McKnight divided into three unnamed members.

F. E. Lozo and C. I. Smith, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 285—306. Winter (1961) revived name McKnight for subsurface usage west of San Marcos platform. Unit has been extended into outcrop and name McKnight is herewith applied to surface exposures. Maximum outcrop thickness about 145 feet and section divisible into lower and upper thin-bedded limestone units separated by petroliferous 25-foot section of black laminated fissile clayey lime mudstone beds. The 70-foot lower section of brown shell fragments and pellet grainstones with thin chert layers is overlain by lighter mudstones with solutioned zones and collapse breccia. The 55-foot upper unit, as exposed at Chalk Bluff, is mostly thin-bedded mudstone; it also contains thin chert layers, solution zones, and another collapse breccia bed near middle. Overlies West Nueces Formation (new); underlies Salmon Peak Formation (new). Although intent of Winter (1961) is implicit, and many requirements of Stratigraphic Code have been met. Winter designated no interval (type section) in any specified well (type locality), and name thus lacks critical elements of definition for formal establishment as subsurface unit. Although unit is now known to crop out and an outcrop type section could be defined (and another name proposed), informal priority and familiar usage of McKnight would seem to favor retaining subsurface name and defining a subsurface type section. No decision, in conjunction with sursurface workers, has been attempted to designate namesake well as type well or to specify the interval. [Atascosa Group not used in this report.]

Outcrop reference section: A composite of two sections: The lower part is from a bluff on right bank of West Nueces River on Bitter Ranch, 1.2 miles south of Tularosa road intersection with the "river road" northeastern Kinney County; upper part is from basal 75 feet of Chalk Bluff on Nueces River, 2 miles south of Nineteen Mile Crossing of State Highway 55 (Uvalde-Rock Springs road), western Uvalde County. Total section is exposed only in reference section. In Mexico the McKnight encircles the southeastern end of the Serrania del Burro.

McKnight Limestone Conglomerate lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of McKnight Limestone Conglomerate lithosome about 10,000 feet. Clasts of Madison Limestone and Triassic and Jurassic formations predominate.

Mapped in southwestern Montana.

McKnight Limestone-Siltstone lithosome (in Beaverhead Formation)

Upper Cretaceous: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of McKnight Limestone-Siltstone lithosome 2,300 feet. Consists mostly of dense limestone and calcareous siltstone.

McKnight Canyon is near Dell, Beaverhead County.

Macks Formation

Miocene, upper: Eastern North Carolina.

R. B. Daniels, 1966, Southeastern Geology, v. 7, no. 4, p. 163—168. A silty, very fine sand that is relatively uniform. Thickness in type section (bore hole) about 32 feet. Overlies Cretaceous. Underlies Pinehurst Formation.

Type section: Bore hole 0.3 mile north of junction of route 50 and Johnston County road 1168 and 0.1 mile east of North Carolina Highway 50, Johnston County. Typical outcrop is about one-eighth mile north of Benson. Macks crossroads is 5 miles north of Benson.

McLouth Formation

Pennsylvanian (Atokan): Subsurface in Kansas and Missouri.

W. B. Howe and others, 1961, Missouri Geol. Survey and Water Resources, 2d ser., v. 40, p. 80, 82 (fig. 16), pl. 1. Between Mississippian rocks and beds referred to Burgner formation in Forest City basin is a succession of dark-gray to black shales, clays, and quartzose sandstones described by Lee (1941, Kansas Geol. Survey Bull. 38, pt. 10) in Kansas, and named McLouth sand. In Missouri, thickness of this unit ranges from featheredge along eastern and southern edge of basin beneath Putnam, Sullivan, Linn, Chariton, Lafayette, Clay, and Platte Counties to more than 200 feet in deeper part of basin beneath Atchison and Andrew Counties. Both McLouth formation and Cheltenham formation lie below Atokan beds referred to Burgner formation, but relationship between McLouth and Cheltenham is not known.

Named for occurrence in McLouth oil and gas field, Jefferson and Leavenworth Counties, Kans.

†McManus Formation (in Albemarle Group)

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 127—128, geol. map. Predominantly felsic tuffaceous argillite, but also contains felsic-crystal, lithic-crystal tuff, and felsic lithic tuff. Maximum thickness 10,000 feet. Overlies Tillery Formation (new); conformably underlies Yadkin Graywacke (new). Name replaces Monroe slate (Nitze and Hanna, 1896).

The U.S. Geological Survey has redefined the Albemarle Group and abandoned the term McManus Formation on the basis of a study now in progress.

Type locality: McManus quarry in Stanly County on county road 1963, 0.3 mile north of its intersection with county road 1964. Reference locality: Near Albemarle on south side of North Carolina Highway 27 bypass 100 yards east of its intersection with North Carolina Highway 52. Second reference locality: At Bakers quarry in Union County about 5 miles west of Monroe on south side of U.S. Highway 74. Present only west and southwest of Troy anticlinorium.

Madden Gravel

Quaternary: Southwestern Texas.

C. C. Albritton, Jr., and J. F. Smith, Jr., 1965, U.S. Geol. Survey Prof. Paper 479, p. 99—100, pl. 1. Gravels on surfaces of erosion in Sierra Blanca area are named (ascending): Miser, Madden, Gills, Ramey, and Balluco. The Madden consists of limestone, sandstone, quartzite, conglomerate, and extrusive and intrusive igneous rocks, all from local sources. Thickness 1 to almost 30 feet.

Type locality: South side Madden Arroyo in northwest corner Fort Quitman quadrangle, Hudspeth County.

Maemong Limestone Member (of Umatac Formation)

Miocene, lower: Guam.

J. T. Stark and J. I. Tracey, Jr., 1963, U.S. Geol. Survey Prof. Paper 403—C, p. C1, C29. Umatac Formation comprises (ascending) Facpi Volcanic (new), Maemong Limestone (new), Bolanos Pyroclastic, and Dandan Flow (new) Members. The Maemong is gradational into tuffaceous shales and sandstones and forms tongues within the Facpi.

W. S. Cole, 1963, U.S. Geol. Survey Prof. Paper 403—E, p. E1, E4, E11. Report discusses larger Foraminifera from Guam. Maemong Limestone Member, with fauna of 18 species, is assigned to Miocene and is divided into two paleontologic zones.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A25—A27, pls. Formal proposal of name. Exposed in two principal areas in south Guam. First is Fena-Mapao area; second is along west slope of southern mountains from Mount Jumullong Manglo to Merizo. Forms outliers on rock of Alutom formation. In places is overlain by tuff breccia and tuffaceous conglomerate of Bolanos pyroclastic member of Umatac. In Fena-Mapao area, the Maemong is typically white or pink hard, compact fine-grained to conglomeratic recrystallized detrital limestone containing abundance of larger and smaller Foraminifera, a few mollusks, many calcareous algae, and many coral heads in position of growth. Intertongues with Facpi volcanic member some of tongues 15 to 260 feet thick. Derivation of name stated.

Named for Maemong River which flows through the Fena-Mapao area in southcentral Guam.

Magee Granite

Precambrian: Southeastern Missouri.

F. G. Snyder and R. E. Wagner, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 13, 14, 85, 87, 89. East of Arcadia, in contact with Silvermine granite. Underlies Lamotte sandstone.

Occurs in St. Francois Mountain area. Magee Hollow is in T. 34 N., R. 5 E., Madison County.

Maggie Creek Flow (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 31, fig. 18. Maggie Creek Flow, sixth from top of formation ["Upper" Basalt] near Middle Fork of Clearwater River, exceeds 200 feet in thickness in most exposures; may be double that figure where it fills depressions in underlying surface near plateau margin. May be equivalent to Johns Creek Flow (new).

Named for its cliff exposures throughout most of length of Maggie Creek. Well exposed near stream level along much of Clear Creek and along east wall of South Fork of Clearwater Canyon where it caps vertical bluff east of Kooskia, Idaho County.

Magic Mountain Gneiss

Age not stated: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Strongly tectonized; consists of interlayered epidote-albite gneiss and epidote-albite, chlorite schist. Grades into Le Conte gneiss (new). Overlies progressively metamorphosed Cascade River schist. Cascade River schist (new) and overlying plate of Magic Mountain gneiss and Spider Mountain schist (new) have been folded into major southeast-plunging synclines and anticlines. Underlies Spider Mountain schist.

Area south of Cascade Pass, northern Cascade Mountains.

Magic Reservoir Rhyolite

Pliocene: Central Idaho.

R. R. Asher, 1965, Idaho Bur. Mines and Geology Pamph. 135, p. 5, 6. Silicic rocks; contain some pumice. Considered to be Pliocene. Name credited to Malde and others (1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—373). [Malde and others described rocks at Magic Reservoir but did not use formal term Magic Reservoir Rhyolite.]

Snake River plain.

Magill Member (of Trowbridge Formation)

Upper Jurassic: East-central Oregon.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 61, 63—64, pls. 1. Predominantly black mudstone similar to dark mudstones of Rosebud Member (new) with sparse and thin intercalated beds of calcareous sandstone and limestone. Thickness about 2,000 feet. Uppermost member of formation. Overlies Officer Member (new); underlies Lonesome Formation.

Type area: NE¼ sec. 32, T. 17 S., R. 28 E., Grant County. Named from Magill Creek.

Magnet Cove igneous complex

Mesozoic: Central Arkansas.

R. L. Erickson and L. V. Blade, 1963, U.S. Geol. Survey Prof. Paper 425, p. 5. One of many silica-poor igneous complexes that intrude the folded and faulted Paleozoic sedimentary rocks of Ouachita geosyncline.

Covers about 4.6 square miles in vicinity of Magnet Cove.

Magueyes Formation (in Río Orocovis Group)

Magueyes Member (of Río Orocovis Formation)

Lower and Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip in Puerto Rico, Nov. 22—24, p. 9. Member of Río Orocovis Formation (new). Consists of intercalated lava, stratified tuff, and tuff breccia.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, pl. 1. Lowermost member of formation. Mainly clinopyroxene-rich tuff and breccia; minor flow rock. Underlies Perchas Member.

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 21—24, pl. 1. Formal proposal of name. Member of Río Orocovis Formation. Consists of two sequences. Lower of amygdaloidal basaltic pillow lava, pyroclastic volcanic breccia, and relatively thin amygdaloidal basaltic pillow lava flows separated by thin layers of greenish-gray reworked tuff. Upper, massive generally basaltic, amygdaloidal pillowed lava flows containing thin lenticular layers of reworked(?) fine tuff, andesitic(?) lava, massive reworked pyroclastic volcanic breccia, and massive basaltic amygdaloidal pillow lava containing many lenticular layers of reworked(?) tuff, some of which are 10 to 15 m thick. Two sequences separated by basalt tuff(?) member. Exposed thickness about 1,560 m. Intertongues with unnamed basaltic member. Underlies Perchas Member. Upper Cretaceous.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C8—C9. Río Orocovis Formation redefined and raised to group rank to include (ascending) Magüeyes, Perchas, Avispa, and Los Negros (new) Formations. Maximum thickness of 1,400 m of Magueyes is exposed in southwestern part of Corozal quadrangle [this report].

The U.S. Geological Survey currently designates the age of the Magüeyes Formation as Lower and Upper Cretaceous on the basis of a study now in progress.

Named for outcrops along, and adjacent to, the Río Orocovis from locality 3 just west of Cerro Magüeyes south to Quebrada El Gato fault, locality 1, Ciales quadrangle. (See pl. 1). Outcrops restricted mainly to southeast corner of quadrangle where member forms central part of northward-plunging faulted syncline.

Mahlac Member (of Alutom Formation)

Oligocene: Guam.

J. T. Stark and J. I. Tracey, Jr., 1963, U.S. Geol. Survey Prof. Paper 403—C, p. C1. Calcareous foraminiferal shale with maximum thickness of 200 feet.

J. I. Tracey, Jr., and others, 1964, U.S. Geol. Survey Prof. Paper 403—A, p. A21—A22, pls. Formal proposal of name. Member is buff to tan or yellowish-tan friable shale; generally weathered in outcrop, and in places contains extremely abundant planktonic Foraminifera. In Fena Valley 3,000 feet north of reservoir, a large exposure 2,000 feet in longest dimension displays folded bedded shale of Mahlac that dips 45° S. Derivation of name stated.

Named for Mahlac River in Mapao area south of Guam.

Mahnomen Formation

Precambrian: Central Minnesota.

R. G. Schmidt, 1963, U.S. Geol. Survey Prof. Paper 407, p. 11, 14—18, 30, 39, pls. 1—8. Oldest formation in Cuyuna stratigraphic sequence. Consists of generally well sorted fine clastic material that is low in iron, and locally includes quartzite lenses near top. Thickness at least 2,000 feet. Underlies Trommald formation (new); base not exposed.

Z. E. Peterman, 1966, Geol. Soc. America Bull., v. 77, no. 10, p. 1031—1044. Rb—Sr dating of middle Precambrian metasedimentary rocks of central and northern Minnesota indicates a loss of radiogenic strontium during regional metamorphism. Samples of Mahnomen Formation yield two distinct isochrons of 1.75 and 1.46 b.y. Samples dated at 1.46 b.y. have undergone intensive alteration by migrating solutions probably at the time the associated iron formations were locally enriched by iron deposits. The 1.75 b.y. isochron defined by unaltered samples most likely dates the metamorphism associated with the Penokean orogeny.

Type area: Mahnomen mines, Cuyuna district, Crow Wing County.

Mahogany Ledge oil-shale bed (in Parachute Creek Member of Green River Formation)

Mahogany oil-shale bed (in Parachute Creek Member of Green River Formation)

Eocene: Northwestern Colorado and northeastern Utah.

W. H. Bradley, 1931, U.S. Geol. Survey Prof. Paper 168, p. 23, pl. 8. Plate 8 shows Mahogany marker near top of upper oil-shale group of Parachute Creek member and "Mahogany ledge" a little lower in the section. Some of the richest oil shale beds weather to look like antique unfinished mahogany. From this resemblance the group of richest oil-shale bed in Green River formation is known as "mahogany ledge."

W. B. Cashion, 1959, U.S. Geol. Survey Bull. 1072, p. 761, pls. 54, 55, 57. An extensive oil-shale bed 5 to 10 feet thick, at base of Parachute Creek member.

J. R. Donnell, 1961, U.S. Geol. Survey Bull. 1082—L, p. 855. Composed of rich oil shale. Unit called Mahogany ledge at outcrop and Mahogany zone in subsurface. Within Mahogany ledge or zone is a persistent thin unit of exceedingly rich oil shale called Mahogany bed. Bed is useful key for stratigraphic reference or structural mapping.

Mahon Glauconite Lentil (in Cook Mountain Formation)

Tertiary: North-central Louisiana.

C. O. Durham, Jr., 1964, Louisiana Geol. Survey Geol. Bull. 41, p. 18—26. A glauconitic lentil at top of formation. Name credited to Jones (1962, unpub. thesis, pl. 3).

Type locality and derivation of name not given.

Main Canyon Formation (in Gentile Valley Group)

Pleistocene, upper: Southeastern Idaho.

R. C. Bright, 1967, Tebiwa, v. 10, no. 1, p. 1—5. Name applied to the light-colored, practically horizontal, unconsolidated sediments that are conspicuously exposed in southern Thatcher Basin. Consists predominantly of beds of gravel, sand, silt, and clay, most of which are marly, but includes sporadic marl beds and a few intercalated tufa and travertine deposits. One marl bed, about 10 feet thick, is exposed almost continuously around flanks of Mound and Gentile Valleys at an altitude of about 5,200 feet. Some clay beds are carbonaceous and some thin peat beds are present. At type section exposed part of formation is 320 feet thick. Base of formation unknown but well data indicate a thickness of more than 600 feet in center of basin north of Thatcher. Underlies Gem Valley Volcanics (new). In some areas underlies Niter Loess. Youngest beds occur no higher than 5,445 feet altitude in Mound and Gentile Valleys where they form a prominent terrace. Fossils extremely abundant.

Type section: Sequence exposed in roadcuts on north side of Main Canyon dugway in SE¼ sec. 7 and adjacent SW¼ sec. 8, T. 12 S., R. 4 E., Preston quadrangle. Type area: East of Bear River in Mound and Gentile Valleys. Name taken from Main Canyon, a major tributary to Mound Valley, in extreme northeastern Franklin County. Formation continuously exposed in low rolling hills along flanks of Mound and Gentile Valleys, and on east side of Bear River and on the west side of Trout Creek north of Thatcher.

Makoti Drift

Pleistocene: North Dakota.

W. A. Pettyjohn, 1967, North Dakota Geol. Survey Misc. Ser. 30 (Guidebook 18th Ann. Field Conf. Friends of the Pleistocene), p. 126—127. Makoti drift sheet consists mainly of gravelly and sandy clay till. Very similar to older Blue Mountain drift sheet, but the Makoti drift sheet generally contains more boulders and less sand and lignite chips. Makoti, Ryder, and Martin moraines are nearly same age.

Makoti end moraine is well developed 4½ miles south of village of Makoti where it blocks Hiddenwood Lake Valley. Distal end of Makoti drift sheet trends northwest-southeast across a 10-mile stretch in Ward County.

Makushin Volcanics

Pliocene(?) and Pleistocene: Alaska.

Harald Drewes and others, 1961, U.S. Geol. Survey Bull. 1028—S, p. 634—641, pl. 75. Basalt and andesite lava, pyroclastic rocks, and minor sedimentary rocks; basalt plugs, sills, and dikes. Thickness several thousand feet. Overlies Unalaska formation and granodiorite plutons with slight angular unconformity; locally unconformably capped by basaltic flows and pyroclastic rocks.

Forms Makushin Volcano, a broad volcanic dome more than 6,000 feet high and 10 miles wide, Unalaska Island.

Malibu Junction Member (of Conejo Volcanics)

Tertiary: Southern California.

B. A. Blackerby, 1965, Dissert Abs., v. 25, no. 12, pt. 1, p. 7199. Named in discussion of Conejo Volcanics in Malibu Lake area. The Malibu Junction member corresponds to the Boney member of Sonnemann (1956).

Malibu Lake area is in western Santa Monica Mountains and includes parts of Point Dume and Thousand Oaks quadrangles, Los Angeles County.

Malo Breccia

Upper Cretaceous: Central Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 12, 13, 14. Volcanic breccia and agglomerate. In some areas interfingers with "Ralate" Formation. Locally overlies Upper Cretaceous Robles Formation and in some areas contains fault wedge of Robles Formation(?). Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

R. P. Briggs, 1967, U.S. Geol. Survey Bull. 1254—A, p. A23—A26. Largely pyroclastic breccia. Average breccia block is about 15 cm in diameter, but blocks 80 cm in longest dimension occur. Most are buff, dark-reddish-brown, dark-gray, and gluish-gray porphyritic lava, with fine feldspar phenocrysts. Matrix is gray to bluish gray where fresh, and is composed chiefly of feldspar crystals and crystal fragments, mostly in the very coarse and coarse sand size ranges. Breccia is massive in character; individual strata or lenses within formation may exceed 200 m in thickness, but for most part thickness is measured in tens of meters. Lenses of andesitic lava with moderate to abundant feldspar phenocrysts present locally at base and middle part of formation and are as much as 100 m thick. Believed to be thickest, at least 1,300 m, in area 2 km west of Cerro El Malo, but maximum thickness not known, because base is not exposed there. Thickness in this area suggests that this was the volcanic center of Malo accumulation. To east interfingers with Robles Formation and ultimately pinches out between Robles and overlying Cariblanco Formation in Barranquitas quadrangle. In most of outcrop overlain by Cotorra Tuff (new). To west and perhaps to north and south, interfingers with or grades into tuff and volcanic sandstone of Tetuán and Vists Alegre (new) Formations. No fossils. Probable Late Cretaceous.

Type locality: 37,830 N., 153,830 E., (Puerto Rico rectangular coordinate system in meters) on a foot trail along east flank of Cerro El Malo. Named for Cerro El Malo, a peak on the Cordillera Central in the southeast-central part of Orcovis quadrangle.

Malta Gravel

Pleistocene: Central Colorado.

Ogden Tweto, 1961, U.S. Geol. Survey Prof. Paper 424—B, p. B—134 (fig. 56.2), B—135. Name applied to gravel that fills valleys of tributaries of Arkansas River. This gravel is the "high terrace gravel" of earlier reports. Malta gravel is buff, massive, coarse, and dirty. Shows little stratification except that imparted by shingled arrangement of cobbles and by small lenses of sand or silt. No fossils; traces of humus present locally. Thickness varies; shafts and drill holes reveal as much as 300 feet of gravel.

Named for railroad station of Malta, 3 miles southwest of Leadville, Lake County.

Maltby Lakes Volcanics

Ordovician(?): Southwestern Connecticut.

C. E. Fritts, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—426; GQ—427. Mapped in Ansonia and Milford quadrangle, respectively. Medium- to fine-grained metavolcanic rocks of mafic to intermediate composition; minor metasedimentary rocks and intrusive metadiabase similar to Allingtown Metadiabase (new). Fine-grained greenish-gray phyllitic schist similar to Derby Hill Schist. Pyroclastic schist and meta-agglomerate or metatuff.

C. E. Fritts, Dec. 1965, U.S. Geol. Survey Bull. 1244—A, p. A30—A32. Formal proposal of name. Burger (1962, unpub. thesis) made threefold division of Milford Chlorite Schist. He called a southeastern unit Savin Schist (new). This unit extends southwestward across northwest Woodmont quadrangle and into Milford quadrangle where it is interpreted as Derby Hill Schist. Burger's central unit, Allingtown Formation, consists of abundant metadiabase intruded into phyllitic metasedimentary rocks. Unit extends southwestward into southeast corner of Ansonia quadrangle [this report] and into Milford quadrangle, where the metasedimentary rocks are mapped separately as Oronoque Member of Derby Hill Schist. Burger's northwestern unit, which includes rocks mapped by Holdway (unpub. thesis) near Maltby Lakes Reservoirs in New Haven quadrangle, consists mainly of metavolcanic rocks but contains subordinate metasedimentary rocks and minor intrusive metadiabase similar to that of Burger's Allingtown. This northwestern unit of predominantly metavolcanic rocks also extends southwestward into Ansonia and Milford quadrangles where it lies above Derby Hill Schist and unconformably below Wepawaug Schist. In present report name Maltby Lakes Volcanics is used for the metavolcanic rocks and Allingtown Metadiabase only for intrusive metadiabase or metabasalt which is probably younger than both Derby Hill Schist and Maltby Lakes Volcanics. Unit contains distinctive basal pyroclastic schist, characterized by numerous lapilli and bomblike masses of metabasalt, but consists mainly of thick sequence of greenschists and amphibolites. Contains minor amounts of metasedimentary schists and impure limestones. Stratigraphic position of Maltby Lakes Volcanics is comparable to Barnard Volcanic Member of Mississiquoi Formation (Doll and others, 1961). Basal pyroclastic schist well exposed at type locality, herein designated, and was mapped by Holdway (unpub. thesis) and Burger (unpub. thesis) as separate unit. Probably Ordovidian(?).

H. R. Burger, 3d, Connecticut Geol. and Nat. History Survey Rept. Inv. 4, p. 4 (fig. 3), 9—11. Maltby Lakes Volcanics in New Haven quadrangle includes all rocks exposed in vicinity of Maltby Lakes and Yale Golf

Course, and along Wilbur Cross Parkway. Formation contains six distinguishable units which are mainly metavolcanics although some include metasedimentary material. Total thickness about 3,250 feet. Overlies Allingtown Volcanics and underlies Wepawaug Schist. No complete section of unit in New Haven quadrangle. Standard section designated. Rock sequence mapped as Oronoque Member of Derby Hill Schist by Fritts (1965) in southwestern part of Ansonia quadrangle and eastern part of Milford quadrangle does not correlate with type Oronoque Member. Upper part of this sequence should be designated as unit 1 of Maltby Lakes volcanics, and the lower part should be included in Allingtown Volcanics.

Type locality: Maltby Lakes Reservoirs near State Route 34 in New Haven quadrangle. Standard section: Along Connecticut Route 152 north and south of Boston Post Road in Ansonia quadrangle. Good exposures appear along entire extent of this road, and all six units seen in New Haven quadrangle are present in normal sequence.

Mameyes Formation

Upper Cretaceous: North-central Puerto Rico.

A. E. Nelson and W. H. Monroe, 1966, U.S. Geol. Survey Bull. 1221—C, p. C5—C6, pl. 1. A sequence of Upper Cretaceous volcanic rocks, consisting mostly of andesite lava that conformably overlies and in places intertongues with part of Vista Alegre Formation (new). Thickness 750 to 1,100 m. Extends from west edge of map area [Florida quadrangle] eastward in arcuate pattern to Damián Arriba fault where it is in juxtaposition with younger Pozas Formation. Underlies Tetuán Formation.

Type locality: Along jeep trail heading west from Cerro Palo de Café between coordinates 46,800—135,620 and 46,920—135,808, Florida quadrangle. Named for exposures in Barrio Mameyes Arriba.

Mammoth Cave Limestone Megagroup

Mississippian: Central North America.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Name Mammoth Cave Limestone is used informally for an almost uninterrupted deposit of relatively pure limestone in west-central Kentucky assigned formally to several formations lying above Warsaw Formation (approximately at Osagian-Meramecan boundary) and beneath Big Clifty Sandstone (middle Chesterian). Proposed herein to extend name as mammoth Cave Limestone Megagroup to entire body of Mississippian carbonate rocks of midwest lying above clastic wedge of Knobs Megagroup (new) and beneath lowest well-developed sandstone or shale of late Meramecan or Chesterian age. Megagroup extends eastward into Appalachian area where it pinches out between Knobs Megagroup clastics (Pocono) and younger clastic units such as Mauch Chunk. It is the Madison or Redwall Limestone of the Cordillera. Toward south some units in megagroup become very cherty, but it is only in and near the Ouachitas that siliceous nature of much of Hunton-Knobs-Mammoth Cave sequence might require replacement of these megagroups by another classification. Upper surface of Mammoth Cave Megagroup in any area is base of lowest strongly developed sandstone or shale of Meramecan, Chesterian, or Pennsylvanian age. In Illinois region surface becomes younger toward southeast. In Iowa surface is at base of sandstones of St. Louis age; it is at base of Ste. Genevieve Formation in Illinois north of Decatur and Mattoon; it is at base of Bethel Sandstone of early Chesterian age in southeastern Illinois and most of Indiana outcrop; it is at base of Big Clifty Sandstone of middle Chesterian age in most of Kentucky part of Illinois Basin. In Black Warrior Basin and southern part of Appalachian Basin top of megagroup is at base of Hardinsburg (Hartselle or "Pencil Cave") Formation and at base of Pennington Formation. Megagroup is nearly 2,000 feet thick in southern Illinois; in east-central Illinois, it is a little more than 100 feet thick. Sequence of alternating sandstone-and-shale and limestone-and-shale formations of late Meramecan and Chesterian age that lies above Mammoth Cave Megagroup is herein named Pope Megagroup. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Mammoth Mine basalt

Age not stated: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 35. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 3.1 ± 0.1 m.y.

Near Old Mammoth mine in Mount Morrison quadrangle.

Mammoth Mountain quartz latite

[Pleistocene, upper]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 37, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon date 0.37 ± 0.04 m.y. Figure 12 mentions quartz latite of Mammoth Mountain.

Mammoth Mountain is in southeastern part of Devils Postpile quadrangle.

Manatí Formation

Upper Cretaceous (Campanian): East-central Puerto Rico.

Guillermo Otalora, 1961, Dissert. Abs., v. 22, no. 5, p. 1583. Overlies Ildefonso formation. Includes Botijas limestone and Farallon andesite (new) members. The Manatí was deposited in shallow, restricted environment. It forms structural block, possibly emplaced in Barranquitas area by westward movement along Botijas-Quebradillos fault.

Guillermo Otalora, 1964, Am. Jour. Sci., v. 262, no. 6, p. 726–734. Discussion of zeolites and related minerals in Cretaceous rocks of east-central Puerto Rico. Manatí Formation, 3,000 feet thick, occurs only in northern part of Barranquitas quadrangle where it is separated from rest of area by major fault. Consists of Botijas Limestone Member at base and Farallon Andesite Member. Campanian.

Barranquitas quadrangle.

Mangas Basalt

Tertiary: West-central New Mexico.

M. E. Willard, 1959, New Mexico Geol. Soc. Guidebook 10th Field Conf., p. 96 (fig. 5), 98, 99. Shown in figure 5 as overlying Datil formation and underlying Santa Fe group. In field trip area [Catron County] basalts and basaltic andesites attain maximum thickness in Mangas Mountains. They are also exposed in Bear Mountains and there were named La Jara Peak member of Datil by Tonking. In general, the Mangas-Bear Mountains basalts overlie unconformably all older volcanic rocks and are unconformably overlain by sediments of Santa Fe group-Gila conglomerate type. Flows of Mangas-type basalt, although recognized at many places in Catron County and adjacent areas, never formed a continuous sheet over entire region.

R. H. Weber, 1963, New Mexico Geol. Soc. Guidebook 14th Field Conf., p. 135, 137. Tonking (1957) subdivided Datil into (ascending) Spears, Hells Mesa, and La Jara Peak Members. Willard (1959) correlated La Jara Peak Member with Mangas basalt, a post-Datil sequence. This interpretation is accepted herein, and if the correlation is correct there is little question that the La Jara Peak Member should be excluded from the Datil.

Manicaboa Formation

Upper Cretaceous: Puerto Rico.

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 45—49, pl. 1. Consists entirely of water-laid clastic debris of volcanic origin. Approximate thickness 2,140 m in southwestern part of Ciales quadrangle. Conformably overlies Avispa Lava Member of Río Orocovis Formation. Intertonguing relation between lower part of Manicaboa and upper part of Avispa indicated. Possibility that tongue of volcanic breccia that seems to be a part of the Manicaboa may be lens within Avispa Member. Conformably underlies Minguillo Lava and Blacho Members of Pozas Formation (all new). Contact sharp at most places. Locally unconformable. Stratigraphic relations to associated rocks suggest Campanian to Maestrichtian(?) age. Positive data for dating not available.

Named for exposures along Río Toro Negro east and west of mouth of Quebrada Manicaboa. Restricted mainly to southwest quarter of Ciales quadrangle.

Manly Lake Beds

Pleistocene: Southern California.

J. H. Maxson, 1963, Death Valley Origin and Scenery; Bishop, California, Chalfant Press, p. 56. Listed with named units in outline of geologic history of Death Valley.

Mannsville Dolomite

Upper Devonian or Lower Mississippian: South-central Oklahoma.

J. P. Shannon, Jr., 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 1, p. 18—19, 24 (fig. 14), 25 (fig. 15). At type section consists of 23 feet of light-brown porous glauconitic dolomite, glauconitic yellow-brown cherty dolomite and dolomite limestone, and brecciated chert with glauconitic dolomite. Overlies Sylvan Shale and underlies Woodford Shale at type section. Oldest unit of Kaskaskia sequence in study area. Has been included in Woodford by some workers and also termed "Misener(?) facies" by others. Spores suggest Late Devonian or Early Mississippian age.

Type section: NW¼NE¼ sec. 20, T. 2 S., R. 4 E., Johnston County, on Goddard Ranch, 1 mile southeast of lake on Oil Creek. Also exposed on Turkey Creek, sec. 35 T. 4 S., R. 4 S. Name derived from town of Mannsville, about 2 miles northwest of Turkey Creek outcrop.

Manorkill Formation

Manorkill Member (of Gilboa Formation)

Middle Devonian: Southeastern New York.

F. W. Fletcher, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 31 (fig. 4), 32—34. Defined as sequence of predominantly red sandstone and shale that lies between Potter Hollow and Grand Gorge (new) Members. These strata contain the tree-bearing sandstones of Gilboa that crop out at level of Schoharie reservoir. Thickness 151 feet at type locality; 220 feet in Durham quadrangle but thickens to southeast. Thins and wedges out southwestward from Schoharie Valley.

F. W. Fletcher, 1967, New York State Geol. Assoc. Guidebook 39th Ann. Mtg., p. C 3—C 7. Referred as formation. Red beds are dominant rock type and consist of brownish-gray to grayish-red shales, claystones, siltstones, and fine-grained sandstones; commonly exceed 50 feet in thickness. Formation about 620 feet thick and forms much of Catskill front. Lower boundary is drawn at base of 37 feet of red shale and siltstone that overlie the gray sandstones of Potter Hollow Formation. Upper contact marked by termination of 80 feet of red shale, claystone, and siltstone. Field tracing of Laurens Sandstone of Tully Formation into Schoharie Creek from west has demonstrated that Manorkill is equivalent of the Laurens. Underlies Gilboa Formation.

Type section: Manorkill Creek adjacent to Schoharie Reservoir, Druham quadrangle.

Maple Formation (in Oquirrh Group)

Pennsylvanian (Atokan-Morrowan): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 11, pl. 5. Name applied to lower 3,200 feet of Oquirrh formation [group]. Lower part of Maple formation is synonymous with West Canyon member of Oquirrh (Nygreen, 1958). Underlies "White Pine" formation; overlies Manning Canyon formation. Consists of cyclical sandstones and limestones. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. Name invalid as either name now extant (Hall Canyon Member or Bridal Veil Falls Member) is utilitarian.

Type section: In secs. 22 and 27, T. 4 S., R. 3 W. Section begins in Maple Flat and traverses north northeast up spur opposite Maple Canyon, Bingham mining district.

Maple Mountain Formation (in Hovey Group)

Silurian: Northeastern Maine.

Louis Pavlides, 1964, U.S. Geol. Survey Bull. 1194—B, p. B1—B5. Name applied to all rocks of Hovey Group above Dunn Brook Formation. Estimated thickness about 6,000 feet. Lenses of graywacke and conglomeratic graywacke probably several hundred feet thick occur at base of formation. Above basal clastic rocks is sequence about 5,000 feet thick of gray-green and green slate containing thin interbeds of graywacke and micaceous quartzite. Near top of this sequence are lenticular manganese- and iron-bearing beds. About 1,000 feet of gray-green and green slate occurs above the manganese- and iron-bearing beds.

Named for Maple Mountain, Howe Brook quadrangle, Aroostook County, where discontinuous section of part of formation is exposed.

Maravillas Formation

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 12, 13, 15. Chiefly thin-bedded limey tuffaceous sandstone. Includes Sabana Hoyos Limestone and San Diego Tuff Members. In some areas intruded by diorite porphyry dikes. Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B5 (fig. 2), B16—B18. Formal proposal of name. Defined as unit of well-bedded volcanic sandstone and siltstone, with some pyroclastic rocks, lying above poorly bedded Achiote Conglomerate (new) and below poorly bedded Coamo Formation. Type locality contains about 80 m of massive brownish-gray coarse-grained lithic tuff, overlain by about 300 m of medium- to thick-bedded volcanic siltstone and sandstone with common hornblende-feldspar porphyry dikes and sills. A thick lens of brownish-gray lapilli tuff and coarse-grained tuff occurs at base of formation in several areas and may be continuous; however, it could not be mapped south of Cerro de Punta fault. Thickens from type locality to at least 560 m, a few kilometers to south. The lapilli tuff and coarse-grained tuff lens is commonly 50 to 80 m thick but is at least 200 m thick east of Quebrada Achiote. Type locality stated.

Type locality: On route 143 east from Cerro Maravillas between (139,450 m E.; 35,360 m N.) and (140,530 m E.; 35,180 m N.). Named after Cerro Maravillas on the Cordillera Central.

Marble Canyon igneous complex

Age not stated: Western Texas.

T. E. Bridge, 1964, (abs.) Geol. Soc. America Spec. Paper 82, p. 19. Consists of five rock types (from center out) coarse-grained syenite; coarse-grained green monzonite; medium-grained gray monzonite; narrow border of olivine gabbro; and small rhyolite dikes which cut the gabbro and monzonites. Intrusion surrounded by bleached zone of contact 150 to 300 feet wide. Exposed contact zone involves Permian Hueco and Bone Springs Formations.

In Marble Canyon, Culberson County.

Marble City Member (of Quarry Mountain Formation)

Upper(?) Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 47—52, pls. A, B. Name proposed for upper limestone part of Quarry Mountain Formation (new). Predominantly pale-gray to pinkish-gray limestone that weathers medium to dark gray. Thickness 63 feet at type locality; as much as 160 feet in core hole. Overlies Barber Member (new); unconformably overlain by various Devonian and younger strata—Frisco Formation, Sallisaw, Sylamore Sandstone Member of Chattanooga Formation, or "Boone" Formation.

Type locality: In quarry of St. Clair Lime Co., about 1½ miles north of Marble City, SE¼SE¼NE¼ and NE¼NE¼SE¼ sec. 14, T. 13 N., R. 23 E., Sequoyah County.

Marble Creek Orthogneiss

Paleozoic(?): Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordilleran in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. Vol. 8, p. 112. In contrast to Shuksan Suite, the Skagit Metamorphic Suite contains a variety of metamorphosed intrusives. Metamorphosed acidic intrusives comprise predominantly trondhjemitic orthogneiss (including a larger elongate stock, Marble Creek Orthogneiss), small bodies of leucotrondhjemitic orthogneiss, and thin sills or dikes of usually gneissose, trondhjemitic metaporphyries. A larger elongate stock of leucotrondhjemitic gneiss, Haystack Creek Gneiss (new), was intruded in a crystalline state during a fairly late stage of metamorphism. Another larger semiconcordant leucotrondhjemite body (Alma Creek Leucotrondhjemite) was intruded near the end of the metamorphism; it is igneous but shows incipient adjustment to the facies of the surrounding schist.

Type locality and derivation of name not stated.

Marble Hill Hornblende Schist

Lower Paleozoic: Northern Georgia.

W. M. Fairley, 1965, Georgia Geol. Survey Bull. 75, p. 30–36. Calc-schists and biotite-hornblende schists. Thickness about 300 feet. Overlies Murphy Marble and underlies Andrews Schist. Included in Roan Gneiss by Bayley (1928, Georgia Geol. Survey Bull. 43).

Named from exposures near town of Marble Hill, Tate quadrangle.

Marcou Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 9, 10. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Marcou flow listed as example of a stage IV flow in which the edge of the flow is visible, the surface rough and broken, and lava tops present but displaced by frost. Spatter cones and pressure ridges are prominent features.

Flow issued from Marcou Crater.

Maribel Shale Member (of Eagle Ford Formation)

Cretaceous: Northeastern Texas.

C. L. McNulty, Jr., 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 375—379. Term proposed for the shale that separates Bells Sandstone Member (new) from the Austin Formation. Maribel is medium- to dark-gray laminated shale with silty and (or) jarositic partings. The Maribel is a northward- and eastward-thinning tongue of the Eagle Ford lithosome of Grayson and Collin Counties. Member loses its identity toward the south as the underlying Bells Member grades laterally into shale. Because of the incompleteness of well-exposed sections and the considerable variation in properties along the outcrop multiple sections are presented for typic definition. Thickness at section 2, 6 feet; at section 3, 2½ feet; and at section 4, 21½ feet. Name replaces Lake Crockett Shale Member of Lake Crockett Formation (McNulty, 1954) which names are abandoned.

Name Maribel taken from a schoolhouse of that name which is 5.375 miles, airline, due east of the county courthouse in Sherman, Tex., about 200 yards south of U.S. Highway 82, and 0.25 mile east of Blue Creek. Schoolhouse is on Austin Formation, and nearest exposure of the Maribel Member is about 0.25 mile across and on the north side of Highway 82 in the channel of Blue Creek.

Marinette Quartz Diorite

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1962, [Abs.] Lake Superior Geology Inst. 8th Ann. Mtg., May 10—12 (Michigan Coll. Mining and Technology), p. 5. Discussion of a Precambrian pluton near Pembine, Wis. Nine rock units mapped within some 350 square miles of the Precambrian granitic and metamorphic complex. Relative age-relationships are suggested primarily from study of xenoliths, as follows (ascending): Quinnesec Formation, biotite gneiss, Marinette Quartz Diorite, Twelve Foot Falls Quartz Diorite (new), metagabbro sills, Hoskin Lake Granite (new), Newingham Granite, Amberg Granite (new), and diabase dikes.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. In Pembine-Amberg area, eight rock units younger than Quinnesec Formation are recognized and mapped. Five of these units are named. Marinette Quartz Diorite is oldest named unit. Younger than unnamed biotite gneiss; older than Twelve Foot Falls Quartz Diorite (new). Name credited to Prinz (1958, unpub. thesis) who studied Niagara area and listed following igneous sequence: Quinnesec Formation (oldest), Marinette Quartz Diorite, Hoskin Lake Granite (new), gabbro sills, and diabase sills.

J. A. Cain, 1964, Michigan Acad. Sci., Arts and Letters, Papers, v. 49, p. 81—103. Described in Pembine area where it consists of three main types: coarse-grained schistose, medium-grained massive, and fine-grained massive. Younger than Dunbar Gneiss (new); older than Twelve Foot Falls Quartz Diorite.

W. C. Prinz, 1965, U.S. Geol. Survey Bull. 1224—A, p. A53—A54. Typical Marinette Quartz Diorite is medium grained, massive or slightly foliated, and consists of 40 to 50 percent oligoclase, 0 to 20 percent potassium feldspar, 10 to 30 percent quartz, and 20 to 30 percent prochlorite, biotite, or hornblende. Intruded by Hoskin Lake Granite and intrudes metabasalts of Quinnesec Formation. Age not known with certainty.

Named for Marinette County where it forms a pluton of about 12 square miles. Good exposures occur south of Niagara, Wis., in NW¼ sec. 22 and SW¼ sec. 15, T. 38 N., R. 20 E., and along Chicago, Milwaukee, St. Paul and Pacific Railroad in S½NE¼ sec. 18, T. 38 N., R. 20 E.

Marlow Mountain Rhyolite (in Middlebrook Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Middlebrook group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Marlow Mountain is in T. 32 N., R. 5 E., Madison County.

Marshall Pass Glaciation

Holocene: Alaska.

W. H. Coulter and E. B. Coulter, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—142. Earliest episode of glaciation represented by mappable deposits is named Marshall Pass glaciation. Older than Worthington glaciation (new). Recent.

The U.S. Geological Survey now uses term Holocene in preference to term Recent.

Named for deposits north of Deserted Glacier in Marshall Pass area at head of Heiden Canyon, Valdez (A—5) quadrangle, in Gulf of Alaska region.

Marsh Creek Breccia Member (of Talkeetna Formation)

Lower Jurassic: Southern Alaska.

R. L. Detterman and J. K. Hartsook, 1966, U.S. Geol. Survey Prof. Paper 512, p. 13—14, pls. Dominantly dark-green to green volcanic breccia. Much of breccia has tuff matrix and is actually a tuff breccia. Bedding not readily discernible in many of the massive units that range from 40 to as much as 1,100 feet thick. Thickness at type section 3,350 feet. Basal member of formation. Underlies Portage Creek Agglomerate Member (new). Overlies unnamed metamorphic rocks.

Type section: Along south shore of Tuxedni Bay, Cook Inlet region.

Marsh Creek Formation

Upper Jurassic and Cretaceous: Northern California.

I. P. Colburn, 1964, Sacramento Geol. Soc. Guidebook to Mount Diablo Field Trip, June 6, p. 10—17, pl. 3, geol. map. A sequence of alternating sandstones and mudstones that total over 30,000 feet thick at Mount Diablo. Earlier workers subdivided this sequence of strata into as many as five formations, but present author found only a few beds that could be considered distinctive marker beds and these were not distinctive enough to be considered formations. Strata exposed at base of column are lithologically unlike those exposed at top, but transition takes place over thick stratigraphic interval; hence, author believes this column of strata should not be subdivided and that none of the formation names previously applied at Mount Diablo to this sequence of strata fit the lithologic boundaries herein defined. Base not exposed and lower boundary drawn at fault contact between this formation and Franciscan rocks that make up central core of Mount Diablo, Underlies Deer Valley formation (new) on northeast side of Mount Diablo. On northwest side of Mount Diablo, the "Domengine" rests on the Marsh Creek with angular discordance of about 10°. In Riggs Canyon syncline, Meganos formation rests with apparent angular discordance of 5° on beds of Marsh Creek. In Black Hills region beds of "San Pablo" formation rest on Marsh Creek strata with apparent concordance.

Type section: On north flank of Mount Diablo Contra Costa County. Base of section is at Mount Diablo mine at boundary of core of mountain (sec. 29, T. 1 N.,.R. 1 E.), and top of section is near old Marsh ranchhouse (NW cor. sec. 34, T. 1 N., R. 1 E.). Marsh Creek runs almost entire length of section, and best exposures of unit are in creek bottom. Formation completely encircles Mount Diablo and extends to southeast along axis of Diablo Range, beyond area of above report.

Marsh Creek Sandstone Member or **Tongue** (of Lee Formation)

Lower Pennsylvanian: Southeastern Kentucky.

R. A. Loney, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—615. Marsh Creek Sandstone Tongue of Lee Formation mapped in Hollyhill quadrangle, McCreary and Whitley Counties. Consists mostly of light-gray quartzose fine- to medium-grained thickly crossbedded sandstone that weathers pink, brownish yellow, and brown. Locally coarse grained and sparsely conglomerate. Upper and lower few feet commonly fine grained, thinly ripple bedded, and platy. Contains thin shale lenses locally. Thins southward and pinches out in Marsh Creek valley north of Clear Creek and probably south of Pleasant Run. Tongue is conformable with shaly units of Breathitt Formation immediately above and below. Thickness 0 to 150 feet. Tongue is not shown on Cumberland Falls side of the border with Hollyhill, but may be equivalent to a mapped sandstone in the Lee in this approximate stratigraphic position farther north in Cumberland Falls quadrangle.

R. W. Tabor, 1967, U.S. Geol. Survey Geol. Quad. Map. GQ—616. Marsh Creek Sandstone Member mapped in Williamsburg quadrangle, Whitley County. Thickness 40 to 80 feet. Overlies unnamed shale in Lee Formation. Underlies River Gem (Swamp Angel) coal bed in Breathitt Formation.

Type section (tongue): Between about one-fourth and one-half mile east of Marsh Creek along the east-trending road that runs past New Liberty Church, Hollyhill quadrangle.

Marslandian Age

Miocene, lower: Western North America.

R. W. Wilson, 1960, Kansas Univ. Paleont. Contr., Vertebrata, art. 7, p. 1—92. Discussion of age and correlation of early Miocene rodents and insectivores from northeastern Colorado. A sparse Marslandian (late Early Miocene) age has been known from lower part of Pawnee Creek Formation of northeastern Colorado for over 50 years. At one locality in Martin Canyon area of Logan County, Quarry A has produced a number of fragmentary specimens of insectivores, lagomorphs, and rodents. These are the subject of present report. Figure 5 shows three charts showing some proposed correlations of North American provincial ages with European standards. The Marslandian is listed on a chart credited to

Schultz and Stout, Stout, from various sources. The Marslandian is placed in the lower part of the Hemingfordian below the Sheepcreekian (new) and above the Arikareean and correlated with part of the European Vindobonian. Quarry A occurs in the Marslandian according to Schultz and Stout. As shown in figure 7, present author places Quarry A and Marsland in the Arikareean. The Marslandian is placed above the Harrisonian (new) and below the Sheepcreekian.

C. B. Schultz and T. M. Stout, 1961, Nebraska Univ. State Mus. Spec. Pub. 2, p. 8 (fig. 3). Marslandian shown on correlation chart of Miocene and Pliocene of the central Great Plains. Placed in lower half of Hemingfordian between Sheepcreekian above and Arikareean below.

M. C. McKenna, 1965, Am. Mus. Novitates no. 2228, 21 p. Wilson (1960) introduced without definition the time terms Harrisonian, Marslandian, Sheepcreekian, and Mascallian, and redefined the Arikareean and Hemingfordian Land-Mammal Ages by moving the boundary between these two time units to include in the Arikareean "Quarry A" in northeastern Colorado and certain correlated deposits. The time terms Marslandian and Sheepcreekian, used without definition by Schultz and Stout (1961), are not equivalent to the inadequately defined Marslandian and Sheepcreekian of Wilson.

The Marsland Formation was named for its occurrence southwest of Marsland along the Niobrara River, in Box Butte County, Nebr.

Martin Drift

Martin-Luverne Drift

Pleistocene: North Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 12, 16 (table 1). Has been shown that Luverne Drift is equivalent to Martin Drift. Shown on table 1 as Martin-Luverne.

J. P. Bluemle and others, 1967, North Dakota Geol. Survey Bull. 51, pt. 1, p. 32, pl. 3. Drift of Martin phase covers about 15 percent of Wells County. It consists of Martin end moraine and large outwash plain in northwestern part of County.

Name Martin was first applied to Martin end moraine by Lemke and Colton (1958, North Dakota Geol. Survey Misc. Ser. 10) for the village of Martin in northeast Sheridan County.

Marye Sand Member (of Gallup Sandstone)

Upper Cretaceous: Northwestern New Mexico (subsurface).

F. F. Sabins, Jr., 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 2, 198, 199 (fig. 5). Bisti stratigraphic trap consists of three individual bar sands called Marye, Huerfano, and Carson sands. Earlier writers have designated these sands by numerical or alphabetical "zones," but these systems do not conform with normal stratigraphic procedure nor with industry practice at Bisti. The Marye, Huerfano, and Carson sands are herein defined as individual members of Gallup Sandstone. The three bar sands are referred to collectively as "Bisti bar complex." Marye Sand Member, which is interval 4,900 to 4,930 feet in type well, grades downward into a thin Low SP interval and is overlain with sharp contact by "Upper" Mancos Shale. Marye bar sand lies above Huerfano bar sand.

Type well: British America No. B—4 Marye (NE¼SE¼ sec. 35, T. 26 N., R. 13 W.), Bisti field, San Juan County.

Marysville Till

Pleistocene (Wisconsin): West-central Ohio.

J. L. Forsyth, 1967, Ohio Div. Geology Rept. Inv. 66 (map only). Three tills recognized in area (ascending): Pickrelltown, Bellefontaine, and Marysville. Marysville is very clay rich, with few pebbles. It is only one of the three tills that can be identified without reference to its soils. Till is present both as ground moraine and end moraine.

Named for Marysville, about 7 miles southeast of East Liberty quadrangle.

Marywood Member (of Ironton Sandstone)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 26 (fig. 9), 37. Name proposed for sandstone overlying Fox Valley Member (new) and underlying Mooseheart Member (new). Thickness 10 to 50 feet. Occurs between 1,120 and 1,168 feet.

Type well: Miller-Batavia No. 3, sec. 22, T. 39 N., R. 8 E., Kane County. Named for hamlet of Marywood, 4 miles south of type well.

Mascallian Age

Miocene: Western North America.

R. W. Wilson, 1960, Kansas Univ. Paleont. Contr., Vertebrata, art. 7, p. 16 (fig. 7). As shown on chart, the Mascallian is placed in upper part of the Hemingfordian above the Sheepcreekian (new) and below the Barstovian.

M. C. McKenna, 1965, Am. Mus Novitates, no. 2228, p. 16. Wilson (1960) introduced the time terms Harrisonian, Marslandian, Sheepcreekian, and Mascallian, and redefined the Arikareean and Hemingfordian Land-Mammal Ages by moving the boundary between these two time units to include in the Arikareean "Quarry A" in northeastern Colorado and certain correlated deposits.

Mashamoquet Brook till

Age not stated: Northeastern Connecticut.

Fred Pressl, Jr., 1966, U.S. Geol. Survey Prof. Paper 550—D, p. D89—D93. Two tills—upper Mashamoquet Brook and lower Mashamoquet Brook—described. Possible that both Lake Chamberlin Till and Hamden till described by Flint (1961) in southern Connecticut are younger than the lower Mashamoquet till, and perhaps are to be correlated with the upper Mashamoquet Brook till.

Present in Mashamoquet Brook valley, in town of Pomfret, southeast corner of Eastford quadrangle, about 1.4 miles northwest of Abington.

Mashel Formation

Miocene: Western Washington.

K. L. Walters, 1965, U.S. Geol. Survey Bull. 1224—A, p. A55—A59. A sequence of unconsolidated fluvial and lacustrine deposits. Consists of predominantly fine-grained upper part and a coarse-grained lower part. Maximum observed thickness about 225 feet. Total thickness may be in excess of 500 feet. Locally, fine-grained upper part may be more than 400 feet thick. Underlies Vashon Drift; overlies consolidated rocks.

Type section: Along Weyerheauser Road descending from Mashel Prairie to Mashel River, SE¼SW¼ sec. 29, T. 16 N., R. 4 E., Pierce County.

Mashipacong Member (of Rondout Formation)

Lower Devonian: Western New Jersey, southeastern New York, and northeastern Pennsylvania.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 14–16, measured sections. Member consists of medium-dark-gray shale and calcareous shale and light-, medium-light, and medium-dark-gray very fine grained to medium-grained argillaceous limestone, which commonly exhibit curly bedding, weather yellowish gray, and are generally mud cracked. Many beds graded. Some beds exhibit cut-and-fill structure. Thickness 15 feet at type section; 11 feet near Tocks Island, Pa. Overlies Whiteport Dolomite Member. Overlies Depue Limestone Member (new) of Coeymans Formation southwest of Hainesville and Thacher Member of Manlius northeast of Hainesville, N. J.

Type section: Abandoned William Nearpass quarry 1.8 miles southwest of Duttonville, N. J., in Port Jervis South quadrangle. Named for its proximity to Mashipacong Island in Delaware River, 1.7 miles west-northwest of William Nearpass quarry.

Maskenozha Member (of New Scotland Formation)

Lower Devonian: Northeastern Pennsylvania, western New Jersey and southeastern New York.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 33–34, measured sections. Consists of dark-gray siliceous laminated shale beds that weather medium gray to light medium gray. Medium-dark-gray dense limestone pods as much as 1 foot wide and 0.8 foot thick, as well as scattered beds and lenses of medium-gray fine-grained argillaceous limestone as much as 1 foot thick, occur 20 to 30 feet above base. Member very poorly exposed. Contact with underlying Flatbrookville Member (new) varies from abrupt to gradational and is placed at highest occurrence of abundant dark-gray chert and abundant pure limestone beds characteristic of the Flatbrookville. Contact with overlying Minisink Limestone (new) is abrupt or gradational and is characterized by change from shale having some argillaceous limestone beds in the Maskenozha to argillaceous limestone in the Minisink. Thickness 23 feet at type section. Estimated total thickness in area of type section 43 to 48 feet. Member persists to southwest end of Godfrey Ridge in Saylorsville quadrangle. Complete sections unknown in southeastern New York.

Type section: About 3.5 miles northeast of Flatbrookville, N. J., in woods and along northeast side of Flatbrookville-Woodpack Center road, 3.2 miles (road distance) from intersection with trans-Kittatinny road joining it from southeast, in Lake Maskenozha quadrangle. Named for Lake Maskenozha, Pa., which is 5.5 miles northwest of type section. Reference section: On northeast bank of Brodhead Creek at Minisink Hills, Pa., in Stroudsburg quadrangle.

Massabesic Gneiss

Upper Devonian(?): Southeastern New Hampshire.

Aluru Sriramadas, 1966, New Hampshire Div. Econ. Devel. Bull. 2, p. 30, 32–38, pl. 1. Chiefly coarse to medium, foliated, compositionally banded, pink gneiss composed of microcline, quartz, biotite, oligoclase, muscovite and magnetite.

Named for exposures around Lake Massabesic, Manchester quadrangle.

Matagamon Sandstone

Matagamon Formation

Lower Devonian: North-central Maine.

A. J. Boucot and others, Jan. 1964, Maine Geol. Survey Quad. Mapping Ser. 2, p. 95. Formation is oldest unit in Traveler Mountain area. A marine subgraywacke of Becraft-Oriskany age. Overlain by 8,500 feet of felsitic flows, tuff, and welded tuff which Toppan (1932) originally named Traveler [Traveller] rhyolite.

D. W. Rankin, 1965, U.S. Geol. Survey Bull. 1194—F, p. F1—F9. Formal proposal of name. Predominantly sandstone but with minor interbedded slate, exposed on Hay Mountain at south end of Grand Lake Matagamon. Clarke (1909, New York State Mus. Mem. 9, pt. 2) included these rocks in Moose River Sandstone. Boucot (1961, U.S. Geol. Survey Bull. 1111—E) redefined the Moose River in its type area west of Moosehead Lake in Somerset County and gave it group status. He specifically excluded the sandstone at Grand Lake Matagamon from Moose River Group on premise that the sandstones in the two areas were probably never continuous with one another. In present report lithology and geologic setting of unit are described in detail and name Matagamon Sandstone proposed. As determined from width of outcrop belt between Seboomook Formation on Hay Lake and axis of Hay Mountain basin, sandstone must be at least 4,000 to 5,000 feet thick. Top of unit not exposed there. Gradational contact with underlying Seboomook Formation. Contact arbitarily drawn where thick-bedded sandstone constitutes more than 50 percent of the rocks. Conformably overlain by Traveller Rhyolite. Metagamon Sandstone considered to be sandstone lens similar to Tarratine Formation and equivalent to upper part of Seboomook Formation.

Type section: On west slope of Hay Mountain, north of Grand Lake Road. Section begins in gully between two prominent strike ridges that are 900 feet N. 25° E. of major sharp corner concave to southwest of Grand Lake Road. Section runs S. 70° E. and ends at southwesternmost 1,600-foot summit of Hay Mountain Ridge. As thus defined, section extends about 2,700 feet along slope of Hay Mountain and contains 1,000 foot thickness of Matagamon. Sandstone is well exposed at Stair Falls on Eact Branch of Penobscot River, around southernmost shores of Grand Lake Matagamon, and on Hay Mountain in Traveler Mountain and Shin Pond quadrangles, Penobscot County.

Matilde Formation

Paleocene, upper and Eocene: Northwestern Puerto Rico.

A. E. Nelson and O. T. Tobish, 1967, U.S. Geol. Survey Bull. 1254—A, p. A19—A22. A sequence of thin-bedded volcanic sandstone and siltstone with some intercalated andesite flows and deposits of lapilli tuff. Most of formation is pale-green to pale-blue fine-grained tuff and grayish-brown fine-to medium-grained volcanic sandstone and siltstone. Thickness 115 to 620 m and trends northwest across the southwest part of quadrangle. Formation is on south limb of principle fold of the west- to northwest-trending island anticlinorium, and except for complications due to local folding, most of strata dip to southwest. Rests disconformably on underlying Robles Formation of Early and Late Cretaceous. Lower contact placed at base of volcanic sandstone that rests upon pyroxene-rich volcanic breccia and lapilli tuff of Robles. Upper contact placed at top of uppermost thin-bedded volcanic sandstone and underlying massive lapilli tuff of Milagros Formation (new). Fossils indicate early Tertiary (late Paleocene and Eocene).

Type section: About half a kilometer northwest of Matilde and consists of exposures along a dirt road in the Bayaney quadrangle between (48,680 N., 108,530 E. and 48,780 N., 108,660 E., Puerto rectangular coordinate system, in meters). Named after settlement of Matilde.

Matson Member (of Joachim Formation)

Middle Ordovician: Eastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 61—62, 228. Relatively pure, gray to light-brown laminated thick-bedded algal dolomite that grades southward into dark-brown limestone. In type section a 17-inch unit 17 inches below top of Matson consists partly of fine-grained faintly crossbedded detrital dolomite. Average thickness 30 feet; thicker in some wells. Overlies Defiance Member (new); underlies Metz Member (new).

Type section: Quarry and bluff exposure in north bluff of Missouri Valley, one-half mile west of village of Matson, St. Charles County, Mo., NE¼NE¼NE¼ sec. 4 projected, T. 44 N., R. 2 E., Augusta quadrangle. Named for village of Matson. Also well exposed in Metz type section.

Mattawamkeag Formation

Ordovician or Silurian: Northeastern Maine.

E. B. Ekren and F. C. Grischknecht, 1967, U.S. Geol. Survey Prof. Paper 527, p. 11—13, pl. 1. Rocks of formation consist of about 50 percent slate and 50 percent siltstone and graywacke. Rocks are thin and thick bedded and very similar to those in the younger Allsbury Formation (new), except that the slates are lighter colored and are not conductive. No fossils. Age of formation very uncertain. Top directions determined from graded beds along northwest and southeast flanks of area of outcrop indicate that the Mattawamkeag is older than both Allsbury Formation and the rock of Island Falls and is probably, therefore, of Ordovician age. Possibility cannot be precluded that part or all of Mattawamkeag is of Silurian age. It is here classed as Ordovician or Silurian.

Type locality: At Warren Falls in eastern part of Island Falls quadrangle near east boundary of Hershey Township. Named after West Branch of Mattawamkeag River. Crops out in area about 3 miles wide and about 10 miles long through Hershey, Dyer Brook, and Merrill Townships.

Matthes Glaciation

Quaternary: Eastern California.

Clyde Wahrhaftig, 1962, California Div. Mines Bull. 182, p. 42 (table 1). Matthes glacial stage table showing correlation and characters of glacial stages in Yosemite Valley. Name credited to Birman (1957, unpub. thesis).

J. H. Birman, 1964, Geol. Soc. America Spec. Paper 75, p. 12, 28, 45, 53—54, pl. 1. Discussion of glacial geology across crest of Sierra Nevada. Youngest glaciation in area. Preceded by Recess Peak glaciation. Represented by at least 13 cliff ice masses, perennial snow accumulations, or glacierets, a few of which contain bergschrund. Occurs at altitudes of 10,500 to 12,500 feet.

Mapped in vicinity of Mount Matthes, Inyo County. Name refers to the latest expansions of cirque ice within the "Neoglaciation" of "Little Ice Age" (Matthes, 1930, U.S. Geol. Survey Prof. Paper 160).

Mauna Kuwale Trachyte

Pliocene, lower or middle: Oahu Island, Hawaii.

Ian McDougall, 1963, Nature, v. 197, no. 4865, p. 344—345. Mauna Kuwale trachyte was included in Lower Waianae Series by Stearns and Vaksvik (1935) who regarded the series as oldest exposed rocks of Oahu. The trachyte is overlain conformably to south-southwest by basalts mapped as Lower and (or) Middle Waianae Series (Macdonald, 1940, Hawaii Div. Hydrography Bull. 5). Thickness about 400 feet. Biotite from the trachyte gives age of 8.4 ± m.y., corresponding to lower or middle Pliocene on time scale of Kulp (1961, Science, v. 33, p. 105). Basalts of Middle and Upper Waianae Series yield upper Pliocene ages ranging from 3.5 ± 0.3 to 2.75 ± 0.1 m.y. These results provide some hitherto nonexistant control as to absolute age of volcanics of western Oahu.

Western Oahu Island.

Mauna Loa Series

Mauna Loa lava flows

Recent: Hawaii Island, Hawaii.

J. G. Moore and W. U. Ault, 1965, Pacific Sci., v. 19, no. 1, p. 3—9. Discussion of historic littoral cones in Hawaii. The three historic littoral cone localities are: Sand Hills, produced by the 1840 Kilauea flow; Puu Hou, produced by the 1868 Mauna Loa flow; and the cone produced by the 1919 Mauna Loa flow. The cone produced by the 1919 Mauna Loa flow is the smallest of the historic littoral cones. It is on southwest coast of the island, about 25 miles northwest of Ka Lae. The 1919 Alika flow which formed the cone broke out 11 miles east of the coast at an elevation of 7,500 feet on the southwest rift zone of Mauna Loa.

Alexander Malahoff and G. P. Woolard, 1966, Pacific Sci., v. 20, no. 3, p. 290, 291 (fig. 16). Mauna Loa Series shown on map and 1919 and 1929 Mauna Loa lava flows mentioned in discussion of geologic implications of magnetic surveys over the Hawaiian Islands.

Hawaii Island, Hawaii.

Maxwell Lavas

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 124. Name applied to lavas from Maxwell Butte.

Maxwell Butte is in Sand Mountain Lava Field, Three Fingered Jack and North Sister area.

Maybe limestone member (of Bingham Mine Formation)

See Bingham Mine Formation.

May Creek Member (of Madera Formation)

Pennsylvanian-Permian: Colorado.

J. A. Rhodes, 1965, Dissert. Abs., v. 25, no. 8, p. 4656. Contains sedimentary structures indicative of deposition on a basinward-tilted slope.

Sangre de Cristo and Wet Mountains in Huerfano Park quadrangle.

Mayflower Hill Formation

Silurian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 25. Patch Mountain formation (new) may be equivalent to Mayflower Hill formation. Name credited to P. H. Osberg (in preparation).

A. M. Hussey, 2d, 1965, New England Intercollegiate Geol. Conf. Guidebook 57th Ann. Mtg., p. 73. In vicinity of York Beach, three distinct groups of rocks recognized. They include Agamenticus Complex, Cape Neddick Complex, and basic dikes. All are intruded into Kittery Formation of Silurian age and correlated with Mayflower Hill Formation, of Waterville area, containing fossils of Llandovery age.

In Waterville area.

Mayo Formation

Precambrian: Southwestern South Dakota.

J. A. Redden, 1963, U.S. Geol. Survey Prof. Paper 297—D, p. 212—215, pl. 21. Name applied to thick unit of quartz- and mica-rich schist that conformably overlies Crow formation (new). Exposed thickness at least 14,000 feet in Fourmile quadrangle; total thickness not known because of cover of Paleozoic rocks.

Most complete section in Fourmile quadrangle, Custer County, extends from 2 miles northeast of Fourmile along U.S. Highway 16 to 4 miles south-southwest of Fourmile along Fourmile Creek. Name derived from old settlement of Mayo, 1 mile east of Fourmile quadrangle.

Meadow Fork Formation

Eocene, upper(?): Northeastern Nevada.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M7—M8, pl. 1. Chiefly tuffaceous and arkosic conglomerate with boulders as much as 5 feet in diameter. Thickness 150 to about 1,300 feet; base not exposed everywhere. At type locality conformably overlies Dead Horse tuff and is unconformably overlain by Danger Point tuff (new) and younger rocks. Cut by Seventy Six basalt (new). Age indeterminate but gradational contact with Dead Horse tuff and coarseness of conglomerate suggest that deposition required only short interval of time immediately following deposition of Dead Horse tuff. Regarded as probably late Eocene in age. Age indicated as Miocene(?) on map explanation, but Eocene date seems preferable on basis of potassium-argon date of Dead Horse tuff.

Type locality: Exposures along Meadow Fork of Copper Creek, Jarbidge quadrangle, Elko County.

Meadow Lake Tonalite

Age not stated: Eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend.

Mapped in Markleeville quadrangle. Meadow Lake is in Alpine County.

Meadow Valley Member (of Highland Peak Formation)

Middle Cambrian: Southeastern Nevada.

C. W. Merriam and A. R. Palmer, 1964, U.S. Geol. Survey Prof. Paper 469, p. 46—48, pl. 1. Comprises medium-gray to dark-gray medium grained to exceedingly fine-grained mottled limestones, which in main are thick bedded and massive. Thickness 430 feet at type section. Conformably underlain by Condor Member and conformably overlain by unit 7 of formation. Meadow Valley Member is virtually equivalent to "Highland Peak G" of Wheeler and Lemmon (1939, Nevada Univ. Bull. 33, no. 3, Geology and Mining Series, no. 31).

Type section: In measured Warm Spring section, northeast of Panaca on edge of Meadow Valley, Pioche mining district.

Meamber formation

Upper Paleozoic(?) or Triassic: Northern California.

W. P. Pratt, 1965, Dissert. Abs., v. 25, no. 7, p. 4084. Chert, phyllite, and greenstone, separated by major fault from Appelgate Group.

In northeastern part of Scott Bar quadrangle, Marble Mountains area, Siskiyou County.

Mecca Quarry Shale Member (of Linton Formation)

Pennsylvanian: Indiana.

Rainer Zangerl and E. S. Richardson, Jr., 1963, Fieldiana: Geology Memoirs, v. 4, p. 25 (table 2), 26—28, 30, 33—95 (sections,). Consists of evenly bedded sheety alternating gray and black carbonaceous shale lying upon Coal IIIA and beneath a marine shale and limestone that have been correlated with Oak Grove member in Illinois and Velpen limestone member in Indiana. In type section, one inch above base of member, is bed of soft gray shale about 3 inches thick containing calcareous concretions that may be several feet in length and more than a foot in thickness. Bottom layer of the Mecca Quarry is commonly a thin transgression shell breccia, consisting of pyritized broken shells in black carbonaceous clayey matrix without bedding.

Type locality: In small quarry in Wabash Township, Parke County, Ind., SW¼NE¼ sec. 29, T. 15 N., R. 8 W., about 1 mile from town of Mecca. Quarry now obliterated by slump of hillside above it, but band of Mecca Quarry shale is exposed on sides of gullies in immediate vicinity.

Medicine Lodge Dolomite (in Blaine Formation)

Permian: North-central Texas.

Robert Roth, 1945, Geol. Soc. America Bull., v. 56, no. 10, p. 902. Consists of (ascending) porous granular buff dolomitic limestone coquina, dense pink secondary limestone, coarsely oolitic calcareous buff dolomite, and light-gray gypsum and oolitic buff dolomite. Thickness about 2½ feet. Present at base of formation.

E. C. Pendery, 3d, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 10, p. 1836, 1837. Investigations have revealed that definitions of Blaine of Texas are not equivalent to original definition of Blaine in Oklahoma. Suggestions made to correct nomenclature regarding "Blaine of Texas." Paul Mayes (oral commun., 1961) reported that the Mangum of Oklahoma (his "Cedartop dolomite") was correlative with Medicine Lodge dolomite as defined by Roth (1945). This correlation equates Medicine Lodge-Mangum Dolomite Members and means that Roth's "Blaine Formation" of Pease River Group is equivalent to only one (Van Vacter) of the four gypsum members of Blaine Formation of southwestern Oklahoma. Recommended that Roth's (1945) term Medicine Lodge Dolomite be replaced by Mangum Dolomite in order to lessen confusion. The Medicine Lodge-Mangum-Altona Dolomites are a correlative unit which constitute the base of Roth's Blaine Formation, the Van Vacter Gypsum Member, and Shimer Gypsum Member, respectively, in various geographic localities.

South Fork of Wichita River. Measured section F, on Little Croton Creek in section 101, block 13, H. and T. C. R. R. Co. survey, Knox County, Tex., then west up creek to foot of hill in northeast part of W. E. Roberts survey, abstract 269, King County, Tex.

Medicine Root Gravel

Pliocene-Pleistocene: Southwestern South Dakota.

J. C. Harksen, 1966, Southern California Acad. Sci. Bull., v. 65, no. 4, p. 251—257. Name Medicine Root gravel applied to remnants of a former major Black Hills drainage which mantle many topographic highs in Shannon and Washabaugh Counties. Medicine Root gravel consists of deposits of sand and gravel. The gravels contain high percentage of igneous and metamorphic rock derived from core of Black Hills. Material shows age of gravel to be near Pliocene-Pleistocene boundary, but not enough material has been collected to positively pinpoint the age. Two deposits of silty sands, occurring below these gravels and above the Tertiary bedrock, have been found. The relation of these deposits to the overlying gravels is at present in question. When this relationship is clarified, the Medicine Root gravel will be proposed as a formal stratigraphic unit and a type section will be designated.

Type area: In T. 40 N., R. 42 W., Shannon County. Medicine Root Creek is present-day drainage of area while Medicine Root River is the old Black Hills drainage that deposited the Medicine Root gravel.

Meduxnekeag Group

Meduxnekeag Formation

Ordovician and Silurian: Northeastern Maine.

Louis Pavlides, 1962, U.S. Geol. Survey Prof. Paper 362, p. 9—12, pl. 1. Consists of a lower dark-gray and green slate and graywacke member about 10,000 feet thick, a middle ribbon rock member of gray-green and green slate intercalated with impure calcareous beds, about 2,000 feet thick, and upper slate member about 9,000 feet thick. The Meduxnekeag is considered to consist of sequence of beds increasing in age eastward from fault that separates it from Hovey formation (new). Intruded by Spruce Top greenstone (new). Rocks of slate and graywacke unit assigned to the Meduxnekeag in wedge-shaped fault block in northeastern part of area are poorly exposed. They are placed in the Meduxnekeag chiefly because irregularly interlayed slate and graywacke beds typical of this unit are present north and south of easternmost Spruce Top greenstone within fault block. Rocks in southern part of this block may belong to Hovey formation but exposures are not adequate to make separation.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, p. A52—A54. Meduxnekeag Formation herein rank raised to group to include (ascending) Chandler Ridge, Carys Mills, and Burnt Brook Formations (all new). Ordovician and Silurian.

Named after Meduxnekeag River, along whose headwater tributary streams it crops out. Various lithofacies are discontinuously exposed in Bridgewater quadrangle, chiefly in streambeds and along banks of North Branch Meduxnekeag River and Number Nine Stream, Maple and Hovey Mountains area.

Meeke Mine Formation

Pliocene, upper, or Pleistocene lower(?): Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 62, pls. A sequence of fluviatile gravel and lacustrine clay. Consists of two units of gravel separated by one clay and one of shale. Thickness about 1,500 feet. Unconformable on Oso Canyon Formation (new). Unconformably overlain by older alluvium. Angular discordance with underlying upper Miocene formations suggests the Meeke Mine is Pliocene or younger, most probably upper Pliocene, possibly early Pleistocene.

Type section: Exposed from contact with Oso Canyon Formation 2½ miles north of west end of Quail Lake northeast 1 mile to Kern-Los Angeles County boundary. Named for nearby Meeke tin mine.

Meeks Table flow

Miocene: South-central Washington.

D. A. Swanson, 1967, Geol. Soc. America Bull., v. 78, no. 9, p. 1093, 1097–1098, pl. 4 (fig. 1). Discussion of Yakima Basalt of Tieton River area. An informal name given by Waters and Fiske to a thick platy red-weathering flow that caps Meeks Table on upper Rattlesnake Creek.

Meiklejohn Formation

Upper Mississippian: Western Nevada.

H. R. Cornwall and F. J. Kleinhampl, 1961, U.S. Geol. Survey Geol. Quad. Map GQ–157. Measured section (type section), bounded top and bottom by thrust faults, is 3,200 feet thick, and consists chiefly of silty claystone with intercalated zones of chert, shale, coarser clastics, and carbonate rocks. Rocks in measured section divided into lower, middle, and upper units 1,000, 800, and 1,400 feet thick respectively. Two fragmentary sections, also bounded by faults, crop out west and northeast of Meiklejohn Peak. Overlies Fluorspar Canyon formation (new).

Type section: Southeast flank of Meiklejohn Peak, Bare Mountain quadrangle, Nye County.

Melon Gravel (in Snake River Group)

Pleistocene, upper: Southern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1216–1217. At type locality the gravel forms bouldery bar more than 1 mile long, one-half-mile wide, and 150 feet thick on canyon floor. About 5 miles from Melon Valley, the gravel overlies eroded Sand Springs Basalt, and farther downstream lies against canyon walls eroded in Bancroft Springs Basalt (new). Identified intermittently in Snake River Canyon as far downstream area between Murphy and Homedale—150 miles. Upstream from Melon Valley the gravel forms bars within canyon as far as Milner, 40 miles east. Underlies McKinney Basalt near Glenns Ferry.

Type locality: Melon Valley, a wide segment in Snake River Canyon, 5 miles north of Buhl, Twin Falls County.

Mendon Till

Pleistocene (Illinoian): Western Illinois.

J. C. Frye, H. B. Willman, and H. D. Glass, 1964, Illinois Geol. Survey Circ. 364, p. 16, 19. Petersburg Silt and Mendon Till included in Liman Substage of Illinoian Stage. Term Payson Substage abandoned.

Town of Mendon is in T. 2 N., R. 7 W., Adams County.

Mentasta argillite

Upper Jurassic-Lower Cretaceous: South-central Alaska.

D. H. Richter, 1967, Alaska Div. Mines and Minerals Geol. Rept. 30, p. 3 (table), 10, 11, fig. 2. Consists of thin-bedded dark-gray argillite and shale, lighter gray to buff siltstone and graywacke, and minor conglomerate, limey clastic rocks, and occasional limestone. Thickness about 9,000 feet. Unconformable above Jack limestone (new). Youngest bedded rock group in area. In this report the Mentasta is considered an informal name.

Upper Slana-Mentasta Pass area covers approximately 275 square miles in eastern Alaska Range between the Chistochina and Tok Rivers.

Merced Falls Slate

Upper Jurassic: East-central California.

L. D. Clark, 1964, U.S. Geol. Survey Prof. Paper 410, p. 30, pls. 1—11. Near Tuolumne River is almost entirely thin-bedded dark-gray slate and siltstone; one thin bed of graywacke. Along Merced River includes considerable graywacke and some felsic tuff. Top of formation not preserved but about 5,000 feet of strata form type section. Overlies and intertongues with Gopher Ridge volcanics (new). Apparently underlies and intertongues with Peaslee Creek volcanics (new). Rocks of Merced Falls were shown as epiclastic rocks by Turner (1897, U.S. Geol. Survey Geol. Atlas, Folio 41) in belt extending southeastward from La Grange to beyond southern boundary of area mapped in present report.

Type section: Along Merced River east of town of Merced Falls, Merced County.

Merle Formation

Paleocene: Central California.

R. M. Kleinpell, D. W. Weaver, and D. P. Doerner, 1967, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook, Oct. 20—21, p. 38. In San Antonio Creek-upper Reliz Creek-Church region, the oldest Tertiary sedimentary rocks are those of "Merle Formation" (Compton, 1957; Dickinson, 1965) referred to but still formally undescribed in the literature. On San Antonio Creek, the "Merle" is 5,000 feet thick and lies unconformably on Cretaceous strata which it overlaps to lie with depositional contact on crystalline basement complex. Marine clastics of same formation also crop out farther north in Arroyo Seco Drainage, in structurally deformed area southeast of Willow Creek fault (Dickinson, 1965, California Div. Mines Spec. Rept. 86). Here, as in area between San Antonio Creek and upper Reliz Creek, they are not in normal contact with younger Eocene beds of region. The "Merle" is Paleocene on basis of fossils. [Compton, 1957, abs. Geol. Soc. America Bull., v. 68, no. 12, pt. 2, described but did not name "a new Paleocene formation" well displayed in secs. 26, and 35, T. 21 S., R. 5 E., Junipero Serra quadrangle.] Stratigraphically higher than the "Merle", but not in contact with it locally, at least in Church Creek area, is Junipero Sandstone. Lack of continuity in deposition between the "Merle" and Junipero Formations in both Reliz Creek and Church Creek areas indicates diastrophism on a regional scale to have taken place during Bulitian time in northern Santa Lucia Range.

Northern Santa Lucia Mountains.

Merriam Flow or Flows

Merriam Crater Lava Flow

Recent: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 10, 22, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Merriam lava flows listed as examples of a stage IV flow in which the true edge of the flow is visible, the surface rough and broken, and lava tops present but displaced by frost. Flow from Merriam Crater is 32 miles long—the longest flow traceable to a source.

H. S. Colton, 1967, The basaltic Cinder Cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 47, 53. Radiocarbon date from caliche gives Merriam lava flow age of 5,600 years.

Flows issued from Merriam Crater. Responsible for forming falls in Little Colorado River.

Mesa Conglomerate

Pleistocene: Southern California.

G. D. Woodard, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2752. Imperial formation separated by erosional unconformity from underlying Split Mountain formation. Imperial beds grade upward into terrestrial deposits of Palm Spring formation. Both the Palm Spring and Imperial are laterally gradational into coarse granitic fanglomerate of Canebreak formation. Name Mesa conglomerate is assigned to cobble fanglomerate and arenite strata that are preserved as erosional remnants unconformably overlying deformed older Neogene strata.

Area of report is west Colorado Desert, San Diego and Imperial Counties.

Mesa Prieta Flow

Pleistocene: Central New Mexico.

H. R. Weber, 1963, New Mexico Geol. Soc. Guidebook 14th Field Conf., p. 141. An isolated flow remnant. Mesa cap consists of dark-gray to nearly black, fine-grained, slightly to moderately vesicular, quartz-bearing olivine basalt. Overlies crossbedded riverine sands and gravels of uppermost Santa Fe Group and underlies soils of Jornada surface. Extruded onto local surface about 250 to 300 feet higher than that underlying Jornada flow.

Mesa Prieta (Black Mesa of modern maps) is about 1 mile north of northwestern tip of Jornada flow, abutted by Rio Grande at its western base, western Socorro County. Former townsite of San Marcial is buried beneath flood deposits that inundated area north of Mesa Prieta, August 13, 1929.

Mesa Redonda flow

Pleistocene: Central New Mexico.

H. R. Weber, 1963, New Mexico Geol. Soc. Guidebook 14th Field Conf., p. 141—142. Mesa cap on southeast consists of two flow units, separated by rubbly flow breccia, aggregating 50 feet thick. Flows composed of fine-grained massive subcolumnar to platy olive basalt or basaltic andesite. Basal reddish-brown basaltic ash 0 to 10 inches thick rests directly on Yeso Formation. Two units exposed farther north consist of basal massive to platy flow overlain by nodular lapilli flow(?).

Mesa Redonda is isolated, arcuate, basalt-capped mesa about 21 miles east-northeast of Socorro, Socorro County.

Mesa Redonda sandstone bed

Upper Cretaceous: Eastern Arizona.

H. W. Miller, Jr., and W. J. Breed, 1963, Plateau, v. 35, no. 4, p. 123—128. *Mammites nodosoides* (Schlotheim) and other fossils collected from Mesa Redonda are indicative of a lowermost Turonian age for the 77-foot-sandstone bed. Bed may be correlated with upper Greenhorn Formation of Kansas and Colorado area. [Probably not same unit as Mesa Redondo, Upper Triassic.]

Mesa Redonda[o] is in western Apache County, south of Little Colorado River.

Metz Member (of Joachim Formation)

Middle Ordovician: Western Illinois and eastern Missouri.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 62, 227—232. Chiefly silty thin- to medium-bedded dolomite with subordinate beds of pure dolomite. Thickness commonly 15 feet; about 10 feet at type section. Overlies Matson Member (new); at type section underlies Brickeys Member of Mifflin Formation; southward from Perry County, Mo., and Jackson County, Ill., underlies Pecatonica Formation.

Type section: Quarry in east bluff of Mississippi River, and exposures in bluff north of quarry, one-fourth mile north of West Point Landing, Calhoun County, Ill., SE¼NE¼SE¼ sec. 19, T. 7 N., R. 2 W., Hardin quadrangle. Named for Metz Lake on floodplain of Mississippi River, 5 miles north of type locality.

Miami Bend Formation

Devonian: Northwestern Indiana.

G. A. Cooper and Thomas Phelan, 1966, Smithsonian Misc. Colln., v. 151, no. 1, 21 p. A light-gray fine-grained *Stringocephalus-Subrensselandia*-bearing limestone. Thickness 11 to 15 feet at type section. Underlies Logansport Limestone. Overlies Silurian rocks. Has been included in Logansport. Devonian (Givetian).

Type section: France Stone Co. quarry, Cass County. Named for community of Miami Bend near the bend of the Wabash River a little less than a mile southeast of the France Stone quarry (Logansport-Anoka 7½-minute quadrangles).

Miamitown Shale

Upper Ordovician: Southwestern Ohio.

J. P. Ford, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 931—932. Name proposed for thin shale unit that overlies Fairview Formation. Consists of shale and mudstone with a few thin, widely spaced limestone interbeds. Contains high proportion of terrigenous detritus and a diagnostic gastropod-pelecypod faunal assemblage that includes forms of *Lophospira, Cyclonema,* and *Byssonychia.* Thickness 5 feet at Clifton Hill, Cincinnati, thickens northwestward to 17 feet at Miamitown, and 35 feet 4 miles northwest of Miamitown. Forms tongue with a east-northeast-westsouthwest strike and a northwest thickening trend. At Cincinnati underlies Bellevue Limestone.

Type section: Exposure in a highway cut along the route of Interstate Highway 74, 1 mile west of Miamitown.

Miccosukee Formation

Miocene, upper: Northwestern Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 115, 185, 229. Name suggested by Hendry and Yon (ms.) for upper Miocene clastics typically exposed near Miccosukee.

C. W. Hendry, Jr., and C. R. Sproul, 1966, Florida Geol. Survey Bull. 47, p. 78—92, pl. 1. Described in Leon County where it mantles much of the northern half of county. Composed of heterogeneous series of clastics commonly referred to as "Miocene Red Beds" and "Unnamed Coarse Clastics." Deposits include continental sediments of interbedded and crossbedded clays, silts, and sands and gravels of varying coarseness and admixtures of these. Thickness 10 to 20 feet. Unconformably overlies Hawthorn Formation in northern section, and Jackson Bluff Formation in western portion. Absent in southern section. Type section designated. Formally named by Hendry and Yon (in press). Choctawhatchee Stage.

J. W. Yon, Jr., 1966, Florida Geol. Survey Bull. 48, p. 53—61, pl. 1. Described in Jefferson County where it includes all deposits in Tallahassee Hills area that lie above the Middle Miocene Hawthorn Formation. Formation covers all of Jefferson County from Cody Scarp northward to Georgia State line. Thickness up to 160 feet. In northeastern Jefferson County, unconformably overlies St. Marks Formation. In southwestern Jefferson County, Pleistocene sands overlie Miccosukee unconformably.

C. W. Hendry, Jr., and J. W. Yon, Jr., 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 2, p. 250—256. Formal proposal of name. Complete section not exposed at surface. Core hole section given where complete section of formation is present.

Type section: Locality LJf—3N—5E—31aa. Roadcut on east side of U.S. Highway 19, about 3.1 miles south of Georgia-Florida State line, Jefferson County. Core hole WLN—2N—3E—8—aa, near town of Miccosukee, NW¼NW¼ sec. 8, T. 2 N., R. 3 E., Leon County. Exposed in vicinity of Lake Miccosukee in Jefferson County, and town of Miccosukee, Leon County.

Michaud Gravel

Pleistocene, upper: Southeastern Idaho.

D. E. Trimble and W. J. Carr, 1961, U.S. Geol. Survey Prof. Paper 424—B, p. B—164—B—166, 1961, Geol. Soc. America Bull., v. 72, no. 12, p. 1742. Deltaic sand and gravel that contains boulders as much as 8 feet in diameter at Pocatello; size diminishes abruptly westward to small cobbles at Michaud and to sand with a few small pebbles northeast of American Falls. Thickness 5 to 50 feet. Overlies American Falls Lake Beds.

Type locality: In gravel pits at south side of Union Pacific Railroad at Michaud, Power County, about 8 miles west of Pocatello.

Michigan Basalt (in Cameron Pass Volcanics Group)

Eocene(?): North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Group divided into three formations: Skeleton Gulch Andesite, Zimmerman Andesite, and Michigan Basalt (all new). Stratigraphic relationship of units not entirely clear.

Exposed in Michigan ditch on west side of Iron Mountain. Area is in Mount Richthofen-Iron Mountain area about 40 miles south of Wyoming border. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Middlebrook Group

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 51. Incidental mention in road log.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 81, 82, 83. Felsites of St. Francois Mountain divided into two groups, Middlebrook, older, and Van East, younger. Middlebrook composed mainly of rhyolite flows which have high potash-soda ratio in which potash content ranges to maximum of 9.76 percent. Tuff present above many flows assigned to group, and it separates them from flows of Van East group. Includes Clark Mountain rhyolite, Marlow Mountain rhyolite, Oak Mountain felsite, Royal Gorge rhyolite, and Pilot Knob felsite (all new) and some miscellaneous units. Name credited to Tolman and Robertson (in preparation).

Middlebrook village is in Iron County. Middlebrook hill consists of unassigned felsites of Middlebrook group.

Middle Canyon Formation (in White Knob Group)

Mississippian: Central Idaho.

O. K. Huh, 1967, Montana Geol. Soc. 18th Field Conf. Guidebook, p. 34—39. Term White Knob raised to group status to include four newly named formations (ascending): Middle Canyon, Scott Peak, South Creek, and Surrett Canyon. The Middle Canyon comprises two lithologies: a thin-bedded dark-gray chert-bearing fine-grained limestone and a light-brown weathering calcareous, quartz siltstone to fine sandstone. Thickness about 1,000 feet. Gradational contact with overlying Scott Peak. At type section, contact is placed at first coarse light-gray crinoidal calcarenite bed. Gradational contact with underlying Milligen Formation.

Type section: East Canyon Middle Canyon section in western side of southern Lemhi Range, near Howe, Idaho.

Middlesboro Member (of Lee Formation)

Pennsylvanian: Southeastern Kentucky.

K. J. Englund, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B30—B38. Name applied to thick sequence of massive conglomeratic sandstone previously included in sandstone member C (Englund and others, 1963). Thickness 400 to 500 feet. Overlies Dark Ridge Member (new); underlies Hensley Member (new).

Type section: On Skyland Road on north side of Cumberland Gap. Named for city of Middlesboro, which is at northwest approach to the gap. Is principal ridge- and cliff-forming unit along Cumberland Mountain and along Pine Mountain on northwest limb of Middlesboro syncline. Also caps Rocky Face Mountain.

Middletown Till

Pleistocene (Wisconsin): Southern Connecticut.

J. G. Odgen, 3d, 1963, Am. Jour. Sci., v. 261, no. 4, p. 346 (fig. 2). Named on map legend.

Type locality and derivation of name not stated.

Midnight Quartzite

Cambrian: Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 13. Name formerly applied to unit now mapped as Prospect Mountain Quartzite.

Named for exposures as a steep ridge between California Gulch and Sheridan Gulch, Bull Run quadrangle.

Midvale Soil

See Draper Formation and Draper-Midvale Substage.

Mikes Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 600, pl. 1. A thick heterogeneous sequence of strata overlying Fry Creek Member (new). Consists mainly of poorly sorted arenites and conglomerates, argillaceous lutites, pebbly mudstones, and thin black cherts. Maximum thickness 2,600 feet. Upper boundary is lower occurrence of volcanic rocks forming base of overlying unit (Harrington Creek Member, new).

Named from exposures along upper part of Mikes Canyon, Wildhorse quadrangle, Elko County.

Milagros Formation

Eocene(?): Northwestern Puerto Rico.

A. E. Nelson and O. T. Tobish, 1967, U.S. Geol. Survey Bull. 1254—A, p. A20 (fig. 2), A22—A23. Massive breccia deposits of feldspathic lapilli tuff interstratified with some volcanic breccia, andesitic lava flows, and thin-bedded volcanic sandstone and siltstone. Thickness at least 1,700 m. Conformably overlies Matilde Formation (new). Upper contact not exposed in Bayney quadrangle. No fossils. Probably Eocene.

Type section: Exposures along Río Angeles about 1½ km east-southeast of Milagros between coordinate lines 46,740 and 46,240.

Milbank Granite

Precambrian: Northeastern South Dakota.

S. S. Goldich and others, 1961, Minnesota Geol. Survey Bull. 41, p. 146. Coarse reddish-brown granite. Potassium-argon date 2.0 b.y.

Exposed in quarry, 1 mile south of U.S. Highway 12, about 7 miles southwest of Ortonville in Grant County.

Mildred Lake Hornfels

Pennsylvanian and (or) Permian(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 25—26, pls. 1, 2. Chiefly light-gray to dark-gray fine-grained massive siliceous hornfels that weather reddish brown. Thickness about 750 feet west of Laurel Mountain; about 1,000 feet north of Lake Genevieve. Conformably overlies Mount Baldwin marble (new); gradationally underlies Lake Dorothy hornfels (new).

Type locality: Along west wall of canyon of Convict Creek about one-half mile north of Mildred Lake, Mount Morrison quadrangle, Sierra Nevada. From type locality, extends northwestward 2½ miles in discontinuous exposure to canyon of Laurel Creek and southeastward about 5 miles in continuous exposure to Big McGee Lake, about 1 mile south of quadrangle boundary in Mount Abbot quadrangle.

Milesburg Member (of Coburn Formation)

Middle Ordovician: Central Pennsylvania.

R. R. Thompson, 1961, Dissert. Abs., v. 22, no. 1, p. 231—232. Contains interlayers of *Sowerbyella* and *Sowerbyella*-trilobite bioskeletal calcirudites in alternation with other rock types. Underlies Coleville member (new). Overlies Roaring Spring member (new) of Salona formation.

R. R. Thompson, 1963, Pennsylvania Geol. Survey 4th ser., Bull. G—38, p. 24—26, 29, 67—77, 90—92, 118—119, 122—123. Term Milesburg as used by Schuchert (1916) should be abandoned in favor of usage of this report. Thickness 119 feet at type locality herein designated. Four metabentonites, all less than 1½ inches thick, recognized in section at Bellefonte at 9, 22, 45½, and 59 feet above base and a questionable metabentonite at 93½ feet above base. Metabentonite R, 45½ feet above base, is only metabentonite that appears useful for regional correlation. At type section overlies Coleville Member; underlies Roaring Spring Member of Salona Formation.

Type section: About 9,750 feet west of 77°45′ long and about 1,250 feet north of 40°55′ lat in Bellefonte quadrangle. Exposure is on northern edge of town of Bellefonte in cut along eastern side Route 53 that leads to Milesburg.

Milk Ranch Formation

Miocene(?): East-central Nevada.

P. E. Playford, 1962, Dissert. Abs., v. 22, no. 12, pt. 1, p. 4322. A unit of piedmont conglomerate and lithic sandstone. Overlies volcanics of probable Oligocene age, angular unconformity. Overlain with angular unconformity by early Quaternary piedmont deposits.

Mapped area includes about 200 square miles of Egan Range, near Lund Township, east-central Nevada.

Milkweed Canyon Gravels

Tertiary: Northwestern Arizona.

Robert Gray, 1964, Arizona Acad. Sci. Jour., v. 3, no. 1, p. 41. Two types of gravels recognized in Milkweed Canyon. One unit composed of locally derived fragments of limestone, quartz sandstone, and volcanic rocks. Its lithology, weak cement, and occurrence resembles closely Buck and Doe Conglomerate (new) and may be related to it. The other conglomerate consists of angular fragments of volcanic rocks and pink granite, and out crops near the head of the canyon. Conglomerate is well indurated; its angularity shows little transportation was involved. In this respect it differs from the lower granitic conglomerate unit of Hindu Canyon Formation (new).

Milkweed Canyon is in northwestern part of Mohave County.

Millarton Drift

Pleistocene: Southeastern North Dakota.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, pt. 1, p. 22—24. Oldest drift unit exposed in Barnes County. Consists primarily of till. Thickness in test holes 28 to 32 feet. In test holes in Barnes County, drift lies directly on Pierre Formation. Underlies Eldridge drift. [Winters, 1963, North Dakota Geol. Survey Bull. 41, described Millarton moraine and drift associated with the moraine but did not use formal term Millarton drift.]

Millarton moraine is at foot of Missouri Escarpment, trends north in Severn Township (T. 137 N., R. 64 W.), and terminates in sec. 26 in Lenton Township in Stutsman County. The end moraine is small and poorly defined in vicinity of Millarton, but associated ground moraine is exposed at surface in Stutsman County.

Mill Brook Member (or Rondout Formation)

Paleozoic: Northwestern New Jersey.

W. J. Spink, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 2001. Rondout subdivided vertically into Millbrook (new), Duttonville (new), Whiteport, and Mashipacong Island (new) Members.

Northwestern New Jersey.

Millbrook Till

Pleistocene (Illinoian? or Wisconsin?): Northeast-central Ohio.

G. W. White, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—71——C—72. A sandy, pebbly, olive-brown till. Thicknesss 4½ feet. Overlies Paleozoic bedrock. Upper part leached and severely weathered in many localities. Underlies Hayesville till (new) in some areas. Older than Navarre till. A deposit of Killbuck glacial lobe.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. Correlates with Knox Lake till (new) of Scioto glacial lobe.

R. M. DeLong and C. W. White, 1963, Ohio Geol. Survey Bull. 61, p. 138—143. Traced from Wayne County into Holmes, Ashland, and Stark Counties but does not extend beyond later Wisconsin tills. Correlation of Millbrook Till and determination of its age must await a regional study. It may prove to be an Illinoian deposit of an Illinoian Killbuck lobe, similar to the Illinoian drift of the Grand River lobe. Or it may be a very old Wisconsin drift, such as the very early Wisconsin drift and associated buried soil reported in western Ohio and the very old Wisconsin drifts identified in Illinois and Ontario.

Measured section: In steep road bank, 1½ miles northeast of Millbrook in SE¼SE¼ sec. 23, Plain Township, Wayne County. Named for village of Millbrook.

Mill Canyon Member (of Havallah Formation)

Lower Permian: North-central Nevada.

R. J. Roberts, 1964, U.S. Geol. Survey Prof. Paper 459–A, p. A47–A48, pl. 1. Consists chiefly of quartzite, sandy limestone, shale, and chert. Quartzite beds medium to dark gray and weather brownish gray, tan, or white. Quartzite commonly medium bedded, ranging from few inches to 2 feet in thickness, some layers thinly laminated with shaly partings, and others thick layered to massive. Limestone layers generally dark gray on fresh surfaces and range from a few inches to as much as 50 feet in thickness. Thickness about 2,386 feet in Antler Peak quadrangle. Overlies Trenton Canyon Member (new).

Type locality: Mill Canyon, Antler Peak quadrangle, Pershing County.

Mill Creek Till

Pleistocene: East-central Missouri.

A. G. Goodfield, 1966, Dissert. Abs., v. 26, no. 9, p. 5368. St. Louis, Mo., area, including both St. Louis City and St. Louis County, contains deposits which record the western limits of two glaciations, the Eastern Kansan and the Illinoian. The Eastern Kansan glacier which deposited the "Mill Creek" till, advanced across much of what is now the heart of St. Louis City.

St. Louis and adjacent St. Louis County, Mo.

Milligan Creek Formation (in Bozeman Group)

Eocene: Southwestern Montana.

G. D. Robinson and H. F. Barnett, 1963, U.S. Geol. Survey Prof. Paper 370, p. 10 (table 1), 61, 64–65, pl. 1. Light-colored fine-grained tuffaceous lake deposits, mainly limestone but ranging from limestone through marlstone to calcareous mudstone, and interfingering stream-channel sandstone and conglomerate. Thickness about 300 feet in type area. Conformably underlies Climbing Arrow formation (new); overlies Sphinx conglomerate, contact gradational. Bozeman group.

Type area: Specifically E¼ sec. 11, NW¼ sec. 12, and SW¼ sec. 1, T. 1 N., R. 1 W., Three Forks quadrangle. Best exposures are in low hills north of Highway 10 S and west of Milligan Creek.

Mill Pond Granite Gneiss

Precambrian: Northwestern Michigan.

G. W. Mathews, 1965, (Abs.) Lake Superior Geology Inst. 11th Ann. Mtg., May 6–8, (Minnesota Univ., St. Paul), p. 23. Some aspects of pegmatites in Felch district, Michigan. Numerous simple, unzoned pegmatites cut pre-Animikian metamorphic units in Felch district. Size and shape of the pegmatites vary from small sinuous bodies in the Mill Pond Granite Gneiss to large irregular masses in the Solbert [Solberg] Schist.

Felch district, Dickinson County, Mich.

Millport Member (of Rhinestreet Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 62, no. 3, p. 392, 393. Consists of gray shales, siltstones, and black shales (rare). Overlies Moreland Member and underlies Dunn Hill Member (both new).

Type section: Lower part in Sleeper Creek and upper part in stream just south of Sleeper Creek where overlying Dunn Creek is exposed at elevation of 1,340 feet. Named for village of Millport, Chemung County, 1.2 miles west.

Milroy Limestone

Ordovician: Central Pennsylvania.

F. M. Swartz and others, 1955, Pennsylvania Geologists Guidebook, 21st Ann. Field Conf., p. F—5, F—6, F—14, F—15 (geol. map). Thickness 300 feet. Underlies Loysburg. Name Milroy is proposed by Rones (ms.) for the "tiger-striped" beds of Kay's reports, in which dolomitic bands of irregular 1- to 2-inch interlayers of dolomitic limestone and purer limestone weather with distinct relief on many of the exposed surfaces that transect the bedding of the rock. Underlies Clover limestone. Overlies Tea Creek dolomite (new). Chazyan stage.

In area from Bellefonte to Pleasant Gap, Nittany Valley.

Mincke Member (of Kings Lake Formation)

Middle Ordovician (Champlainian): Eastern Missouri.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 111, 235. Consists of (1) interbedded layers 1 to 5 inches thick; (2) very fossiliferous calcarenite; and (3) green to brown shale. Bed of yellow bentonite ½ to 2 inches thick persistently present, commonly in a bed of brown shale, from 1 to 1½ feet below top. Thickness 6 feet at type section. Underlies Tyson Member (new); overlies Glencoe Member of Spechts Ferry Formation.

Type section: Exposure in south bluff of Meramec River along St. Louis-San Francisco Railroad, a quarter of a mile northeast of Mincke Siding, St. Louis County, Mo., near center E½ SE SE 21, 44N—4E, Manchester quadrangle. Named for Mincke Hollow, a small tributary of Meramec River, mouth of which is a quarter of a mile southwest of type section.

Mineola Crinoidal physiofacies (of Callaway lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Callaway lithofacies of Cedar City formation (new) divided into four physiofacies: Lupus sandstone, Mineola Crinoidal or arenaceous limestone, Sandy Hook dolomitic limestone or dolomite, and Calwood limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 39—41. Branson (1920, Am. Jour. Sci., 4th, v. 49) used name Mineola as a formation but term is used here as physiofacies of Callaway lithofacies of the Cedar City. Formation was referred to as Crinoidal limestone by Broadhead (1873, Reports on the geological survey of state of Missouri, 1855—1871) from exposures in Warren and Montgomery Counties.

Maximum thickness about 18 feet. Mineola interfingers with other facies of the Callaway Lithofacies. Also interfingers with Lamine River physiofacies and Little Splice Creek facies of Cooper lithofacies. Overlies Ordovician formations—Jefferson City, St. Peter, Joachim, and Plattin. Underlies *Siphonodella* Beds of Bachelor Formation (basal Mississippian).

Crops out in Saline, Cooper, Moniteau, Boone, Lincoln, Pike, Ralls, Callaway, and Montgomery Counties.

Miner Creek Formation (in Livingston Group)

Upper Cretaceous: South-central Montana.

A. E. Roberts, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B86—B92. Consists largely of alternating beds of siltstone and sandstone. At base is ridge-forming sandstone and tuff unit, 160 feet thick, herein named Sulphur Flats Sandstone Member. Thickness 1,350 feet at type section. Conformably overlies Cokedale Formation (new); conformably underlies Billman Creek Formation (new).

Type section: Exposures along Miner Creek in E½ sec. 19 and NW¼ sec. 20, T. 2 S., R. 9 E., Park County.

Miners Delight Formation

Precambrian: Southwestern Wyoming.

R. W. Bayley, 1965, U.S. Geol. Survey Geol. Quad. Maps CG—458, 459. Consists of (1) graphitic schist member, mainly black schistose rocks, commonly sheared; (2) mixed member, chiefly mafic lava flows and graywacke conglomerate, much sheared and metamorphosed, gneissic locally; and (3) chiefly feldspathic and micaceous graywacke (turbidites), conglomerate, and mica schist, probably more than 5,000 feet thick. In fault contact with Roundtop Mountain Greenstone (new) in South Pass City quadrangle, Fremont County.

R. W. Bayler, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—460. Formal proposal of name. Type locality stated.

Type locality: General vicinity of Miners Delight mine, sec. 32, T. 30 N., R. 99 W., Miners Delight quadrangle, Fremont County.

Minguillo Lava Member (of Pozas Formation)

Upper Cretaceous: Puerto Rico

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 50—51, pl. 1. A massive unit with no apparent internal stratification. Forms lens at base of formation in west-central Ciales quadrangle and is absent south of headwaters of Quebrada Manicaboa. Maximum thickness about 300 meters along the Río Toro Negro. From there thins southward and pinches out in distance of only a little over half a kilometer. Underlies Blacho Tuff Member (new). Conformably overlies Manicaboa Formation (new). In westernmost outcrop and in fault blocks north of Río Grande de Manatí fault, is in fault contact with Avispa Lava Member of Río Orocovis Formation and Manicaboa Formation.

Named for outcrops along highway west of Quebrada Minguillo, barrio Pesas, Municipio de Ciales, west-central Ciales quadrangle.

Minisink Limestone (in Helderberg Group)

Lower Devonian: Northeastern Pennsylvania, western New Jersey and southeastern New York.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 34—35, measured sections. A thin unit of dark- to medium-gray fine-grained argillaceous limestone between Port Ewen Shale and shale of the New Scotland Formation in eastern Pennsylvania and New Jersey has in past been assigned, with some uncertainty, to Becraft Limestone. However, inasmuch as type Becraft of New York consists of "very coarse-grained, crinoidal, dark-gray or pink limestone containing such an abundance of fossils in places that it may be classified as a shellrock or coquinite" and its stratigraphic relations to the limestone interval between the New Scotland and Port Ewen Formations in the Pennsylvania-New Jersey area are unknown, name Minisink Limestone is proposed for these belts. Contact with overlying Port Ewen is abrupt. Contact with subjacent dark-gray laminated shale of New Scotland is gradational in Lake Maskenozha quadrangle but is abrupt near Minisink Hills, Pa. Thickness 14 feet at type section; 11.5 feet in Lake Maskenozha quadrangle. Continues northeast to Trilobite Mountain, N.Y. where it is 20 feet thick. Persists southwest to point near Bossardsbille, Pa. Position of the Minisink between the New Scotland Formation and Port Ewen Shale suggests that the Minisink is equivalent to the Becraft and (or) Alsen Formations. However, the Minisink may be stratigraphically lower than either the Becraft or Alsen. If it is, the New Scotland and Port Ewen are not equivalents between the two areas. Rather than introduce new names for these formations, names New Scotland and Port Ewen are retained in this report.

Type section: In roadcut on southwest side of U.S. Interstate Highway 80, about 0.4 mile southwest of Minisink Hills, Pa. The Minisink is completely exposed, although upper and lower contacts tend to become covered with shale. Section lies along overturned asymmetrical syncline. Reference section: Type sections for the Maskenozha and Flatbrookville Members of New Scotland Formation.

Minnie Gap Sandstone Tongue (of Rock Springs Formation)

Minnies Gap Tongue (of Rock Springs Formation)

Upper Cretaceous: Eastern Utah and southwestern Wyoming.

H. W. Roehler, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 11. Major littoral and shallow-marine sandstone benches in Rock Springs Formation have been named Chimney Rock Tongue, "Minnies Gap" Tongue, Brooks Tongue, and McCourt Tongue.

R. E. Keith, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 44 (fig. 1), 48, 49 (fig. 7), 50. Minnie Gap Sandstone Tongue was named by Roehler for massive light brown cliff-forming sandstone which is present in northeastern Utah (T. 3 N., R. 21 E.). According to Roehler, unit is about 500 feet thick at type locality and thins generally to east and northeast. In area of present study [Sweetwater County, Wyo.] Minnie Gap consists of series of interbedded sandstone and shale. To northwest, sands interfinger with Paludal Member of the Rock Springs Formation. To east and southeast, sands are siltier and thinner, and interfinger with marine shales of Black Butte Tongue.

Named for occurrence on north side of Lucerne Valley, Utah.

Minot Drift

Minot-Edinburg Drift

Pleistocene: North Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 18. Notes on Pleistocene stratigraphy of North Dakota. Named drifts are ecostratigraphic units (Krumbein and Sloss, 1963, Stratigraphy and Sedimentation: San Francisco, W. H. Freeman and Co.) a variety of which has been called morphostratigraphic units by Frye and Willman (1960, Illinois Geol. Survey Circ. 285). Named surface drifts are lithologically indistinguishable on regional scale and belong to a single lithostratigraphic unit to be defined in later report. Drift K (Minot Drift) is equivalent to drift 4a of Christiansen (1965, Saskatchewan Research Council Map 2) which is about 12,000 years old.

Present in Bottineau, Renville, Mc Henry, and Ward Counties.

Mint River Glaciation

Mint River Drift

Pleistocene: Alaska.

C. L. Sainsbury, 1966, Dissert. Abs., v. 26, no. 8, p. 4578. Datable Pleistocene events in New York Mountains begin with Yarmouth Interglaciation when the New York terrace, a marine platform, was cut. In Illinoian time, the New York terrace was uplifted almost 400 feet, and during Sangamon Interglaciation a second marine platform (Lost River terrace) was cut and is not deformed. During Wisconsin time, the widespread York Glaciation (new) was followed by the more restricted Mint River Glaciation.

C. L. Sainsbury, 1967, *in* The Bering Land Bridge: Stanford, California, Stanford Univ. Press, p. 121—143. Formal proposal of name. York Mountains contain drift recording a glaciation later and less extensive than the York Glaciation. This later glaciation is herein named Mint River Glaciation. Drift of the Mint River can be distinguished from drift of the York by position of its moraines nearer the cirques in which ice originated, by its better preserved topography and by the presence in two places of polished and striated limestone bedrock exposed at the surface in cirque walls. Gravel terrace deposits overlie and bevel the drift of the York Glaciation but do not touch or bevel the terminal moraines and drift of the Mint River Glaciation. At least two ice advances during the Mint River Glaciation are recorded at the type locality.

Type locality: Area in the western headwaters of the East Fork of Grouse Creek. Named after moraines on the Mint River, Seward Peninsula.

Miranda Sand Member (of Cibao Formation)

Oligocene or Miocene: Puerto Rico.

W. H. Monroe, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—334. Consists of about 10 m of angular to subangular coarse-grained quartz sand in noncalcareous silty clayey matrix. Uppermost member of formation. Overlies Quebrada Arenas limestone member (new). On basis of preliminary fossil studies it is believed that the Cibao below the Quebrada Arenas limestone is of Oligocene age.

Type locality: On Route 645, 900 m north of southern edge of Manati quadrangle and 860 m west of eastern edge. Named for Comunidad Rural Miranda which is shown on map as Parcelas Mirante.

Miser Gravel

Quaternary: Southwestern Texas.

C. C. Albritton, Jr., and J. F. Smith, Jr., 1965, U.S. Geol. Survey Prof. Paper 479, p. 99—100, pl. 1. Gravels on surfaces of erosion in Sierra Blanca area are named (ascending): Miser, Madden, Gills, Ramey, and Balluco. The Miser consists chiefly of limestone, sandstone, and quartzite derived from nearby parts of Quitman Mountains. Thickness 1 to 20 feet.

Type locality: Miser Arroyo along southwest part of Quitman Mountains, Hudspeth County.

Misery Quartzite Member (of Tarratine Formation)

Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 167—168, pl. 34. Consists of interbedded quartzite, dark sandstone, and slate which occurs near top of formation. Thickness 4 to 500 feet. Where member is present, it divides the Tarratine into an upper and lower part. Fossils not found in member but it lies within main part of the Tarratine, which is of Oriskany age.

Type section: At northwest end of railroad cut through Misery Ridge at east end of Tarratine in Brassau Lake quadrangle.

Mitchell Butte Member (of Deer Butte Formation)

Miocene, upper and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 9, 37. Uppermost of seven members of formation. Overlies Sourdough Basin Basalt Member (new). Total exposed thickness of member at type section of the Deer Butte, 503 feet.

Named for exposures on Mitchell Butte, sec. 1, 2, and 12, T. 21 S., R. 45 E., Malheur County.

Moapa Formation

Upper Devonian: Southeastern Nevada.

R. L. Langenheim, Jr., and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 5, p. 596 (fig. 4), 601. Formation is 300 feet thick at type locality and is characterized by easily eroded buff to yellow rocks which form prominent bench. Thickness 270 feet at Tungsten Gap. Lower part of the Moapa consists of thin- to medium-bedded dolomite which weathers light gray to buff and crops out in ledges and benches. Upper part weathers to talus-covered slope, but is composed of gray to light-gray, buff to yellow-weathering, thin- to medium-bedded dolomite and limestone with scattered stromatopotoidal layers. Overlies Piute Formation (new).

F. G. Poole and others, 1967, *in* International symposium on the Devonian: Calgary, Alberta, Alberta Geol. Soc. Petroleum Geologists, v. 1, p. 885 (fig. 2b). Age shown on correlation chart Upper Devonian.

Type locality: North of Toronto Gulch, Arrow Canyon quadrangle, Arrow Canyon Range, Clark County.

Moccasin Creek Bed (in Cloud Chief Formation)

Permian (Custerian Series): Northwestern Oklahoma and southern Kansas.

R. O. Fay, 1965, Oklahoma Geol. Survey Bull. 106, p. 73—74, 145, pl. 1. At type locality divided into three parts: an upper 4-inch greenish-gray quartzose limestone or dolomite, a middle 1-foot red-brown siltstone and shale, and a lower 1.5-foot greenish-gray calcitic sandstone. Lower unit overlies fine-grained orange-brown sandstone of Rush Springs Formation, and upper unit underlies red-brown shale of Kiger Member. Mapped in southern Kansas.

Type section: In SE¼SE¼ sec. 8, T. 28 N., R. 18 W., Woods County, Okla. Named for West Moccasin Creek, Woods County.

Modoc porphyry

Cretaceous or Tertiary: Southwestern Montana.

H. W. Smedes and others, 1962, U.S. Geol. Survey Mineral Inv. Field Studies Map MF—246. A local term applied to a light-colored strikingly porphyritic rock with abundant phenocrysts of plagioclase in mapped area.

Present in Elk Park quadrangle, Jefferson and Silver Bow Counties.

Moffat Lentil (in Edwards Formation)

Lower Cretaceous: Southern Texas.

W. L. Fisher and P. U. Rodda, 1967, Kansas Geol. Survey Spec. Distrib. Pub. 34, p. 56. Incidental mention of Whitestone lentil, Moffat lentil, and Sweetwater lentil (new) in discussion of stratigraphy and genesis of dolomite of Edwards Formation. These are oolitic shoal units locally developed along northern margin of Comanche platform, possibly along and at heads of local embayments of the platform in areas of relatively high tidal velocities. [Some authors have referred to "the Moffat mound of the Edwards".]

Mokst Butte Flow

See Lava Cast Forest Flow.

Momence Sandstone Member (of Eminence Formation)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 26 (fig. 9), 41. Name applied to light-gray dolomitic medium-grained sandstone at base of Eminence. Thickness 5 to 15 feet. Occurs between 1,650 and 1,660 feet in type well. Overlies Potosi Dolomite.

Type well: Hughes Oil Co. No. 1 Parish, a rotary well in NW¼NW¼SW¼ sec. 24, T. 31 N., R. 13 E., Kankakee County. Name derived from city of Momence, just east of type well.

Monida Formation (in Beaverhead Group)

Monida Sandstone Lithosome (in Beaverhead Formation)

Upper Cretaceous and Paleocene(?): Southwestern Montana.

M. D. Wilson, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2487—2488. Late Cretaceous and Paleocene(?) sediments in area separated into laterally equivalent units of formation rank (informally defined), Lima and Monida. Formations are placed in Beaverhead group (term Beaverhead informally raised to group status). The Monida is a sandstone-dominated succession. In area halfway between Snowline and Monida, the Monida is further divided into two sandstone members.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Monida Sandstone lithosome 2,500 feet. Consists mostly of calcareous salt and pepper sandstone (chert fragments).

Monida is in Beaverhead County.

Mono Basin Glaciation

Pleistocene (Illinoian ?): Eastern California.

R. P. Sharp and J. H. Birman, 1963, Geol. Soc. America Bull., v. 74, no. 8, p. 1079—1086. Two additions proposed for Blackwelder's (1931, Geol. Soc. America Bull., v. 42, no. 4) sequence of four Pleistocene glaciations, Tioga, Tahoe, Sherwin, and McGee of the Sierra Nevada. The younger, Tenaya, lies between Tioga and Tahoe, giving three-fold subdivision of the Wisconsin. The older, Mono Basin, fills long-recognized gap between Tahoe and Sherwin; it is possibly Illinoian. Evidence for Mono Basin glaciation is scanty because its ice streams were less extensive than subsequent Tahoe glaciers.

Features of the glaciation are visible from U.S. Highway 395 and are shown on U.S. Geological Survey Mono Craters topographic quadrangle of 1953.

Monocline Valley Formation

Lower Ordovician: Southeastern Nevada.

C. R. Longwell and M. C. Mound, 1967, Geol. Soc. America Bull., v. 78, no. 3, p. 405—412. Predominantly dolomite. Thickness 725 feet. Overlies Buffington Formation (new). Underlies Muddy Peak Limestone. Known outcrops limited to area in which the Muddy Mountains thrust plate has been uplifted and deeply eroded. Exposures of formation, distributed irregularly in the faulted plate, extend about 8 miles south-southwestward and 12 miles eastward from type locality. Formation thins toward east.

Type locality: In Muddy Mountains, Clark County. Complete section exposed on north side of deep valley parallel to strike of beds in a steep monocline which is named Monocline Valley.

Monola Formation

Middle Cambrian: Eastern California.

C. A. Nelson, 1965, U.S. Geol. Survey Bull. 1194—A, p. A29—A33. Name applied to basal part of Middle Cambrian section in White-Inyo Mountains. In type area divided into three members: lower member, 660 feet thick, of limy siltstone, shaly siltstone, and thin-bedded silty limestone, all generally buff to orange brown weathering; middle, 115 feet thick, of well-bedded gray to blue-gray limestone with thin siltstone interbeds and forming bold gray cliff; and an upper, 425 feet, of dark-brown-weathering platy siltstone capped by gray and blue-gray limestone and interbedded limy shale. Conformably overlies Mule Spring Limestone; conformably underlies Bonanza King Dolomite.

Type area: Exposures on west flank of Inyo Mountains within Waucoba Mountain quadrangle, east and southeast of abandoned rail station of Monola. Principal section (type section): On northwest-facing spur in SE¼ projected sec. 6, T. 10 S., R. 35 E., about 1 mile east of Mule Spring. Supplementary section: On southwest-trending spur in SE¼SE¼ projected sec. 33, T. 10 S., R. 35 E.

Monroe Canyon Limestone (in Chesterfield Range Group)

Upper Mississippian: Southeastern Idaho.

J. T. Dutro, Jr., and W. J. Sando, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 11, p. 1963—1986. A 924-foot predominantly carbonate rock sequence that conformably overlies Little Flat Formation (new). Lower 408 feet is massive limestone member; overlying 204 feet is medium-bedded limestone member; upper 311 feet is cherty limestone member. Underlies Wells Formation.

Type section: In NW¼ sec. 20, T. 7 S., R. 40 E., Bannock County. Named for Monroe Canyon.

Monrovian Park Latite Member (of Bullion Canyon Volcanics)

Miocene(?): Central Utah.

Eugene Callaghan and R. L. Parker, 1961, U.S. Geol. Survey Geol. Quad. Map GQ—155. Consists of conspicuous gray porphyritic flows. About 500 feet thick in Monroe Canyon. Overlies pyroclastic member; underlies calcic latite flows of Bullion Canyon volcanics.

Named for exposures in Monroe Canyon, one-half mile northwest of Monrovian Park, Monroe quadrangle. Member extends north along the canyon of First Lefthand Fork to place where it is covered by landslide; thins and disappears 2½ miles south of Monroe Canyon.

Monteagle Formation

Upper Mississippian: Central Tennessee and southern Kentucky.

M. N. A. Peterson, 1962, Jour. Geology, v. 70, no. 1, p. 2, 3 (chart), 9—13. A carbonate unit between St. Louis limestone and Big Clifty sandstone. Name credited to Vail (1959, unpub. thesis).

R. G. Stearns, 1963, Tennessee Div. Geology Inf. Circ. 11, p. 3—8. White and lightgray fine- to coarse-grained thin to very thick bedded fossiliferous and oolitic limestone, 150 to 300 feet thick; 200 feet at type section. Subdivided into six divisions (I to VI). Subdivision V is La Follette Member (new). Overlies St. Louis Limestone; underlies Hartselle Formation.

R. Q. Lewis, Sr., and R. E. Thaden, 1965, U. S. Geol. Survey Geol. Quad Map GQ—475. Mapped and described in Cumberland City quadrangle, southern Kentucky, where it is as much as 280 feet thick. Includes Ste. Genevieve Limestone Member, about 80 feet thick, in lower part and unnamed limestone member, 90 to 200 feet thick, in upper part. Overlies St. Louis Limestone. Underlies Hartselle Sandstone. Ste. Genevieve Limestone, not recognized at type section of Monteagle, is mappable unit above St. Louis Limestone and is herein reduced in rank, in this area only, to member status in the Monteagle. Upper Mississippian.

Type section: Roadcut along Highway 41, 1½ miles southeast of village of Monteagle, Marion County, Tenn.

Montebello Limestone Member (of Cibao Formation)

Oligocene, upper, and Miocene, lower: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 24, 28, 29. Relatively pure thick-bedded limestone. In some areas overlies Lares Limestone. Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

A. E. Nelson and W. H. Monroe, 1966, U.S. Geol. Survey Bull. 1221—C, p. C16—C17, pl. 1. Formal proposal of name. Throughout most of Florida quadrangle, Cibao Formation consists of friable pure limestone that is indurated on surface at most places into a very finely crystalline texture. This unit is named Montebello Limestone Member. At type locality, herein designated, about 20 m of massive limestone rests on about 10 m of thin-bedded and crossbedded limestone that is composed largely of medium to coarse grains, many of which are Foraminifera and shell fragments. Base of unit not exposed but exposures updip toward south and less than 5 m stratigraphically lower are massive fine-grained white crystalline limestone of the Lares. In central and western parts of quadrangle, thickness of the Montebello is about 210 m. This is more than the thickness of entire Cibao Formation at east edge of quadrangle. Member is overlain in most of quadrangle by calcareous clay or marl which is less than 10 m thick in west half of quadrangle. Toward east intertongues with marl and limestone beds that have been recognized farther east. Quebrada Arenas Limestone Member can be recognized from east edge of quadrangle to point about a kilometer west of Montebello where it becomes indistinguishable from limestone beds of the Montebello.

Type locality: In cliff face on east side of a trail 1,300 m air line S. 33° E. of Montebello, coordinates 58,330—143,560. Named from village of Montebello, Barrio Rio Arriba Poniente, Municipio de Manati, Florida quadrangle.

Montenegro Member (of Campito Formation)

Lower Cambrian: East-central California and western Nevada.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 141. Upper member of Campito (redefined). Typically gray shale and interbedded fine-grained quartzitic siltstone and sandstone. Locally, thin lenticular archeocyathid limestone beds present at top of member. Thickness about 1,000 feet. Overlies Andrews Mountain Member (new); underlies Poleta Formation (new). Lower Cambrian.

J. P. Albers and J. H. Stewart, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D24—D27. Geographically extended into Esmeralda County, Nev., where it is largely greenish-gray siltstone. Overlies Andrews Mountain Member; underlies Poleta Formation.

C. A. Nelson, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—528. Mapped in Waucoba Mountain quadrangle, Inyo County, Calif. Consists of gray shale and interbedded fine-grained quartzitic siltstone and quartzitic sandstone. Overlies Andrews Mountain Member. Underlies Poleta Formation.

Named for exposures at Montenegro Spring, Blanco Mountain quadrangle, White Mountains, Calif.

Montini Formation

Pleistocene, lower to middle: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Consists of lower member of lacustrine sand, silt, and clay about 100 feet thick overlain by a basalt tuff member and an upper member about 200 feet thick of sand, silt, and clay. Younger than Jackass Butte Formation (new) and Otter Basalt (new). Covered by an alluvial fan, the Hart Creek Fanglomerate (new).

Present in Oreana quadrangle in foothill country of Owyhee Mountains and southern margin of western Snake River Plain.

Montour Member (of Middlesex Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Lowest member of Middlesex Formation in area. Consists of interbedded dark-gray shales, black shales, and thin-bedded siltstones (rare). Underlies Johns Creek Member (new). In Watkins Glen-Elmira area occurs above West River Member of Ithaca Formation; in Ithaca-Owego area occurs above Treman Member (new) of Ithaca Formation.

D. L. Woodrow and R. C. Nugent, 1963, New York Assoc. Guidebook 35th Ann. Mtg., p. 64 (fig. 2). In Binghamton area underlies Kattell Member of Middlesex and occurs above the Ithaca. In Watkins Glen-Elmira area underlies Johns Creek Member and occurs above West River Member of Ithaca.

Type section: In Catlin Mill Creek at Odessa (elevation 1,030 feet) and east of Montour Township. Traced southeastward to Chenango Forks, 38 miles southeast of Ithaca.

Monument Creek Alluvium

Pleistocene (Wisconsin): Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 24—26, pl. 1. Stream deposits of pebbly sand. Forms second major terrace above modern flood plain. Top of terrace is 20 to 25 feet above the stream. Terrace is underlain by bedrock surface. Locally, this bedrock surface is even and at a fairly uniform elevation above the stream; elsewhere it is irregular and channeled. In some places the alluvium is exposed in continuous section from creek level to top of terrace, but more commonly 2 to 15 feet of Dawson Arkose shows at base of terrace. Thickness of alluvium 5 to 25 feet; average thickness 15 to 20 feet. Younger than Kettle Creek Alluvium (new). Late Wisconsin.

Type locality: Valleys of Monument Creek, Air Force Academy area, El Paso County. Occurs along most of streams flowing into Monument Creek from the east.

Moody Brook Formation (in Buckfield Group)

Silurian: Western and northwestern Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser., 3, p. 11 (table 1), 22—24, pls. 1, 2. Consists mainly of migmatitic gneiss with dark fraction made up of dense quartz-feldspar-biotite schist and quartz-feldspar-two-mica-sillimanite schist. Thickness about 600 feet. Overlies Berry Ledge formation (new). Thickness at least 600 feet. Uppermost unit of what is termed herein the southern sequence. To north the Moody Brook is in fault contact with some units of northern sequence and with the Songo granodiorite. May correlate with upper part of Waterville formation as defined by Osberg (in preparation) in Waterville area.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., 57th Ann. Mtg., Trip K, p. 104 (table 1), 105, figs. 1, 2, road log. Included in Buckfield Group (new). Overlies Berry Ledge Formation. Underlies Anasagunticook Formation (new) of Woodstock Group (new).

Type locality: Along upper part of Moody Brook, Bryant Pond quadrangle. Also well exposed on hills immediately north of West Paris and hill just east of Stearns Hill.

Mooney Falls Member (of Redwall Limestone)

Mississippian: Northwestern Arizona.

J. W. Parker and J. W. Roberts, June 1963, Four Corners Geol. Soc. 4th Field Conf., p. 45, 51. Thick-bedded cliff-forming unit. Thickness 311 feet at type section. Overlies Thunder Springs Member (new); underlies Horseshoe Mesa Member (new). Name credited to McKee (unpub. ms.)

E. D. McKee, [Nov.] 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C21—C22. Formal proposal of name. Mostly very pure limestone, locally, as in lower part in type section, contains dolomite. Thin chert beds common near top. Large scale crossbedding in some areas. Contains coral heads *(Syringopora)*. Thickness 312 feet at type section. Overlies Thunder Springs Member; underlies Horseshoe Mesa Member.

Type section: Mooney Falls in Havasu Canyon, a tributary of Grand Canyon from the north.

Mooney Trail Tuff

Miocene: North-central Arizona.

B. E. Sabels, 1962, New Mexico Geol. Soc. Guidebook 13th Field Conf., p. 100—106. Discussion of Mogollon Rim volcanism and geochronology. The tuff of Thirteen Mile Rock Volcano compared with other tuff sections which possibly are part of this "blanket tuff"—Mooney trail tuff, Cedar Ranch tuff, lower Bidahochi tuffs, and Hopi Buttes tuff. Tuff from gravel deposit on Mooney Trail was studied by thermoluminescence and emission spectography and found to be very similar to bottom tuff at Thirteen Mile Rock Volcano. It is believed that activity of the Mogollon Rim volcano commenced at a time when coarse gravels were being transported in Sycamore Canyon area from a southerly source. At that time the older basalts of lower Hickey formation were already elevated some 400 feet above valley floor, which was being continuously lowered by erosion.

In Sycamore Canyon area near Casner Mountain.

Moonstone Formation

Pliocene, lower and middle: Central Wyoming.

J. D. Love, 1961, U.S. Geol. Survey Bull. 1121—I, p. I—25—I—35. A thick sequence of very soft white to brown claystone, shale, and tuffaceous sandstone and lesser amounts of limestone, conglomerate, and pumicite. Thickness 1,356± feet at type section. Overlies Split Rock formation (new) and in some areas the Precambrian. No rocks younger than Moonstone are present in type area. Has been considered part of White River formation or called Miocene, undifferentiated, in earlier reports.

N. M. Denson, 1965, U.S. Geol. Survey Bull. 1224–A, p. A70–A74. The Moonstone, originally defined to include some lower or middle Pliocene rocks in Granite Mountains area, is referred to in this report as part of Ogallala because of its limited areal extent. Term Split Rock Formation abandoned and term Arikaree used in this report.

Type section: Extends from SW¼ sec. 4, T. 30 N., R. 89 W., southward to stratigraphically highest bed in Vice Pocket, NE¼NE¼SE¼ sec. 33, T. 30 N., R. 89 W., Natrona County. Named from the Moonstone, a smooth monolith of Precambrian granite, against steep face of which strata of Moonstone formation were deposited. The Moonstone is in sec. 32, T. 30 N., R. 89 W., Natrona County, about 4 miles north of Split Rock, and is shown on topographic sheet of Lankin Dome quadrangle.

Moonstone Tuff (in Datil Group)

Oligocene-Miocene: Western New Mexico.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 71 (table 2). Listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Age 26.5±0.9 m.y. [Name Moonstone Tuff may have been used by J. G. Wargo, 1959, unpub. thesis.]

W. E. Elston, 1965, New Mexico Geol. Soc. Guidebook 16th Field Conf., p. 169 (fig. 2), 170, 171. Has been proposed to expand "Datil Formation" to "Datil Group". Most conspicuous and widespread members of group are rhyolite and quartz-latite ash flow tuffs. At least three major sequences have been recognized. They are informally termed (ascending) Whitewater Creek Rhyolite-Cooney Quartz Latite section, biotite-rich two feldspar rhyolites and quartz latites, and Moonstone Tuff. Moonstone Tuff characterized by presence of conspicuous phenocrysts of quartz and moonstone and by relative scarcity of biotite and plagioclase. Massive columnar-jointed ash flows for 700-foot cliffs in canyon walls of West and Middle Forks of Gila River northwest of Gila Cliff Dwellings National Monument. Their thickness there is at least 1,000 feet and may be even more. They seem to center on Diablo Range. From there they extend southward into northwestern end of Pinos Altos Range and northward into east flank of Mogollon Range. Moonstone Tuff forms most of higher ledges of 3,000-foot canyon of Gila River downstream from junction of the three forks of Gila River. It continues for at least 15 miles southwestward beyond mouth of Gila Canyon, into Bear Mountain-Silver City Range and Schoolhouse Mountain quadrangle at northern end of Big Burro Mountains (Wargo, 1959). Damon dated sample from Moonstone Tuff at Schoolhouse Mountain. It yielded K-Ar age of 26.5±0.9 m.y. on the Oligocene-Miocene boundary.

P. E. Damon and others, 1967, Arizona Univ. Geochronology Labs. Ann. Prog. Rept. No. C00–689–76 to Research Div. U.S. Atom. Energy Comm., p. 65 (table 25), 68. Radiometric ages have forced some important changes to be made in correlations of Datil age rocks. The Moonstone Tuff from Reserve, dated in present study, gave age of 23.2 m.y., compared with earlier value of 26.5 m.y. for sample from Schoolhouse Mountain quadrangle from 50 miles south. It is possible to temporarily assume the validity of the dates as stated, which would indicate more than one similar-appearing moonstone bearing rhyolite eruption has occurred. Age of Swartz rhyolite had been considered by Elston (1965) to be post-Moonstone Tuff on geologic grounds, but now it is coeval with older Moonstone unit and older than the Reserve ash flow.

Mooseheart Member (of Ironton Sandstone)

Cambrian: Northeastern Illinois (subsurface)

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 26 (fig. 9), 37–38. Name proposed for persistent dolomitic sandstone overlying Marywood Member (new) and underlying Franconia Formation. Thickness 20 to 60 feet. Occurs between 1,092 and 1,120 feet in type well.

Type well: Miller-Batavia No. 3, sec. 22, T. 39 N., R. 8 E., Kane County. Named for Mooseheart Lake, 2 miles southwest of type well.

Moosehorn Stade

Pleistocene: Southern Alaska.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1). Naptowne Glaciation includes four stades (ascending): Moosehorn, Killey, Skilak, and Tanya.

Karlstrom (1960, 1964) used term Moosehorn advance. However, terms advance and readvance are not accepted as part of formal stratigraphic nomenclature.

Name derived from Moosehorn Rapids, formed where the Kenai River cuts through the outermost morainal belt of Naptowne age near Sterling (formerly Naptowne), Cook Inlet region.

Moredock Member (of Dunleith Formation)

Middle Ordovician (Champlainian): Southwestern Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 124–125, 238–239. Consists mostly of coarse-grained calcarenite. Thickness commonly 60 to 70 feet. Overlies Eagle Point Member; underlies New London Member (new). Where New London is missing the Moredock is overlain unconformably by Cincinnatian strata, either Cape Limestone, Elgin Shale, or Thebes Sandstone. At type section underlies Cape Limestone. Is a previously undifferentiated part of Kimmswick Limestone and is equivalent to Fairplay, Mortimer, and Rivoli Members of northern outcrop area.

Type section: Quarry of Columbia Quarry Co., and exposure in Mississippi River bluff, just north of crushing plant, center N line SW 3, 3S–11W, Kimmswick quadrangle. Named for Moredock Lake at Valmeyer, Monroe County.

Moreland Member (of Rhinestreet Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Lowermost member of Rhinestreet Formation. A 20-foot tongue of black shale, gray shale, and thin-bedded siltstones (rare) equivalent to lower Rhinestreet in western New York. Underlies Millport Member (new).

Type section: In Hamilton Creek (elevation 1,360 feet), a tributary of Glenn Creek. Mapped as far east as West Danby where it is exposed at elevation of 1,350 feet. Name derived from hamlet of Moreland, Schuyler County, 2½ miles south of type section.

Morgan Trail Member (of New Albany Shale)

Upper Devonian and Lower Mississippian: Southeastern Indiana.

J. A. Lineback, 1965, Dissert Abs., v. 25, no. 11, p. 6538. Carbon-rich shale with thin pyritic beds. Overlies Camp Run Member (new) and underlies Selmier Member (new).

Type locality and derivation of name not stated.

Morita Ranch Formation

Tertiary: Western Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 27, pl. 2, road logs. Rix (1953, unpub. thesis) described two successions of volcanic rock in Chinati Peak quadrangle, with outcrops separated by Paleozoic rock or gravel in Cibolo Creek valley. He divided volcanic rock east of Cibolo Creek into four mappable units (T1 through T4) and correlated the units with formations of Buck Hill Group. He mapped the thick succession of flows in Chinati Mountains as the Chinati Mountain Group (units T5 through T8). He considered Chinati Mountain Group to be younger than flows correlated with Buck Hill Group. Dietrich (1965, in press) included Rix's units T1 through T4 and other rocks that crop out east and southeast of Shafter in Morita Ranch Formation. Correlation has not been established between flow rock in Chinati Mountain Group (Rix's units T5 through T8) and Shely Group to northwest or Morita Ranch Formation to southeast. Future work may establish better correlation between Buck Hill Group and Morita Ranch Formation.

J. W. Dietrich, 1966, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 28 (with text). Formal proposal of name. Name is proposed for the succession of interbedded flow and sedimentary rocks that crops out between pre-Cenozoic strata and Perdiz Conglomerate at southeastern end of Chinati Mountains. Following members mapped in Presidio area (ascending): basalt porphyry, rhyolite, ash-flow tuff, and basalt. The basalt porphyry overlies intrusive rock of Morita pluton and all pre-Cenozoic formations that crop out in map area except Santa Elena Limestone. The basalt porphyry includes many flows 20 to 40 feet thick. Maximum exposed thickness in Presidio area is between 150 and 200 feet. The rhyolite crops out along Cienega Creek near northern boundary of may area. Greatest exposed thickness is about 300 feet where Cienega Creek cuts a canyon through largest outcrop. The ash-flow tuff conformably overlies basalt porphyry in southeastern Chinati Peak quadrangle. Near northern boundary of Presidio area the tuff oversteps pre-Cenozoic rock. At all outcrops in Ocotillo quadrangle the ashflow tuff overlies Santa Elena Limestone or Sue Peaks Formation. Thickness of ash-flow tuff as much as 75 feet. Highest lava unit is basalt. Maximum exposed thickness in Presidio area is on the order of 250 feet. Type locality designated. No type section presented.

Type locality: Northern end of the Three Sisters, a mountain 1.3 miles southeast of Shafter, Presidio County. Morita Ranch, source of the name, is in Chinati Peak quadrangle 4 miles southeast of Shafter.

Morningview Sandstone Member (of Monongahela Formation)

Upper Pennsylvanian: East-central Ohio, Pennsylvania, and West Virginia.

H. L. Berryhill, Jr., 1963, U.S. Geol. Survey Prof. Paper 380, p. 37. Overlying Benwood limestone member is clastic unit whose stratigraphic position ranges from 43 to 74 feet above Sewickley coal bed and from 36 to 52 feet below Uniontown coal bed. In many places, unit is greenish-gray siltstone but locally is massive crossbedded sandstone. at first, unit was included in "Uniontown limestone," which included all strata, sandstone and limestone alike, between "Fulton green shale" and Uniontown coal bed, and later, when "Uniontown limestone" was subdivided, it was included in "Arnoldsburg limestone" which included all strata between "Fulton green shale" and "Arnoldsburg sandstone." Unit is herein designated Morningview sandstone member. A layer of greenish-gray siltstone in part of Benwood limestone member is lower tongue of the Morningview. This tongue joins with main body of member eastward in West Virginia and Pennsylvania. Thickness 3 to 12 feet.

Type section: South bank of Deep Run south of paved road in eastern part of sec. 32, Pease Township, Belmont County, Ohio.

Morris Ranch Sandstone Member (of Deese Group)

Pennsylvanian: Southern Oklahoma.

E. C. Parker, 1966, Ardmore Geol. Soc. Guidebook Ardmore Basin, p. 33. Name applied to massive sandstone 200 feet above what C. W. Tomlinson referred to as the "brachiopod" limestone. The "brachiopod" limestone is about 400 feet above the upper Devils Kitchen Member of the Deese Group.

Well exposed 400 feet east of SW corner of sec. 10, T. 3 S., R. 2 E., on ranch of C. B. Morris. His house is built on the sandstone.

†Morrow Mountain Rhyolite (in Tater Top Group)

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 132, geol. map. Dark-gray to black porphyritic rhyolite commonly showing excellent flow foliation. Rhyolite flows may be as much as 200 feet thick and apparently cap only the highest hills in Albemarle quadrangle. Interpreted to conformably overlie Badin Greenstone (new), but where the Badin is absent, conformably overlies Uwharrie Formation (new) and Tillery Formation of Albemarle Group (both new).

The U.S. Geological Survey has abandoned the Tater Top Group and its formations the Badin Greenstone and Morrow Mountain Rhyolite on the basis of a study now in progress.

Type locality: In Morrow Mountain State Park, near bridge over Sugarloaf Creek on road to park office; 0.4 mile east of intersection of this road and road to top of Morrow Mountain. Named after Morrow Mountain in Stanly County.

Morton Drift

Pleistocene: North Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 7, 16 (table 1). Morton Drift (drift A) oldest drift listed. Consists of scattered erratic boulders and rare patches of till. Little original morainic topography remains. No radiocarbon dates from this drift. May be pre-Wisconsinan. In contrast to Morton Drift, the Napoleon Drift, or drift B, retains much of its original morainic topography.

Present in southwestern part of state. Morton County is in drift area.

Morton Member (of Fall River Formation)

Lower Cretaceous: Subsurface in Wyoming, Montana, and South Dakota.

D. W. Bolyard and A. A. McGregor, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 10, p. 2221—2244. Fall River Formation subdivided into (ascending) Liscom Creek, Morton, and Coyote Creek Members (all new). Regionally, these members exhibit geometric characteristics of roof shingles. Whereas total formation maintains relatively uniform thickness, each member, or shingle, is sheet-like body which reaches maximum thickness where the other two are either relatively thin or absent. Coyote Creek Member is at top of formation in Wyoming but pinches out northward in Montana, and Morton becomes upper limit of formation farther north. At type well member was penetrated from 4,891—4,919 feet. Consists of light-gray fine-grained slightly kaolinitic sandstone grading downward into gray to buff siltstone.

Type well. Dan C. Morton No. 1 Morton, in center of SW¼NE¼ sec. 15, T. 54 N., R. 68 W., Crook County, Wyo.

Morzhovoi Volcanics

Tertiary, upper, to Pleistocene, middle: Alaska.

H. H. Waldron, 1961, U.S. Geol. Survey Bull. 1028—T, p. 688—690, pl. 79. A sequence of lava flows and interbedded pyroclastic rocks, and some associated volcanic sedimentary rocks that overlie Belkofski tuff and Tachilni formation (new). Total thickness not known; at least 3,000 feet exposed. Not older than latest Tertiary; Morzhovoi volcano believed to be not younger than middle Pleistocene.

Comprises composite volcanic cone herein called Morzhovoi Volcano, in area of Frosty Peak, on western end of Alaska Peninsula, between Cold Bay on east and Morzhovoi Bay on west.

Mostest limestone member (of Bingham Mine Formation)

See Bingham Mine Formation.

Mount Abraham Schist (in Camels Hump Group)

Mount Abraham Schist Member (of Underhill Formation)

Lower Cambrian(?): Central Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Member of Underhill formation. Light-gray sericite (muscovite-paragonite)-quartz-chloritoid rock and silvery sheen. Porphyroblasts of magnetite common, and porphyroblasts of chlorite, chloritoid garnet, and kyanite present locally. Cambrian(?).

W. M. Cady, A. L. Albee, and J. F. Murphy, 1962, U.S. Geol. Survey Geol. Quad. Map GQ—164. Formation in Camels Hump group in Lincoln Mountain quadrangle. Lower part of the Mount Abraham on western slopes of Lincoln Mountain grades laterally westward into upper part of Underhill formation. North of Mount Grant and Mount Cleveland, upper part grades laterally northeastward into lower part of Hazens Notch formation. In easternmost exposures, northeast of Lincoln Mountain, the Mount Abraham thins to extinction between Underhill and Hazens Notch formations. Lower Cambrian(?).

Named for exposures on summit of Mount Abraham, Addison County.

Mount Aetna Quartz Monzonite Porphyry

Paleocene(?) to Eocene(?): Southwestern Colorado.

M. G. Dings and C. S. Robinson, 1957, U.S. Geol. Survey Prof. Paper 289, p. 30—31, pl. 1. Abundant large pink orthoclase and smaller white plagioclase phenocrysts in a fine- to medium-grained gray groundmass. Crawford (1913, Colorado Geol. Survey Bull. 4) named a distinctive quartz monzonite porphyry in central part of mapped area the Etna quartz monzonite porphyry. Name Etna is preempted. Name changed to Mount Aetna quartz monzonite. Spelling of "Etna" changed to "Aetna" in order to conform to that used on topographic base map of Garfield quadrangle. At type locality the unit occurs as an irregular stock extending about 3 miles northwest to head waters of Tomichi Creek. A long dike near west side of stock extends from upper Tomichi Creek valley almost 10 miles northeast across the Continental Divide to point about a mile beyond St. Elmo where it apparently pinches out in Mount Princeton quartz monzonite. Less than a mile to the northeast, another dike having same general trend is exposed for about a mile, and the two probably connect at depth. The dike pinches and swells, ranging in width from about 50 to 1,000 feet. Most of dike is vertical but in vicinity of St. Elmo it dips about 50° NW. Another large dike extends from south side of Mount Aetna 4½ miles northeast to border of map area, and Crawford (1913) shows it extending about 2 miles farther, almost to Browns Creek.

Type locality: On Mount Aetna, 3 miles north of Monarch, Garfield quadrangle.

Mount Aggie Formation

Ordovician(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 20, pls. 1, 2. From type locality south to Mount Aggie, formation is distinctive assemblage of interbedded very thin to thick-bedded slate and marble. Southeast of Mount Aggie, formation shows general progressive southward increase in sandstone content and accompanying decrease in slate and marble content. Southwest of Horsetail Falls contains lentil of calcareous sandstone 1,000 feet thick. Southeast of Horsetail Falls, consists of interbedded laminated dark-gray siliceous hornfels, light-gray siliceous calc-hornfels, fine-grained sandy marble, and calcareous quartz sandstone. Thickness about 2,500 feet at type locality. East of Mount Aggie, formation may be as much as 5,000 feet thick, but two strike faults cut rocks, and amount of displacement along them not known. Overlies Buzztail Spring formation (new). Underlies Convict Lake formation (new).

Type locality: North shore of Convict Lake, Mount Morrison quadrangle, Sierra Nevada. Forms east slope of Mount Aggie, a prominent peak about 1½ miles southeast of Mount Morrison.

Mountain View Sand and Gravel

Pleistocene, upper: Northwestern Washington.

D. J. Easterbrook, 1963, Dissert. Abs., v. 23, no. 8, p. 2873. Mountain View formation consists of sand and gravel deposited unconformably on Cherry Point clay (new).

D. J. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1470—1471, pl. 3. Formal proposal of name. Sediments well stratified, with rounded pebbles, crossbedding, and other features typical of fluvial deposits. Locally primary dips as high as 10°. Thickness about 45 feet along Strait of Georgia, north of Neptune. Within 1 mile to north sediments thin and pinch out laterally between Vashon till and Cherry Point silt. To south, near Neptune Beach, sediments disappear beneath beach level but reappear several miles to southeast along sea cliffs of Lummi Peninsula. Overlies Cherry Point silt at type section of the Cherry Point.

Occurs in northern part of Puget Lowland which occupies about 400 square miles in northernmost Washington between Cascade Range on east and Georgia Strait on west. Mountain View is in Whatcom County.

Mount Aix Andesite (in Keechelus Andesitic Series)

Tertiary: Central Washington.

M. L. Stout, 1964, Geol. Soc. America Bull. 75, no. 4, p. 330. Hypersthene bearing. Uppermost member of Keechelus. Name credited to Abbott (1953, unpub. thesis).

Present in Mount Aix quadrangle.

Mount Baldwin Marble

Pennsylvanian: East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 24–25, pls. 1, 2. Fine-grained bluish-gray to dark-gray marble; chert locally abundant as irregular nodular beds and zones of nodules. Thickness about 500 feet. Overlies Bright Dot formation (new); contact generally sharp but locally gradational. Conformably underlies Mildred Lake hornfels (new). Unit here named Mount Baldwin marble was named Laurel Canyon formation by Mayo (1934).

Type locality: East wall of canyon of Laurel Creek, a few hundred feet east of end of west branch Laurel Creek Jeep trail, Mount Morrison quadrangle, Sierra Nevada. Almost continuously exposed from type locality southeastward to south boundary of quadrangle, a distance of 7 miles. Near south boundary the strike swings eastward, and formation terminates against granodiorite.

Mount Belknap Rhyolite (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah

M. W. Molly and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 222. Massive siliceous pinkish-gray rhyolite about 300 feet. Believed to represent youngest member of Mount Belknap volcanic group.

Caps Mount Belknap, Tushar uranium area, near Marysvale, Piute County.

Mount Biedeman Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacramento Geol. Soc. Guidebook Ann. Field Trip June 18–19, p. 12, 14, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, and Mount Biedeman, and Silver Hill. Mount Biedeman Series consists principally of andesite, some dacite and rhyolite. Central part of Mount Biedeman appears to be a dome composed of andesite which has intruded a former volcano, also composed of andesite. Almost completely encircling the central dome near its base are a number of plugs of hornblende andesite which intrude the former volcano. Several irregular bodies of rhyolite intrude the andesite. One of these rhyolite bodies is exposed along Clearwater Creek road to Bodie and another, still larger, lies low on the east flank of Mount Biedeman. The rhyolite consists of two distinct phases: a crystalline phase and a glassy phase. The rhyolite bodies were emplaced late as they cut both the andesite and dacite of Mount Biedeman Series. The dacite is distinguished in the field by its biotite content and occurs as small pluglike bodies.

Mount Biedeman is north of Mono Lake, in Mono County.

Mount Carbon Member (of Pocono Formation)

Lower Mississippian: Eastern Pennsylvania.

J. P. Trexler, G. H. Wood, Jr., and H. H. Arndt, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C36—C39. Upper member of formation. Overlies Beckville Member (new); underlies Mauch Chunk Formation. Thickness 560 feet at type section. Consists of fine to coarse quartz-pebble conglomerate overlain by intercalated beds of fine pebble conglomerate, conglomeratic sandstone, quartzose sandstone, subgraywacke, siltstone, shale, and a few thin lenses of anthracite. Basal unit is a 30-foot-thick light-olive-gray to light-gray quartz-pebble conglomerate which grades downward into a thin coarse sandstone, below which the contact is placed. Upper unit in type section is a poorly exposed light-gray conglomeratic sandstone about 45 feet thick.

Type section: East side of water gap cut in Second Mountain by West Branch of Schuylkill River in Pottsville quadrangle, Schuylkill County. Named from Mount Carbon, a village on southern outskirts of city of Pottsville. Rocks of type section slightly overturned to north.

Mount Davis Volcanics

Eocene(?) to Miocene(?): Northwestern Arizona and southern Nevada.

C. R. Longwell, 1963, U.S. Geol. Survey Prof. Paper 374—E, p. E7 (fig. 2), E10 (table 1), E18, E24—E29, pl. 1. Five episodes of volcanism recognized along Colorado River south of Lake Mead. Mount Davis volcanics, third of the eruptive series, consist largely of basalt and dark andesite; at several horizons are units of high-silica glass and pumiceous tuff. Thickness 0 to 4,000+ feet. In many places lies with angular unconformity on Golden Door volcanics (new) or on older rocks. Unconformably underlies Muddy Creek formation.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2491. In Eldorado mining district, Clark County, Nev., Tertiary rocks consist of middle to late Tertiary flows any pyroclastic beds of andesite, basalt, and rhyolite. These are assigned to three volcanic formations: Patsy Mine, Golden Door, and Mount Davis volcanics.

Type locality: On and near Mount Davis, western Mohave County, Ariz.

Mount Fairplay granite

Age not stated: East-central Alaska.

G. J. Wasserburg, G. D. Eberlein, and M. A. Lanphere, 1963, (abs.) Geol. Soc. America Spec. Paper 73, p. 258. Age measurements on biotites from Mount Taylor batholith and Mount Fairplay granite gives ages of 190 and 66 m.y. respectively.

Mount Hamilton Formation or Group

Upper Cambrian to Middle Ordovician: West-central Vermont.

E-an Zen, 1961, Geol. Soc. America Bull. 72, no. 2, p. 297 (fig. 2), 306—307, pl. 1. Lithologically heterogeneous unit yet of such close stratigraphic association that the various types can be mapped together. Six rock types included: (1) interbedded gray and green slate and fine quartzite; (2) black slate and fine quartzite; (3) dark-red and purple slate and fine quartzite; (4) red slate; (5) black slate with spongy, brown-weathering black calcareous massive quartzite; (6) and limestone matrix, limestone and chert pebble conglomerate. Unit 1 is largely Keith's (1932) Poultney slate; unit 4 is Keith's Indian River slate. Term group is preferred because work in adjacent areas shows that unit is separable into formations. Overlies West Castleton formation; underlies Pawlet formation (new).

C. G. Doll and others, 1961, Centennial Geologic map of Vermont (1:250,000): Vermont Geol. Survey. Mapped as formation.

E-an Zen, 1963, Am. Jour. Sci., v. 261, no. 1, p. 92—93, C. G. Doll and others, 1961, Am. Jour. Sci. v. 261, no. 1, p. 94—96. Discussion of usage of name and correlations on Centennial Geologic map of Vermont.

E-an Zen, 1964, U.S. Geol. Survey Bull. 1174, p. 51—54. Mount Hamilton Formation of Doll and others differs from Zen's Mount Hamilton Group by excluding beds designated as Unit 5 and associated strata by Zen (1961) and as Hatch Hill Formation by Theokritof (1959). Name Mount Hamilton Formation is synonymous with combination of Indian River Slate and Poultney Slate as used by Keith (1932). Mount Hamilton Group synonymy listed. Group Late Cambrian to Middle Ordovician. Formation Early to Middle Ordovician.

Named for Mount Hamilton.

Mount Hoffmann Quartz Monzonite

[Cretaceous]: Central California.

R. L. Rose, 1957, Am. Mineralogist, v. 42, nos. 9 and 10, p. 636, 637. Named on geologic sketch map showing portion of Yosemite National Park. Younger than Cathedral Peak granite and older than Yosemite Creek granodiorite (new). [This may be same as Hoffman Quartz Monzonite of Evernden, Curtis, and Lipson, 1957.]

Mount Liberty Till

Pleistocene: Northeastern Ohio.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. A deposit of Scioto glacial lobe. Correlates with Navarre till of Killbuck glacial lobe.

Report discusses glacial geology of Richland County.

Mount Lord Ignimbrite

Cretaceous: Southeastern Arizona.

B. N. Watson, 1964, Dissert. Abs., v. 25, no. 3, p. 1853. Includes (1) major body of extrusive ignimbrite, (2) capping unit of lithic tuff, and (3) sill-like and dikelike intrusive ignimbrites closely related to major extrusive body. Reflects final expression of Laramide extrusive activity.

R. L. Mauger, P. E. Damon, and B. J. Giletti, 1965, Am. Inst. Mining, Metall. and Petroleum Engineers Trans., v. 232, p. 84, 85 (table 2), 86. Apparent age 59.7±1.8 m.y. Cat Mountain equivalent.

Occurs in Silver Bell Mountains, Pima County.

Mount Morrison Sandstone

Ordovician or Silurian(?): East-central California.

C. D. Rinehart and D. C. Ross, 1964, U.S. Geol. Survey Prof. Paper 385, p. 21—23, pls. 1, Composed chiefly of fine- to medium-grained calcareous quartz sandstone that ranges in color from white to medium-dark gray with lighter shades predominating. Thickness about 1,000 feet northwest of Convict Lake; about 1,800 feet near south end of moraine-filled cirque south of Convict Lake. Overlies Convict Lake formation (new). Underlies sandstone and hornfels of Sevehal Cliff (informal group).

Type locality: Low ridges immediately west of Convict Lake, Mount Morrison quadrangle, Sierra Nevada. Well exposed on summit and east flank of Mount Morrison. Formation discontinuously exposed along strike for 5 miles—from northernmost exposure, 1½ miles northwest of Convict Lake, southeast to termination against granodiorite one-half mile northeast of Mount Baldwin. Cut midway along exposed length by northeast branch of Laurel-Convict fault; southern segment displaced southeast 2½ miles.

Mount Pinos Granite

Jurassic(?): Central California.

M. F. Carman, Jr., 1964, California Div. Mines and Geology Spec. Rept. 81, p. 18—20, pl. 1, 5. Unit is variable, ranging from alaskite, through biotite granite, to biotite-quartz diorite. Most abundant type is pinkish-gray rock with mostly coarse hypautomorphic granular texture. No clue to age of rocks, except that whole assemblage is pre-Eocene.

Makes up most of southeast slope of Mount Pinos, underlies western part of Yellowjacket Ridge, and extends southward at least as far as Mutaw Flat, southwest of San Andreas fault, Lockwood Valley area, Kern and Ventura Counties.

Mount Powell Porphyritic Granite

Tertiary: Western Montana.

T. A. Mutch, 1961, Montana Bur. Mines and Geology Spec. Pub. 22 (geol. map 5). Named on map legend. Text discusses rocks of Mount Powell batholith.

On northeast flank of Flint Creek Range.

Mount Royal Granodiorite

Cretaceous(?): Western Montana.

T. A. Mutch, 1961, Montana Bur. Mines and Geology Spec. Pub. 22 (geol. map 5). Named on map legend. Text discusses Royal stock.

On northeast flank of Flint Creek Range.

Mount Rubidoux granite

See Rubidoux Mountain granite or leucogranite.

Mount Scott Granite (in Wichita Granite Group)

Middle Cambrian(?): Southern Oklahoma.

C. A. Merritt, 1965, Oklahoma Geology Notes, v. 25, no. 10, p. 263—271. A leucogranite with low ferromagnesian content. A one-feldspar granite with microperthite the dominant constituent and free plagioclase minor or absent. Measured thickness 980 feet on Mount Scott, but, as dip of sill is unknown, true thickness may be considerably less. Intruded by Lugert Granite. Intrudes Raggedy Mountain Gabbro Group. Was mapped as Lugert Granite by Taylor (1915). Middle Cambrian(?).

R. E. Denison, E. A. Hetherington, Jr., and G. S. Kenny, 1966, Oklahoma Geology Notes, v. 26, no. 6, p. 170—176. Discussion of isotopic-age dates from basement rocks in Oklahoma. Age determination made on biotite from Mount Scott Granite gave 490±20 million years.

C. A. Merritt, 1967, Oklahoma Geology Notes, v. 27, no. 3, 45—53. Discussion of names and relative ages of granites and rhyolites in Wichita Mountains. Combining conclusions from the mineralogic data, differentiation indices, and field relationships appears to be, Mount Scott (oldest), Headquarters, Reformatory, Lugert, Quanah, and aegirine-riebeckite granite dikes (youngest). Cold Springs Granite is a hybrid rock formed by the assimilation of the basic rocks by Mount Scott Granite.

Named for Mount Scott which is composed of this granite. Forms half of outcrop area in eastern and central parts of Wichita Mountains.

Mount View Formation

See Mountain View Sand and Gravel.

Mount Wow lava complex

See **Ohanapecosh Formation.**

Mucarabones Sand

Oligocene, middle: Northern Puerto Rico.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C3 (table 1), C4 (fig. 2), C18. A distinctive unit of quartz sand. Consists of grayish-orange to grayish-yellow generally crossbedded quartz sand interbedded with glauconitic calcareous sandstone and thin beds of calcareous clay. Locally contains a few persistent layers of hard sandy limestone. Thickness 5 to 50 m. Overlies San Sebastian Formation in eastern part of quadrangle. Toward west grades laterally into middle and upper Oligocene Lares Limestone. As far west as longitude of Corozal, the sand is 40 to 50 m thick and is overlain by increasingly thick sequence of Lares Limestone. West of Corozal, successively lower parts of the sand grade laterally into Lares until near western boundary of quadrangle only 5 m of calcareous glauconitic sandstone separates San Sebastian from overlying Lares.

Type locality: Along Highway 861, 700 to 2,000 m northwest of its intersection with Highway 827, near northwest corner of Naranjito quadrangle. Named after barrio Mucarabones in Naranjito quadrangle where formation is well exposed along the Quebrado Piña.

Mud Lake clays

Quaternary: Southwestern Nevada.

Necip Güven and P. F. Kerr, 1965, Selected Great Basin playa clays: U.S. Air Force Cambridge Research Lab. Sci. Rept. 4, 35 p. Mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and

Animas clays indicate that mica-type clay minerals, illite, vermiculite, and montmorillonite are prominent in the playa crusts.

Mud Playa is a circular smooth gray clay surface 5 miles in diameter. It is occasionally used as an alternate landing field for high-speed aircraft.

Mudlick Latite

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Named on table showing batholithic rocks in southeastern Missouri. Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Mudlick Hollow and Mudlick Mountain are in Wayne County.

Mud Springs Mountain Formation (in El Paso Group)

Canadian (Demingian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. *Bridgites* reef zone above Jose formation (new) is named Mud Springs Mountain formation. Older than Snake Hills formation (new). Canadian treated as system in this report.

Named from exposures in Mud Springs Mountain, near Hot Springs.

Muir Till or Formation

Pleistocene, upper: Southeastern Alaska.

G. M. Haselton, 1966, Ohio State Univ. Inst. Polar Studies Rept. 18, p. 8—12. Name applied to lower of two tills in the section. Chiefly sandy loam in which cobbles and boulders make up minor percentage of the coarse constituents. Yellowish-brown to reddish-brown in oxidized parts. Below oxidized zone, depth of which ranges from 1 to 5 m, the till may appear bluish-gray with yellow mottling. Overlies Forest Creek Formation (new). Underlies Van Horn Formation (new).

G. M. Haselton, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2480. Referred to as Muir Formation.

Named for its several exposures along east side of Muir Inlet which is in northeastern part of Glacier Bay National Monument, about 135 km northeast of Juneau.

Mulberry Wash Volcanic Formation

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 119—I, p. I1—I12. Latite, quartz latite, and andesite flows and interbedded conglomerate. Comprises three principal units, each of which forms a rugged brown ridge. Lowest unit, about 1,100 feet thick, is mostly alternating pink and gray quartz latite porphyry flows and some fine-grained porphyritic andesite flows. Middle, about 900 feet thick, is mostly pink agglomerate or conglomerate. Upper, about 1,000 feet thick, contains mostly pink latite porphyry, red laminated felsite, and flows(?) of red and dark-gray andesite porphyry. Rests nearly conformably on Pitoikam Formation (new). Underlies Chiuli Shaik Formation (new).

Type locality: Along Fresnal Wash, Baboquivari Mountains, Papago Indian Reservation. Named for Mulberry Wash which cuts across north end of exposures of unit.

Mule Ear Spring Tuff Member (of Chisos Formation)

Eocene, upper: Southwestern Texas and northern Mexico.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 23, 26, road logs. Overlies Bee Mountain Basalt Member (new) and underlies Tule Mountain Trachyandesite Member.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 119—121, pls. Formal proposal of name. Member is 8 to 12 feet thick and is punky ash to very hard, brittle, silicified tuff with conchoidal fracture. Fresh surfaces are pinkish salmon, brick red, and yellowish gray to bluish gray, but rock weathers brown. Truncates middle Chisos beds and probably originated as an ash fall that blanketed a surface of low relief. In some places rests on Bee Mountain Member and in some places is separated from that member by about 125 feet of tuffaceous rocks in Chisos Formation. Underlies Tule Mountain Trachyandesite Porphyry Member.

Named from Mule Ear Spring, 1½ miles northwest of Mule Ear Peaks, Big Bend National Park, Brewster County, Tex. Member crops out in escarpment northwest of Contrabando Dome and along west wall of Fresno Canyon. East of Fresno Creek, it caps prominent hill northwest of Fresno mine and crops out in hills southwest and northwest of Chimney Rock in Terlingua quadrangle. Extends into Mexico.

Mule Spring Limestone

Mule Spring Formation

Lower Cambrian: East-central California and western Nevada.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 142, 143. Name Mule Spring Formation applied to uppermost olenellid-bearing strata in White and Inyo Mountains, Calif. Predominantly massive to well-bedded blue-gray limestone containing abundant concretionary algal structures *(Girvanella)*. Locally formation contains minor interbeds of gray shale, and in some areas much of limestone has been replaced by dolomite. Thickness 850 feet. Overlies Saline Valley Formation (new). Underlies gray shale bearing typical Middle Cambrian trilobites.

J. P. Albers and J. H. Stewart, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D24—D27. Geographically extended into Esmeralda County, Nev., where term limestone is used in preference to formation as unit consists everywhere of distinctly bedded commonly mottled limestone. Thickness about 500 feet. Overlies Harkless Formation; underlies Emigrant Formation.

D. C. Ross, 1965, U.S. Geol. Survey Bull. 1181—O, p. O14—O15, pl. 1. Limestone described in Independence quadrangle, California, where it crops out in discontinuous belt west of Side Hill Spring in addition to several areas of outcrop on east slope of Inyo Mountains, including an upland area east of Lead Canyon. Thickness about 400 feet measured 2 miles west of Side Hill Spring. Conformably overlies Saline Valley Formation and is overlain conformably by Monola Formation.

C. A. Nelson, 1965, U.S. Geol. Survey Bull. 1194—A, p. A30, A32, A33 (table 2). Conformably underlies Monola Formation (new).

D. C. Ross, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—612. Mule Spring limestone mapped in Waucoba Wash quadrangle, Inyo County, Calif., where it is a dark-blue-gray limestone with abundant *Girvanella* in part. Best section is in ridge in sec. 27, T. 11 S., R. 37 E., but section is faulted. There a distinctive oolite bed 200 feet above base of formation makes conspicuous yellow-brown marker in the blue-gray unit. Thickness 590 feet in section measured in Saline Range. *Girvanella* abundant in measured section from 300 to 400 feet above base. Overlies Saline Valley Formation. Underlies Monola Formation.

Type section: Along east end of Walcott's (1908, Smithsonian Misc. Colln., v. 53, no. 5) Waucoba Spring section, east of Waucoba Springs, on Saline Valley road, east of Inyo Range, Inyo County, Calif. Named after exposures at Mule Spring on west flank of Inyo Mountains, Waucoba Mountain quadrangle, California. Rocks at Mule Spring are structurally complex.

Mullenix Member (of De Forest Formation)

Quaternary: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, and G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 5, p. 473—487. Composed of silt-loam and silty clay-loam sediments. Discontinuous erosion surfaces marked by sand and gravel lenses that can be traced for a few feet, or at most a few hundred feet. present within member. Maximum thickness 26 feet. Separated from underlying Hatcher member (new) by scour-and-fill disconformity. Overlain by post-settlement alluvium, contact sharp. Locally overlain by Turton member (new). Major part of member deposited after 1100 B. P. Deposition must have ended prior to 250 years B.P.

Type section: On Thompson Creek, 100 yards east of country road between secs. 13 and 14, in SW¼ sec. 13, T. 80 N., R. 43 W., Harrison County. Named for tributary of Thompson Creek.

Munger Granite Porphyry (in Musco Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Musco group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Munger village and Munger School are in T. 33 N., R. 2 E., Reynolds County.

Munn Formation

Permian: Western Texas.

J. W. Wood, 1965, Dissert. Abs., v. 26, no. 2, p. 987. Mentioned in report on geology of Apache Mountains, Trans-Pecos. Formation crops out along western base of the range and makes up the southwestern ridges. The two members of the formation are composed of dolomite, siltstone, and limestone, deposited as shelf and shelf-margin facies.

V. E. Barnes, project director, 1967, Geologic atlas of Texas, Van Horn-El Paso sheet with text (1:250,000): Texas Univ. Bur. Econ. Geology. Dolomite, limestone, siltstone, and sandstone. Upper part mostly dolomite and limestone, fine to coarse grained, in part oolitic, medium to thick bedded, white to grayish orange; some siltstone and fine-grained quartz sandstone, proportion increases southward. Lower part mostly dolomite and dolomitic limestone, fine grained, very thick bedded, light brownish gray to pale yellowish brown, weathers a distinctive brown; thin beds of siltstone and fine-grained sandstone scarce, more numerous northward. Marine megafossils and microfossils. Thickness about 450 feet. Guadalupe.

Mapped in Culbertson County. Type locality and derivation of name not given.

Munsons Granite[1]

Middle Devonian(?): Northeastern Maine.

Original reference: H. E. Gregory, 1900, U.S. Geol. Survey Bull. 165, p. 105—106, 146—148.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. 2, p. 64—65. Only granite in this area [Presque Isle quadrangle] is referred to by Williams and Gregory (1900) as both Munsons granite and Mapleton granite. Name Mapleton is used for a sandstone and should not be applied to the granite. Age of granite not clearly defined but is younger than Lower Ludlovian Perham formation into which it is intruded. Evidence suggests that the granite was emplaced subsequent to Acadian orogeny, which affects beds of New Scotland (Lower Devonian) age.

Named from Munson's farm in Mapleton Township.

Murderers Creek Graywacke (in Aldrich Mountains Group)

Upper Triassic(?): Northeastern Oregon.

C. E. Brown and T. P. Thayer, 1966, U.S. Geol Survey Misc. Geol. Inv. Map I—447. Thickness at type locality 1,500 to 2,000 feet. At type locality consists almost entirely of medium- to fine-grained calcareous graywacke. Lenses of limestone breccia and breccia-conglomerate as much as 1,500 feet long and 120 feet thick occur at and near base of formation at Ingle Rock and high on slope of Dans Creek near type locality. Appears to be conformable with underlying Laycock Graywacke (new). Underlies Keller Creek Shale (new).

Type locality: Steep slopes along both sides of Murderers Creek in southwestern part of Mount Vernon quadrangle, Grant County.

Murrysville Sandstone Member (of Pocono Formation)

Mississippian: Pennsylvania.

W. S. Leeper, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 177. Lies 350 feet below Burgoon Sandstone Member.

Wilmarth (1938, U.S. Geol. Survey Bull. 896, p. 1453) lists a Murrysville sand, a subsurface unit in western Pennsylvania that probably corresponds to Berea Sandstone of Ohio. Sand was named for village in Westmoreland County. Leeper did not state type locality and derivation of name Murrysville. Area of his report is Somerset County.

Musco Group

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 81, 82, 83 (table 1). Includes Carver Creek granite porphyry, Buford granite porphyry, Munger granite porphyry, Slabtown granite, and Stono granite (all new). Believed to be older than Bevos group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Musco creek is in Madison County.

Museum Basalt Member (of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 8, 11—12. Overlies Rocky Coulee Basalt Member (new); underlies Vantage Sandstone Member (new). Best known from holes drilled on Columbia Valley floor in a 4-mile segment south of Vantage. Core sections indicate flow is 90 ± 5 feet thick.

Type locality: Washington State Ginkgo Petrified Forest Museum, southwest of Vantage, Kittitas County. Museum building is on stripped structural surface developed on basal 10 to 12 feet of the colonnade of Museum flow.

Muskrat Conglomerate Bed (in Puddle Springs Arkose Member of Wind River Formation)

Eocene, lower: West-central Wyoming.

P. E. Soister, 1966, U.S. Geol. Survey Bull. 1244—A, p. A44—A45. Is 100 feet above Dry Coyote Conglomerate Bed (new) and lies stratigraphically above the middle of the formation; however, owing to overlap on pre-Wind River erosion surface, bed rests on Cloverly Formation of Early Cretaceous age in sec. 20, T. 32 N., R. 91 W., and is near base of formation in other localities south of its outcrop. Thickness 19.5 feet at type locality.

Type locality: The SE¼SW¼SE¼ sec. T. 32 N., R. 90 W. Named for exposures at Muskrat Creek in secs. 10, 15, 16, 20, and 21, T. 32 N., R. 91 W., south-central Wind River Basin.

Mutual Spur Till

Pleistocene: Southwestern Ohio.

R. P. Goldthwaite, Leader, 1955, Pleistocene chronology of southwestern Ohio: Guidebook 5th Bienn. Pleistocene Field Conf., Sept. 6—13, p. 63. Till belongs to Scioto lobe deposits. Predominantly dolomites and limestones. Age not clear.

Near Mutual, Champaign County.

Naashoibito Member (of Kirtland Shale)

Upper Cretaceous: Northwestern New Mexico.

E. H. Baltz, S. R. Ash, and R. Y. Anderson, 1966, U.S. Geol. Survey Prof. Paper 524—D, p. D10—D13, pls. Named and defined to include the lower conglomerate and the (medial) shale and soft sandstone unit of Bauer's (1916, U.S. Geol. Survey Prof. Paper 98—F) type Ojo Alamo Sandstone. It is the lower conglomerate and "shales with dinosaurs, upper horizon" of Sinclair and Granger's (1914, Am. Mus. Nat. History Bull., v. 33, stratigraphic section A of their fig. 2) Ojo Alamo Beds. It is the upper part of the rocks mapped (in the Hunter Wash-Barrel Spring area) as the upper shale member of the Kirtland by O'Sullivan and Beikman (1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—345). At type locality basal conglomerate sandstone is 2 to 4 feet thick, and the overlying shale and soft sandstone unit is (locally only) 22 feet thick. Thickness of member ranges from 10 to about 88 feet. Underlies Ojo Alamo Sandstone (restricted).

Type locality: Naashoibito (Navajo for "Lizard Spring"), a small spring with a nearby small tree in sec. 1, T. 24 N., R. 12 W. Reference section: West-facing cliffs east side of Barrel Spring Arroyo, about one-eighth mile north of Barrel Spring, sec. 16, T. 24 N., R. 11 W., western Juan Basin.

Nada Member (of Borden Formation)

Mississippian: South-central Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224—F, p. F15, F31—F32. A slope-forming unit that consists of clayey and silty shale with minor siltstone. Shale, which is mostly olive gray with patches of grayish red and grayish-purple, locally grades into thin-bedded resistant limy siltstone, which is more abundant near southern edge of member. Nonresistant glauconitic siltstone present locally. Thickness 30 to 65 feet. Conformably overlies Cowbell Member (new). Conformably underlies Renfro Member (new). South and southwest of Brea its upper part grades into Wildie Member and its lower part into Nancy Member (new). Includes beds assigned to Brodhead, Floyds Knob, and Muldraugh Formations by Stockdale (1939, Geol. Soc. America Spec. Paper 22).

Type section: Measured up roadcut on north side of Mountain Parkway 0.4 mile northwest of Nada (Lombard Post Office), Powell County, about 10 miles east of Stanton.

Naknek Lake Granite

Lower Jurassic: Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 38, 39, 48. Term used in discussion of Naknek Formation. Spurr (1900) considered Naknek Formation to have been derived from early Jurassic hornblende-biotite Naknek Lake Granite exposed along axis of Aleutian Range northeast of Becharof Lake. [Compiler unable to locate statement in which Spurr used formal expression "Naknek Lake Granite."]

Naknek Lake batholith is on Alaska Peninsula.

Nakwasina Group

Permian(?) and Triassic(?): Southeastern Alaska.

H. C. Berg and D. W. Hinckley, 1963, U.S. Geol. Survey Bull. 1141—O, p. O6—O9, pl. 1. Made up largely of metachert, volcanic rocks, and greenstone; marble, volcanic breccia, graywacke, argillite, phyllite, calcareous siltstone, schist, and hornsfels present locally. Rocks highly deformed and lack presistent marker beds. Probably many thousands of feet thick. Separated from younger rocks by faults. Older than Kelp Bay Group (new). Contact between Nakwasina Group and underlying gneiss and schist unit not observed. Paleozoic(?).

R. A. Loney and others, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I—388 (with separate text). Considered to be Permian(?) and Triassic(?).

Type area: On shores of Nakwasina Passage and Nakwasina Sound, Baranof Island. Crops out along western shoreline of island from St. John Bay southward to Katlian Bay, and forms most of Halleck Island.

Nancy Member (of Borden Formation)

Lower Mississippian: Southeastern Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224—F, p. F11—F13. Includes all beds assigned to New Providence Formation by Stockdale (1939, Geol. Soc. America Spec. Paper 22) and in places a large part of beds that he assigned to Brodhead Formation. Chiefly nonresistant gray clayey to silty shale. Stockdale's (1939) Gum

Sulphur Siltstone Member of New Providence Formation is herein called Gum Sulphur Bed on Nancy Member. Thickness 150 to 300 feet. Overlies New Albany or Chattanooga Shale. Overlain in most of area south of Berea by Halls Gap Member (new) and by Cowbell Member (new) north of Berea. At type locality overlain by Muldraugh Member. In small area south of Mount Vernon is overlain by Renfro Member (new).

Type section: Measured about 2 miles east of village of Nancy, Pulaski County, Ky. (Delmar quadrangle), in Pulaski County Park, beginning at point about 500 feet below park entrance.

Nancy Lake Limestone

See 111 [one hundred eleven] Ranch Beds.

Napoleon Drift

Pleistocene (early Wisconsin): North Dakota.

J. W. Bonneville, 1961, North Dakota Acad. Sci. Proc., v. 15, p. 6, 7. Informally named in report on iron-cemented glacial drift in Logan County.

Lee Clayton, 1962, North Dakota Geol. Survey Bull. 37, p. 56. Formal proposal of name. Defined as lithostratigraphic or morphostratigraphic unit consisting of till of ground moraine of Napoleon subdistrict plus all other associated drift that originated from same glacial ice. Thickness 1 to 15 feet in McIntosh County.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 7—8. In contrast to Morton Drift (drift A), Napoleon Drift (drift B) retains much of its original morainic topography. Drift is thin blanket, a few tens of feet thick at most. In Emmons and McIntosh Counties, underlies Zeeland Drift (drift C). Ice that deposited the Napoleon moved southwestward over 30 to 40 miles of Fox Hills Formation, whereas ice that deposited the Zeeland moved southwest and then northwest over hundreds of miles of nothing but Pierre Shale and older drifts derived from it. In Burleigh County, Napoleon Drift and drift C (Long Lake Drift) are nearly identical because directions of advance are nearly identical. Older than Burnstad Drift.

Type area: South of Napoleon in secs. 32 and 33, T. 135 N., R. 72 W., and secs. 4, 5, 8, and 9, T. 134 N., R. 72 W., Logan County.

Narrows ash layer

Pliocene, upper, and Pleistocene, lower: Southwestern Idaho.

H. A. Powers and H. E. Malde, 1961, U.S. Geol. Survey Prof. Paper 424—B, p. B—167——B—170. Name informally applied to a volcanic ash layer that is useful as stratigraphic marker in basin deposits near Hagerman and Glenns Ferry.

Named for the Narrows, 5 miles west of Glenns Ferry, Elmore County.

Narrows Tuff Member (of Leach Canyon Formation)

Miocene: Southwestern Utah and southeastern Nevada.

P. L. Williams, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 2003. Moderately to densely welded, light colored, and contains 1 to 2 percent lithic fragments. A simple cooling unit made up of from 1 to 3 ignimbrites. Lower member of formation. Underlies Table Butte Tuff Member (new).

Southwestern Utah and southeastern Nevada.

Nasorak Formation (in Lisburne Group)

Lower and Upper Mississippian: Northwestern Alaska.

R. H. Campbell, 1965, U.S. Geol. Survey Bull. 1194—A, p. A22—A25. Basal formation of Lisburne Group. Lowermost 165 feet consists of interbedded dark-gray to grayish-black silt and clay shale, locally calcareous, and medium-gray to dark-gray cherty limestone. This zone overlain by about 225 feet of very thick bedded light-gray to light olive-gray limestone, which in turn succeeded by about 50 feet of very thick bedded grayish-black calcareous mudstone containing small pyrite concretions and some pyritized fossils. Uppermost 1,660 feet of formation consists of rhythmically interbedded, thin-bedded to medium-bedded dark-gray limestone and very thin bedded silty calcareous shale. Total thickness about 2,100 feet. Contact with overlying Kogruk(?) Formation of Lisburne Group is gradational. It was arbitrarily drawn at base of lowermost thick-bedded dolomite in sea cliff section west of mouth of Nasorak Creek. Gradational and intertonguing contact with underlying mustone-sandstone-limestone sequence of Early Mississippian age. Nasorak includes the lower three of five informal units described in Lisburne Group of this area (Campbell, 1960, U.S. Geol. Survey Prof. Paper 400—B, U.S. Geol. Survey TEI—753).

R. H. Campbell, 1967, U.S. Geol. Survey Prof. Paper 395, p. 7—14, 30—34, pls. Lower member consists of 165 feet of interbedded dark-gray to grayish-black silt clay shale, locally calcareous, and medium-gray to dark-gray cherty limestone. This zone is overlain by Cape Thompson Member (new). The Cape Thompson is overlain by an unnamed upper member. Total exposed thickness about 1,970 feet. Underlies Kogruk(?) Formation. Apparently beds of the Nasorak represent continuous deposition from Lower Mississippian at base to Upper Mississippian at top.

Named from outcrops in sea cliffs near mouth of Nasorak Creek, Chariot Test Site, in vicinity of Cape Thompson.

Navajoe Mountain Basalt-Spilite Group

Lower Cambrian(?): Southwestern Oklahoma (subsurface).

W. E. Ham, R. E. Denison, and C. A. Merritt, 1964, Oklahoma Geol. Survey Bull. 95, p. 21, 22, 79—90, 156—157, pl. 12, table 18. Basalt, spilite, andesite, and altered palagonite tuff, at least partly of marine origin, in a subsurface sequence having drilled thickness of 1,050 feet and probable total thickness of several thousand feet. Underlies Carlton rhyolites (Carlton Rhyolite Group, new) and is intruded by Wichita granites (Wichita Granite Group, new). Probable extrusive equivalent of Raggedy Mountain Gabbro Group (new). Isotopic age 535 ± 30 m.y. Present knowledge about thickness and composition of group is derived mainly from thick penetrations in two wells immediately northwest of Navajoe Mountain and from well on north flank of Wichita Mountain. Latter well designated as type well.

Type well: Stanolind Oil and Gas Co. 1 Perdasofpy in SE¼NW¼SW¼ sec. 11, T. 4 N., R. 12 W., Comanche County. Name taken from Navajoe Mountain, a locally well-known hill of Wichita granite in eastern Jackson County.

Navarre Till

Pleistocene (Wisconsin): Northeast-central Ohio.

G. W. White, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C72—C73. A sandy to moderately pebbly till with scattered cobbles and a few boulders. Yellow brown where oxidized. Thickness about 18 feet. Younger than Millbrook till (new). Underlies Hayesville till (new). A deposit of Killbuck glacial lobe. Same age as Kent till of Grand River lobe in eastern Ohio and northwestern Pennsylvania.

S. M. Totten, 1963, Dissert. Abs., v. 23, no. 8, p. 2879. Correlates with Mount Liberty till (new) of Scioto glacial lobe in Richland County.

R. M. DeLong and G. W. White, 1963, Ohio Geol. Survey Bull. 61, p. 143—146. Navarre Till is surface material in most of Jackson, the eastern half of Perry, most of Bethlehem, and almost all of Sugar Creek Townships. Margin of till, which is also glacial boundary, enters Stark County from a point 1 mile east of southwest corner of Tuscarawas County, and passes east-northeast across Sugar Creek and Bethlehem Townships to Tuscarawas River. Thence it passes northeastward to Pike Township line, and north to western part of Canton at Meyers Lake. Two miles north of Meyers Lake, Navarre Till of Killbuck lobe adjoins Kent Till of Grand River lobe.

Measured section: Two miles south of Navarre and 50 feet north of highway bridge in cut of Nickel Plate Road, SW¼ sec. 16, Bethlehem Township. Named for village of Navarre, Stark County. Also exposed in Summit, Holmes, and Ashland Counties.

Navarro Stage

Upper Cretaceous (Gulfian): Atlantic and Gulf Coastal Provinces.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 359. Navarro stage is used here as a provincial time-rock subdivision of the Gulfian to include all beds in the Atlantic and Gulf province that can be demonstrated to be equivalent to the type Navarro and its typical units. These beds are generally considered correlative with Maestrichtian and possibly part of the lower Danian of Europe. In part Navarroan strata rest disconformably on the Tayloran; they are separated from overlying Tertiary (Paleocene) beds by widespread regional disconformity in eastern North America coastal region.

Needle Siltstone Member (of Chainman Formation)

Carboniferous: Eastern Nevada and western Utah.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978. Chainman, about 2,000 feet thick at Utah-Nevada boundary, is herein subdivided into six lithostratigraphic members which intertongue with each other. They are (ascending): Needle Siltstone, about 500 feet thick, Skunk Spring Limestone, Camp Canyon, Donner, Willow Gap, and Jansen.

Type locality and derivation of name not given.

Needle Mountain Granodiorite

Oligocene(?)-Miocene,(?)-Pliocene(?): Northwestern Wyoming.

F. S. Fisher, 1966, Wyoming Univ. Contr. to Geology, v. 6, no. 1, p. 71—86, pl. 1. Name applied to granodiorite in the larger of two plutons in Stinkingwater area. The Needle Mountain granodiorite and its many apophyses represent the oldest period of intrusive activity. Has intruded entire sequence of layered rocks in area. Cross cuts lowermost 2,900 feet of Wiggins Formation at its highest point leaving approximately 1,000 feet of Wiggins rocks on top of pluton at that point. Cut by Crater Mountain dacite (new).

Well exposed on Needle Mountain. Stinkingwater mining region is in southern Absaroka Mountains, Park County, Wyo. Makes up bulk of intrusive material underlying Needle Mountain. Total exposed area is about 4 square miles. Has an exposed vertical extent on Needle Mountain of about 3,500 feet.

Needleseye Conglomerate Member (of Vandever Formation)

Pennsylvanian: Southeastern Tennessee.

E. T. Luther and G. D. Swingle, 1963, Geologic map of Fairmount quadrangle, Tennessee (1:24,000): Tennessee Div. Geology GM105—NE. At type section consists of 110 feet of thick-bedded, fine- to medium-grained, light brownish-gray to light-brown conglomeratic sandstone, crossbedded in part. Underlies unnamed upper shale member; overlies unnamed lower shale member.

Type section: Along road leading from Huckleberry (crossing Mowbray Creek) to Mowbray Church, in southwestern part of Soddy (111-SW) quadrangle, about 5 miles northeast of the Needleseye which is located just west of Sawyer Cemetery at 2,215,900 E., 298,300 N., according to Tennessee coordinate system.

Neenach Volcanic Formation

Oligocene(?) and Miocene, lower or middle: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 58, pl. A volcanic sequence of andesite and felsite and tuff breccia. Unconformable on pre-Tertiary granitoid rocks and overlain by sedimentary rocks of late Miocene age. Unconformable on Oso Canyon Formation (new).

Type section: In large canyon about a mile east of La Liebre Ranch (projected S½ sec. 14, secs. 23, T. 8 N., R 17 W., San Bernardino meridian) in which all facies of formation are present. Named for former school in Neenach quadrangle. Exposed in hills west of Antelope Valley, northeast of San Andreas fault and in narrow strip adjacent to this fault near Gorman, and from La Liebre Ranch southeast to Pine Canyon, Los Angeles County.

Nelson Quartz Monzonite

Tertiary, middle to late: Southeastern Nevada.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2491. Four intrusive stocks of middle to late Tertiary age, but younger than the volcanic rocks, intrude foliated basement rocks and volcanics. These are named Nelson quartz monzonite, Nob Hill and Aztec granodiorites, and Keyhole leucogranite. Nelson and Keyhole intrusives appear to be structurally controlled.

Eldorado mining district, Clark County.

Netop Formation

Lower Cambrian: Southwestern Vermont.

J. B. Thompson, Jr., 1967, Vermont Geol. Survey Bull. 30, pt. 2, p. 85—86, pl. 1. Name proposed for the predominantly dark albitic phyllites and associated rocks cropping out on the slopes of Dorset and Netop Mountains. Has been distinguished from the Ira, though not always with certainty, by being rather more quartzose and less carbonaceous, and by presence of numerous minute porphyroblasts of albite. Blue-gray limestones and dark-gray to black dolomites occur in upper part of formation. Pale-green chloritic phyllites present in lower part of formation on Dorset Mountain. Thickness at least 400 feet on Dorset Mountain, but if base is a tectonic contact, as believed, total thickness may be much greater. Rocks have been mapped as Berkshire Schist by Thompson (1959, New England Intercollegiate Geol. Conf., Guidebook 51st Ann. Mtg.) but continued use of name "Berkshire" is unwise in view of the many meanings attached to it. Assignments of ages to Netop and St. Catharine Formations is dependent on one's choice among many divergent hypotheses regarding the Taconic sequence. As shown on map legend the Netop Formation is placed below the St. Catharine Formation.

Exposed on slopes of Dorset and Netop Mountains, Pawlet quadrangle, eastern portion.

Neuse Formation

Pleistocene: Southeastern North Carolina.

W. C. Fallow, 1966, Dissert. Abs., v. 26, no. 7, p. 3860—3861. Term proposed for Pleistocene deposits in southeastern North Carolina. Terms Pamlico Formation and Flanner Beach have been used for these deposits. Consists of four facies: (1) clay to fine-grained quartz sand, fossiliferous, moderately to very poorly sorted bay facies; (2) fine-grained quartz sand, fossiliferous, moderately sorted (shallow shelf facies); (3) very fine grained quartz sand and sand-silt-clay, fossiliferous, poorly to very poorly sorted (lagoonal facies); and (4) coquina (inlet-shoal facies).

Type locality: Pamlico County, on Neuse River Estuary.

New Brighton Formation

Pleistocene (Wisconsin): Southeastern Minnesota.

H. E. Wright and others, 1965, Internat. Assoc. Quaternary Research 7th Cong., Boulder Colo., Guidebook Field Conf. C, Upper Mississippi Valley, p. 47 (fig. 6—3), 50 (fig. 6-6), 51, 52. A lake deposit. Overlies Twin Cities Formation (new). Traced in both surface and subsurface.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2 (with text), p. 6, (table 2), 21—23. Formal proposal of name. Has three distinct but closely related lithofacies: (1) light-gray to very pale brown fine- to medium-sand facies, (2) a clayey silt facies, and (3) a gravelly fine- to coarse-sand facies. First two facies similar to those of Fridley Formation (new). Younger than Arsenal Sand (new). Type section and alternate type section given for each facies. Type area given.

Type area: Mapped extent of formation in New Brighton quadrangle. Type section (fine-sand facies): Roadcut on east side of Interstate Highway 35 W immediately north of tracks of Minneapolis, St. Paul, and Sault Ste. Marie Railroad in New Brighton, SE cor. sec. 29, T. 30 N., R. 23 W.; alternate type section: Borrow Pit immediately east of Long Lake in New Brighton, SE¼NE¼NW¼ sec. 20, T. 30 N., R. 23 W. Type section (silt facies): Boring for bridge at southwest corner of intersection of Interstate

Highway 35 W and Ramsey County Road C in Roseville, NE cor. sec. 8, T. 29 N., R. 23 W. Type section (coarse sand facies): Cut at rear of lot at 251 Pearl St., in New Brighton, NW¼SW¼SW¼ sec. 29, T. 30 N., R. 23 W.; alternate type section: Gravel pit between Poplar and Jones Lakes in New Brighton, NE¼SE¼NW¼ sec. 32, T. 30 N., R. 23 W. Named for New Brighton.

New Creek Limestone

Lower Devonian: West Virginia and Maryland.

Z. P. Bowen, 1966, Jour. Paleontology, v. 40, no. 5, p. 1051—1062. Mentioned in relation to Elbow Ridge Sandstone (new). In area around Hancock, Md., entire Lower Devonian sequence undergoes pronounced facies changes over the short distance of 10 or 15 miles, and the ages and relationships of these facies are not well known. In eastern part of area, all or part of the normally carbonate facies of New Creek Limestone (new) is replaced by Elbow Ridge Sandstone.

Z. P. Bowen, 1967, Geol. Soc. America Mem. 102, p. 6, 70. In report area, Keyser Limestone is overlain by interval of massive or poorly bedded intrasparite less than 14 feet thick. This unit has been called Coeymans Limestone by earlier workers because gross similarities exist between the fossils in these beds in western Maryland and type Coeymans in New York. However, the two units are not traceable through the intervening areas. The fossils in neither have been studied in past 50 years. Use of name "Coeymans" Limestone in area should be discontinued. Name New Creek Limestone is herein proposed for these rocks. At type section underlies "New Scotland" Formation.

Type section: In quarry on north side of U.S. Route 50, one-half mile south of New Creek, Mineral County, W. Va. Quarry is located 100 yards east of stream called New Creek where U.S. Route 50 crosses New Creek Mountain.

New Enterprise Member (of Salona Formation)

Middle Ordovician: Central Pennsylvania.

R. R. Thompson, 1961, Dissert. Abs., v. 22, no. 1, p. 231—232. Composed almost entirely of black variously argillaceous calcilutites. A blanketlike deposit over most of region. Underlies Roaring Spring member (new).

R. R. Thompson, 1963, Pennsylvania Geol. Survey 4th ser., Bull. G—38, p. 20—22, 124—125. Formal proposal of name. Thickness 90 feet at type section herein designated. Composed of calcilutites that as whole are characterized by (1) lack of apparent sedimentary structure, (2) aphanitic texture, and (3) nearly black color. The calcilutites occur in 6-inch to 1-foot beds and comprise more than 95 percent of member. Six meta-bentonite beds recognized. Conformable contact with overlying Roaring Spring Member of Nealmont.

Type section: At New Enterprise Co. quarry near Roaring Spring, Blair County, and near town of Rodman.

New Era Formation

Pliocene(?): Central northern California.

J. L. Burnett and C. W. Jennings, 1962, Geologic map of California, Chico Sheet (1:250,000): California Div. Mines and Geology. Consists of conglomerate, sandstone, and siltstone. Underlies Tuscan Formation in

Oroville area. Mapped with middle and (or) lower Pliocene marine sedimentary rocks.

R. S. Creely, 1965, California Div. Mines and Geology Bull. 184, p. 62—64, pls. 1, 2. Formal proposal of name. Reddish-brown conglomerate, sandstone and siltstone. Thickness 90 feet at type locality. Thins out both north and south. At type locality strata appear to lie in broad, shallow, southwest-trending channel, whose width is about 6,000 or 7,000 feet. Underlies Tuscan Formation. In eastern part of area is underlain with profound unconformity by "Bedrock series". Along Dry Creek underlain in part by bedrock, but at south end of outcrop abuts with disconformity against Ione strata. Pliocene(?).

Type locality: New Era mine (recently renamed Jack and Jim mine) near head of Dry Creek, sec. 1, T. 21 N., R. 3 E., Oroville quadrangle, Butte County.

New Holland Till Member (of Lagro Formation)

Pleistocene (Wisconsin): Northeastern Indiana.

W. J. Wayne, 1963, Indiana Geol. Survey Bull. 25, p. 14 (fig. 2), 17, 40 (fig. 5), 44. Easternmost of three intertonguing parts of Lagro Formation. Consists dominantly of clay-rich mudstone that is only slightly pebbly. Normally calcareous below depth of about 75 cm and commonly exhibits blocky structure. Commonly less than 20m.

Type section: Along bank of Rush Creek, one-half mile south of New Holland, Wabash County, in NE¼NE¼ sec. 29, T. 27 N., R. 8 E., Largo quadrangle.

Newingham Granodiorite

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1961, (abs.) Lake Superior Geology Inst. 6th [7th] Ann. Mtg., April 27—29 (Canadian Inst. Mining and Metallurgy and Ontario Dept. Mines), p. 6. Newingham Granite selected for detailed structural and modal analysis. Unit lies immediately adjacent to town of Pembine, Wis., is some 40 square miles in area, and has intrusive contacts with greenstone, biotite gneiss, and hornblende gneiss.

J. A. Cain, 1962, (abs.) Lake Superior Geology Inst., 8th Ann. Mtg., May 10—12 (Michigan Coll. Mining and Technology), p. 5. Discussion of a Precambrian pluton near Pembine, Wis. Nine rock units mapped within some 350 square miles of the Precambrian granitic and metamorphic complex. Relative age relationships of units are suggested primarily from study of xenoliths, as follows (ascending): Quinnesec Formation, biotite gneiss, Marinette Quartz Diorite (new), Twelve Foot Fall Quartz Diorite (new), metagabbro sills, Hoskin Lake Granite (new), Newingham Granodiorite, Amberg Granite (new), and diabase dikes.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. In Pembine-Amberg area, eight rock units younger than Quinnesec Formation are recognized and mapped. Five of these units are named. Newingham Granodiorite is sixth in sequence (ascending). Younger than Hoskin Lake Granite and older than Amberg Granite.

J. A. Cain, 1964, Michigan Acad. Sci., Arts and Letters Papers, v. 49, p. 81—103. Described in Pembine area. Fairly homogeneous in eastern and central parts of area toward west becomes increasingly xenolithic. Typical Newingham Granite is medium to coarse grained, leucocratic gray, with weak foliation exhibited by biotite crystals.

Well exposed in neighborhood of Newingham Farm.

New London Member (of Dunleith Formation)

Middle Ordovician (Champlainian): Northeastern Missouri and western Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 125, 239. Fine- to medium-grained calcarenite and fine-grained to lithographic, calcarenitic limestone in medium beds, moderately pure, mostly cherty, with some thin argillaceous and weakly shaly beds. Entire member present only in extreme northern part of southern outcrop area where it is 35 to 45 feet thick; about 32 feet at type section where it overlies Moredock Member (new) and underlies Wise Lake Formation. South of Calhoun County, Ill., is overlapped by Cape Limestone and Elgin Shale of Maquoketa Group. It is a previously undifferentiated part of Kimmswick Limestone and appears to be essentially equivalent to middle cherty member of Kimmswick (McQueen and Greene, 1938, Missouri Geol. Survey and Water Resources, 2d ser., v. 25), which is 55 feet thick in northwestern Missouri. Equivalent to Sherwood, Wall, and Wyota Members by northern outcrop area.

Type section: Roadcut of U.S. Highway 61 in north side of Salt Creek, 2 miles north of New London, Ralls County, Mo., NE SW 25, 56N—5W, Hannibal quadrangle.

New Paris Interstade, Silt

Pleistocene (Wisconsin): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 676—677, 681 (fig. 3, table 6). New Paris interstade follows Whitewater stade (new) and is followed by Fayette stade (new). New Paris silt overlies Whitewater till and in some areas Fayette till. Radiocarbon dates on interstadial deposit show ages greater than 40,500 and 738,000 radiocarbon years.

Type section: American Aggregates pit section in east side of railroad cut at gravel quarry in north-central part of sec. 36, T. 14 N., R. 1 W., Wayne County. Named after New Paris, 1½ miles northeast of type section.

Newport Limestone

Age not stated: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2433. Occurs between Vassalboro and Waterville Formations. Included in Waterville in this report.

Pittsfield quadrangle.

Newton Hill Formation (in Woodstock Group)

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 106, figs. 1, 2, road log. Composed of cyclically bedded schist and quartzite. Individual layers 2 to 15 cm thick. Beds graded in many places. Pods of calc-silicate granulite present near top of unit. Present as discontinuous(?)

lenses at top of group. Above Thompson Mountain Formation and below Peru Formation (new). Listed as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not given. Area of report is Buckfield and Dixfield quadrangles.

Newton Drift

Pleistocene: Northwestern North Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 3 (fig. 1). Shown on map of significant late Pleistocene ice-margin positions.

In Williams and Mountrail Counties.

New York Mountain Fanglomerate

Pleistocene(?): Southern California.

S. E. Medall, 1962, Compass, v. 39, no. 2, p. 77—85. Name proposed for fanglomerate derived from New York Mountains. Consists of four general rock types of quartz monzonite, gneiss, andesite, and marble. Maximum thickness over 200 feet. Overlies Precambrian rocks.

Occurs on eastern flank of New York Mountains and continues southeasterly over Precambrian basement. Study area is about 8 miles east of Ivanpah, San Bernardino County.

Nickerson Till

Pleistocene, lower: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 27—28, 52, 53, 55. Name applied to oldest till of Kansan age in Nebraska. Thickness about 15 feet at type locality; about 50 feet at Fremont Bluff section, Saunders County. Includes Fontanelle Soil in upper part. Younger than Iowa Point Till (new) and older than Cedar Bluff Till (new).

Type locality: Roadcut on east side of Elkhorn River valley, one-half mile north and 2 miles east of Nickerson, in SE¼SW¼ sec. 8, T. 18 N., R. 9 E., Washington County. Also well exposed on southwest side of Platte River valley, 1½ miles southwest of Fremont near SW cor. sec. 27, T. 17 N., R. 8 E., Saunders County.

Nightingale Member (of Wasatch Formation)

Eocene: Southwestern Wyoming.

H. W. Roehler, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 140 (chart), 144—145. Name applied to non-red bed fluviatile rocks in western part of T. 18 N., R. 105 W., Sweetwater County. In subsurface, the Nightingale is composed of grayish blue-green shales interbedded with light-gray fine-grained micaceous sandstones. Type section includes only main body of Wasatch Formation underlying Luman Tongue, but a few miles north, where Luman Tongue is missing, it includes equivalents of Niland Tongue. By definition, the Nightingale does not include thick lacustrine, red bed, or coal-bearing sequences. It differs from mixture of lacustrine, paludal, and fluviatile rocks of Red Desert Member. It differs from Hiawatha Member in that it does not include Luman and Niland Tongues, Ramsey Ranch Member (new), of Green River Formation, or Paleocene rocks. Most of main body of Wasatch surrounding Rock Springs uplift can be included in Nightingale Member. Thickness 1,230 feet at type section.

Type section: Well exposed in N½ sec. 17, NE¼ sec. 18, and SE¼ sec. 7, 2 miles northeast of Nightingale Compressor Station on Mountain Fuel Supply Co. natural gas pipeline.

Nimrod Granite

Oligocene, upper: Western Oregon.

E. M. Baldwin, 1964, Geology of Oregon, Ann Arbor, Michigan, Edwards Bros., Inc., p. 7 (fig. 7), 66. A light-pinkish-gray medium-grained rock. Penetrates flows and tuffs of western Cascades.

Crops out near Nimrod, Lane County.

Nine-Lake Formation (in Hovey Group)

Ordovician or Silurian: Northeastern Maine.

Louis Pavlides, 1964, U.S. Geol. Survey Bull. 1194—B, p. B1—B4. Gray-green and green shale interlayered with graywacke and conglomeratic graywacke about 8,000 feet thick. Encloses red and purple slate lenses 0 to about 500 feet thick; lentils of conglomeratic graywacke 0 to about 1,200 feet thick; and lentils of metaperlite and other volcanic rocks 0 to about 4,000 feet thick. Basal formation in group. Underlies Dunn Brook Formation. Name Saddleback Mountain Member, which had been assigned to metaperlitic rocks in lower part of Hovey Formation is herein abandoned; and such volcanic rocks are considered unnamed volcanic lenses of uncertain stratigraphic position within Nine Lake Formation.

Named after Number Nine Lake, near which formation, in part, is exposed, Howe Brook quadrangle, Aroostook County.

Nipe Clay

Recent: Western Puerto Rico.

J. D. Weaver, 1962, Zeit. fur Geomorph., v. 6, no. 2, p. 218—232. Discussion of nature of "Nipe Clay" on Las Mesas. Recent studies of these deposits show that they are largely sedimentary in origin and not residual weathering products as they had previously been described. These deposits were described as 'Nipe Clay' by R. C. Roberts and others (1942, Soil survey of Puerto Rico, U.S. Dept. Agr. Bur. Plant Industry, ser. 1936, no. 8) who considered them residual limonite deposits derived from weathering of underlying serpentine.

Las Mesas is in western Puerto Rico, southwest of city of Mayaguez.

Niter Loess

Pleistocene, upper: Southeastern Idaho.

R. C. Bright, 1964, Dissert. Abs., v. 25, no. 4, p. 2440. Overlies Gem Volcanics (new) of Gentile Valley Group. Believed to be younger than Bonneville Formation.

R. C. Bright, 1967, Tibewa, v. 10, no. 1, p. 3—4, 6 (fig. 1). Formal proposal of name. Name is applied to extensive brown, gray, or yellow windblown silt that overlies Gem Valley Volcanics (new), Main Canyon Formation (new), and various undefined, local alluvial units, as well as older rock units in nearby mountains. Thickness at type sectioh 7.5 feet, but thicknesses range from a few inches to 25 feet.

Type section: At top of roadcut on Idaho Highway 34 in east sloping face, about 100 feet south of north end of the cut and in SW cor. E¼ sec. 1, T.

11 S., R. 40 E., Preston quadrangle, Franklin County. Type locality: System of roadcuts at intersection of Idaho Highway 34 and east-west section line road 1 mile south of Niter.

Nobel Canyon Rhyolite

Pliocene, upper: Eastern California.

G. B. Dalrymple, April 1964, Dissert. Abs., v. 24, no. 10, p. 4142. Late Pliocene (4.7—4.8 m.y.) potassium-argon date.

G. B. Dalrymple, July 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 20—22, 32, 36, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon ages 4.8 ± 0.1 and 4.7 ± 0.1 m.y. Thickness 800 to 1,000 feet. Overlain and underlain by andesite mudflow breccia. Curtis (1951, unpub. thesis) interpreted Nobel Canyon rhyolite as welded tuff. If this interpretation is correct, the andesite mudflow breccia that overlies tuff is no older than late Pliocene. Wilshire (1956, unpub. thesis) concluded that Nobel Canyon rhyolite may be intrusive body; if so, overlying andesites could be Miocene or Pliocene. Question of genesis of Nobel Canyon rhyolite still to be resolved. Nobel Canyon rhyolite, near Ebbetts Pass, was deposited about time of deposition of upper part of Mehrten Formation in central Sierra foothills.

Nobel Canyon is in southeastern part of Markleeville quadrangle.

Nob Hill Granodiorite

Tertiary, middle to late: Southeastern Nevada.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2491. Four intrusive stocks of middle to late Tertiary age, but younger than the volcanic rocks, intrude foliated basement rocks and volcanics. These are named Nelson quartz monzonite, Nob Hill and Aztec granodiorites, and Keyhole leucogranite.

Eldorado mining district, Clark County.

Noble Limestone Member (of Conemaugh Group)

Pennsylvanian: Eastern Ohio.

J. L. Murphy and Larry Picking, 1967, Kirtlandia (Cleveland Mus. Nat. History), no. 1, 7 p. Name Noble Limestone Member proposed for a previously undescribed marine unit in Conemaugh Group. Thickness at type section 4¾ feet. Consists, at type section, of basal blue nonfossiliferous clay shale a little more than 2 feet thick; a gray to white nodular marine, sparingly fossiliferous, limestone interbedded with green to greenish-gray dense calcareous fossiliferous marine shale, a little more than 2 feet thick; and gray nodular thin-bedded marine brecciated, sparingly fossiliferous, limestone about 4 inches thick. Occurs above Ewing Limestone and below Rock Riffle Limestone. [If the Conemaugh is considered a group, the Noble should be of formation rank and not member rank.]

Type section: Shale pit of Ava Brick Co., in SE¼NW¼ sec. 31, Buffalo Township, Noble County.

Nobles Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Nobles sand occurs at depth of 8,700 to 8,750 feet in type well.

Type well: California Co., No. 1 Nobles (V-33), sec. 12, T. 19 N., R. 4 W., Knowles field. Reference well: California Co., No. 1 Calloway, sec. 11, T. 19 N., R. 4 W., Knowles Field, Lincoln Parish.

Nodaway Underclay (in Aarde Shale Member of Howard Limestone)

Pennsylvanian: Eastern Kansas.

N. J. McMillan, 1956, Kansas Geol. Survey Bull. 119, pt. 6, p. 191—249. Discussion of petrology of Nodaway underclay, a persistent unit of Howard formation. Occurs below Nodaway coal. Ranges from thin film to 1.7 feet in thickness. Typically ash gray, but variations include gray, blue gray, olive green and yellowish green. Yellows are most common where Aarde shale member within.

Occurs across eastern Kansas from Oklahoma to Nebraska.

Noh Formation

Silurian: Northeastern Nevada.

Marshall Kay, 1966, Canadian Petroleum Geology Bull., v. 14, no. 4, p. 585 (fig. 3), 587 (fig. 4). Comparison of Lower Paleozoic volcanic and nonvolcanic geosynclinal belts in Nevada and Newfoundland. Noh Formation listed in table showing distribution of the sequences with argillites, cherts, and volcanics rocks in Nevada and Idaho. Thickness of formation 1,300+ feet. Occurs above Agort Chert (new).

Type locality and derivation of name not given.

Nokomis Sandstone Member (of Glenwood Formation)

Nokomis Bed (in Glenwood Member of St. Peter Sandstone)

Middle Ordovician (Champlainian): Southeastern Minnesota, northwestern Illinois, northeastern Iowa, northern Michigan, and southwestern Wisconsin.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13 (fig. 2), 51—52, 226. Member of Glenwood Formation. Name applies to sandstone with Glenwood texture lying between St. Peter Sandstone and Harmony Hill Shale Member of Glenwood. It results from merger of Kingdom Sandstone and Loughridge Sandstone beyond the northern and western margin of intervening Daysville Dolomite Member. Maximum thickness nearly 11 feet in type section.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Shown on columnar section as bed in Glenwood Member of St. Peter Sandstone. Underlies Harmony Hill Bed and overlies Tonti Member of St. Peter Sandstone.

Type section: Exposure in west bluff of Mississippi River at Lock and Dam No. 1 in Minneapolis, Hennepin County, Minn., in NW¼SW¼NW¼ sec. 17, T. 27 N., R. 23 W., St. Paul quadrangle. Named for Lake Nokomis (formerly Amelia Lake) 1½ miles west of type section.

Noland Formation (in Crab Orchard Group)

Noland Member (of Brassfield Formation)

Silurian: East-central Kentucky and Ohio.

C. B. Rexroad and others, 1965, Kentucky Geol. Survey, ser. 10, Bull. 2, p. 7, 8 (fig. 2), 9, 10, 11, 14—23. Name proposed to include rocks from top of Brassfield Formation to base of Estill Shale. Thickness 39½ feet at type section where it includes (ascending) Plum Creek Clay, Oldham Limestone, Lulbegrud, and Waco Members. All members not everywhere present. From northern Bath County, Ky., to northern Adams County, Ind., lower part of formation is undifferentiated and in these areas upper part of formation is Dayton Limestone Member.

Edward O'Donnell, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2485. Study of Lower Silurian Brassfield Formation in Cincinnati Arch area. The Noland "Formation" of the Crab Orchard "group" is best evaluated as a member within Brassfield Formation.

Type section: Along private road and on hillslope in The Bend (of Kentucky River) about 1.6 miles northwestward from College Hill, and north of Waco, 11—P—65, Madison County, Ky. Named from Noland Creek, a tributary of Kentucky River opposite type section.

Nolia Volcanic Formation

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H6—H8. Composed of brick-red, maroon, and black andesite flows. Generally the brick-red flows are eroded into bold reddish-brown hills; the black flows weather more readily and form dark-greenish-black piedmont slopes. Thickness of lower unit (reddish andesite) as much as 2,000 feet and upper unit as much as 5,000 feet in and near Ko Vaya Hills. Thickness of formation only a few hundred feet in central part of Comobabi Mountains. Presumed to be older than Cocoraque Formation (new) which contains fragments apparently derived from Nolia flows. Definitely underlies Sand Wells Formation (new) on west side of North Comobabi Mountains.

Type locality (lower sequence): Along a south- to southeast-trending line through Ko Vaya Hills; (upper sequence): Along southeast-trending creek that goes through village of Nolia, Papago Indian Reservation.

Noralyn Member (of Bone Valley Formation)

Miocene: Central Florida.

S. R. Riggs, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 1998—1999. Hawthorn Group subdivided into Arcadia and Bone Valley Formations. Bone Valley further subdivided into Noralyn and Homeland Members (both new). The Noralyn constitutes bulk of phosphorite section in Noralyn mine. It lies both conformably and unconformably over the Arcadia and is a marine unit of Miocene age.

Present in Noralyn mine in phosphate district of central Florida.

Norbeck Quartz Diorite

Lower Paleozoic: Central Maryland.

C. A. Hopson, 1964, The geology of Howard and Montgomery Counties: Maryland Geol. Survey, p. 160—163, pl. 7. Dark quartz diorite that occurs in pluton in east-central Montgomery County. Pluton is bounded on north and west by Sykesville Formation and on south and east by Wissahickon Formation. Kensington Quartz Diorite (new) impinges on part of its eastern border.

Named for Norbeck, a small community near center of pluton. Pluton is 8½ miles long and 1½ miles wide and trends north parallel to structure of country rock.

Noria Limestone

Lower Cretaceous: Southwestern New Mexico.

Christina Lochman-Balk, 1965, New Mexico Geol. Soc. Guidebook 17th Field Conf., p. 105. Listed in lexicon of stratigraphic names used in southwestern New Mexico. Name credited to W. E. Bowers (1960, unpub. thesis).

North Obsidian Flow

Recent: Central Oregon.

A. C. Waters, 1967, Moon Craters and Oregon Volcanoes: Oregon State System of Higher Education, Condon Lectures, p. 32—33 (figs. 10, 11). As shown North Obsidian flow forks into two prongs where blocked by Pumice Cone. Pumice Cone is dated as having been built roughly 2,000 years ago.

Newberry Volcano is about 25 miles south of Bend and some 35 miles east of crest of the High Cascades, Deschutes County.

North Anson Formation

Quaternary: Western Maine.

H. W. Borns, Jr., and D. J. Hagar, 1965, Geol. Soc. America Bull. 76, no. 11, p. 1244—1246. Name proposed for gravel deposit in northern Kennebec River valley. Characterized by its coarseness as compared to Embden Formation (new). The lack of fines gives it a lower cohesiveness than that of the Embden. Thickness 5 to 70 feet. Unconformably overlies Presumpscot Formation. Also overlies the Embden.

Named for occurrence in vicinity in of North Anson, Carrabassett River Valley.

North Bend Tongue (of Fairview Formation)

Upper Ordovician: Southwestern Ohio.

J. P. Ford, Jan. 1966, Dissert. Abs., v. 26, no. 7, p. 3861. Name applied to tongue in lower Fairview Formation. Overlain by Wesselman Tongue (new) of Kope Formation.

J. P. Ford, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 918—936. Formal proposal of name. Fairview Formation grades progressively into Wesselman Tongue of Kope Formation. As consequence a lower Fairview tongue is separated from main part of the formation. This unit is herein named North Bend Tongue of the Fairview. Thickness 12 feet at type section. Intertongues with Kope Formation and wedges out in northernly and northwesterly direction.

Type section: Exposure at about 618 to 630 feet elevation in south-facing bank of a southwest-flowing stream, slightly more than 1 mile east-northeast of North Bend, Ohio.

North Brittain Member (of Bull Formation)

North Brittain Limestone Conglomerate Member (of Bull Formation)

Lower Cambrian: West-central Vermont.

E-an Zen, 1961, Geol. Soc. America Bull., v. 72, no. 2, p. 303—304, pl. 1. Name proposed for a slate-matrix, limestone-pebble conglomerate, which forms excellent marker bed, principally near top of formation. Locally, at extreme west side of map area [Taconic Range], it is just above bottom of West Castleton formation. Wherever the two are found together, it [North Brittain] lies immediately above Mudd Pond quartzite member. Thickness 1 to 2 feet in Poultney River bed west of Fair Haven; more than 20 feet on cliff at Hooker Hill.

E-an Zen, 1964, U.S. Geol. Survey Bull. 1174, p. 61—62. North Brittain Limestone Conglomerate Member. Replaces name Castleton Limestone Conglomerate of Zen (1959). Early Cambrian (carries *Elliptocephala asaphoides* fauna).

Type locality: Valley of North Brittain Brook, town of Castleton, Vt.

North Creek Volcanics

Upper Paleozoic or pre-Upper Jurassic: Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the western Cordillera in British Columbia and neighboring parts of the United States—a symposium:Canadian Inst. Mining and Metallurgy, Spec. vol 8, p. 103, 116, pl. 7—1. A sequence of altered dominantly andesitic volcanics with commonly arkosic sedimentary beds. On northwest grades into Elijah Ridge Schist (new).

In Skagit region, Northern Cascades.

North Evans Limestone (in Genesee Group)

Upper Devonian: New York.

L. V. Rickard, 1964, New York State Mus. and Sci. Service Geol. Survey, Map and Chart Ser., no. 4. Name suggested by J. W. Wells as geographic name for condont bed of Hinde at base of Genesee Group along Eighteen Mile Creek in Eden 15-minute quadrangle. Underlies Genundewa Limestone. Interfingers with Penn Yan Shale and Geneseo Shale.

Type locality and derivation of name not stated.

North Fork Member (in Monterey Group)

See Plush Ranch Formation.

North Landing Formation

Pleistocene, middle or upper: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, V. 140, no. 3570, p. 979—983. Beach sand, gravel, and shells. Maximum thickness 20 feet. Overlies Nansemond Formation; underlies Great Bridge Formation (new).

North Landing River flows through Princess Anne County.

North Merced Gravel

Pleistocene, lower: Central California.

R. J. Arkley, 1962, California Div. Mines Bull. 182, p. 26 (fig. 2), 29. Mantles North Merced pediment. Thickness 10 to 20 feet. Similar to late Pliocene China Hat gravel (new). May be same age as Arroyo Seco gravel.

North Merced pediment occurs in San Joaquin Valley on both sides of Merced River, near ghost town of Merced Falls, Merced County. Pediment truncates Ione, Valley Springs, and Mehrten Formations and is thought to be same age as Arroyo Seco pediment.

North Summit Flow

See Lava Cast Forest Flow.

North Twistwood Creek Member (of Yazoo Clay)

Eocene, upper: Central and eastern Mississippi and western Alabama.

G. E. Murray, 1963, Mississippi Geol. Survey Bull. 95, p. 97—99. Proposed as corrected name to replace North Creek clay (Murray, 1947), a unit of Jackson group. Type exposures are on North Twistwood Creek, not on North Creek as stated in reference in which name was established. Status of unit as a member or formation should be based upon judgment of Yazoo clay, of which it is a subdivision, as a member, as a formation, or as a group.

Type section: On west side of North Twistwood Creek in SW¼ sec. 1, T. 3 N., R. 12 E., Jasper County, 2 miles southwest of Rose Hill along state highway to Bay Springs, Miss.

Norwood Cove Member (of Raccoon Mountain Formation)

Lower Pennsylvanian: Eastern Tennessee.

R. L. Wilson, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2488. Formation subdivided into Norwood Cove and Flat Rock Members (both new).

Northern Sand Mountain.

Noyes Mountain Formation (in Buckfield Group)

Silurian: Western and northwestern Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table), 17—20, pls. 1, 2. Mostly gray-weathering migmatitic gneiss: dark fraction mainly two-mica-sillimanite schist and biotite schist. Thickness 800 feet. Grades into underlying Patch Mountain formation (new); upper limit is Berry Ledge formation (new), which is a thin but distinctive quartz-calcite-plagioclase-diopside granulite. Suggested that Noyes Mountain, Berry Ledge, and Moody Brook formations are equivalent to Waterville formation. (P.H. Osberg, in preparation).

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., 57th Ann. Mtg., Trip K, p. 104 (table 1), 105, figs. 1, 2, road log. Included in Buckfield Group (new). Overlies Patch Mountain Formation; underlies Berry Ledge Formation.

Type locality: On Noyes Mountain, Bryant Pond quadrangle. Underlies large areas in southern third of quadrangle. Also well exposed on Nubble, Shaw Ledge, lower parts of first brook south of Stearns Hill, and on two hills immediately northwest of Moose Pond.

Nuevo León Group

Nuevo León Stage

Cretaceous (Coahuila Series): Gulf Coastal Province.

R. W. Imlay, 1944, Geol. Soc. America Bull., v. 55, no. 8, p. 1007, chart 10a. Coahuila group proposed by Imlay (1940) "to include all Lower Cretaceous strata older than *Dufrenoya texana* zone which were deposited in the ancestral Gulf of Mexico, in the Mexican sea, and in closely connected waters" is herein redefined as Coahuila series and is subdivided into Nuevo León and Durango groups. Nuevo León belongs to upper part of series and is limited basally by the lowest ranges of the ammonites *Pulchellia*, *Barremites*, and *Pseudohaploceras*, and corresponds to the Barremian and lower Aptian of European sequence.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 299, 301. Nuevo León and Durango used as time-rock subdivisions (stages) of Coahuilian series to include all rocks in coastal province which can be reasonably demonstrated to be equivalent to Durango and Nuevo León of Imlay (1944). Imlay did not specify a type locality or type section but it is obvious that the name was derived from Mexican State of Nuevo León.

Nuka Formation

Upper Mississippian to Upper Permian: Northern Alaska.

I. L. Tailleur and E. G. Sable, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 4, p. 632—642. A succession of fine clastic feldspathic coarse clastic rocks and cherty strata, and correlative coarse clastic rocks in a 170—mile—long band along northern front of Brooks Range. Thickness of succession more than 6,500 feet. Composed of 13 members, informally designated in ascending order e through q; members f, h, l, and o are fine clastic; e, i, m, and p are coarse clastic; g, j, k, n, and q are cherty. Overlain by Jurassic(?) graywacke—type strata; base not exposed but may be gradational with Mississippian Lisburne Group.

Type section: Exposed between lat 68°38′00″ N., long 159°15′ W., and lat 68°36′30″ N., long 159°12′ W., across nose of Nuka Ridge syncline, headwaters of Nuka River. Away from type area outcrops are sparse and probably represent fault slivers. They are along narrow band that extends from Utukok River in De Long Mountains, 170 miles eastward to Oolamnagavik River in Southern Foothills Section; may extend to Kiruktagiak River, 40 miles farther east. Band is included in structural belt which, analagous with foothills belt of Canadian Rockies, borders main mass of Brooks Range and consists of complexly folded, faulted, and overthrust rocks of Devonian to middle Cretaceous age.

Oak Bay Formation

Middle Silurian: New Brunswick, Canada, and southeastern Maine.

Original reference: F. J. Alcock, 1946, Canada Geol. Survey Papers 46—2, 46—3.

D. H. Amos, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 173 (fig. 3), 175, pl. 1. Exposed along St. Croix River, southeast of Calais, Maine. Near Calais, formation is a steeply dipping metamorphosed conglomerate composed of well-rounded pebbles and cobbles in a schistose matrix. Thickness 320 to 1,300 feet. Overlies dark argillite division of Charlotte Group. Middle Silurian.

Named from exposures at village of Oak Bay, New Brunswick, Canada.

Oak Flat formation

Lower-Upper Cretaceous: West-central California.

R. L. Rose and I. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 40 (strat. column), 41—42, geol. map. Name informally applied to an

8,500-foot sequence of clastic sediments. Consists of Lower Oak Flat mudstone, Dowdle sandstone and conglomerate member (new), and Upper Oak Flat mudstone. Overlies Springs Road sandstone (new); underlies Curry Mountain sandstone.

Name derived from Oak Flat, about one-half mile east of Kreyenhagen Peak, east-central Priest Valley quadrangle. Present in northeastern part of map area and well exposed in vicinity of Coalinga Mineral Springs.

Oak Mountain Felsite (in Middlebrook Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 53. Consists of series of nearly black flows containing small phenocrysts of potash feldspar and quartz. Name credited to Tolman and Robertson (in preparation).

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83. Included in Middlebrook Group (new).

Occurs in St. Francois Mountain area. Oak Mountain is in St. Francois County.

Oak Point Granite

Devonian: Maine.

P. S. Wingard, 1961, Dissert. Abs., v. 21, no. 12, p. 3752. Incidental mention in report on Castine-Blue Hill area, Maine.

Oak Springs Cliffs Member (of De Chelly Sandstone)

Permian: Northern Arizona.

H. W. Peirce, 1964, Mus. Northern Arizona Bull. 40, p. 15—32. Consists of slope-forming noncross-stratified red calcareous, in many places micaceous, sandstones and silty sandstones. Thickness 128 feet at Oak Springs Cliffs. Thins northward along east flank of Defiance Plateau. Forms the "notch" at Hunters Point where it is 50 feet thick. Overlies Hunters Point Member and underlies White House Member (both new). Is the transition unit of the De Chelly of Read (1951, New Mexico Geol. Soc. Guidebook 2d Field Conf.), tongue of Supai formation of Read and Wanek (1961, U.S. Geol. Survey Prof. Paper 374—H) middle unit of De Chelly of McKee (1934, Am. Jour. Sci., 5th ser., v. 28, no. 165) at Canyon De Chelly, Yeso Formation of Baars (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 2).

H. W. Peirce, 1967, New Mexico Geol. Soc. Guidebook 18th Field Conf., p. 61. Discussion of Permian stratigraphy of Defiance Plateau, Ariz. The unit herein called Oak Springs [Cliffs] Member is the unit that Baars calls the Yeso Formation (restricted). Present author views the unit as being stratigraphically below the White House Member but Baars views it to be above the White House and that it has been eroded from the type area by a pre-Shinarump episode of uplift and removal.

Well developed at Oak Springs Cliffs, on Defiance Plateau, Apache County.

Oakwood Gravels

See Kahoka Till.

Obsidian Cliff Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 402–403, 405, pl. 1. Obsidian Cliff flow was erupted from plateau of welded tuff and basalt east of Obsidian Cliff. Nonporphyritic.

Covers area of 4½ square miles, in Yellowstone National Park. Obsidian Cliff is about 200 feet high.

Oceana Ridge Sand

Post-Miocene: Southeastern Virginia.

J. E. Sanders and others, 1962, Preliminary report on the geology of southeastern Virginia and adjacent coast and continental shelf, with remarks on sediment sampling techniques using vibro-drilling methods: New Haven, Conn., Yale Univ., Dept. Geology, p. 28. Name applied to sand in Oceana Ridge. Nonfossiliferous. Resembles Lawnes Creek formation (new) but stratigraphic relationships not known at present.

Ocean City Formation

Miocene, upper: Western Washington.

F. H. Wurden, 1959, World Oil, v. 149, no. 1, p. 98. At end of Blakeley time area subsided and about 1,700 feet of marine shales in Ocean City formation was deposited. Older than Astoria formation. Subsurface data.

H. G. Billman, 1965, (abs.) Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1080. Marine sediments of late Miocene to questionably Pliocene occur only in Grays Harbor-Montesano basin and Pacific Ocean coastal strip. In Grays Harbor-Montesano basin, these rocks are mapped as Montesano Formation and consist of 2,500 feet of marine conglomerate, sandstone, and siltstone containing Foraminifera which indicate late Miocene age equivalent to Mohnian and Delmontian stages of California. Along Pacific Coast, in vicinity of Ocean City, sediments of equivalent age are represented by up to 6,000 feet of sediments informally denominated Ocean City and Quillayute Formations. Late Miocene on basis of fossils.

Present in vicinity of Ocean City, Grays Harbor County.

Odessa Granite

Precambrian: Southwestern Minnesota.

S. S. Goldich and others, 1961, Minnesota Geol. Survey Bull. 41, p. 145–146. Commonly red with some pinkish-gray to reddish-brown phases. Generally medium to coarse grained or pegmatitic.

Between Odessa and Ortonville, Big Stone County.

Odanah Member (of Pierre Shale)

Odanah Series[1]

Upper Cretaceous: Manitoba Canada, and northeastern North Dakota.

Original reference: J. B. Tyrrell, 1893, Canada Geol. Survey, new ser., v. 5, pt. 1, p. 83E–85E, 199E, 212E–215E.

J. R. Gill and W. A. Cobban, 1965, U.S. Geol. Survey Prof. Paper 392–A, p. A15–A16, A18. Study of Pierre Shale in eastern North Dakota Manitoba. Name Odanah is assigned to the hard siliceous shale that overlies the De Grey Member. Thickness in Pembina Mountain area of North Dakota largely unknown. Lower 65 feet can be seen along North Dakota Highway 5 near the Tongue River. About 200 feet of member present in

Manitoba part of Pembina Mountains. Outcrops of member in North Dakota outside Pembina Mountain area are scarce, and thickness of beds exposed at most places is small. One of largest outcrops, in Devils Lake area, shows only 20 feet of beds. Part of the Odanah grades southward into Virgin Creek Member of Pierre Shale of South Dakota.

Name Odanah taken from locality near Minnedosa, Manitoba, about 85 miles north of North Dakota boundary.

Officer Member (of Trowbridge Formation)

Upper Jurassic:East-central Oregon.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 61—62, pls. 1, 3. About half black and green mudstone similar to that in underlying Rosebud Member (new). Other half made up of resistant volcaniclastic strata. The two rock types occur in alternating sequences, each 25 to 100 feet thick, that give rise to a ridge and swale topography. Within mapped area, the basal resistant sequence is a ledge-forming felsite tuff unit, informally named Buck Creek felsite tuff (Dickinson, 1962), that maintains thickness of 60 to 75 feet throughout area east of Sheep Creek, but thins rapidly to feather edge in west. Thickness 100 to 500 feet. Underlies Magill Member (new).

Type locality: In Cottonwood Draw (tributary to Rosebud Creek) in NW¼ sec. 22, T. 17 S., R. 28 E. Named from Officer Creek.

Ogo Member (of Budden Canyon Formation)

Upper Cretaceous: Northern California.

M. A. Murphy, G. L. Peterson, and P. U. Rodda, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 4, p. 496—502. Proposed for beds between Rector Conglomerate Member (or basement contact where conglomerate is absent) and Roaring River Member. Includes thick-bedded sandstone, mudstones, thin-bedded sandstones, and conglomerates. Typical section has lower unit of 50 to 200 feet of thick-bedded sandstone. This is followed by mudstone unit with concretionary limestone and minor amounts of thinly bedded sandstone which ranges from 50 to several hundred feet in thickness. Above these beds is sequence of thin- to medium-bedded sandstones alternating with slightly thicker beds of mudstone that is as much as 9,000 feet thick. Thickness about 850 feet near Ono to nearly 10,000 feet in Budden Canyon-Dry Creek section.

Reference section: Along Budden Canyon from contact with Rector Conglomerate in secs. 35 and 36, T. 29 N., R. 9 W., to thick-bedded sandstone units of Roaring River Member in sec. 1, T. 28 N., R. 8 W. Name derived from Ogo Station in northwest part of Ono quadrangle.

Ogotoruk Formation

Jurassic or Cretaceous: Northwestern Alaska.

R. H. Campbell, 1965, U.S. Geol. Survey Bull. 1194—A, p. A22, A25—A26; 1967 U.S. Geol. Survey Prof. Paper 395, p. 20—24, pls. Chiefly dark-gray mudstone interbedded with variable amounts of siltstone and very fine to medium-grained dark-gray and brown sandstone. Base, where exposed east of Agate Rock, consists of several feet of dark-greenish-gray claystone. Conspicuous red-weathering layer occurs about 3 feet above base. Thickness not accurately known because of complex structure, lack of exposures, and lack of marker beds, but total of about 5,000 feet estimated from structure sections. Formation exposed in normal contact with underlying Sublik Formation only along seal cliff east of Agate Rock. Elsewhere, contact with older rocks is concealed by unconsolidated surficial deposits, or is faulted. Gradational contact with overlying Telavirak Formation (new). Corresponds with mudstone-sandstone unit of Campbell (1961, U.S. Geol. Survey TEI—779) and with strata tentatively assigned in earlier reports (Kachadoorian and others, 1958, U.S. Geol. Survey open-file rept, Sainsbury and Campbell, 1959, U.S. Geol. Survey open-file rept, and Campbell, 1960, U.S. Geol. Survey TEI—753) to Tiglukpuk Formation.

Type locality: Exposures along Ogotoruk Creek and its tributaries, near Chariot Test Site in vicinity of Cape Thompson.

Ohanapecosh Formation

Eocene, upper: Central Washington.

A. C. Waters, 1961, Northwest Sci., v. 35, no. 2, p. 39, 48—52, 56. Consists of thick lensoid accumulations of lavas and mudflows surrounded by larger volumes of water-laid clastic rocks, mainly massive tuff-breccias interstratified with thin-bedded volcanic silts, volcanic graywackes, and gritty pumice conglomerates. Thickness over 10,000 feet. Unconformably underlies Stevens Ridge formation (new). Formation has been folded and faulted and metamorphosed to zeolite facies. Was uplifted, extensively eroded, and locally weathered to a thick red saprolite before the Stevens Ridge was deposited. Upper Eocene. Name credited to Fiske, Hopson, and Waters (in press).

R. S. Fiske, C. A. Hopson, and A. C. Waters, 1963, U.S. Geol. Survey Prof. paper 444, p. 4—20, pl. 1. Formal proposal of name. Volcanic clastic rocks and lava flows comprise bulk of formation. For purposes of description the formation is divided into three parts: (1) lava flow-mudflow complexes, (2) adjacent accumulations of volcanic clastic rocks, and (3) ash flows and rhyolite. Two major complexes of lava flows recognized and mapped. Sarvent complex, well exposed in cirque walls of Sarvent Glaciers, is as much as 3,800 feet thick. Mount Wow complex, in Mount Wow—Satulick Mountain area, is at least 7,000 feet thick. Neither base nor original uneroded top of formation seen in Mount Rainier National Park. Original thickness probably exceeded 15,000 feet. Thickness more than 10,000 feet, measured across strike from Cascade crest to Stevens Canyon; more than 9,000 feet in Mount Wow-Satulick Mountain area. West of park, the formation rests upon and intertongues with arkoses and siltstones of Puget Group. Along Mowich and Puyallup Rivers, Ohanapecosh volcanic clastic rocks are interbedded with and grade into arkoses and carbonaceous shales. This junction is not time line; in area just west of park the arkose intertongues higher and higher into Ohanapecosh section toward north. East of park, rocks of formation are in fault contact with highly sheared shales, graywacke, and basic lavas of Mesozoic(?) age. Within the park, the formation is unconformably overlain by Stevens Ridge Formation.

Named from Ohanapecosh Hot Springs, a small park community located on Washington State Highway 5 in southeast corner of Mount Rainier National Park. Ohanapecosh Hot Springs lies near center of a thick westward-dipping section of Ohanapecosh rocks.

Ojinaga Formation[1]

Upper Cretaceous: Northeastern Mexico and southwestern Texas.

Original reference: R. H. Burrows, 1909, Mining and Scientific Press, v. 99, no. 10, p. 326-327.

J. D. Powell, 1965, Am. Assoc. Petroleum Geologists Bull. 49, no. 5, p. 517—519. Extended into Quitman Mountain area, Texas. Thickness about 2,300 feet. Contact with underlying Buda Limestone disconformable at south end of mountains but probably gradational a few miles south of Cieneguilla, Chihuahua.

Named for occurrence in Ojinaga basin, Chihuahua, Mexico.

OkanoganComplex

Mesozoic: North-central Washington.

C. F. Royse, Jr., 1965, Northwest Sci., v. 39, no. 1, p. 18. In contact with Pipestone [Canyon] formation.

OK-Bar Conglomerate

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines Mineral Resources Geol. Map 17. Poorly sorted, weakly consolidated boulder and cobble conglomerate and sandstone. Interbedded thin basalt flows and beds of pumice containing nodular obsidian inclusions occur in southern part of area. Resembles Gila Conglomerate to north. Equivalent to Pine Canyon Formation and Double Adobe Latite (both new).

Southern Animas Mountains.

Old Port Formation

Lower Devonian: Central Pennsylvania.

R. R. Conlin and D. M. Hoskins, 1962, Pennsylvania Geol. Survey, 4th ser., Topog. and Geol. Survey Atlas A-126, p. 20—24. In past, Lower Devonian sequence of central Pennsylvania has been divided into two groups containing several constituent formations as follows: Helderberg Group with Coeymans, New Scotland, and Mandata Formations, and Oriskany Group with Shriver and Ridgeley Formations. In Mifflintown quadrangle and adjacent areas this interval is treated as single rock unit and sequence represented by Helderberg and Oriskany Groups is reduced to formational rank and name Old Port assigned to the formation. Formation consists essentially of thin quartz sandstone (Ridgeley Member) at top; underlain by chert and cherty limestone with varying thicknesses of shale interbeds. Thickness 150 to 190 feet in Mifflintown quadrangle. Contact with underlying Keyser formation gradational. Contract with overlying Onondaga Formation sharp.

Type section: Along a stream and roadcut about 1½ miles west of Old Port, Mifflintown quadrangle. Beginning of section is 2,000 feet south of lat 40°13′15″ N., along long 77°25′W.

Olympia Interglaciation

Pleistocene: Northwestern Washington, and southwestern British Columbia, Canada.

J. E. Armstrong and others, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 321—330. The climatic episode immediately preceding the last major glaciation and represented by nonglacial strata lying beneath Vashon Drift is herein named Olympia Interglaciation. Physical evidence for this episode exists at many places in southern Puget Lowland in Washington, and on both sides of Strait of Georgia in British Columbia. Deposits of the interglaciation are typically exposed along shores of Puget Sound between Olympia and Seattle. At type section nonglacial fluvial and lacustrine clay, silt, and sand about 70 feet thick underlie proglacial lacustrine silt and clay of Vashon age. Olympia Interglaciation started at least 36,000 years B. P., and continued until advance of Cordilleran glacier ice during Fraser Glaciation (new).

Type section: Sea cliff 0.6 mile southeast of West Point at Seattle, Wash.

Omar Formation (in Columbia Group)

Pleistocene: Delaware (subsurface and surface).

R. R. Jordan, 1962, Delaware Geol. Survey Bull. 9, p. 14 (fig. 2), 23 (fig. 3), 41—43, pl. 4. Name proposed for sediments that overlie Beaverdam Formation. Consists of interbedded gray to dark-gray quartz sands and silts. Individual beds range in thickness from a few inches to more than 10 feet. Thickness about 45 feet in type well.

H. J. Hansen, 3d, 1966, Maryland Geol. Survey Rept. Inv. 2, p. 21. Beaverdam Formation considered a facies of Salisbury Formation (new) in this report. Omar Formation of Pleistocene age is in part the Beaverdam facies of this report.

Type section: In well Qh44—1 at junction of Delaware Route 26 with County Road 353, 2½ miles east of Frankford, Sussex County. Name taken from village 2 miles east of Frankford. Omar is town nearest to well number Qh44—1.

111 [one hundred eleven] Ranch Beds

Pleistocene, lower and middle (Blancan-Irvingtonian): Eastern Arizona.

Philip Seff, 1962, Dissert. Abs., v. 23, no. 4, p. 1328. A sequence of lower and middle Pleistocene sediments, interpreted as being of floodplain, paludal, and lacustrine origin, are informally designated as 111 Ranch beds. Sediments consist of sand, gravel, clay marl, limestone, diatomite, tuff, tuffaceous silt, silt, and chert.

Philip Seff, 1964, Arizona Geol. Soc. Digest, v. 7, p. 115—121. Thickness of composite stratigraphic section about 135 feet. Divided into 11 units. Oldest exposed unit is Kiln Diatomite, 18 feet thick. Ed's Limestone (unit 3), 5 feet thick, consists of impure silty limestone with thin chert lenses. Lake Nancy Limestone (unit 6), 5 feet thick, is key unit because it is most extensive and continuous deposit in 111 Ranch area. Capybara Limestone (unit 10), 6 feet thick, grades into massive diatomite near Whitlock Hills. Interbedded with the diatomite, and almost always near center of unit, are thick beds of green chert.

Exposed in badland topography about 14 miles southeast of Safford and just north of volcanic Whitlock Hills near intersection of Gila and San Simon Valleys in T. 8 S., R. 28 E., Graham County.

Opal Mountain Volcanic Formation

Oligocene(?) to Miocene, middle: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof. Paper 522, p. 86, pls. Volcanic rocks of rhyolite and quartz latite composition occurring as intrusive plugs and extrusive flow breccias in pyroclastic rocks of Pickhandle Formation. Volcanic rocks emplaced during time of deposition of Pickhandle Formation are therefore the same age as the Pickhandle.

Type locality: In vicinity of Opal Mountain and forks of Black Canyon to northwest. Mohave Desert, San Bernardino County.

Oquirrh Mountain facies

Upper Mississippian-Lower Permian: North-central Utah.

M. D. Crittenden, Jr., 1964, Utah Geol. and Mineralog. Survey Bull. 69, p. 21. An informal term applied to rocks of Late Mississippian through Early Permian in Oquirrh Mountains, Traverse Mountains, and Wasatch Range south of head of Dry Canyon and Deer Creek (Utah County).

Oreana Formation

Pliocene, upper: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Composed of a silt-sand member and a gravel member. Younger than Brown Creek Formation (new) and older than Jackass Butte Formation (new). Included in Idaho Formation of Cope (1884), which name is herein abandoned.

Present in Oreana quadrangle in foot hill country of Owyhee Mountains and southern margin of western Snake River Plain.

Oreana Peak Formation

Upper Triassic and Lower Jurassic: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Oreana Peak and Gardnerville (new) Formations composed of 5,500 to 6,000 feet of marine carbonate and clastic rocks and interbedded volcanic material. These formations were warped and eroded near end of Jurassic time. During Middle and (or) Late Jurassic, Preachers Formation (new) was deposited.

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Oregon City Formation

Upper Jurassic: Central northern California.

J. L. Burnett and C. W. Jennings, 1962, Geologic map of California, Chico Sheet (1:250,000): California Div. Mines and Geology. Metavolcanic rocks containing lesser amounts of metasedimentary rocks. Mapped with Jurassic and (or) Triassic metavolcanic rocks.

R. S. Creely, 1954, R. S. Creely, 1965, California Div. Mines and Geology Bull. 184, p. 21—24, pls. 1, 2. Formal proposal of name. Characterized by pyroclastic rocks—tuff-breccia, tuff, and agglomerate—and their epiclastic derivatives—volcanic sandstone and volcanic conglomerate. Maximum thickness about 3,200 feet, where exposed in Morris Ravine on west limb of Monte de Oro syncline; base of formation not exposed here. Overlies Calaveras Formation; conformably overlain by Monte de Oro Formation. Upper Jurassic.

Type locality: At Oregon City, sec. 16, T. 20 N., R. 4 E., Oroville quadrangle, Butte County. Well exposed in Feather River Canyon, north and east of Oroville.

Organ Mountains Quartz Monzonite

Oligocene: Western New Mexico.

F. E. Kottlowski, 1966, (abs.) Geol. Soc. America Spec. Paper 87, p. 91. Silver Cliff prospect in southern Organ Mountains is in Soledad Rhyolite, an early Tertiary welded tuff that overlies Orejon Andesite. Both have been intruded by Organ Mountains quartz monzonite.

Organ Mountains are in Dona Ana County.

Orlano Spring Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 9. Overlies Red Butte Member and underlies Holdout Member (both new).

Type section: E½ sec. 15, T. 25 S., R. 43 E., Malheur County. Named for exposures near Orlano Spring.

Orofino Creek interbeds (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 22—23, fig. 18. Lowest unit of "Upper" Basalt of Columbia River Basalt [Group] in northeastern part of Clearwater Embayment. Overlie a thickly highly porphyritic flow of "Lower" Basalt which is possibly Rock Creek Flow (new). Composed of two marginal interbeds separated by basalt flow. In Orofino Creek area the Interbeds have cumulative thickness of about 100 feet; lower of the two units averages about 15 feet and upper about 25 feet. Intervening basalt flow has poorly defined colonnade and entablature totalling about 60 feet in thickness. Lies about 400 feet below Whiskey Creek Interbeds (new).

Named for exposures in road cuts 500 feet above canyon bottom one-half mile east of confluence of Orofino Creek and Whiskey Creek, Clearwater County, Clearwater Embayment.

Oronoque Member (of Derby Hill Schist)

Ordovician(?): Southwestern Connecticut.

C. E. Fritts, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—426, GQ—427. Mapped in Ansonia and Milford quadrangles, respectively. Mainly slabby to thinly laminated medium- to fine-grained greenish-gray to medium dark-gray quartz-rich and albitic paragneiss with schistose to phyllitic partings and layers containing abundant muscovite and chlorite. Green or brown biotite and garnet present locally. Upper part contains minor epidote-rich greenschists and amphibolites similar to those characteristic of undivided Maltby Lakes Volcanics (new).

C. E. Fritts, Dec. 1965, U.S. Geol. Survey Bull. 1224—A, p. A30. Formal proposal of name. Rocks exposed at type locality, herein designated, are in kyanite zone of regional metamorphism and are similar to rocks mapped as part of Oronoque Member just north of Far Mill River in western part of Pine Rock Park in Ansonia quadrangle. Abundant quartz-rich paragneiss, or siliceous metatuff, distinguishes member from predominant schist of Derby Hill Schist. Near Shelton and Derby, entire formation is highly sheared; there Oronoque Member is difficult to recognize but presumably is in upper part of formation and grades into predominant schist.

H. R. Burger, 3d, 1967, Connecticut Geol. and Nat. History Survey Rept. Inv. 4, p. 3, 4 (fig. 3), 5. Fritts (1962, 1965) maps rocks in southeastern Ansonia and eastern Milford quadrangles, adjoining the area on the west, as Derby Hill Schist and divides this formation into two members, Oronoque Member above and an unnamed member below. Field mapping in New Haven quadrangle and inspection of field relations in Ansonia and Milford quadrangles suggest that correlation of these rocks with the type Derby Hill Schist at Derby Hill in Ansonia quadrangle is tenuous and difficult to substantiate. Present author prefers following revisions: (1) Rocks mapped by Fritts (1965) as unnamed member of Derby Hill Schist in southeastern Ansonia and eastern Milford quadrangles are identical to those mapped by author as Savin Schist in New Haven quadrangle and should henceforth be designated as Savin Schist; (2) Upper part of rocks mapped as Oronoque Member should preferably be included as a unit in Maltby Lakes Volcanics. The lower portion is regarded as merely interbedded within Allingtown Volcanics.

Type locality: Long roadcut at intersection of Merritt Parkway and State Route 110 on the west bank of Housatonic River about 1,300 feet south of Ansonia quadrangle. Named for unincorporated community of Oronoque in northwestern part of adjacent Milford quadrangle.

Oroville Table Mountain tuff

[Miocene]: Central California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 20, 22, 38. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 23.8 m.y. Refers to Creely (1954, unpub. thesis). Abstract (page 1) mentions dacite tuff at Oroville Table Mountain.

Locality: Oroville quadrangle.

Orrs Mills Member (of Decker Ferry Formation)

Silurian: Southeastern New York and northern New Jersey.

S. G. Barnett, 3d, 1967, Dissert. Abs., v. 27, no. 9, sec. B, p. 3145. Two new units named—Berkshire Valley Formation and Orrs Mills Member of Decker Ferry Formation—in this study of Late Cayugan and Helderbergian stratigraphy.

Area of study is Green Pond-Schunemunk Mountain outlier and also main Silurian Devonian outcrop belt 25 miles to northwest in southeastern New York and northern New Jersey.

Ortiz Formation

Paleocene or Eocene: Northern Puerto Rico.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244–C, p. C3 (table 1), C17. Highly calcareous thick-bedded coarse sandstone with interbeds of dusky-red shale occurs at base of formation. This sandstone is overlain by a thin conglomerate bed containing many limestone pebbles. Upper part of exposed section consists of mostly interstratified somewhat varicolored, red, green, and dark-gray volcanic sandstone and siltstone and pale-green tuff. A thin gray limestone present in upper part of formation. Some bentonitic clay. Thickness as much as 600 m. Conformably overlies Corozal Limestone.

Type locality: In the Rio Corozal between coordinates 55,320 and 55,720. Named for settlement of Ortiz, Corozal quadrangle.

Osceola Argillite (in McCoy Creek Group)

Precambrian: Central northeastern Nevada.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 296, 298–299 (pl. 1), 301–302. Most rocks of formation are slate gray in medium to more rarely dark shales, commonly with bluish or purplish hues. Greenish colors common but restricted to laminae in strikingly banded varieties. Thickness 800 feet. Conformably overlies Shingle Creek Quartzite (new); underlies Stella Lake Quartzite (new). South of Shingle Creek, Drewes (1958, Geol. Soc. America Bull., v. 69, no. 2) mapped unit as "unnamed slate member" within lower part of Prospect Mountain Quartzite and gave thickness of about 300 feet.

Complete section exposed on northern slope of Strawberry Peak and also about 2 miles east of Osceola, on east side of range crest, northern part of Southern Snake Range.

Oso Canyon Formation

Miocene, upper: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof., Paper 522, p. 60–62, pls. A coarse fluviatile sedimentary sequence of late Miocene age. Composed of beds and intergradations of fanglomerate, conglomerate, sandstone, and siltstone. Maximum thickness about 5,500 feet. Lower part gradational southwestward and downward into Quail Lake Formation (new). Northeastward becomes unconformable on Neenach Volcanic Formation (new) and on Mesozoic granite. Unconformable overlain by Meeke Mine Formation (new). Has been mapped as Santa Margarita Formation.

Type section: Exposed from contact with buff sandstone of Quail Lake Formation along line N. 20° E., for 2 miles, across Oso Canyon to contact with overlying Meeke Mine Formation, Los Angeles County. Named for Oso Canyon.

Otero Granite

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194–I, p. I1–I12. Mostly a gray medium-grained quartz-biotite porphyritic rock. Appears to underlie Pitoikam Formation (new). Age of Otero unknown. Assumed to be of Mesozoic age and is older than bedded formations described in this report. Name credited to P. G. Donald (unpub. thesis).

Area of report is Baboquivari Mountains, Papago Indian Reservation. Otero Ranch is east of area.

Otowi Member (of Bandelier Tuff)

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 48–49, pl. 1. A buff-colored massive aggregate of poorly sorted rhyolitic pumice fragments and some fine pumiceous glass, all of which weathers to a chalky light gray. Throughout Los Alamos area it is chiefly a single pumice flow. Thickness 0 to 215 feet. The 215-foot-thick section is in test hole 19.6.17.234. Overlies Guaje Member (new); underlies Tshirege Member (new). Where Guaje Member is absent the Otowi rests on pre-Bandelier erosion surface which was cut on Puye Conglomerate, the old alluvium unit and the basaltic rocks of Chino Mesa.

Type locality: Otowi section of Bandelier National Monument. Named for exposures in vicinity of Otowi ruins, NE¼NE¼ sec 18, T. 19 N., R. 7 E., in Pueblo Canyon.

Ottawa Limestone Megagroup or Supergroup

Middle and Upper Ordovician: Central United States.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Ottawa Limestone in Ontario (Wilson, 1938, Ottawa sheet, east half, Carleton and Hull Counties, Ontario and Quebec: Canada Geol. Survey Map 413—A, 1946, Canada Geol. Survey Mem. 241) includes equivalents of seven formations of Black River and Trenton rocks recognized in New York. Use of name, in form of Ottawa Limestone Megagroup, is herein extended to entire body of Champlainian (Middle Ordovician) carbonates lying on sandstones, sandy shales, or sandy dolomites usually referred to the St. Peter, Glenwood, Simpson, or Alymer, and lying beneath shales of Cincinnatian (Upper Ordovician) or late Champlainian age. Megagroup, typically 500 to 1,000 feet thick in central states, thickens to a few thousand feet in southern and central Appalachians where it becomes more complex. Farther west it is thinner and its formal recognition as a megagroup would serve no useful purpose. Bighorn and Fremont in the Cordillera are essentially synonymous with Ottawa. Megagroup grades laterally into and is underlain by sandstone or sandstone-and-shale or sandstone-and-dolomite formations of which St. Peter Sandstone is best known. The Ottawa overlaps sandy units eastward and southward and lies on Knox Megagroup. Upper boundary of Ottawa is at base of clastic wedge that extends westward from Appalachians and records Taconic orogeny. As clastics were deposited in east earlier than in west, top of Ottawa in general rises from position within Champlainian in eastern states to one within Cincinnatian in the Cordillera. This lithologic surface crosses time surface at a low angle. In much of southern Illinois, top of Ottawa is unconformity, and latest Champlainian strata are present. In southernmost Illinois the Ottawa is about 1,300 feet thick and includes (descending) Galena and Platteville Limestone Groups, Joachim Dolomite, and Dutchtown Limestone. In northern Illinois, only Galena and Platteville are present in the Ottawa which is 300 to 400 feet thick. In small area west of Chicago a thick dolomite member within the Glenwood directly underlies the Platteville and is included in the Ottawa. In parts of southwestern Illinois a thin lenticular limestone of Cincinnatian age rests on the Galena and is included in the Ottawa. Maquoketa Shale Group of Cincinnatian age is not at present placed in a megagroup. It is only representative in Illinois of the "Medina" clastics of Ordovician and Silurian age marking the Taconic revolution of Applachians. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

W. L. Calvert, 1963, Ohio Geol. Survey Rept. Inv. 48, p. 6 (table 1), 7. Ottawa Limestone Supergroup is lower carbonate unit of Tippecanoe Sequence. Name "Ottawa Limestone Megagroup" as proposed by Swann and Willman included all rocks from top of Trenton Limestone down to top of St. Peter Sandstone. Considered advisable to call this unit a supergroup and to include underlying Simpson Group, which contains much carbonate as well as clastic material. As used in this report, Ottawa Limestone Supergroup consists of Trenton Limestone, Black River Group, and Simpson Group. Unconformable above Knox Dolomite Supergroup.

Ott Creek Member (of Schoonover Formation)

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 600—601, pl. 1. Consists of alternating chert and limestone units. Estimated maximum original thickness 1,600 feet. Overlies Cap Winn Member (new); underlies Frost Creek Member (new).

Exposed on slopes and ridge immediately south of Ott Creek, northern Independence Mountains, Bull Run and Whitehorse quadrangles.

Otter Basalt

Pleistocene, lower to middle: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Early to middle Pleistocene stream action formed elongate valley, at least 300 feet deep, whose southern margin was about parallel to and about a mile south of present Snake River in Oreana quadrangle. At least two small volcanoes erupted material (Otter Basalt) into topographic low and, locally, basalt, flowing into water, formed pillow lava. Younger than Jackass Butte Formation (new) and older than Montini Formation (new).

Present in Oreana quadrangle, in foothill country of Owyhee Mountains and southern margin of western Snake River Plain.

Otter Creek coral bed (in Preachersville Member of Drakes Formation)

Upper Ordovician (Richmond): East-central Kentucky.

G. C. Simmons and W. A. Oliver, Jr., 1967, U.S. Geol. Survey Bull. 1244—F, 13 p. A gray medium-grained limestone. Bed is a useful stratigraphic marker at base of Preachersville Member of Drakes Formation. It separates Preachersville from underlying Rowland Member of the Drakes in parts of southeast-central Kentucky. Also important because it contains the only well-preserved fauna that has been recognized in Drakes Formation on east side of Cincinnati arch, and because it is one of similar beds in Upper Ordovician rocks of the Kentucky-Ohio-Indiana region. Bed has sporadic distribution and ranges in thickness from 0 to 8 feet. Systematic annotations of fauna.

Crops out near East Fork Otter Creek in Union City quadrangle.

Otter Point Formation

Upper Jurassic: Southwestern Oregon.

J. G. Koch, 1963, Dissert. Abs., v. 24, no. 4, p. 1572. Contains volcanic rocks and bedded cherts; fossiliferous.

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 30 (fig. 2), 31 (fig. 3), 33 (fig. 4), 36—45. Formal proposal of name. Myrtle Group of Imlay (1959, Am. Assoc. Petroleum Geologists Bull., v. 43, no. 12), whose type locality is along South Umpqua River near Days Creek, consists of Upper Jurassic Riddle Formation and Lower Cretaceous Days Creek Formation. Rocks of like age in Port Orford-Gold Beach area were designated by these names. Koch (1963) renamed the coastal rocks (ascending) Otter Point, Humbug Mountain Conglomerate, and Rocky Point Formation. The Otter Point includes bedded chert, numerous graded beds, and several zones of pillowed flows and pyroclastic rocks. These previously undescribed lithologic types are not present in the inland Oregon, temporally equivalent Riddle Formation. At type section the formation consists of repetitiously interstratified dark-gray to black thin mudstone, and several thin beds of andesitic keratophyric volcanic breccia. Widmier (1962, unpub. thesis [1963, Dissert. Abs., v. 23, no. 11]) used name Whalehead Formation for belemnoid- and chert-bearing sedimentary section faulted against the Dothan, a few miles south of Crook Point. This name is considered less desirable than that of the correlative Otter Point Formation. Concordant with Vondergreen Hill Peridotite.

Type section: At Otter Point, in NE¼ sec. 13, T. 36 S., R. 15, Gold Beach quadrangle. Otter Point is a promontory 3 miles north of Gold Beach, southwestern Oregon Coast.

Otto Interstadial Beds

Pleistocene (Wisconsin): Western New York.

E. H. Muller, 1964, Am. Jour. Sci., v. 262, no. 4, p. 466 (fig. 2), 477. Name applied to beds exposed at Otto, N.Y. Beds consist of gravel, silt, rhythmite, and till with several organic zones. Radiocarbon dating and palynological data confirm correlation of Otto interstadial beds with St. Pierre deposits in Quebec and show them to predate Port Talbot zone of western Ontario and Ohio. Post dates Sangamon interglacial.

Exposed in reach of South Branch Cattaraugus Creek, extending 200 yards downstream from highway bridge at southedge of Otto, in northern Cattaraugus County, 35 miles due south of Buffalo and 14 miles north-northwest of Salamanca.

Oval Peak Meta Quartz Diorite

Age not stated: Northern Washington.

W. G. Libby, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 211. A weakly gneissose to directionless metamorphosed quartz diorite. Homogeneous in outcrop but contains several mineralogical zones defined in terms of abundance of pistacite, muscovite, and amphibole, which apart from green hornblende, includes a sodic-ferrian variety characterized by small axial angles. Adjacent to Skagit Gneiss.

W. G. Libby, 1965, Dissert. Abs. 25, no. 9, p. 5212—5213. Oval Peak Meta Quartz Diorite (unit) may be equivalent to basement Yellow Aster Complex or may be a later, pre-metamorphic intrusive body.

Between upper Lake Chelan and Methow Valley in Northern Cascades. Oval Mountain is on border of Chelan and Okanogan Counties.

Owens Gorge Basalt

Tertiary: Central eastern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380, 387. Potassium-argon age 3.2 m.y.

J. F. Evernden and G. T. James, 1964, Am. Jour. Sci., v. 262, no. 8, p. 967. Sample from olivine basalt that conformably overlies a 3- to 4-inch bed of tuff, tuffaceous sandstone, and shale containing pollen of Owens Gorge Florule of Axelrod and Ting (1960, California Univ. Pub. Geol. Sci., v. 39). Basalt sample dated is within 100 yards of Axelrod's Owens

Gorge Florule locality. Axelrod and Ting considered Owens Gorge Florule to be in tuff equal in age to Coso Mountain Formation [sic Coso Formation]. K/A dates of 2.1 and 2.3 m.y. on Coso Mountain Formation (Evernden and others, 1964, Am. Jour. Sci., v. 262, no. 2) indicate Axelrod's proposed correlation in error. North American land mammal age according to references: Blancan (lower Pliocene). North American land mammal age according to K/A date: Blancan.

Collecting locality: SW¼ sec. 31, T. 4 S., R. 31 E., in Owens Gorge, a few miles north of Bishop, Inyo County.

Oxbow Complex

Lower Triassic(?): Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Paleozoic rocks in area were deformed by an orogeny between Middle Permian and Middle Triassic time. Plutonic rocks (Oxbow Complex) of gabbro, quartz diorite, diorite, and albite granite were intruded during Early Triassic(?) time. Movements along the Oxbow-Cuprum shear zone occurred during and after the intrusions.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Oxbow Formation

Permian(?): Northeastern Oregon.

H. T. Stearns, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 226. Consists of hard chlorite schists 2,000 feet thick, granitized in places. Belongs to Seven Devils Volcanics(?).

In Oxbow area on Snake River near Homestead, 70 miles northeast of Baker.

Oxframe Formation

Lower(?) Cretaceous: South-central Arizona.

D. J. Lootens, 1965, Dissert. Abs., v. 26, no. 4, p. 2135. A thick sequence of andesitic and rhyolitic pyroclastics and flows. Unconformably overlain by dominantly rhyolitic pyroclastics of Upper(?) Cretaceous age.

D. J. Lootens, 1966, Arizona Geol. Soc. Digest, v. 8, p. 36—37. Formal proposal of name. Consists of thick sequence of andesitic and rhyolitic volcanics which occur as flows, flow breccias, agglomerates, tuff breccias, welded and nonwelded tuffs. Interbedded with the volcanics, particularly in upper part of formation, are thin sedimentary horizons consisting of shale, sandstone, quartzite, and occasional local conglomerattic zones. Thickness 6,000 to 6,500 feet. Base of formation not exposed. Overlain by Silver Bell and younger rhyolite formations and intruded by various hypabyssal igneous bodies. Seems plausible that Oxframe Formation is pre-Amole but still part of the Cretaceous.

Named for exposures of sequence which occur in Oxframe Canyon east of Red Boy Peak, east side of Sierrita Mountains, Pima County.

Pacific Grade Complex

Age not stated: Eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend of western half Markleeville quadrangle.

Mapped along Highway 4, Alpine County.

Packsaddle beds (in Ogallala Formation)

Pliocene: Western Oklahoma.

D. B. Kitts, 1965, Oklahoma Geol. Survey Circ. 69, p. 13—14. Informal name applied to distinctive beds in the formation. Consist of about 75 feet of thinly interbedded fine-grained sandstones, siltstones, and clays, which range from bright red to reddish brown, overlain by about 30 feet of massive light-gray and tan sands and silts and a layer of volcanic ash about 16 feet thick. Beds are shown as Permian on state map, but this study has shown they bear a Pliocene vertebrate fauna. Apparently represent a basin fill or valley fill deposited before deposition of surrounding beds of typical Ogallala aspect.

Exposed along Canadian River in T. 16 N., Rs. 23, 24 W., Ellis County.

Page Mill Basalt

Miocene, lower or middle: West-central California.

T. W. Dibblee, Jr., 1966, California Div. Mines and Geology, Map Sheet 8. Extrusive basalt at or just above base of unnamed sandstone. Thickness about 160 feet at type section; underlain by a few feet of fine-grained sandstone that rests unconformably on Butano(?) Sandstone. Early or middle Miocene. Younger than Mindego Basalt.

Type section: From base of basalt at lower old Page Mill quarry south up Page Mill Road to top of basalt about 2,200 feet from quarry, Palo Alto quadrangle. Named after old Page Mill quarry by Matadero Creek 2 miles south-southeast of Stanford University.

Pah Canyon Member (of Paintbrush Tuff)

Miocene, upper: Southeastern Nevada.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224—A, p. A44—A51. A simple cooling unit of rhyolitic ash-flow tuff. In most outcrops includes basal zone of ash-fall tuff; this tuff is commonly less than 3 feet thick but is locally as much as 15 feet. In much of area of outcrop member consists of light-gray to light-brown partly to densely welded devitrified ash-flow conglomerate containing 5 to 15 percent phenocrysts of biotite alkali feldspar, and plagioclase. Thickness 280 feet at type locality. Maximum thickness 300 feet at Yucca Mountain. Overlies Topopah Spring Member; underlies Yucca Mountain Member.

The. U. S. Geological Survey currently designates the age of the Paintbrush Tuff and its members as late Miocene on basis of recent potassium-argon dates.

Named for Pah Canyon, Nye County.

Pahranagat Lakes Formation (in Quichapa Group)

Miocene: Southwestern Utah and southeastern Nevada.

P. L. Williams, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 2003. Pahranagat Lakes Tuff is single ignimbrite, and consists of light-colored nonwelded tuff. Contains about 16 percent penocrysts by volume, mostly quartz, sanidine and plagioclase, and minor biotite. Overlies Condor Canyon Formation. Underlies Harmony Hills Formation.

Southwestern Utah and southeastern Nevada.

Paintbrush Tuff (in Piapi Canyon Group)

Miocene, upper: Southeastern Nevada.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224—A, p. A44—A51. Includes (ascending) Stockade Wash, Topopah Spring, Pah Canyon (new), Yucca Mountain Member, and Tiva Canyon Members. Yucca Mountain Member absent in Yucca Flat area. Underlies Timber Mountain Tuff (new). Term Survey Butte Member abandoned and rocks in this stratigraphic interval designated bedded tuff of Paintbrush Tuff.

P. W. Lipman and E. J. McKay, 1965, U.S. Geol. Survey Quad. Map GQ—439. Mapped in Topopah Spring SW quadrangle, where it includes Topopah Spring Member, 700 feet, Pah Canyon Member, as much as 150 feet, Yucca Mountain Member, as much as 175 feet, and Tiva Canyon Member, 400 feet. Underlies Rainier Mesa Member of Timber Mountain Tuff. Miocene(?) and Pliocene.

The U. S. Geological Survey currently designates the age of the Paintbrush Tuff as late Miocene on the basis of a study now in progress.

Type locality: Paintbrush Canyon, 2½ miles northeast of Yucca Mountain, Nye County.

Paiute Formation

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—111. Consists of at least 40 feet of alluvial and colluvial gravel. Overlies andesitic and basaltic lavas of Pliocene and early Pleistocene(?) age with pronounced unconformity; underlies pre-Lake Lahontan soil and earliest deposits of Lake Lahontan (Eetza formation, new) with slight or no disconformity.

R. B. Morrison, 1964, U.S. Geol. Survey Prof. Paper 401, p. 23—24. Overlies Bunejug formation (new) and older rocks with pronounced unconformity and overlain by Eetza formation.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 9—11. Subaerial sediments of pre-Lake Lahontan Quaternary age are divided into two formations Lovelock (oldest) and Paiute. In present report the Paiute is restricted to include only those subaerial sediments (alluvial, colluvial, and eolian) that are intermediate in age between Humboldt Valley and Cocoon soils, and including those coeval with Cocoon soil. At Rye Patch Dam overlies Rye Patch Formation.

Type locality: Exposure along middle part of Paiute Wash (sec. 8, T. 16 N., R. 31 E.), near Fallon, Churchill County. Exposed locally, above 3,960 feet altitude, on piedmonts and in highlands.

Paiute Ridge Member (of Antelope Valley Limestone)

Lower and Middle Ordovician: Southeastern Nevada.

F. M. Byers, Jr., and others, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—108. Lower member of Antelope Valley; underlies Ranger Mountains member; overlies Ninemile formation. Gray limestone with silty limestone that weathers brown. Straight-coned cephalopods. Thickness 350 feet.

F. M. Byers, Jr., and Harley Barnes, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—557. Mapped in Nye County where it is 370 feet thick. Underlies Ranger Mountains Member. Overlies Ninemile Formation.

Type locality: Paiute Ridge, Nye County.

Palisades Dam Andesite

Tertiary: Eastern Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology County Rept. 5, p. 36. Mentioned in report on Bonneville County. Gray to bluish black, fine-grained, locally porphyritic, and a little vesicular. Hamilton (1961, unpub. thesis) stated that Palisades Dam andesite (or basalt depending upon one's system of identification) does not appear to be related petrographically to any of the igneous rocks in Caribou Mountain area. Also referred to as Palisades andesite.

Occurs at Palisades Dam in eastern Bonneville County.

Palmarejo Formation

Paleocene or Eocene: Northern Puerto Rico.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C3 (table 1), C4 (fig. 2), C15. An alternating sequence of thin-bedded volcanic sandstone and siltstone. Maximum thickness almost 370 m in area near Escuela Segunda Unidad de Palmarejo. Conformably overlies hornblende tuff. Conformably overlain by Corozal Limestone.

Type locality: Valley of the Río Mavilla between coordinates 166,960 and 167,220 about 750 m south-southeast of Escuela Segunda Unidad de Palmarejo. Named for exposures in barrio Palmarejo, Corozal quadrangle.

Palmer Hill Member (of Waterville Formation)

Middle Silurian: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Uppermost member of formation. Overlies Pittsfield Member (new).

Report discusses geology of Pittsfield quadrangle.

Palmyra Member (of Waterville Formation)

Middle Silurian: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Composed of extremely fine-grained black slates of the euxinic facies. Believed to be base of section in area. Underlies Pittsfield Member (new). Middle Silurian on basis of *Monograptus colbiensis*. Also referred to as Palmyra Slates.

Report discusses geology of Pittsfield quadrangle.

Pancho Rico Formation

Pliocene, lower: Southern California.

Original reference (Poncho Rico Formation): R.D. Reed, 1925, Jour. Geology, v. 33, p. 591, 592, 605—607.

D. L. Durham and W. O. Addicott, 1964, U.S. Geol. Survey Bull. 1194—E, p. E1—E7. Formation redefined to apply to sandy beds stratigraphically above Monterey Shale and Santa Margarita. As herein redefined, consists of beds of sandstone, mudstone, porcelanite, porcelaneous mudstone, diatomaceous mudstone, and conglomerate. Most characteristic type of rock is fine to very fine grained marine sandstone. Commonly overlies marine Monterey Shale and underlies nonmarine Paso Robles Formation. Northeast of King City lies nonconformably on basement complex. Near Vineyard Canyon lies conformably on Santa Margarita Formation. Where Pancho Rico overlies Monterey Shale, lower contact is placed at base of stratigraphically lowest sandstone unit above fine-grained strata of Monterey. Where Pancho Rico overlies Santa Margarita Formation, lower contact is placed at top of stratigraphically highest bed that contains giant fossil oysters typical of Santa Margarita. Upper contact with nonmarine Paso Robles is placed at top of stratigraphically highest lithologic unit that contains marine fossils. Thickness about 275 feet northeast of King City; 450 to 550 feet near Sargent Canyon; 650 feet near Indian Valley; about 850 to 1,000 feet northeast of King City; 900 feet north of Jolon. Reed (1925) did not define unit adequately. Presumably he intended that beds exposed along Pancho Rico Creek should be considered type section. Names applied by other investigators to strata herein assigned to Pancho Rico Formation: San Pablo Formation (Eldridge, 1901); Santa Margarita Formation (Hamlin, 1904; Pack and English, 1915; Reed, 1925; Kleinpell, 1930; Clark, 1930; Taliaferro, 1943); Santa Margarita Sandstone (Bramlette and Daviess, 1944); Jacalitos and Etchegoin Formations (English, 1918); Jacalitos horizon (Clark, 1930); Etchegoin Formation (Taliaferro, 1943); Poncho Rico Formation (Reed, 1925; Clark, 1940); Pancho Rico Formation (Bramlette and Daviess, 1944).

D. L. Durham and W. O. Addicott, 1965, U.S. Geol. Survey Prof. Paper 524—A, p. A1—A22, pls. Formation discussed in detail. Previous nomenclature noted and units included in redefined Pancho Rico noted and discussed briefly. Early maps showed Poncho Rico Creek. Board on Geographic Names now favors spelling Pancho Rico Creek and this is now considered proper form for the name of the formation.

Type section assumed to be Pancho Rico Creek, Monterey County.

Panhandle Rhyolite

Precambrian: South-central New Mexico.

W. R. Muehlberger and R. E. Denison, 1964, New Mexico Geol. Soc. Guidebook 15th Field Conf., p. 64. Mentioned in discussion of Precambrian geology of south-central New Mexico.

Panorama Hills Formation

Pliocene: Central California.

T. W. Dibblee, Jr., 1962, San Joaquin Geol. Soc., and Pacific Sec., Am. Assoc. Petroleum Geologists and Soc. Econ. Paleontologists and Mineralogists Guidebook Geology of Carrizo Plains and San Andreas Fault, p. 8, 10 (fig. 5), pl. 1. Northwesterly from Elkhorn Hills the Bitterwater [Creek] shale (new) grades laterally through littoral sandstone with Pliocene molluscan fossils into nonmarine gravel herein named Panorama Hills formation. Unit is composed of some 4,000 feet of crudely bedded gray pebble-cobble gravels and coarse sand of granitic and some siliceous shale detritus. Unconformably underlies Paso Robles formation.

Type locality: Panorama Hills and vicinity, SW¼ T. 31 S., R. 21 E., and secs. 1, 2, and 3, T. 32 S., R. 21 E., Kern County.

Papago Formation

Tertiary, lower: Southern Arizona.

J. E. Kinnison, 1966, *in* Geology of the porphyry copper deposits of southwestern North America: Tucson, Ariz., Univ. of Arizona Press, p. 283, 284, 285 (fig. 5). Two units that consist of unsorted siltstone and volcanic pebble conglomerate are present in the Mission ore body. These rocks are hard and uniformly textured and are referred to as argillite or conglomerate for purposes of mine mapping. The oldest, the Papago Formation, consists dominantly of argillite, and the younger Kino Formation (new), which consists dominantly of conglomerate, lies beneath a pre-ore thrust fault. Early Tertiary on basis of district and regional geologic mapping.

Present at Mission mine, a recently developed open pit near Tucson.

Papoose Lake Member (of Bonanza King Formation)

Middle Cambrian: Southeastern Nevada.

Harley Barnes and A. R. Palmer, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—101 (fig. 1872), C—103. Lower member of the Bonanza King; underlies Banded Mountain member (new); overlies Jangle limestone member of Cadiz formation. Thickness about 2,700 feet.

Harley Barnes, R. L. Christiansen, and F. M. Byers, Jr., 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D27—D31. Member comprises three subunits. About lower fifth of member is distinctive dark-gray limestone thinly interbedded and interlaminated with slightly coarser grained medium-gray limestone. Basal subunit equivalent to unit A of upper part of Johnson and Hibbard's (1957) Yucca Flat Formation. Overlying subunit is well-bedded laminated to thin-bedded light- to medium-gray limestone with minor dolomite and several thin zones containing brownish-weathering siltstone laminae. Upper two-thirds of unit is heterogeneous. Much of it is well-bedded light- to medium-gray thick-bedded dolomite and limestone. Thickness about 2,160 feet. Overlies Carrara Formation which name replaces names Latham Shale, Chambless Limestone, and Cadiz Formation for entire transitional sequence between quartzite of Lower Cambrian Wood Canyon Formation and carbonates of Bonanza King Formation.

Named for the playa, 9 miles east of Banded Mountain, Nye County.

Paradise debris flow

Recent: Western Washington.

C. R. Crandell, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B135—B139. Consists of angular and subangular rock fragments as large as 8 feet in diameter in a purplish-gray matrix of sand, silt, and clay, which oxidizes to yellowish brown. Thickness 1 to 5 feet in most outcrops; locally as much as 15 feet thick. Roughly correlative in age with the 4,800-year-old Osceola Mudflow on northeast flank of Mount Rainier.

Blankets Paradise Park area on south flank of Mount Rainier.

Paradise Valley Chert

Upper Cambrian: North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U.S. Geol. Survey Prof. Paper 431, p. 13—14, pl. 1. Predominantly chert but also contains minor amounts of siliceous shale and limestone. Chert, light- to dark-gray, light- to dark-brown, and black; well bedded but extensively fractured. Full thickness not known; estimated exposed thickness on west side Hot Springs Range about 300 feet; about 500 feet north of Stewart Gap. Base not exposed.

Stratigraphic relation to Osgood Mountain quartzite and Preble formation not known. Contact with overlying Harmony formation depositional, but exposures not good enough to be sure whether contact is conformable or not.

Exposed along west side of Hot Springs Range in two narrow belts in northwest corner of Osgood Mountains quadrangle. Most extensive exposures are in secs. 27 and 28, T. 39 N., R. 40 E.; two south belts become narrow and disappear under alluvium in sec. 33, T. 39 N., R. 40 E. Named for Paradise Valley which drains to Little Humboldt River.

Paris Peak Member (of Fish Haven Dolomite)

Ordovician: Southeastern Idaho.

A. S. Keller, 1967, Dissert. Abs., v. 27, no. 8, sec. B, p. 2746. Fish Haven Dolomite divided into Paris Peak, Deep Lakes, and Bloomington Lake Members (all new).

Area is behind Bannock thrust in parts of Preston and Montpelier quadrangles.

Park Tuff

Tertiary: Northwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines and Mineral Resources Geol. Map 17. White welded rhyolite tuff with phenocrysts of clear quartz and iridescent sanidine with pumiceous lithic lenses; sandstone bed commonly found at base; formation thin but persistent. Younger than Center Peak Latite (new). Older than OK Bar Conglomerate and Pine Canyon Formation (both new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 54—56, pl. 1. Described in Walnut Wells quadrangle, Hidalgo County. Consists of basal sandstone member 20 to 100 feet thick and overlying bed of uniform white rhyolite tuff ranging from 0 to nearly 300 feet thick. Rests on erosion surface cut into Center Peak Latite, Gillespie Tuff, and Cedar Hill Andesite. Overlain by OK Bar Conglomerate in most areas. Along northern part of Double Adobe Creek overlain by Double Adobe Latite.

Named from exposures around rim of the Park, a small plateau produced by erosional stripping of soft OK Bar Conglomerate from more resistant Park Tuff, Walnut Wells quadrangle, Hidalgo County.

Park Creek Flow

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 122, 123 (fig. 1). Composed of blocks which have been somewhat rounded by weathering. Flow originated near a small hill at north margin of Sand Mountain Lava Field, moved south for 2 miles and forced Park Creek to undercut high cliff.

Three Fingered Jack and North Sister area.

Parkdale Lava Flow

Recent: Northern Oregon.

V. N. Peterson and E. A. Groh, 1963, Ore Bin, v. 25, no. 3, p. 35. Flow issued from small vent on northern slope of Mount Hood. End of flow is about 1 mile west from town of Parkdale in Hood River valley. Radiocarbon dating of wood carbonized by heat of lava places age about 200 years ago, therefore setting eruption about 1720.

Named from town of Parkdale, Hood River County.

Parker Bog Formation

Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U.S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 173, pl. 34. Interbedded light-gray limestone and white-weathering flinty felsite in beds a few inches to a few feet thick. Thickness about 200 feet at type section and below Gore Rapids (Spencer quadrangle). Underlies Seboomook formation; overlies undifferentiated strata of Silurian or Devonian age.

Type section: Parker Bog Ponds where strata is vertical. Exposed at Parker Bog Ponds (northwest part of southwest quarter of Pierce Pond quadrangle) and extending southwestward as a narrow belt about 8 miles long.

Parker Spring Formation (in Pogonip Group)

Ordovician (Canadian): East-central Nevada.

H. E. Kellogg, 1963, Geol. Soc. America Bull., v. 74, no. 6, p. 693, pl. 1. Medium- and dark-gray laminated to medium-bedded calcisiltite; intraformational limestone conglomerate and olive-gray flaky shale. Thickness 770 to 900 feet. Overlies House Limestone; underlies Shingle Limestone (new). Correlative of lower Fillmore Limestone of Utah.

Named for exposures in channel of Ninemile Canyon, 1 mile west of Parker Spring, southwest corner T. 10 N., R. 62 E., White Pine County.

Parleys Member (of Kelvin Formation)

Lower Cretaceous: North-central Utah.

M. D. Crittenden, Jr., U.S. Geol. Survey Prof. Paper 475—B, p. 95—98. Name proposed for lower member of Kelvin Formation (redefined). Forms prominent white marker about 100 feet thick in Parleys and Emigration Canyons as far east as Weber River. Its striking appearance is due to beds or scattered nodules of fine-grained limestone that weathers pale gray to pure white, though such rocks make up only about a third of total thickness in exposures west of Parleys Summit. Remainder is lavender-gray siltstone (40 percent), sandstone (20 percent), and conglomerate (10 percent). All units lenticular and vary rapidly in proportion along strike. Thickness 157 at type section. Overlies Preuss Sandstone, contact drawn at base of first pale-gray, lavender-gray, or white beds above continuous deep-red, chocolate-red, or brick-red sandstone of underlying Preuss Sandstone. Underlies upper member consisting of conglomerate and siltstone. Unit was called Morrison(?) by Granger and Sharp (1952, Utah Geol. Soc. Guidebook 8) and Granger (1953, U.S. Geol. Survey Circ. 296).

Type section: Along U.S. Route 40, in N½SW¼ sec. 8, T. 1 S., R. 3 E., Salt Lake County, 1.1 miles west of Parleys Summit.

Parnell Limestone Member (of Bingham Mine Formation)

Pennsylvanian: Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), pl. 5. Overlies Commercial limestone member and underlies

Petro limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

L. A. Hansen, 1961, Utah Geol. Soc. Guidebook 16, p. 71 (fig. 14), 76. In Carr Fork section the Parnell is about 35 feet thick and consists of dark-gray to black limestone and sandy limestone. Underlies Tilden formation; overlies unnamed quartzite unit with Bullard limestone near top.

Bingham mining district, Oquirrh Mountains.

Parrott Formation

Devonian and Mississippina: Southwestern Virginia.

B. N. Cooper, 1961, Geol. Soc. America Guidebook Cincinnati Mtg., p. 59—60, (also Virginia Polytech. Inst. Eng. Ext. Ser., Geol. Guidebook 1). Name used for succession overlying the reddish-brown sandstones of the "Chemung" or Broadford sandstone and underlying "jelly-bean" quartz pebble conglomerates at base of Price formation. Consists chiefly of rusty-weathering sandstones and siltstones many of which contain abundant marine fossils. Thickness 350 to 600 feet. These beds have been included in Price formation. Name credited to Glover (1953, unpub. thesis).

B. N. Cooper, 1963, Geol. Soc. America Guidebook Southeastern Sec., Mtg., p. 23; also Virginia Polytech. Inst. Engineering Ext. Ser., Guidebook 2. Described in section along New River between Goodwins Ferry, Giles County, and Belspring, Pulaski County. Thickness 453 feet. Overlies Broad Ford Sandstone; underlies Price Formation.

Named for exposures along Norfolk and Western Railway 0.5 mile northwest of Parrott, Pulaski County.

Passamari Formation

Oligocene: Southwestern Montana.

H. F. Becker, 1961, Geol. Soc. America Mem. 82, p. 12. Name applied by Dorr and Wheeler (1948) [reference not cited in bibliography] to thick fossiliferous shale beds of lacustrine origin.

J. A Dorr, Jr., and W. H. Wheeler, 1964, Michigan Univ. Mus. Paleontology Contr., v. 13, no. 12, p. 297—339. Consists of two members, both deposited under quiet, lacustrine conditions. Lower is light-tan fine-grained shales. Upper mainly very light buff and very light gray, calcareous, thin-bedded shales. Thickness 129.7 feet at Sweetwater Creek section. Overlies "red conglomerate"; underlies Madison Valley equivalent.

Type section: Secs. 21 and 28, T. 8 S., R. 5 W., 1 to 2 miles west of Williams Ranch buildings, Madison County. "Passamari" is Indian name meaning "stinking water." This refers to Ruby River which was, until turn of century, called Passamari River.

Patagonia Tuff

Miocene: Southeastern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc., v. 7, p. 71 (table 2). Listed on table showing K-Ar dates for mid-Cenozoic plutonic and volcanic rocks from southeastern Arizona. Apparent age 25.3 ± 5.1 m.y.

From near Patagonia Water Gap, Santa Cruz County.

Patch Mountain Formation (in Buckfield Group)

Silurian: Western and Northwestern Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table 10), 12–16, pls. 1, 2. Thin-bedded to massive-bedded green calc-silicate granulite interbedded with thinner beds of purplish-gray biotite schist; a few thin beds of impure marble. Thickness about 2,000 feet. Underlie Noyes Mountain formation (new) with gradational contact. Lowest unit exposed in what is herein termed southern sequence in Bryant Pond quadrangle. Base of unit not exposed. Suggested that Patch Mountain formation is equivalent to Mayflower Hill formation (Osberg, in preparation).

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., 57th Ann. Mtg., Trip K, p. 104 (table 1), 105, figs. 1, 2, road log. Included in Buckfield Group (new). Overlies Turner Formation (new). Thickness about 1,000 feet in Buckfield and Dixfield quadrangles.

Type locality: On eastern slopes of Patch Mountain, Bryant Pond quadrangle. Underlies broad belt along southern border of quadrangle and extends northward about 5 miles into quadrangle.

Patoka Formation (in McLeansboro Group)

Pennsylvanian (Conemaugh): Western Indiana.

C. E. Wier and H. H. Gray, 1961, Geologic map of the Indianapolis 1° by 2° quadrangle, Indiana and Illinois, showing bedrock and unconsolidated deposits (1:250,000): Indiana Geol. Survey. Overlies Shelburn Formation; underlies Bond Formation. Name credited to Wier (in preparation).

C. E. Wier and W. A. Gridley, 1963, Indiana Acad. Sci. Trans., v. 72, p. 212. Includes Inglefield and Dicksburg Hills Sandstone Members.

Patsy Mine Volcanics

Eocene(?) to Miocene(?): Northwestern Arizona and southern Nevada.

C. R. Longwell, 1963, U.S. Geol. Survey Prof. Paper 374–E, p. E7 (fig. 2), E18–E20, pl. 1. Five episodes of volcanism recognized along river south of Lake Mead. Patsy Mine volcanics, oldest of eruptive series, consist mainly of brown andesitic lavas and agglomerates. Thickness 0 to 5,000+ feet. Underlies Golden Door volcanics (new); overlies Precambrian rocks. Patsy mine volcanics may be equivalent to Ransome's (1923) bedded breccia, Alcyone trachyte, Esperanza trachyte, and Oatman andesite in Oatman mining district.

S. M. Hansen, 1963, Dissert. Abs., v. 23, no. 7, p. 2491. In Eldorado mining district, Clark County, Nev., Tertiary rocks consist of middle to late Tertiary flows and pyroclastic beds of andesite, basalt, and rhyolite. These are assigned to three volcanic formations; Patsy Mine, Golden Door, and Mount Davis Volcanics.

Type section: Extends west to east through vicinity of Patsy mine, about 3 miles northwest of Nelson, Mohave County, Ariz.

Patterson Lake Gneiss

Age not stated: North-central Washington.

J. R. Snook, 1963, Dissert. Abs., v. 23, no. 8, p. 2878. Comprises a heterogeneous group of migmatitic feldspathic rocks and associated minor isochemically metamorphosed amphilolites and calcsilicate rocks. Intruded by four hypabyssal dikes. Unconformably underlies Columbia River Basalt. Is south of Tonasket Gneiss (new).

Area of report includes parts of Tonasket and Omak Lake quadrangles. Mapped area comprises 320 square miles along and east of Okanogan Valley.

Patterson Pass Shale

Middle Cambrian: East-central Nevada.

H. E. Kellogg, 1963, Geol. Soc. America Bull., v. 74, no. 6, p. 689, pl. 1. Lower 584 feet of type section is covered with some float or questionable exposures of shale and thinly bedded calcisiltite. Above this, formation is largely buff-weathering calcareous mudstone and shale. Thin limestones increase in abundance upwards. Thickness 2,113 feet. Base of Patterson Pass shale placed at top of highest exposed limestone bed of Pole Canyon Limestone. Underlies Emigrant Springs Limestone (new).

Type section: South side of Patterson Pass near its west entrance, sec. 2, T. 8 N., R. 64 E., Lincoln County. Here a down-faulted block of Pogonip Limestone forms low hill bounding formation on west, and member A of overlying Emigrant Springs Limestone forms ridge above it.

Pauchaug Gneiss

Paleozoic: West-central Massachusetts.

Peter Robinson, 1967, Massachusetts Univ. Conf. Econ. Geology in Massachusetts Proc. 1966, p. 30. Report on bedrock geologic mapping. Consists of massive feldspar-quartz gneiss of intrusive derivation with minor inclusions of amphibolite and layered gneiss. Identical with much of Oliverian Plutonic Series of Billings (1956, Geology of New Hampshire, pt. 2, Bedrock geology: Concord, New Hampshire State Plann. Devel. Comm.) in western New Hampshire. Similar to Swanzey Gneiss (new).

In Warwick dome, Orange area.

Paulina Basalt

Pliocene, upper(?) and Pleistocene: South-central Oregon.

E. R. Hampton, 1964, U.S. Geol. Survey Prof. Paper 383—B, p. B5 (fig. 4), B14, pl. 1. Paulina Basalt is dark reddish brown on weathered surfaces and dark gray on fresh surfaces. Has diktytaxitic texture common to many Pliocene and Pleistocene basaltic lavas. Individual flows range in thickness from about 5 to 20 feet. Total thickness of unit probably exceeds 1,000 feet near eruptive centers. Unconformably overlies Peyerl Tuff (new) and, where Peyerl is absent, the Hayes Butte Basalt (new). Unconformably overlain by younger basalt and by unconsolidated deposits.

Type area: Secs. 1, 2, 11, and 12, T. 26 S., R. 16 E., Lake County, where five overlapping flows from possibly three different sources are exposed. Named for Paulina Mountains, which are northwest of and adjacent to Fort Rock Basin.

Paveloff Siltstone Member (of Chinitna Formation)

Upper Jurassic: Southern Alaska.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 42—47, pls. Massive arenaceous dark-gray siltstone constitutes major part of member. Thick sandstone interval present at base of nearly all sections, and large ellipsoidal limestone concretions and lenticular beds of limestone occur throughout member. Thin beds of sandstone interlayered with the siltstone above the massive basal sandstone. Thickness 900 to 1,350 feet. Thicker sections near central part of area and thinner sections at both north and south ends of mapped area. Thinner sections are unconformably overlain by Naknek Formation. Upper member of formation. Overlies Tonnie Siltstone Member.

Type section: Begins about 1,800 feet N. 40° W. of Front Mountain and continues upstream for 750 in strata that dip 20° — 25° SE. Named after Paveloff Creek, and easterly tributary of Bowser Creek, along which member is exposed in nearly vertical cliffs on the west face of Front Mountain, Iniskin-Tuxedni region.

Pawlet Formation or Graywacke

Middle Ordovician: Western Vermont.

E-an Zen, 1961, Geol. Soc. America Bull., v. 72, no. 2, p. 307—308, pl. 1, C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,00): Vermont Geol. Survey. Name refers to thick sequence of interbedded silty to fissile slate and graywacke beds of Middle Ordovician age and overlying all other units of Taconic sequence. These beds are Dale's (1898, U.S. Geol. Survey Ann. Rept. 19, pt. 3) Hudson grits and have been mapped as Normanskill by Fowler (1950, Vermont Geol. Survey Bull. 2). Name credited to Shumaker (unpub. thesis). Consists of roughly equal amounts of slate and graywacke; base of formation is everywhere a slate. Because of regional unconformity the Pawlet rests unconformably on Bull formation, West Castleton formation, and Mount Hamilton group. No direct contact noted between Pawlet formation and Biddie Knob formation.

R. C. Shumaker, 1967, Vermont Geol. Survey Bull. 30, pt. 1, p. 31—35, pl. 1. Formal proposal of name Pawlet Graywacke. About 70 percent of Formation is massive tan-weathering fine-grained metagrawacke. Beds of graywacke, up to 6 feet thick, alternate with ½ inch to 2 feet of gray-black slates. Base of formation marked by a 2- to 12-foot fossiliferous black slate. To east near Tadmer Hill, basal beds are limy and at a few places outcrop as an impure limestone. Pawlet Graywacke is youngest metasediment within Taconic sequence of Pawlet quadrangle. Overlies Middle Ordovician unconformity and is about 300 feet thick. Separated by angular unconformity from underlying Indian River Slate. In some places Pawlet Graywacke rests upon Lower Cambrian St. Catharine slates. Synonymies noted. Fossil list. Type section.

Type section: Outcrops of slate, graywacke, and basal fossiliferous slate about three-fourths of a mile west of Rock Hill. Named for Pawlet Township. Readily accessible exposures are near railway depot in town of West Pawlet. The graywacke crops put along western border of Pawlet quadrangle, east and southeast of Lake St. Catharine, and in synclines within Edgerton Window.

Paymaster Member (of Great Blue Formation)

Upper Mississippian: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 107, 109—110, pl. 5. Mostly limestone but contains abundant interbedded brown-weathering olive-green shales and quartzites. Thickness 623 feet at type section. Overlies Topliff member (new); underlies Chiulos member.

Type section: North side Edwards Canyon, North Tintic district, in N½NE¼ sec. 6, T. 9 S., R. 3 W., East Tintic Mountains. Named from Paymaster Hill, in sec. 20, T. 9 S., R. 2 W.

Payson diorite

Payson granite

Precambrian: Central Arizona.

G. W. Putman and C. W. Burnham, 1963, Geochim. et Cosmochim. Acta, v. 27, no. 1, p. 61, 73—74. Names used for rock units in trace elements study. Both diorite and Payson granite were described briefly [but not named] by Lausen and Wilson (1925, Arizona Univ. Bur. Mines Bull. 120). Use of names herein has no claim to priority.

Payson diorite pluton underlies large area east of Mazatzal Range in vicinity of North Peak and extends slightly to east of Payson where it is in contact with Payson granite. Payson granite batholith underlies large area that extends eastward from contact with Payson diorite to base of Mogollon Rim escarpment, where it is exposed in fault contact against younger down-dropped sediments of the Rim.

Peace Treaty Bed (in Cedar Hills Sandstone Member of Hennessey Shale)

Peace Treaty Bed (in Cedar Hills Sandstone)

Permian: South-central Kansas and north-central Oklahoma.

G. H. Norton, 1939, Am. Assoc. Petroleum Geologists Bull., v. 23, no. 12, p. 1762 (fig. 2), 1789—1790. A sandstone bed about 100 feet below top of Cedar Hills sandstone.

R. O. Fay, 1965, Oklahoma Geol. Survey Bull. 106, p. 19, 20, 21, pl. 1. Bed in Cedar Hills Sandstone Member of the Hennessey. Peace Treaty is a 10- to 15-foot resistant sandstone with greenish-gray band in middle. Occurs about 105 feet below top of the Cedar Hills. Overlies and underlies unnamed units of the Hennessey.

Type area: State park 2 miles east of Medicine Lodge, Barber County, Kans., where bed forms natural amphitheater in which a peace treaty was signed in 1867 with Plains Indians whereby they agreed to make no further attacks on wagon trains or railroad constructions.

Peach Springs Gravels

Tertiary: Northwestern Arizona.

Robert Gray, 1964, Arizona Acad. Sci. Jour., v. 3, no. 1, p. 41. General reconnaissance of Peach Springs Canyon near its head shows a variety of conglomerates, gravelly sandstones, and sandstones. Red conglomerate crops out on northwest slope of the canyon near Peach Springs; its lithology, induration, matrix, and elevation of its occurrence are so similar to middle and upper member of Hindu Canyon Formation (new) that it is probably part of the same formation.

Peach Springs Canyon is north of Peach Springs in Mohave County.

Peach Springs Tuff

Cenozoic: Northwestern Arizona.

R. A. Young, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1994. Only widespread volcanic formation that can be correlated throughout area with any certainity is a complex tuff, herein named Peach Springs Tuff.

On Hualapai Plateau the tuff is composed of ash fall and ignimbrite. West of Lower Grand Wash Cliffs and near Valentine the uppermost part of this acid volcanic sequence has all the aspects of a true volcanic flow. Total thickness of tuff decreases to north and northeast which indicates a southwesterly source outside the plateau.

Area of report is edge of Colorado Plateau in northwestern Arizona.

Peaked Hill Greenstone

Probably lapsus for Peaked Mountain Greenstone.

Peaked Mountain Member or Greenstone (in Underhill Formation)

Lower Cambrian: Northern and central Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Member of Underhill formation.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 24, 25—26, pl. 1. Two main bands of greenstone present in Underhill Formation of Richford syncline: a westerly one herein named Bakerfield Greenstone and a more easterly one named Peaked Mountain Greenstone.

Named for occurrence east of Peaked Mountain, Enosburg area.

Pearse Peak Diorite

Upper Jurassic: Southwestern Oregon.

J. G. Koch, W. R. Kaiser, and R. H. Dott, Jr., 1961, Ore Bin, v. 23, no. 3, p. 24, 26 (map), 29. Occurs in small intrusive pluton. Diorite contains andesine with well-developed zoning, hornblende, quartz (5 to 10 percent), and biotite, with alkali feldspar, sphene, and magnetite as accessories.

J. G. Koch, 1963, Dissert. Abs., v. 24, no. 4, p. 1572. Pearse Peak Diorite intrudes Galice Formation(?). Dated both geologically (intra-Late Jurassic) and radioactively (141—147 m. y.) as "Nevadan" in age.

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 25—71. During Nevadan orogenesis (ca. 145 m.y. ago), the Galice(?) Formation was regionally metamorphosed (greenschist facies) to phyllites and schists of Colebrook Formation, the Pearse Peak Diorite was emplaced, and the Port Orford-Gold Beach area, Oregon, underwent intense compressional deformation. The central dominant mass of the Pearse Peak is hornblende-biotite quartz diorite. It is bordered primarily at the northwest, by pyroxene-hornblende diorite. Both phases and related dioritic and dacite porphyry dikes, sills, and plugs were deformed to abundant cataclastite and mylonite along most of western border of pluton. Field relations indicate that Pearse Peak Diorite should be assigned to post-early Kimmeridgian (Galice(?) Formation) and pre-late Portlandian (Otter Point Formation) Nevadan orogeny. A definitely unfaulted depositional contact of the Lower Cretaceous with the Pearse Peak Diorite not recognized.

Typically exposed along Elk River, just north of Pearse Peak, Curry County.

Peaslee Creek Volcanics

Upper Jurassic: East-central California.

L. D. Clark, 1964, U.S. Geol. Survey Prof. Paper 410, p. 31, pls. 1—11. Name given to isolated mass of volcanic and hypabyssal rocks, at western edge of exposed bedrock south of La Grange. Base of formation, lying on Merced Falls slate (new) is exposed immediately south of Tuolumne River but top is not preserved. Thickness as exposed uncertain, but probably more than 3,000 feet. Volcanics not exposed in Tuolumne River section and relatively poor exposures about 1 mile south of La Grange were examined to complete Tuolumne River section. Here, bedded pyroclastic rocks form northeastern and lower part of unit. Southwestern higher part of unit consists of massive rocks without amygdules but with small feldspar phenocrysts and hardly with quartz phenocrysts. Stràtigraphic relations to Merced Falls slate indicate Late Jurassic.

Type area: About 2 miles south of La Grange, Stanislaus County.

Pecan Grove Sandstone (in Joachim Formation)

Middle Ordovician: Southeastern Missouri.

C. H. Johnson, 1962, Missouri Geologists Assoc. Guidebook 9th Ann. Field Trip, Sept. 28—29, p. 26. A calcareous sandstone about 5 feet thick present about 60 feet above base of Joachim in Cape Girardeau area. Informally named "Pecan Grove" by McQueen. [McQueen, 1937, Missouri Geol. Survey and Water Resources 59th Bienn. Rept., app. 1, described sandstone west of Pecan Grove School but did not use term Pecan Grove sandstone.]

Exposed one-fifth of a mile west of Pecan Grove School, on north side of State Highway 74, Cape Girardeau quadrangle.

Pecatonica Drift

Pleistocene: Northern Illinois and southern Wisconsin.

M. M. Leighton and J. A. Brophy, 1965, (abs.) *in* Internat. Assoc. for Quaternary Research, 7th Cong., Boulder, Colo., p. 287. Pecatonica drift believed to offer best record in North America of a late Farmdale substage, Wisconsin stage, of glaciation. Radiocarbon age 29,000 to about 31,000 B. P.

Pecatonica River basin, northern Illinois and southern Wisconsin.

Pembina Drift

Pleistocene: Northeastern North Dakota.

Lee Clayton, 1966, North Dakota Geol. Survey Rept. Inv. 44, p. 16. (table 1). Listed on table of tentative correlation of upper Midwest drifts. Younger than Minot-Edinburg.

In Pembina County.

Pembina Member (of Pierre Shale)

Pembina Beds[1]

Upper Cretaceous: Manitoba, Canada, and northeastern North Dakota.

Original reference: S. R. Kirk, 1930, Canada Geol. Survey Summ. Rept. 1929, pt. B, p. 130.

J. R. Gill and W. A. Cobban, 1965, U.S. Geol. Survey Prof. Paper 392—A, p. A6—A10. Manitoba name Pembina extended into North Dakota and applied to the basal member of the Pierre Shale. Strata making up the Pembina Member continue southward into North Dakota along Pembina Mountain. Rocks of Pembina Member are lithologically similar to Sharon

Springs Member of Pierre Shale along Missouri River in central South Dakota and extension of that name into North Dakota has been considered. Present authors believe that usage of name Pembina, which has its type locality a few miles north of international boundary, is preferable to extending name Sharon Springs 700 miles from the type locality. Thickness in two measured sections: 44.6 feet and 75 feet. Consists mostly of black shale and dark gray shale with many interbeds of bentonite.

Named for exposures on Pembina Mountain and along Pembina River valley in southern Manitoba. Pembina Mountain lies partly in North Dakota and partly in Manitoba, and Pembina River cuts through the mountain in both areas.

Pen Formation (in Terlingua Group)

Pen Clay (in Terlingua Group)

Upper Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pl. 1. Formation is a marl-clay unit that includes middle and upper members of Udden's (1907) Terlingua Beds. Basal 50 feet is normally light-bluish-gray marl that may include a few 1-inch chalk beds. Concretions are conspicuous lithographic feature. Thickness 200 to 600 feet; commonly 400 feet. Overlies San Vicente Member (new) of Boquillas Formation. Underlies Aguja Formation.

B. E. St. John, 1966, Texas Univ. Bur. Econ Geology Geol. Quad. Map 30 with text [1965]. Pen Clay mapped and described in Black Gap area, Brewster County. Pen Clay crops out only in basalt-capped center part of mapped area. No Cretaceous strata younger than Pen Clay remain in Black Gap area.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 71—78, pls. Formal proposal of name Pen Formation. Term is used to designate a lithostratigraphic unit that includes Udden's (1907) middle and upper members of his Terlingua Beds and the unit called Terlingua equivalent by Adkins (1933, Texas Univ. Bull. 3232). Thickness 219 to about 700 feet in Big Bend Park. Basal 50 feet is normally calcareous clay, light bluish gray, with 1-inch beds of gray chalk. Above this is yellow clay with scattered sandy beds in which some concretions are in beds and others are irregularly distributed. Top clay is sandy and there are beds of sandstone up to 5 feet thick at some places. Badlands occur in some places but where indurated terrace gravels cap the clay it stands in steep-faced slopes and some of its unprotected surfaces are low and are subject to sheet wash. Thickness 457 feet at type section.

Type section: About 2 miles north of Hot Springs, Big Bend National Park, Brewster County. Formation at type locality crops out along crest of faulted anticline west of Chisos Pen. Its base is exposed along Cottonwood Creek near where it crosses Burro Mesa fault.

Penfield Member (of Lockport Formation)

Middle Silurian: New York.

D. H. Zenger, 1962, Dissert. Abs., v. 23, no. 6, p. 2097. A 60-foot unit equivalent to Gasport, Brockport, Goat Island, and Eramosa Members to west. Overlies DeCew Member; underlies Oak Orchard Member.

D. H. Zenger, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2249—2253. A quartzose, crinoidal dolomite. Lower fourth is light-gray medium-bedded medium-grained saccharoidal quartzose dolomite. Both upper and lower contacts are gradational.

D. H. Zenger, 1965, New York State Mus. Bull. 404, p. 74 (fig. 13), 75—79. Member extends from Rochester eastward into Palmyra quadrangle. The crinoidal, biostromal lithology in eastern part of Albion and Bergen quadrangles is believed to represent transition from lower Lockport in the west to the Penfield. Thicknesses: 52 feet at Gates; 58 feet along Barge Canal; 54 feet along Allen Creek; 62 feet at type section. Complete section not available east of Penfield.

Type section: In Dolomite Products Company quarry, north of Whalen Road, 1.0 mile north-northwest of the four corners in village of Penfield (W 1/9 Macedon quadrangle).

Penryn quartz diorite

Pre-Cretaceous: Northern California.

F. R. Olmsted, 1964, Dissert. Abs., v. 24, no. 9, p. 3693. Chief constituent in Penryn pluton. Potassium-argon dating places approximate age as 143 m.y. Older than Rocklin trondhjemite.

Occurs in Pilot Hill and Rocklin quadrangles, in foothills of northern Sierra Nevada.

Pensacola Clay

Miocene, middle and upper: Subsurface in Alabama and Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 11), 117 (fig. 14), 194—195. Name proposed by Marsh (1964, ms.) for subsurface lithologic unit of Alum Bluff age that occurs in southern part of Escambia and Santa Rosa Counties and extends laterally into Okaloosa County and into Alabama. Thickness about 380 feet in type area. Attains maximum thickness beneath Mobile Bay, Ala., where it is over 1,000 feet. Subdivided into three members, an upper and lower clay member separated by Escambia Sand Member (new). Overlies Chattahoochee Formation. Eastward grades laterally into Miocene coarse clastics (Fort Preston formation?). Alum Bluff-Choctawhatchee Stages.

O. T. Marsh, 1966, Florida Geol. Survey Bull. 46, p. 54—68, 124—128, 130—131. Formal proposal of name. Three oil test wells 22 to 24 miles west and southwest of Pensacola, Fla., have been selected as type wells. Formation consists of three members: an upper member composed of clay, the relatively thin Escambia Sand Member in middle, and lower clay member. Upper and lower members consist of tough dark- to light-gray clay, but at a few localities it is brownish gray. Escambia Sand Member consists predominantly of light-gray to brownish-gray fine to coarse quartz sand. The Pensacola cannot be traced into any established formation, either to west, north, or to east. South of area it extends for an unknown distance beneath Gulf of Mexico. In central and eastern Escambia and Santa Rosa Counties and also about 28 miles east of area the Pensacola grades laterally into Miocene coarse clastics. Contact with underlying Tampa Formation gradational and probably conformable. In south-central Escambia County and southwestern Santa Rosa Counties, overlain unconformably by Citronelle Formation.

Type wells: South Baldwin Oil Co., Dr. A. Garrett No. 1, NE¼NW¼ sec. 9, T. 9 S., R. 5 E., Baldwin County, Ala.; A. R. Temple-Walshe-Ehle No. 1, cen. NE¼SE¼ sec. 15, T. 8 S., R. 4 E., Baldwin County, Ala.; A. R. Temple-F. W. Sherrill et al No. 1, SE¼NE¼ sec. 15, T. 7 S., R. 4 E., Baldwin County, Ala. Type area: Vicinity of Pensacola, Escambia County, Fla.

Pentz Sandstone Member (of Calaveras Formation)

Mississippian(?) to Permian(?): Central northern California.

R. S. Creely, 1965, California Div. Mines and Geology Bull. 184, p. 14—16, pls. 1, 2. Consists of two major belts of relatively coarse grained sediments—sandstone and conglomerate. Thickness at least 3,000 feet at type locality where it consists of interbedded sandstone and slate, with subordinate amounts of conglomerate, and small, widely separated masses of chert and limestone. Thickness 2,300 feet in northern belt of outcrop at junction of Concow Creek and West Branch. At type locality underlain by undifferentiated Calaveras slates; next youngest beds are Oregon City Formation (new). In northern belt, member is in gradational contact with slates of Calaveras, which both underlie and overlie the unit.

Type locality: Exposures east of settlement of Pentz, secs. 19, 30, T. 21 N., R. 4 E., Oroville quadrangle, Butte County. In vicinity of type locality, rocks are exposed from Parish Camp and Glover Ridge southwestward to lower part of Sawmill Ravine and Messila Valley and also appear intermittently from beneath Tertiary sediments for a distance of several miles. Second belt extends northwestward from upper part of Rich Gulch nearly to top of Tertiary-capped ridge north of Cape Horn.

Peoa Tuff

Oligocene, lower: Northeastern Utah.

S. B. Willes, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 2, p. 8. Discussion of Keetley-Kamas volcanic area. O'Toole (1951, unpub. thesis) named andesitic tuffs the "Peoa Tuff" but stated that the bed may correlate with Norwood Tuff of Wasatch Mountains.

Area is in northern part of Wasatch County.

Peralta Tuff Member (of Bearhead Rhyolite)

Peralta Tuff Member (of Santa Fe Formation)

Pliocene, middle: North-central New Mexico.

C. E. Stearns, 1953, Geol. Soc. America Bull., v. 64, no. 4, p. 499, 500 (fig. 9). Represents latest Santa Fe in Santo Domingo Valley. Name credited to Bryan and Upson (unpub. ms.).

C. S. Ross, R. L. Smith, and R. A. Bailey, 1961, New Mexico Geol. Soc. Guidebook 12th Field Conf., p. 141. Mentioned in discussion of volcanic stratigraphy of Jemez Mountains, where a group of precaldera rhyolites intrudes and overlies andesites and older dacites. Largest center for these rocks is in vicinity of Bearhead, where nearly 2,000 feet of rhyolitic tuffs, breccias, and flows occur. Peralta tuff member (of local usage) is related to this center.

The U.S. Geological Survey currently classifies the Peralta Tuff as a member of the Bearhead Rhyolite and designates the age as middle Pliocene on the basis of a study now in progress.

Exposed in lower Peralta Canyon.

Perchas Formation (in Río Orocovis Group)

Perchas Lava Member (of Río Orocovis Formation)

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip in Puerto Rico Nov. 22—24, p. 8. Member of Río Orocovis Formation (new). Chiefly pyroxene basalt with well-developed pillow structure. Thickness about 1,500 m. Formation also includes Magüeyes Member (new). Upper Cretaceous.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, pl. 1. Member of Río Orocovis Formation. Mainly clinopyroxene-rich flow rock; plagioclase-rich flow rock. Apparently 8,000 feet thick in Ciales quadrangle; thins irregularly eastward to less than 2,000 feet in Naranjito quadrangle. Overlies Magüeyes Member and underlies Avispa Member (new).

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 25—28, pl. 1. Formal proposal of name. Member of Río Orocovis Formation. A sequence of massive amygdaloidal pillow lavas and thin lenticular layers of tuff, epiclastic volcanic sandstone, and epiclastic volcanic breccia. Thickness about 1,500 m. Lavas virtually indistinguishable from most lavas of Magüeyes Member. Contact placed at stratigraphic position where relatively thick tuff layers characteristic of the Magüeyes become much less numerous. Underlies Avispa Lava Member. Area of outcrops largely defined by faults; locally near center of quadrangle, member is truncated by Morovis stock. Structurally, occupies west limb of faulted syncline.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C3 (table 1), C9. Río Orocovis Formation redefined and raised to group rank to include (ascending) Magüeyes, Perchas, Avispa, and Los Negros (new) Formations. Approximately 800 m of Perchas Formation exposed in Corozal quadrangle [this report]. Contacts with underlying Magüeyes and overlying Avispa, and locally, Los Negros Formations are conformable.

Type area: Extends along Morovis-Orocovis Highway from locality 6 in barrio Gato northward to locality 7 which is just south of the Río Grande de Manatí, Ciales quadrangle (See p. 1). Named for outcrops along banks of highway that crosses Quebrada Perchas in barrio Pesas, Municipio de Morovis.

Perdiz Conglomerate Member (of South Rim Formation)

Tertiary: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 28, road logs. Ramsey's (1961 unpub. thesis) Perdiz Conglomerate will be formally proposed by DeFord and Ramsey (in preparation) as the name of the thick conglomerate that crops out on Cuesta del Burro and in Frenchman Hills. Plate 2 of present report lists Perdiz Conglomerate as member of South Rim Formation (new). In list, occurs above Petan Basalt Member and below Wasp Spring Flow Breccia Member (new). No volcanic rock found above the Perdiz east or north of Chinati Mountains where the conglomerate is 300 feet thick and overlies Petan Basalt. Southwestern edge of conglomerate body separates Tascotal Formation and overlying Rawls lava near western edge of Tascotal Mesa escarpment.

J. W. Dietrich, 1966, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 28 (with text). Perdiz Conglomerate (DeFord and Ramsey, ms.) is widespread fanglomerate composed mainly of detritus shed from Chinati Mountains. Formation crops out in northern third of map area [Presidio area] from Cibolo Creek eastward to Fire Place triangulation station on the Tascotal Mesa escarpment. Both thickness and composition of the Perdiz are highly variable in report area. Conglomerate overlies a highly irregular erosion surface in north-central Presido area where maximum exposed thickness is 250 feet and maximum thickness is probably about 500 feet. Coarse detritus filled deep canyon eroded in lavas of Morita Ranch Formation and broad valleys eroded in pre-Cenozoic rock. From point south of Cienega Mountains to eastern edge of the fan, the Perdiz overlies Tascotal Formation. Perdiz not a mappable unit in Tascatal Mesa escarpment and east of Fire Place.

Named for occurrence in vicinity of Perdiz Creek, on U.S. Highway 67 in Frenchman Hills, Presidio County.

Perham Formation

Silurian: Northeastern Maine.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. No. 2, p. 16 (table 2), 33, 40, pl. 1. Perham formation roughly approximates Ashland formation of previous workers. In present report formation is divided into two parts. Upper member contains orange-weathering commonly finely calcareous siltstone, gray shale, and limestone conglomerate lenses. Lower member contains gray, gray-red, and gray-green shale and slate; locally contains lenticular, layered iron and manganese deposits. Average thickness about 4,000 feet. Thickness 2,230 feet at type section. About 1,000 feet of upper member lies above upper part of measured section at type section. From east to west in Presque Isle quadrangle [this report], the Perham appears to be underlain successively by unnamed Silurian limestone, ribbon rock member of Meduxnekeag formation, Pyle Mountain argillite (new), and Frenchville formation (new). Underlies Hedgehog formation of Dockendorff group (new) in region east of Castle Hill area.

Louis Pavlides and others, 1964, U.S. Geol. Survey Prof. Paper 501—C, p. C32. Consists mostly of shale and siltstone, minor amounts of limestone, and limestone breccia and lenticular ferruginous manganese deposits of sedimentary origin. Lower member is of Wenlock age and upper member is of early Ludlow age.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, p. A52—A57. Overlies Spragueville Formation (new).

The U.S. Geological Survey currently designates the age of the Perham Formation as Silurian on the basis of a study now in progress.

Type section: On Holster Blackstone farm in southwest part of Woodland Township, 1.36 miles north of southern boundary of township, Caribou County. Section measured from east to west beginning 140 feet west of road 0.53 mile east of western boundary of Woodland Township.

Perish Spring Dacite

Quaternary: East-central Nevada.

Robert Scott, 1966, Am. Jour. Sci., v., 264, no. 4, p. 275 (fig. 2). Discussion of variations within ignimbrite cooling units. Generalized Cenozoic section of Grant Range lists following Quaternary units (ascending): Local breccia sheets; Perish Spring Dacite, 0 to 400 feet thick; Deer Park Andesite (new) and local breccia sheets.

Grant Range is in Nye County.

Peru Formation

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 107, figs. 1, 2, road log. In west part of Dixfield quadrangle, composed of thinly-bedded calc-silicate (locally marble) and biotitic granulite. Grades into biotitic granulite with pods of calc-silicate in east part of quadrangle. Is a calcareous sandstone interbedded with minor calcareous slate in Farmington quadrangle. Occurs above Newton Hill Formation (new) in Woodstock Group (new). Stratigraphically below Severy Hill Formation (new). Listed as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not given.

Pescadero Member (of Roskruge Rhyolite)

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H13, H14. Composed predominantly of pyroclastic flows. Intertongues with Dobbs Buttes Member (new), and because their basal members in their type localities are similar, they are believed to be generally equivalent.

Type locality: Along a general northeast-trending line through Pescadero Mountain, in central part of Roskruge Mountains, Papago Indian Reservation.

Peshtigo River Porphyry

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), 8. A dark-gray porphyry. In contact with Hager rhyolite near High Falls reservoir.

Peshtigo River and Hill Falls reservoir are in Marinette County.

Pete Gulch Member (of Rabbit Ears Volcanics)

Oligocene: Northwestern Colorado.

G. A. Izett, 1966, U.S. Geol. Survey Prof. Paper 550—B, p. B42—B46. Distinctive trachybasalt flows in lower part of Rabbit Ears Volcanics (new). Thickness 0 to 200 feet. Near Pete Gulch, lower 70 feet of unit is polygonally jointed and overlain by about 100 feet of massive-weathering trachybasalt. Deposited on intensely eroded terrain cut on Middle Park Formation. Tentatively dated as Oligocene inasmuch as it overlies Middle Park Formation of Late Cretaceous and early Tertiary age and seems to be spatially related to upper part of the Rabbit Ears.

Type locality: Near Pete Gulch in secs. 4 and 9, T. 2 N., R. 79 W., Hot Sulphur Springs quadrangle, Grand County.

Peters Drift

Pleistocene: Alaska.

T. N. V. Karlstrom, 1964, U.S. Geol. Survey Misc. Geol. Inv. Map I—357. Listed with named glacial drifts included in moraine units.

Lake Peters area.

Peters Glaciation

Pleistocene: Alaska.

G. W. Holmes and C. R. Lewis, 1959, (abs.) Canadian Oil and Gas Industries, v. 12, no. 12, p. 55, 1961, *in* Geology of the Arctic, First Internat. Symposium Proc., v. 2: Toronto, Canada, Univ. Toronto Press, p. 859—861. Last major advance in area. Did not extend beyond mountain front and formed fresh bouldery steep-sided lateral and end moraines. Frost features rare or absent. Moraines confined to major valley of Franklin Mountains.

G. W. Holmes and C. R. Lewis, 1965, U.S. Geol. Survey Bull. 1201—B, p. B15—B17, pl. 1. Formal proposal of name. Youngest of major glaciations in Mount Chamberlin area. Moraines of glaciation confined to valleys in Franklin Mountains. Type moraine consists of group of very steep boulder-strewn hillocks and ridges on west side of creek valley, about 2 miles from its mouth. Outwash from glacier was deposited as large delta in Lake Schrader. Till largely composed of quartzite, schist, and phyllite of Neruokpuk Formation, and has light-gray-brown sandy matrix. Only terminal moraines contain appreciable quantities of limestone or dolomite of Lisburne Group. Younger than Schrader Glaciation.

Named for Peters Lake, Mount Chamberlin area, Brooks Range.

Petersburg Silt

Pleistocene (Illinoian): Central Illinois.

J. C. Frye, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 264 (fig. 1), 365. Thick fossiliferous Petersburg Silt occurs below Payson Till. This silt has been referred to as Loveland, but as it lies below oldest Illinoian till, it seemingly is not stratigraphic or age equivalent of Loveland or Great Plains. It either represents a glacial pulsation earlier than the Payson or was derived from advancing Payson glacier.

H. D. Glass, and J. C. Frye, 1963, Illinois Geol. Survey Circ. 347, p. 2 (fig. 1), 6, 53 (geol. sec.). Formal proposal of name. In Petersburg section, where it is 20 feet thick, consists of massive compact silt, gray-tan in upper part and purplish-brown in lower part. In most localities consists of both water-laid and wind-deposited silts.

Named from exposures in roadcut south of Petersburg, in NW¼NW¼NE¼ sec. 23, T. 18 N., R. 7 W., Menard County.

Peters Gulch ash layer

Pliocene, upper, and Pleistocene, lower: Southwestern Idaho.

H. A. Powers and H. E. Malde, 1961, U.S. Geol. Survey Prof. Paper 424—B, p. B—167——B—170. Named informally applied to ash layer that is useful as stratigraphic marker in basin deposits near Hagerman and Glenns Ferry.

Named for Peters Gulch, 4 miles southwest of Hagerman, Gooding County.

Peters Valley Member (of Coeymans Formation)

Lower Devonian: Western New Jersey, southeastern New York, and northeastern Pennsylvania.

A. G. Epstein, and others, 1967, U.S. Geol. Survey Bull. 1243, p. 21, measured sections. Varies laterally from medium-gray arenaceous limestone to light-medium-gray fine- to coarse-grained pebbly calcareous sandstone that weathers light tannish gray to medium light gray. Thickens gradually from feather edge near Port Jervis, N.Y., to 9 feet at Shawnee on Delaware, Pa. In most places occurs as one massive bed and grades into Shawnee Island Member (new) above and Depue Member (new) below.

Type section: In cut on northwest side of county road that extends along southwest flank of Wallpack Ridge, 1.5 miles northwest of Flatbrookville, N.J., and 0.1 mile southwest of a V-shaped bend in the road, Flatbrookville quadrangle. Reference sections: Type section of Shawnee Island and Depue Limestone Members of Coeymans Formation; in woods on northeast side of road along ascent of Wallpack Ridge in Pennsylvania.

Petro Limestone Member (of Bingham Mine Formation)

Pennsylvanian (Missourian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1). Overlies Parnell limestone member and underlies Maybe limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

L. A. Hansen, 1961, Utah Geol. Soc. Guidebook 16, p. 71 (fig. 14), 76. In Carr Fork section the Petro is about 6 feet thick. Overlies Tilden formation; underlies unnamed quartzite. Also referred to as York or Phoenix.

Bingham mining district, Oquirrh Mountains.

Petroglyph Cliff Ignimbrite

Oligocene: Eastern Nevada.

E. F. Cook, 1965, Nevada Bur. Mines Rept. 11, p. 19—20. A sheet of tuff breccia and eutaxite in lower part of Pahrock sequence. If identification of unit is correct it extends over area of about 1,800 square miles and has average thickness of about 50 feet. Occurs below Shingle Pass Formation and above Needles Range Formation. Martin (1957) used name in unpublished thesis.

Type section: Near cliff on east side of Seaman Range, about a mile north of White River Narrows, on which are Indian petroglyphs. Between petroglyph cliff, approximately in sec. 15, T. 1 S., R. 62 E., Lincoln County, and White Rock Spring, 2½ miles north, the ignimbrite is continuously exposed.

Petroglyph Hill Andesite

Oligocene-Miocene: Southeastern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 70 (table 2). Listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Age 27.9±1.4 m.y.

Silver Bell mining district, Pima County.

Pettit Oolite Member (of Blackgum Formation)

Lower Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 22—26, 97, pls. A, B. At base of Blackgum Formation (new). Thickness less than 2 feet. Overlies Sylvan Shale.

Type locality: About 1 mile west of Qualls, Cherokee County. Named for town of Pettit.

Peyerl Tuff

Pliocene, upper, or Pleistocene, lower: South-central Oregon.

E. R. Hampton, 1964, U.S. Geol. Survey Prof. Paper 383—B, p. B5 (fig. 4), B12—B14, pl. 1. A sequence of tuff, tuffaceous sandstone and pumice conglomerate. Thickness about 227 feet at type section. Unconformably overlies Hayes Butte Basalt (new); unconformably underlies and in part contemporaneous with Paulina Basalt (new). Considered latest Pliocene or early Pleistocene because of its stratigraphic position.

Type section: In roadcut of State Highway 31 in sec. 31, T. 25 S., R. 13 E., Lake County. Reference section: Where county road crosses an erosional escarpment in center part of sec. 28, T. 25 S., R. 13 E. Named for Peyerl Ranch.

Peyton Creek Beds or Shale (in Pitkin Formation)

Mississippian (Chesterian): Northern Arkansas.

J. A. McCaleb, J. H. Quinn, and W. M. Furnish, 1964, Oklahoma Geol. Survey Circ. 67, p. 7 (fig. 1). "Peyton Creek" shown on table showing stratigraphic distribution of *Girtyoceratidae* in southern midcontinent. Contains *Eumorphoceras richardsoni.* Occurs above Pitkin(?) equivalent and below Pennsylvanian Hale Formation.

W. M. Furnish, J. H. Quinn, and J. A. McCaleb, 1964, Paleontology, v. 7, pt. 2, p. 173—180. In northwestern Arkansas and adjacent Oklahoma, the uppermost Mississippian formation is Pitkin Limestone, the type locality for which is in Washington County, Ark. This unit is typically a limestone about 50 feet thick bounded by unconformities. In north-central Arkansas, 150 miles to east, thicker strata with a similar stratigraphic position in the Leslie area of southern Searcy County and northern Van Buren cannot be correlated lithologically with any particular part of the Pitkin, but are regarded as approximately equivalent. The upper 100 feet of predominantly shaly strata in the 200-foot shale and limestone section of this vicinity are known as the "Peyton Creek Beds" of the upper Pitkin Formation. Typical development (type locality) noted. Abundant molluscan fauna occurs in the Peyton Creek beds at the type locality. Well-preserved goniatites include *Delepinoceras, Anthracoceras, Cravenoceras, Eumorphoceras,* and *Dimorphoceras.* At the Leslie, Ark., vicinity there are lithologic variations within the Peyton Creek beds, especially along the depositional strike. The upper fossiliferous beds at Peyton Creek south of Leslie are not associated with a completely exposed Pitkin section, although about 170 feet of strata crop out. East of Leslie on State Highway 66 (SE¼ sec. 23, T. 14 N., R. 15 W.) the Fayetteville Shale and 200 feet of younger Mississippian are exposed along the road. Above the Fayetteville the basal 40 feet of a section is a massive limestone; this unit is succeeded by a similar thickness of dark calcareous shale. Above the shale is a bed of conglomeratic limestone 6 feet thick which contains an abundance of large *Eumorphoceras bisulcatum.* About 120 feet of exposed strata overlie the *Eumorphoceras bisulcatum* horizon in the road section east of Leslie. These upper layers include limestone, shale, and sandstone, most of which is correlated with the 'Peyton Creek shale' locality 5 miles to the south. At the top of the

Leslie section there is a limestone grading into calcareous conglomerate above. The upper bed is overlain by about 4 feet of fine-grained sandstone and then some 5 feet of coarse conglomerate containing pebbles and granules of phosphatic material. The phosphatic conglomerate may be of Pennsylvanian age and is believed to represent a hiatus. The Mississippian cephalopod, the genus *Delpinoceras* has not been previously described from the western hemisphere. It indicates precise correlation of the upper Chester Series and the late lower Namurian of Eurasia and Africa.

Typical development (type locality): An exposure in Frank Stewart's Peyton Creek Phosphate Mining Co. strip mine about 5 miles south of Leslie (sec. 12, T. 13 N., R. 15 W.) but across the county line in northern Van Buren County. Another exposure is nearby in a roadcut on U.S. Highway 65 about one-fourth mile south of the bridge over Peyton Creek.

Phayles Member (of Mesaverde Formation)
Phayles Reef Member (of Mesaverde Formation)

Upper Cretaceous: Central Wyoming.

J. R. Barwin, 1959, Am. Assoc. Petroleum Geologists, Rocky Mountain Sec., Geol. Record, p. 141. Name Phayles Reef proposed for lowermost regressive sequence of Mesaverde. Underlies Wallace Creek tongue (new) of Cody shale.

J. R. Barwin, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 174—176, 177 (fig. 4). Name proposed for basal member of Mesaverde. West of type locality member subdivided into three distinct lithologic units (ascending): basal sandstone bed, carbonaceous shale zone, heterogeneous sequence of interbedded sandstone, siltstone, claystone, shale, carbonaceous shale, and coquina. Thickness 240 feet at type section. Westward merges with overlying unnamed middle member of Mesaverde. To east, thins as it intertongues with underlying Cody shale and overlying Wallace Creek tongue (new) of Cody. Barwin (1959; 1961, unpub. thesis) applied name Phayles Reef member to this unit. Term is herein shortened to Phayles.

Type section: On northeast flank of Rattlesnake Hills in SW sec. 4, T. 33 N., R. 87 W., Natrona County, southeastern Wind River Basin. At this locality basal sandstone of member forms ridge locally known as "Phayles Reef."

Phoenix Member (of Santa Margarita Formation)

Miocene, upper: Southern California.

C. A. Hall, Jr., 1962, California Univ. Pubs. Geol. Sci., v. 40, no. 2, p. 58 (fig. 7), 60—61 (table 2), 62, figs 5, 6, map 1. Middle member of formation. Consists of sandstone or siltstone alternating with siliceous mudstone. Sandstone is a fine- to coarse-grained arkosic or quartz arenite, locally containing much shell debris. Siltstone and mudstone locally contain abundant *Pecten discus* remains. Overlies Huasna member and underlies Saucelito member (both new).

C. A. Hall, Jr., and C. E. Corbato, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 562, (fig. 2), 572, 573. Described in Nipomo quadrangle, San Luis Obispo County. Subdivided into 12 subunits. Total thickness about 4,300 feet. Overlies Huasna Member. Underlies Saucelito Member. Upper Miocene.

Type locality and derivation of name not stated. Original report discusses Phoenix-Saucelito Creeks area, San Luis Obispo County.

Phonodoree Formation

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—G, p. G1—G9. Consists of red, brick-red, and light-brown mudstone, red feldspathic sandstone, white to gray quartzite, and white, gray, and orangish-brown pebble conglomerate. A bluish-gray basal quartzitic conglomerate is generally only a few inches to a few feet thick but as much as 20 feet where it fills channels in underlying Paleozoic rocks. Near Phonodoree shaft, formation is about 150 feet thick and consists mainly of quartzitic conglomerate, quartzite, and feldspathic quartzite; basal conglomerate thin or absent. Southeast of Copperosity mine, as much as 300 feet thick and consists mostly of siliceous mudstone. Thins northward from Copperosity mine to Vekol mine. Absent 4 miles north of Vekol mine. Rests with angular unconformity on Devonian Martin Formation near Phonodoree shaft, on Mississippian Escabrosa Limestone 2 miles west of the shaft, and on Pennsylvanian Horquilla Limestone near Copperosity mine. Underlies Vekol Formation (new). The Phonodoree is lower red sandstone unit of Hadley (1944, Copper and zinc deposits in Reward area, Casa Grande Mining District, Pinal County: U.S. Geol. Survey Strat. Minerals Inv.) and the Cretaceous red beds of Carpenter (1947, unpub. thesis) southeast of Copperosity mine.

Type section: Reward mine area, Vekol Mountains, Papago Indian Reservation. Reference section: Copperosity mine. Named for Phonodoree shaft.

Piapi Canyon Group

Piapi Canyon Formation (in Oak Spring Group)

Miocene, upper and Pliocene, lower: Southern Nevada.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Includes following members of Hinrichs and Orkild (1961) in ascending order, Survey Butte, Stockade Wash, Topopah Spring, Tiva Canyon, and Rainier Mesa. Overlies Indian Trail Formation (new). All members except Survey Butte are multiple-flow simple or compound cooling units of rhyolitic welded and nonwelded ash-flow tuff and associated ash-fall tuff. Believed to be early Pliocene or younger.

P. W. Lipman and R. L. Christiansen, 1964, U.S. Geol. Survey Prof. Paper 501—B, p. B74—B78. As originally described, Piapi Canyon Formation comprises five members. Four are ash-flow sheets (ascending): Stockade Wash, Topopah Spring, Tiva Canyon, and Rainier Mesa Members. The fifth member, Survey Butte, consists of lithologically distinctive ash-fall tuffs into which the three lower ash-flow sheets wedge out. The newly recognized sheet, herein named Yucca Mountain Member, occurs immediately below Tiva Canyon Member and conformably overlies thick sequence of bedded tuffs correlative with Survey Butte Member.

D. C. Noble, and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D25. Thirsty Canyon Tuff (new) overlies Rainier Mesa Member of Piapi Canyon Formation, in Nye and Esmeralda Counties.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224—A, p. A44—A51. Piapi Canyon redefined and raised to group rank. Includes two new formations, Paintbrush Tuff and overlying Timber Mountain Tuff. Names Piapi

Canyon Group and Indian Trail Formation are restricted to areas where they were originally used: Yucca Flat and Frenchman Flat areas. Potassium-argon dating gives age of Paintbrush Tuff as Miocene(?) and Pliocene, and Timber Mountain Tuff as Pliocene.

The U.S. Geological Survey currently designates the age of the Piapi Canyon Group as late Miocene and early Pliocene on the basis of more recent potassium-argon dating.

Type locality: In vicinity of Piapi Canyon, about 2 miles northwest of Shoshone Mesa, Nye County.

Picacho Alluvium

Pleistocene (Wisconsinan): South-central New Mexico.

See Tortugas Alluvium.

Piceance Creek Sandstone Tongue (of Anvil Points Member of Green River Formation)

Eocene: Northwestern Colorado.

H. R. Ritzma, 1965, Mountain Geologist, v. 2, no. 3, p. 103—107. Proposed to restrict term Douglas Creek Sandstone (or Member) to southwest part of Piceance Creek basin to southwest part of basin where these sandstones can be readily identified as a tongue of type Douglas Creek. Further proposed that basal sandstone tongue of Green River Formation on east flank of basin be called Piceance Creek Sandstone Tongue of Anvil Points Member of Green River Formation. In exposures along Lower Piceance Creek, the tongue is identified at the lower 40 to 50 feet of total Anvil Points Member. Overlies Wasatch Formation.

Crops out along west side of White River valley in T. 1 N., Rs. 96 and 97 W., and extends to about sec. 33, T. 2 N., R. 97 W. Persists southwestward for 6 to 10 miles from exposures on the outcrop.

Pickrelltown Till

Pleistocene (Wisconsin): West-central Ohio.

J. L. Forsyth, 1967, Ohio Div. Geol. Survey Rept. Inv. 66 (map only). Three tills recognized in area (ascending) Pickrelltown, Bellefontaine, and Marysville. The Pickrelltown is characterized by loam texture and abundant limestone pebbles and by Miami 6A soils. Till is present both as ground moraine and end moraine.

Named for Pickrelltown about 2 miles west of East Liberty quadrangle.

Picture Gorge Basalt (in Columbia River Group)

Miocene, middle: Northeastern Oregon.

A. C. Waters, 1961, Am. Jour. Sci., v. 259, no. 8, p. 583—611. Columbia River basalt raised to group status to include two formations: Yakima basalt as defined by Smith (1901) and older basalts of John Day Basin, called "Columbia Lava" by Merriam (1901, California Univ. Pub. Bull. Dept. Geol., v. 2, no. 9) but herein renamed Picture Gorge basalt. At Picture Gorge, underlies Mascall formation, farther northwest disappears unconformably beneath Yakima basalt; unconformably overlies John Day formation at Picture Gorge.

T. P. Thayer and C. E. Brown, 1966, U.S. Geol. Survey Prof. Paper 550—C, p. C73—C74. At type locality, Picture Gorge Basalt consists of about 14 flows, nearly equal in thickness, which together are about 1,500 feet thick; they lie on John Day Formation. In valley of Flat Creek 10 miles southeast of Picture Gorge, a section that is 6,000 feet thick and comprises at least 50 basalt flows and 500 feet of bouldery gravels appears to be stratigraphically about equivalent to Picture Gorge Basalt. Lower flows appear identical with those at Picture Gorge, but the individual upper flows range from about 20 to 200 feet, the flows have a much larger proportion of top and bottom breccia, and they may be equivalent in part to Yakima Basalt. The thick section here dips vertically between the John Day fault and fault to the south; it is a segment of the steep north limb of the strongly asymetrical Aldrich Mountain anticline. Exposures nearby show that the flows lie unconformably on Clarno Formation and are conformable with overlying Mascall.

Type section: Picture Gorge, Grant County, Oreg.

Picture Rock Basalt

Pliocene, lower(?): South-central Oregon.

E. R. Hampton, 1964, U.S. Geol. Survey Prof. Paper 383—B, p. B5—B7, pl. 1. Name applied to sequence of basaltic lava flows and interbedded pyroclastic materials. Oldest rock unit in area. Underlies unnamed volcanic rocks of intermediate composition which in turn underlie Fort Rock Formation (new). Pyroclastic and sedimentary interbeds are as much as 250 feet thick. Exposed thickness of basalt at eastern edge of Silver Lake exceeds 700 feet, and unit may reach thickness greater than 1,000 feet. Individual flows of basaltic lava range in thickness from 10 to 50 feet. Tentatively assigned an early(?) Pliocene age. Pliocene on map bracket and figure 4. Type section and reference section designated.

Type section: Exposures in secs. 14 and 15, T. 29 S., R. 16 E., Lake County. Reference section: Exposure in fault scarp, about 6 miles south of Buffalo Wells, in sec. 8, T. 28 S., R. 20 E. Named for Picture Rock Pass, the pass between the Fort Rock and Summer Lake basins, where a great thickness of flows typical of unit are exposed.

Piedmont Point Member (of Doyle Creek Formation)

Upper Triassic: Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1575. Doyle Creek Formation (new) contains two members, Ashby Creek Conglomerate and Piedmont Point.

Mapped area includes area between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Piedra Parada Member (of Zia Sand Formation)

Miocene, lower and middle: Northwestern New Mexico.

Ted Galusha, 1966, Am. Mus. Novitates, no. 2271, 12 p. Name proposed for the approximately 400 feet of lower part of type section of Zia Sand lying below the obscure unconformity. Underlies Chamisa Mesa Member (new). Overlies Galisteo Formation.

Type section: Lower 400 feet of type section of Zia Sand Formation, Sandoval County. Name derived from Canyada Piedra Parada which drains the type locality.

Pier Gorge Schist Member (of Quinnesec Formation)

Precambrian: Northwestern Wisconsin.

J. A. Cain, 1964, Michigan Acad. Sci., Arts, and Letters Papers, v. 49, p. 84. Name used by Prinz (1958, unpub. thesis) in report of geology of part of Menominee district.

Pierz Till, Drift

Pleistocene: Central Minnesota.

A. F. Schneider, 1961, Minnesota Geol. Survey Bull. 40, p. 40—42. Name Pierz till applied to brown sandy till of Patrician drift of Leverett (1932). Red till termed Superior till. Lithologically similar to Brainerd till. In Pierz drumlin field, eastern Morrison County, Pierz till both underlies and overlies Superior till. In most areas overlies Wadena till.

Town of Pierz is in Morrison County.

Pilot Knob Felsite (in Middlebrook Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Middlebrook group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Pilot Knob is in T. 34 N., R. 4 E., Iron County.

Pine Salt Member (of Spearfish Formation)

Pine Salt

Upper Permian: Western North Dakota (subsurface).

D. L. Zeiglar, 1955, North Dakota Geol. Soc. Guidebook Sept. 14, 15, 16, p. 49—55. Pine salt is essentially an evaporite deposit. Samples show anhydrite and reddish-brown mudstone through interval. Overlies Spearfish formation. Underlies Saude formation.

W. G. Dow, 1967, North Dakota Geol. Survey Bull. 52, p. 8—9, pls. Member of Spearfish Formation. The Pine was named by Zeiglar (1955) who included a persistent sandy siltstone unit and an equally persistent anhydrite and salt unit in its upper part. The anhydrite and salt unit is referred to in present report as the G marker bed. Top of Pine Salt is herein revised to exclude these two units. At type section herein designated, the member occurs between depths of 5,237 and 5,432 feet. The member consists of clear halite with thin interbeds of reddish-orange siltstone and white anhydrite. Overlies Belfield Member (new) and extends somewhat beyond the Belfield in northwestern North Dakota where it rests with angular discordance on rocks as old as Mississippian. Underlies Saude Member. Name Pine is considered to have been established through popular usage.

Type section: Interval between 5,237 and 5,432 feet, mechanical log depth, in Carter Oil Co., L. L. Johnson No. 1 well, NW¼ sec. 9, T. 129 N., R. 106 W., Bowman County. Unit thickens somewhat south of Cedar Creek anticline, reaching maximum thickness of about 300 feet 35 miles north of Spearfish outcrop area in Black Hills.

Pine Canyon Formation

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., 1962, New Mexico Bur. Mines and Mineral Resources Geol. Map 17. Latitic flows and agglomerate; in part equivalent to OK Bar Conglomerate and Double Adobe Latite (both new).

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines and Mineral Resources Bull. 84, p. 58—59, pl. 1. Described in Walnut quadrangle, Hidalgo County. Originally interpreted as upper flow facies of Park Tuff. Intertongued with and equivalent to Double Adobe Latite. Overlies OK Bar Conglomerate.

Named for Pine Canyon, southwestern part of Walnut Wells quadrangle.

Pine Creek interbeds (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 24, fig. 18. Member composed of two marginal interbeds and a flow. At Pine Creek locality, the 35-foot lower interbed is composed mostly of finely laminated lacustrine siltstones; overlying flow is about 50 feet thick; upper interbed of stratified and crossbedded sandstone is more than 100 feet thick. Thins southward to about 130 feet at Juliaette. Stratigraphically below Sweetwater Creek Interbed (new). Occurs in "Upper" Basalt of Columbia River Basalt [Group].

Named for esplanade formed at their expense in Pine Creek and adjoining canyons in vicinity of Potlatch River. Best exposed on Kendrick-Deary Highway, one-half mile to west of Pine Creek, where both lower and upper interbeds and separating flow are present.

Pinecrest Beds

Miocene, upper, and Pliocene: Southern Florida.

A. A. Olsson, 1964, Bulls. American Paleontology, v. 47, no. 217, p. 511—526. Name applied to unit overlying Tamiami formation and underlying Caloosahatchee marl. Largely fine quartz sand 10 to 20 feet thick. Formation has much the appearance of a beach deposit and worn flat disk-shaped quartz pebbles are plentiful at some places. Locally, Pinecrest beds in type area may be fossiliferous, carrying predominantly a pelecypod assemblage in which *Macrocallista reposta* (Conrad) are most numerous.

Encountered directly below a surface limestone in general region of the 40-mile bend on Tamiami Trail (Route 1) west of Miami in western part of Dade County and extending across its boundary into Collier County. Name taken from an old settlement on Everglades road (which branches off from the present highway at 40-mile bend) about 1 mile from west of Dade-Collier County line. Largest known area of beds in shallow subsurface extends through parts of Glades, Highland, and Hendry Counties, north and northwest of Lake Okeechobee.

Pine Flat basalt

[Pliocene]: Northern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 37, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 3.5 ± 0.1 m.y. Figure 12 mentions basalt at Pine Flat.

Pine Flat is in southeast corner of Devils Postpile quadrangle, Madera County.

Pine Hill gabbro and pyroxenite

Pre-Cretaceous: Northern California.

F. R. Olmsted, 1964, Dissert. Abs., v. 24, no. 9, p. 3693. Chief minerals in Pine Hill pluton.

Occurs in Pilot Hill and Rocklin quadrangles in foothills of northern Sierra Nevada.

Pinehurst Formation

Miocene, upper, or Pliocene(?): South-central North Carolina.

J. F. Conley, 1962, North Carolina Div. Mineral Resources Bull. 76, p. 18—19, pl. 1. Name applied to so-called high-level gravels. In Moore County [this report] the Pinehurst is nonfossiliferous sand and gravel which caps all of higher Coastal Plain hills in central and western part of county. Formation exposed on top of high hill at Carthage at elevation of over 500 feet. From here it slopes to southeast until it reaches elevation of 350 feet in southern part of county. Gravels on hill at Carthage range in thickness from 3 to 7 feet and consist of coarse brown, iron-stained sand containing lenses of quartz pebbles. Thickens downdip to over 150 feet in southern part of county. Bedding and composition rapidly change from coarse sands, containing pebble beds and lenses, at Carthage to festooned crossbedded sands and fine gravels downdip. Unconformably overlies upper member of Tuscaloosa formation. Contact is undulating line. Upper Miocene.

R. B. Daniels and others, 1966, Southeastern Geology, v. 7, no. 4, p. 168—172. In area near Benson, the Pinehurst is subdivided into two informally named members, Piney Grove and Plainview. Overlies Macks Formation (new). Underlies "Brandywine Formation" Probable Pliocene.

Type section: In D. H. Wilson sand pit on north side of Highway 211, about 1½ miles southeast of center of town of West End. Named from town of Pinehurst, Moore County.

Pine Lakes cordierite trondhjemite

Lower Cretaceous(?): Northeastern Oregon.

W. H. Taubeneck, 1964, Geol. Soc. America Bull., v. 75, no. 11, p. 1096, 1097 (fig. 2), 1102, 1106. Cornucopia stock contains at least five distinct tonalites and trondhjemites; each is separate injection. Oldest and largest is Cornucopia tonalite. Next oldest is Tramway trondhjemite. Following unit, first in series of three cordierite trondhjemites is the Big Kettle, and the two subsequent units are Pine Lakes and Crater Lake.

Pine Lakes—a group of small lakes about 1½ miles northwest of Cornucopia Peak, Baker County.

Pine River quartzite conglomerate member (of Michigamme Slate)

Precambrian: Northeastern Wisconsin.

T. H. Nilsen, 1964, Lake Superior Geology Inst., 10th Ann. Mtg. May 6—9 (Ishpeming, Mich.) p. 23—25. Pine River (formerly Breakwater) and Keyes Lake (new) units are informally designated members of Michigamme Slate in Baraga Group of Animikie Series of middle Precambrian. They crop out in separate fault blocks as resistant northwest-southeast-trending ridges in northeastern Florence County. Because they occur as steeply dipping homoclines, it is impossible to judge their original extent; also the lateral boundaries are generally vague due to lack of outcrop. They appear to be anomalous local lenticular quartz-rich bodies within the more typical dark Michigamme slates, graywackes, and basic volcanics. Pine River quartzite conglomerate consists of a lower conglomerate, middle cross-stratified quartzite and pebbly quartzite, and an upper conglomerate, each of which thins to the northwest from a maximum total thickness of 600 feet to 150 feet in distance of 3 miles. Strike of homocline is northwest-southeast with dip of about 70° to southwest; top of unit everywhere faces southwest.

Crops out near Pine River Reservoir 5 miles south of Florence, Florence County.

Pine Valley Gravel

Pleistocene (Wisconsin): Southeastern Colorado.

D. J. Varnes and G. R. Scott, 1967, U.S. Geol. Survey Prof. Paper 551, p. 22—23, pls. 1, 6, West of Monument Creek consists primarily of reddish-brown fragments of Pikes Peak Granite, some of which has been reworked from Lehman Ridge and Douglass Mesa Gravels (both new). Generally the deposits contain a greater admixture of sand, silt, and clay than do the two older gravel pediments. East of Monument Creek, Pine Valley Gravel was derived largely from Dawson Arkose which crops out to east of Air Force Academy site. It, therefore, contains no material larger than 1½-inch pebbles. Thickness ranges from 5 to about 30 feet. Thickness east of Monument Creek appears to average about 20 feet; that west of Monument Creek may be somewhat less. Illinoian or Sangamon age.

Type locality: In roadcut in SW¼NE¼ sec. 36, T. 12 S., R. 67 W., Pine Valley, a small valley west of mouth of Kettle Creek, and almost the entire area east of Monument Creek, Air Force Academy area, El Paso County. Occupies eastern part of Lehman Valley, eastern part of South Lehman Valley, and eastern part of Douglass Valley.

Piney Grove Member (of Pinehurst Formation)

Pliocene(?): Eastern North Carolina.

R. B. Daniels and others, 1966, Southeastern Geology, v. 7, no. 4, p. 169—171. In Benson area Pinehurst is subdivided into two informally named members—Piney Grove and Plain View. Name Piney Grove applied to sediments between altitudes of 350 and 325 feet. Overlies Macks Formation (new).

Benson is in Johnston County on the Neuse-Cape Fear drainage divide.

Pink Cliff limestone (in Chaffee Formation)

Upper Devonian: West-central Colorado.

A. C. McFarlan, 1961, Rocky Mountain Assoc. Geologists Guidebook 12th Ann. Field Conf., p. 128 (fig. 4), 130. A lenticular pinkish-gray limestone of local development in the lower part of the Chaffee. Thickness 26 feet.

Borders Walrod Creek in Cement Creek area Gunneson County.

Pinnacle Overlook Member (of Lee Formation)

Mississippian: Southeastern Kentucky.

K. J. Englund, 1964, U.S. Geol. Survey Prof. Paper 501–B, p. B30–B38. Name applied to lowermost member of Lee that previously was referred to as basal or lower tongue. Consists of thick-bedded well-sorted fine- to medium-grained quartzose sandstone in lower and upper parts and massive conglomeratic quartzose sandstone in middle. Thickness 250 feet at type locality; 360 feet about 2 miles northeast of Cumberland Gap. From point of maximum thickness member thins in broad arc to form northwestward-protruding lobe. Where lobe is thickest basal contact is sharp and locally undulates as much as 10 feet into underlying shale. Toward periphery of lobe, contact is conformable and typical Lee lithology grades into upper part of Pennington Formation. Underlies Chadwell Member (new) at southwest end of outcrop area.

Type section: The Pinnacle, a scenic overlook formed by the member on northeast side of Cumberland Gap.

Pinnacle Peak Phyllite

Triassic(?): Southeastern Alaska.

R. A. Loney and others, 1963, U.S. Geol. Survey Misc. Geol. Inv. Map I–388 (with separate text). Name given to thinly laminated, siliceous phyllite of possible Triassic age that crops out in belt averaging about 1 mile wide near west coast of Chichagof Island. Underlain generally by Goon Dip Greenstone (new) and locally by intervening Whitestripe Marble (new); overlain by Waterfall Greenstone (new). Because of intense folding of phyllite, nature of lower and upper contacts as well as stratigraphic thickness unknown. In region north of Pinnacle Peak, which was not mapped in present work, the Pinnacle Peak Phyllite correlates with basal part of "schist" unit of Coats and Reed (1941, U.S. Geol. Survey Bull. 929) and Rossman (1959, U.S. Geol. Survey Bull. 1058–E).

Type locality: Pinnacle Peak, Chichagof Island. Formation, as mapped, extends from Pinnacle Peak southeastward for at least 15 miles.

Pío Juan Limestone Member (of Cariblanco Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I–335. Medium dark-gray thin- to thick-bedded impure limestone interbedded with siltstone. Thickness probably not more than 30 m. Near top of formation above Jobo Dulce limestone member (new) and below Sabana Hoyos limestone member (new).

Named for exposures on Cerro Pío Juan, located southeast of center of Coamo quadrangle in U.S. Military Reservation. Exposed only in area of about 4 sq km.

Pipestone Formation

Probably lapsus for Pipestone Canyon Formation.

Pisgah Flow

Quaternary: Southern California.

T. W. Dibblee, Jr., and A. M. Bassett, 1966, U.S. Geol. Survey Misc. Geol. Inv. Map I–467. Pisgah flow mapped in Cady Mountains quadrangle. Basalt forms one or several flows on alluvium.

J. S. Watkins, R. H. Godson, and Kenneth Watson, 1967, U.S. Geol. Survey Prof. Paper 599–A, p. A2–A12. Experiment in seismic detection of near-surface cavities. Field study tests made over small lava tunnel in Kana-a lava flow near Flagstaff and over lava tunnel in Pisgah flow. Flow surface is characterized by roughly equal areas of aa and pahoehoe lava. The tunnel, which is in the area of pahoehoe, was traced at least 1.1 km northward from base of Pisgah cinder cone.

Flow is adjacent to and south of U.S. Highway 66, about 60 km east of Barstow, San Bernardino County.

Pistol Range Member (of McKelligon Formation)

Canadian (Jeffersonian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Name applied to horizon with *Mcqueenoceras.* Canadian treated as system in this report.

Crops out just above Pistol Range along Scenic Drive.

Pistol River Complex

Jurassic: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4321. Name applied to series of pillowed metavolcanic rocks, graywacke, and conglomerate. Believed to be either most westerly part of Chetco Formation (new) or equivalent to Rogue Formation of inland Oregon.

Report discusses west-central Klamath province in southwestern Oregon and northwestern California. Pistol River is in Oregon.

Pitchstone Plateau Flow (in Plateau Flows)

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 403—404, pl. 1. Composes Pitchstone Plateau. Front along southwestern margin of plateau is 1,000 feet high; along eastern and southern margins, the front ranges between 300 and 500 feet in height. Covers area of about 100 square miles. If average thickness is taken to be 500 feet, then 10 cubic miles of rhyolite has been erupted to form this single flow.

In southwestern corner of Yellowstone National Park.

Pitoikam Formation

Mesozoic(?): Southwestern Arizona.

L. A. Heindl and C. L. Fair, 1965, U.S. Geol. Survey Bull. 1194—I, p. I6—I7. Almost entirely sedimentary rocks, mostly conglomerate and shale. Divided into a lower conglomerate member; middle Contreras Conglomerate Member (new); and upper Chiltepines Member (new). Members grade into each other. Thickness at least 9,200 feet. Formation appears to thin to southeast where it passes out of mapped area. Underlies Mulberry Wash Volcanic Formation (new). Overlies Otero Granite (new).

Named for a village of Pitoikam, Baboquivari Mountains, Papago Indian Reservation. Strikes generally about N. 20° W. and dips about 60° — 70° SW.

Pit River Diorite

Triassic: Northern California.

G. A. Davis, 1966, [abs.] Geol. Soc. America Spec. Paper 87, p. 42—43. Potassium-argon age determinations on Salmon Hornblende Schist and

Pit River Diorite of 272—289 and 218 m.y., respectively, are interpreted as bracketing the major orogenic event in the south-central Klamath Mountains of California, heretofore considered Late Jurassic in age. An upper age limit on thrusting of the eastern Paleozoic belt plate is tentatively established by the Early to Middle Triassic age of the Pit River stock which intrudes the Lower Permian limestones of the plate.

South-central Klamath Mountains.

Pittsfield Member (of Waterville Formation)

Middle Silurian: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Overlies Palmyra Member (new); underlies Palmer Hill Member (new). Thinly bedded slates and phyllites.

Report discusses geology of Pittsfield quadrangle.

Piute Formation

Lower and Middle Devonian: Southeastern Nevada.

R. L. Langenheim, Jr., and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 5, p. 596 (fig. 4), 600—601. Formation is 320 feet thick at type locality and consists chiefly of medium-grained gray dolomite in beds as much as 5 feet thick. Exposures of the Piute form series of small cliffs and benches somewhat more resistant than upper member of underlying Laketown Dolomite and overlying Moapa Formation (new). Top of Piute Formation placed at top of second rusty-weathering layer above Eureka Quartzite. *Acrospirifer kobehana* occurs in basal member, hence lower part of Piute is assigned to Early Devonian; top is assigned to Middle Devonian.

S. H. Frost and R. L. Langenheim, Jr., 1966, Jour. Paleontology, v. 40, no. 4, p. 911—930. Discussion of paleontology of the *Stringocephalus* biostrome, Piute Formation (Middle Devonian), Arrow Canyon Range, Clark County. Main ridge of Arrow Canyon Range trends north-south, is about 35 miles long and 1½ miles to 5 miles wide, and is bordered on the east by a series of low hills and a large dissected alluvial fan. Main ridge, composed of Cambrian through Permian rocks, is thrust southeastward over the subsidiary ridge. Eastern ridge is also composed of Cambrian through Permian strata. Devonian strata are about 2,000 feet thick and range in age from Coblenzian through Fammenian. Piute Formation, Coblenzian through Givetian, consists of from 252 to 320 feet of dolomite, a thin basal sandstone, and is capped by *Stringocephalus* biostrome. This formation is at base of Devonian sequence and crops out in two interrupted V-shaped belts reflecting the broad northwesterly plunging anticline and syncline which lie slightly transverse to the axis of the main range. The formation is also exposed in overturned sequence in northern half of eastern subsidiary ridge. Throughout area the *Stringocephalus* biostrome appears to be single continuous bed characterized by abundant fossils.

Type locality: Toronto Gulch, Arrow Canyon quadrangle, Arrow Canyon Range, Clark County.

Plain View Member (of Pinehurst Formation)

Pliocene(?): Eastern North Carolina.

R. B. Daniels, 1966, Southeastern Geology, v. 7, no. 4, p. 169—171. Pinehurst subdivided into two informally named members—Piney Grove and Plain View. Name Plain View is applied to sediments below 325 and above 280—270 feet. Overlies Macks Formation (new).

Occurs at Plain View Church northwest of junction of route 50 and 42 in Johnston County.

Plaskett schist

Age not stated: Northern California.

E. D. Ghent, 1964, Dissert. Abs., v. 25, no. 4, p. 2443. Structurally overlies Franciscan Formation. Both gradational and sharp contacts observed. Plaskett schist and Black Butte metabasalt (new) have undergone at least three deformations.

Present in Black Butte area, Hull Mountain and Anthony Peak quadrangles.

Plateau Flows

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 403—409, pl. 1. Rhyolite plateau of Yellowstone Park is made up of flows and welded tuff with subsidiary rhyolite domes, basalt, and rhyolite-basalt mix-lava (Grizzly Lake rhyolite-basalt complex). Two most important parts are Yellowstone tuff (new) and group of younger flows, Plateau flows. The Plateau flows occupy tectonic basin rimmed by Yellowstone tuff and older rocks in central and southwestern Yellowstone Park. Includes Gibbon River, Pitchstone Plateau, Canyon, Cougar Creek, Crystal Springs, and Obsidian Cliff flows (all new). Individual flows range up to 1,000 feet in thickness and cover areas up to at least 100 square miles. Surficial features, including vent domes, are locally well preserved. Exposed portions of flows are mainly banded obsidian and perlite and breccias. Includes large area that is undifferentiated.

Cover about 1,000 square miles in Madison, Central, and Pitchstone Plateaus.

Plattekill Formation (in Hamilton Group)

Middle Devonian: Southeastern New York.

F. W. Fletcher, 1962, New York State Geol. Assoc. Guidebook 34th Ann. Mtg., p. D—4, pl. 4. Strata called Kiskatom by Chadwick (1932) is divided into three units. Lower zone, which loses its red beds rapidly to west and south, is designated Plattekill Formation. Middle zone is called Potter Hollow Formation. Upper red zone is Oneonta Formation.

F. W. Fletcher, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 29. Consists of grayish-red-purple claystones and siltstones, medium-gray and medium-dark-gray shales, and fine-grained crossbedded subgraywackes. Maximum thickness 860 feet in Phoenicia quadrangle. Thins to 309 feet in Durham quadrangle and wedges out in Schoharie Valley where thin red beds occur in series of strata assigned by Cooper (1933) to Panther Mountain Formation. Overlies Ashokan Formation; underlies Gilboa Formation.

F. W. Fletcher, 1967, New York State Geol. Assoc. Guidebook 39th Ann. Mtg., p. C1, C3. Oldest red-bed formation in area. Characterized by three tongues of grayish-red claystone and shale interbedded with medium-dark-gray shale and crossbedded sandstone. Base drawn at base of lowest red bed because the gray shales and sandstones are indistinguishable from those of Ashokan Formation. Maximum thickness 1,000 feet at Catskill Front. Thins rapidly westward because of wedging out of the two lowest tongues. Sedimentary cycles well developed in red-bed parts of the formation and are composed of a fining-upward sequence of sandstone (gray or red) at base, followed by red siltstone, red shale and claystone, and at the top a thin layer of greenish-gray claystone. Cycles commonly less than 20 feet in thickness. Underlies Potter Hollow Formation.

Named for exposures in Plattekill Creek at West Saugerties, N. Y.

Pleasants Valley Shale

Upper Cretaceous: Northern California.

D. O. Emerson and R. D. Roberts, 1962, California Div. Mines Bull. 181, pt. 4, map 3. Named on map legend where it is placed above Forbes formation and below Upper Cretaceous, undifferentiated.

Pleasants Valley is in Putah Creek area, near Vaca Mountains, Napa County.

Plentywood Formation

Pleistocene: Northeastern Montana.

R. B. Colton, 1962, U.S. Geol. Survey Bull. 1111–G, p. 264–266, pls. 36, 37. Name applied to gravel deposits that overlie Fort Union Formation and till. Consists of poorly sorted and bedded gravel deposits 20 to 50 feet thick containing cobbles and boulders. Drilling for shot holes to northwest of Otter Creek quadrangle indicated thickness of 70 to 120 feet is common. Deposits of Plentywood are remnants of gravel fill deposited during retreat and melting of Cary(?) ice sheets.

Named for deposits along Big Muddy Creek just north of Otter Creek quadrangle near Plentywood, Sheridan County. In Otter Creek quadrangle, the formation crops out along Big Muddy Creek in secs. 4, 15, and 27, T. 34 N., R. 55 E.; in sec. 34, T. 33 N., R. 55 E., and in secs. 2, 11, 12, and 22, T. 32 N., R. 55 E.

Plum Creek rhyolite tuff

Miocene: Northern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 20, 21, 22, 37. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 23.4 ± 0.5 m.y. Plum Creek rhyolite tuff rests on basement rock and is overlain by andesite mudflow breccia. Miocene age indicated.

At Plum Creek Mill site, Leek Spring Hill quadrangle.

Plush Ranch Formation

Plush Ranch Member (of Sespe Formation)

Oligocene(?)-Miocene(?): Southern California.

G. T. James, 1963, California Univ. Pub. Geol. Sci., v. 45, p. 5, 7, figs. 1, 2. Present in Cuyama Valley Badlands area. Gray to yellowish to boulder conglomerate and sandstone beds. Underlies Caliente Formation. Possible correlative of Simmler Formation. Name credited to Carman (1957, *in* Geol. Soc. America Official Program, Cordilleran sec., 53d Ann. Mtg.).

M. F. Carman, Jr., 1964, California Div. Mines and Geology Spec. Rept. 81, p. 22—37, pls. 1, 5. Formal proposal of name. Between Big Pine fault and band of Eocene rocks on North Fork in Lockwood Valley area, is at least 6,000 feet of rocks of varied lithology. Here and in creeks to east, the beds consist of apparently continental and broadly conformable conglomerate, fanglomerate, arkosic sandstone, shale, clay, and limestone with interbedded olivine basalt and light-colored tuff. Gazin (1930, unpub. rept.) named upper portion of this section "North Fork Member" of his "Monterey Group" and designated the basalt as base of "Monterey Group." However, beds immediately above and below the basalt are not only identical and occur interbedded with basalt flows, but pass conformably into overlying and underlying rocks. This group of rocks is herein designated Plush Ranch Formation. Divided into six lithologically distinct sedimentary members, broadly superimposed in vertical stratigraphic sense, but displaying marked interfingering between different members. Aggregate thickness about 6,525 feet. Extends beyond mapped area to west, but eastward is cut out between Big Spring, Big Pine, and Mount Pinos faults just north of Cuddy Ranch. Is in a fault wedge south of San Andreas fault at easternmost extremity of map. Is always in fault contact with basement rocks and with younger Tertiary beds within mapped area. Unconformable with overlying Caliente beds west of mapped area in Dry Canyon. Oligocene(?)-Miocene(?).

R. C. Flemal, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 1991. Rank reduced to member status in Sespe Formation. Overlies Simmler and underlies the Vasquez both rank reduced to member status in the Sespe.

Type locality: In North Fork of Lockwood Creek, north of Plush Ranch, sec. 30, T. 8 N., R. 21 W., to SW¼ sec. 24, T. 8 N., R. 22 W., Mount Pinos quadrangle, Ventura County.

Pocamoonshine Gabbro-Diorite

Devonian: Eastern Maine.

D. M. Larrabee, 1964, U.S. Geol. Survey Geol. Quad. Map GQ—358. Medium gray-green to black gabbro-diorite. Intrusive mass is about 3 miles wide, 15 miles long, and extends southward into Wesley quadrangle. Believed to be Devonian. Love Ridge Quartz Monzonite (new) and Wabassus Quartz Monzonite are mapped as Devonian in area.

D. M. Larrabee, C. W. Spencer, and D. J. P. Swift, 1965, U.S. Geol. Survey Bull. 1201—E, p. E19—E20, pl. 1. Described in Grand Lake area. Intrusive mass is about 6 miles wide in Wesley quadrangle. Shown on map legend below Chiputneticook Quartz Monzonite and unit termed slate at Baskahegan Stream. Devonian.

Type localtiy: On east shore of western part of Pocamoonshine Lake, Big Lake quadrangle, Washington County.

Pocasset Bed (in Chickasha Formation)

Permian: Southern Oklahoma.

L. V. Davis, 1955, Oklahoma Geol. Survey Bull. 73, p. 57. Lower boundary of Dog Creek and Blaine formations (undifferentiated) in southern Grady County is marked by a bed of conglomeratic mudstone. This boundary in northern Grady County is marked by a bed which at some places is dolomitic sandstone and at other places is gypsiferous sandstone. This bed is at top of Brown's (1937, Am. Assoc. Petroleum Geologists Bull., v. 21, no. 12) Chickasha formation and locally known as Pocasset bed.

R. O. Fay, 1964, Oklahoma Geol. Survey Bull. 98, p. 51. In Grady County, a local 1-foot-thick gypsum bed, termed "Pocasset" by Davis (1955), is here considered an equivalent of the Shimer Gypsum Member of the Blaine.

Named for town of Pocasset, Grady County.

Poe Mountain mica schist

See Wenatchee Ridge Gneiss.

Pogue Mountain Quartz Monzonite

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert Abs., v. 25, no. 12, pt. 1, p. 7205. Most of rocks underlying thesis area were formed under conditions of regional metamorphism; magmas ranging from peridotitic to granitic intruded the metamorphic rocks. The resulting igneous bodies have been mapped as Loup Loup Granodiorite, Pogue Mountain Quartz Monzonite, and Darling Lake Anorthosite Gabbro.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Poker Knoll Limestone Member (of Great Blue Formation)

Upper Mississippian: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 107, 111, pl. 5. Mostly thin-bedded argillaceous limestone. Thickness 600 to 700 feet. Uppermost member of formation; overlies Chiulos member; underlies Manning Canyon shale.

Type locality: On Poker Knoll, near west entrance of Tenmile Pass in south-central part of Fivemile Pass quadrangle, East Tintic Mountains.

Polaris olivine latite member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Cannot be accurately dated in reference to other flows in area. No evidence to suggest it is older than Alder Hill basalts (new). At least 20 flows (or groups of flows) recognized in area. Nine flows (or groups of flows) named and given informal member status in Lousetown Formation.

Mapped in vicinity of settlement of Polaris, Truckee area, north of Lake Tahoe.

Pole Canyon Granodiorite

Cretaceous: Northwestern Nevada.

J. D. Smith, 2d, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 236. Plutonic units were intruded into older rocks during the Cretaceous. From oldest to youngest they are: Cove Camp syenodiorite (new); Corral Creek (new); fine-grained quartz monzonite; Snow Creek trondhjemite (new); and Pole Canyon granodiorite.

Area of report is southern Pine Forest Range, Humboldt County.

Poleta Formation

Lower Cambrian: East-central California and western Nevada.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 141—142, 143. Name applied to succession of archeocyathid limestone, shale, and quartzite above Campito Formation (Montenegro Member, new). Divided into two members. Lower is massive- to thick-bedded gray-blue limestone with archeocyathids, some in reef form. Upper member is sequence of gray-green shale, mottled blue-gray limestone beds, and *Scolithus* (worm borings)—bearing quartzite, capped by a thin gray-blue archeocyathid limestone. Thickness about 1,200 feet at Waucoba Spring. Underlies Harkless Formation (new). Deformation strong, complete section not exposed. Formation is in Waucoba Spring section described by Walcott (1908, Smithsonian Misc. Colln., v. 53, no. 5).

J. P. Albers and J. H. Stewart, 1962, U.S. Geol. Survey Prof. Paper 450-D, p. D24—D27. Geographically extended into Esmeralda County, Nev., where it underlies Mule Spring Limestone and overlies Montenegro Member of Campito Formation. Thickness about 1,000 feet.

C. A. Nelson, 1966, U.S. Geol. Survey Geol. Quad. Map GQ—528. Formation described in Waucoba Mountain quadrangle, Inyo County, Calif. In some areas consists of two mappable members. In some areas formation is undivided. Formation greatly attenuated and transformed to foliated marble with garnet-epidote skarn, black quartz-mica schist, and minor metaquartzite near Papoose Flat pluton.

D. C. Ross, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—612. Waucoba Wash quadrangle, Inyo County. Formation is a light-colored unit of abundant carbonate rocks sandwiched between two thick dark clastic formations. Section of 660 feet measured along south wall of Wheeler Canyon. Base of section is at NW cor. SE¼SW¼ sec. 20, T. 11 S., R. 37 E. Lower member 165 feet thick; middle member 260 feet; and upper member 235 feet. Overlies Campito Formation. Underlies Harkless Formation.

Type section: Waucoba Spring section, on Saline Valley road, east of Inyo Range, Inyo County, Calif. Named for exposures in Poleta Canyon on east-central edge of Bishop quadrangle (west of Blanco Mountain quadrangle), California.

Pomona Basalt Flow or Member (of Yakima Basalt)

Miocene or Pliocene: South-central Washington.

H. U. Schmincke, 1965, Dissert. Abs., v. 25, no. 11, p. 6541—6542. The four youngest Yakima Basalt flows intertongue with volcaniclastic and arkosic sediments of the Ellensburg Formation in much of south-central Washington. From oldest to youngest these are: Umatilla, Pomona, Elephant Mountain, and Ward Gap. Umatilla and Pomona flows are separated by Selah Member of the Ellensburg. Rattlesnake Ridge Member (new) of the Ellensburg lies between the Pomona and Elephant Mountain flows. Age not stated.

H. U. Schmincke, 1965, (abs.) Geol. Soc. America Spec. Paper 82, p. 275—276. Pomona flow, the third youngest flow of the late Yakima Basalt in south-central Washington has been defined and clearly distinguished from underlying and overlying flows by following features: geometry and structures—total thickness, zones of characteristic jointing, thickness and form of columns, pipe vesicles, and vesicle cylinders; textures—crystallinity, grain size, phenocrysts, glomeroporphyritic clots; composition—olivine and pyroxene, and total chemical composition; and weathering features. Field recognition of Pomona flow is aided by its association with a distinctive tuff containing accretionary lapilli. Over much of area this tuff was welded or fused at the contact by the overriding hot Pomona flow. In some places the Pomona flow burrowed into this tuff, producing a pépérite. Pomona flow and associated tuff cover area of at least 6,000 square miles. West of Yakima, Pomona flow decreases rapidly in thickness. The overlying Elephant Mountain flow and Ward Gap flow thin toward the west; neither flow extends west of Yakima.

J. W. Bingham and M. J. Grolier, 1966, U.S. Geol. Survey Bull. 1224—G, p. G11. Referred to as one of the Saddle Mountains flows.

H. U. Schmincke, 1967, Geol. Soc. America Bull., v. 78, no. 3, p. 319—330. Discussion of fused tuff and pépérites in south-central Washington. Reference is made to Pomona Basalt, Pomona Basalt Member of Yakima Basalt, and to Pomona flow.

Columbia River Plateau. Town of Pomona is on Yakima River, north of city of Yakima, Yakima County.

Ponaganset Gneiss

Mississippian(?) or older: Northwestern Rhode Island.

A. W. Quinn, 1967, U.S. Geol. Survey Bull. 1241—G, p. G13—G19, pl. 1. Rocks vary considerably in composition and general appearance. General pattern of variation is one of north-trending lenses. Color ranges from light gray through light pink to medium dark gray. Map shows a variable group of gneissic rocks which make up most of formation and a light-colored facies that makes up minor part of unit. Emerson's map (1917, U.S. Geol. Survey Bull. 597) showed some of the rock here called Ponaganset Gneiss as Northbridge Granite Gneiss. He considered the Northbridge Archean because. ."the Algonkian(?) overlaps it normally and the Milford granite cuts both." The "Algonkian(?) quartzite" is the Westboro Quartzite of the Pawtucket quadrangle and elsewhere in Rhode Island (Quinn and others, 1948, Rhode Island Port and Indus. Devel. Comm. Geol. Bull. 3; 1949, U.S. Geol. Survey Geol. Quad Map [GQ—11]). The Ponaganset Gneiss intruded the Blackstone Series which includes Westboro Quartzite. Therefore the gneiss cannot be older than the quartzite. Because of this contradiction, it seems best not to use name Northbridge Gneiss for the rocks in Chepachet quadrangle [this report]. Older than Scituate Granite Gneiss. Mapped as Mississippian(?) or older.

Type locality: Exposures around Ponaganset Reservoir, Chepachet quadrangle, Providence County.

Poncho Rico Formation[1]

See **Pancho Rico Formation**

Pond Quartzite Member (of Ellsworth Formation)

Silurian(?): South-central Maine.

Lester Greenwood and John Hogan, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trips E and J, p. 54. Dense to gray to blue gray quartzite with well-developed bedding generally very regular but occasionally crenulated. Conglomerate with ¼ to 1 inch gray and brown pebbles at base. Thickness 200 feet. Separated from Douglas Quartz Member (new) by Banded Quartzite Member 175 feet thick.

Type locality and derivation of name not given. Area of report is Blue Hill copper mine.

Pony Trail Group

Mesozoic: North-central Nevada.

L. J. P. Muffler, 1964, U.S. Geol. Survey Bull. 1179, p. 20—37, pl. 1. Includes three new formations (ascending): Big Pole, Sod House Tuff, and Frenchie Creek Rhyolite. Thickness about 3,500 feet at type section, but much of Big Pole Formation cut out by Crescent fault; as much as 10,000 feet in Frenchie Creek and Big Pole Creek areas. All three formations are cut by Lower Cretaceous(?) plutons.

Type section: Pony Trail Canyon in Frenchie Creek and Pine Valley quadrangles, from mouth of the canyon at E. 310,500, N. 2,068,300 eastward along main canyon into Pine Valley quadrangle.

Pool Creek Member (of Carlile Shale)

Upper Cretaceous: South Dakota, Montana, and Wyoming.

M. M. Knechtel and S. H. Patterson, 1962, U.S. Geol. Survey Bull. 1082—M, p. 903 (table 1), 905, 921—922, pls. 60, 61. Dark-gray fissile shale with prominent zone of ironstone concretions in upper part. Locally contains thin bentonite beds and limestone concretions showing cone-in-cone structure. Thickness 70 to 150 feet. Basal member of Carlile in area; underlies Turner sandy member; overlies Greenhorn formation.

W. J. Mapel and C. L. Pillmore, 1964, U.S. Geol. Survey Bull. 1181—J, p. J25. Described in Upton quadrangle, Wyoming, where it is 40 to 50 feet thick and consists mostly of dark-gray noncalcareous shale. Basal member of Carlile. Underlies Turner Sandy Member. Lower part of Pool Creek thickens southeastward beyond quadrangle at expense of underlying Greenhorn Formation.

Type locality: Near point at which Highway 85 crosses head of Pool Creek, 5 miles north of town of Belle Fourche, Butte County, S. D.

Poorman Peak Formation

Permian: Northern Nevada.

J. R. Coash, 1967, Nevada Bur. Mines Bull. 68, p. 5 (table 1), 14, pl. 1. Consists of black mudstones and dark cherts, with crinoidal limestone and fine conglomerates. Thickness about 3,100 feet. Overlies Hammond Canyon Formation (new). Underlies Triassic(?) rocks.

Named for Poorman Peak at the western boundary of Mount Velma quadrangle, Elko County, in secs. 11 and 14, T. 44 N., R. 55 E. Exposed in area north of Poorman Peak, especially from Jenkins Peaks road eastward across the ridges lying off the quadrangle to the northwest of Poorman Peak, to the contact with Hammond Canyon Formation.

Popcorn Sandstone Bed (in Shetlerville Member of Popcorn Sandstone in Paoli Limestone)

Upper Mississippian (Chesterian): Indiana and Illinois.

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 32 (fig. 7), 78, pl. 1. Proposed for bed of sandstone, shale, or impure limestone of earliest Gasperian age that forms basal few inches or feet of Shetlerville Member of Renault Formation in Illinois or of Paoli Formation in Indiana and Kentucky. It underlies purer limestone beds forming rest of these units and overlies Levias Limestone Member of Renault Formation or beds assigned to the Ste. Genevieve that are equivalent to the Levias. Thickness 7 feet at type section.

Type section: On hillside about 50 feet above Popcorn Spring, 3½ miles northwest of Springville, about 700 feet west of Popcorn Church, and 200 feet north of section line, SE¼SE¼ sec. 5, T. 6 N., R. 2 W., Owensburg quadrangle, Lawrence County, Ind.

Pope Megagroup

Mississippian (Meramecian-Chesterian): Central United States.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Name proposed for sequence of alternating sandstone-and-shale and limestone-and-shale formations of late Meramecian and Chesterian age that lie above Mammoth Cave Megagroup (new) and that are overlain by Pennsylvanian and younger rocks. In general, includes those rocks which in early reports were assigned to Kaskaskia, Huron, or Chester Groups in different areas. Kaskaskia and Huron have been abandoned in this sense, and both are used in current stratigraphic literature for entirely different units. Chester is now used almost entirely in time-stratigraphic sense. Base of megagroup has been described as upper surface of Mammoth Cave Megagroup. The Pope is truncated by sub-Absaroka or "pre-Pennsylvanian" unconformity, though there may be no unconformity at places in southern Midcontinent basins, Black Warrior Basin, and southern Appalachians. Has discontinuous distribution. In Illinois Basin thickens from featheredge at north to about 1,300 feet at south. Megagroup may be useful in Black Warrior Basin, where its base is younger toward east, and in Appalachian Basin where its base is younger toward south. In Appalachians carbonate components pinch out northeastward, and megagroup is replaced by nonmarine red beds of Mauch Chunk. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Named for Pope County, southern Illinois.

Poplar Tank Member (of Skinner Ranch Formation)

Lower Permian (Leonard): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1583, 1584 (fig. 2), 1585, 1587. Name applied to shale between Decie Ranch Member (new) below and Sullivan Peak Member (new) above. Composed mostly of dark-brownish crumbly shale and siltstone, and layers of sandstone, pebble conglomerate, calcarenite, shell breccia, and fusulinids. Thickness about 250 feet. Member extends entire length of Lenox Hills. In Dugout Mountain separates the Decie Ranch Member from Sullivan Peak Member.

Type section: In face of Hill 5300, central Lenox Hills, Altuda quadrangle, Brewster County. This section is about middle of Lenox Hills in P. B. King's (1931, Texas Univ. Bull. 3038) section 11, Leonard Formation (beds 1 to 6). Poplar Tank is 1½ miles south of east end of Lenox Hills on King's (1931) geological map of Glass Mountains.

Popovich [formation] unit

Upper Devonian: Eastern Nevada.

B. S. Hardie, 1966, Nevada Bur. Mines Rept. 13, p. 76 (fig. 4), 77, 78. Two lower-plate sedimentary formations crop out in Carlin gold mine area. Upper part of "Popovich" unit is gray fossiliferous medium- to thin-bedded bedded limestone with sandy limestone with some bioclastic units. Stratigraphically below these sediments are alternating limy siltstone and dolomitic siltstone with intercalated limestone areas. Upper Devonian on basis of fossils. Appears to be an unconformity with some movement between the "Popovich" and subjacent Roberts Mountains formation of Silurian age. In fault contact with Ordovician Vinini formation of upper plate of thrust.

Present in Carlin mine area, Lynn district, northern Eureka County.

Poppin Shale Member (of Anita Shale)

Eocene, middle: Southwestern California.

T. W. Dibblee, Jr., 1950, California Div. Mines Bull. 150, p. 26. About 30 feet of highly foraminiferal red and green clay shale known as "Poppin shale" occurs from 200 to 400 feet below top of the Anita in Santa Anita Canyon. The Poppin shale and Sierra Blanca limestone in Jalama Canyon occur at about the same horizon in the Anita shale, and it is possible that this horizon may be the base of the Eocene section of the Santa Ynez Range.

D. W. Weaver, 1962, California Univ. Pubs. Geol. Sci., v. 37, no. 5, p. 354 (fig. 2), 358 (fig. 3), 359–360. In vicinity of Nojoqui Park, Santa Barbara County, the Anita consists of three units, lower member, Poppin' shale member, and upper member. Poppin' shale consists of red calcareous, richly foraminiferal mudstone which attains thickness of about 20 feet. Believed to persist throughout western and central part of Santa Ynez Mountains stratigraphically within a few hundred feet of Matilija-Anita contact. Ulatisian.

R. M. Kleinpell and D. W. Weaver, 1963, California Univ. Pubs. Geol. Sci., v. 43, p. 8, fig. 2. Traditionally, red beds have been regarded as of continental origin, or at least to be poor hunting ground for marine foraminifers. After long experience with Sespe formation, J. R. Dorrance found a rare exception or two, and mapping on Ranch San Julian in western Santa Ynez Range some thirty years ago, he sank his pick into what is now known as upper Anita formation. In the laboratory, D. D. Hughes exclaimed at the consequences: "Why, the forams just pop out of this red shale!" Ever since, in the *lingua franca* of Coast Range geologists and paleontologists, with or without the final letter "g" that is now formally missing, this unit has been known as the "Popping shale."

Portage Creek Agglomerate Member (of Talkeetna Formation)

Lower Jurassic: Southern Alaska.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 14—18, pls. Composed mainly of fragmental volcanic ejecta somewhat similar to that of underlying Marsh Creek Member (new), the main difference being in the form and color of the ejecta. In this member the fragments are mostly rounded volcanic bomb-type detritus, and form massive beds of agglomerate and lapilli tuff having an overall red or pink color. Thickness believed to be between about 2,250 feet and 2,850 feet. Underlies Horn Mountain Tuff Member (new).

Type section: On south shore of Tuxedni Bay. Section starts about 2.4 miles northwest of Fossil Point and continues along shoreline to contact with underlying Marsh Creek Member.

Portal Schist

Cretaceous: Southern California.

J. G. Evans, 1967, Dissert. Abs., v. 27, no. 11, sec. B, p. 3991. Segment of San Andreas fault zone in Leona Valley, west of Palmdale, selected for structural analysis includes (1) Mesozoic or older diorite and gneiss and Antelope Granodiorite, (2) Cretaceous or older Pelona and Portal Schists, (3) middle Pliocene Anaverde Formation, and (4) Pleistocene to Recent terrace gravels and alluvium.

Area is west of Palmdale, Los Angeles County.

Porter Peak Limestone

Cambrian: Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 15—17, 36 (table 1), pl. 1. Upper two-thirds of massive blue-gray limestone; lower part contains ½- to 2-inch black and tan bands of dolomitic limestone and two intraformation limestone conglomerate layers. Thickness about 3,200 feet. Overlies Edgemont Formation (new); underlies Aura Formation (new), both contacts conformable.

Named after Porter Peak in northern part of Bull Run quadrangle, Elko County. Two of the three summits of Porter Peak are developed on the limestone.

Port Huron Substage or Subage

Pleistocene (Wisconsin): Illinois.

J. L. Hough, 1958, Geology of the Great Lakes: Urbana, Illinois Univ. Press, p. 94, 95, 96. A substage of the Wisconsin Mankato.

D. R. Stewart, 1961, Vermont Geol. Survey Bull. 19, p. 17. Retention of terminology used by Leighton would be less confusing than that proposed by Hough.

J. E. Moore, 1961, Jour. Sed. Petrology, v. 31, no. 2, p. 404. In this report Leighton's "Mankato Subage" has been replaced by "Port Huron Subage"; the two names probably are correlative but the name based on the local Port Huron morainic belt is considered preferable in order to avoid confusion.

Possession Drift

Pleistocene: Northwestern Washington.

D. J. Easterbrook, 1965, *in* Internat. Assoc. Quaternary Research, 7th Cong., Boulder Colo., Guidebook Field Conf. J, Pacific Northwest, p. 68—75. Overlies Whidbey Formation (new). Separated from Vashon till by thin sand unit. Thickness about 60 feet. Radiocarbon dating gives more than 40,000 years B.P.

D. J. Easterbrook, D. R. Crandell, and E. B. Leopold, 1967, Geol. Soc. America Bull., v. 78, no. 1, p. 13—20. Formal proposal of name. At type locality, herein designated, the compact gray till is underlain by peat-bearing sand and silt of Whidbey Formation and overlain by younger sand and Vashon till. Thickness of Possession Point about 80 feet in eastern part of bluffs but thins and wedges out to west. In sea cliffs along east side of Useless Bay the Possession Drift consists of 14 feet of fairly compact, gray till-like drift containing marine shells and shell fragments. The upper few feet of the drift is oxidized in what seems to be a weathering profile. Beneath the till is about 100 feet of interbedded sand, silt, clay, and peat of Whidbey Formation. Overlying it is about 15 feet of sand in turn overlain by about 15 feet of Vashon Drift. Possession Drift is discontinuous, appearing and disappearing laterally within a few hundred yards in sea-cliff exposures. Base of the drift at Possession Point is about 135 feet above sea level and at Useless Bay about 90 feet, but elsewhere ranges from below sea level to 150 feet above sea level. Radiocarbon date from wood in Possession Drift on east side of Useless Bay indicates age of more than 40,000 years. As indicated by this age, the Possession Drift is older than the "classical Wisconsin", but its fresh appearance suggests that it is younger than Puyallup Interglaciation.

Type locality: Sea cliffs at Possession Point, southernmost tip of Whidbey Island, Puget Sound.

Postal Rift flows

Holocene: Hawaii.

D. W. Peterson, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—667. An informal term applied to lava flows that were products of 1919 and 1918 eruptions of Kilauea.

Present on northern part of Kilauea caldera.

Potash Sulfur Springs Igneous Complex

Upper Cretaceous: Southeastern Arkansas.

J. S. Hollingsworth, 1967, Geol. Soc. America Guidebook Field Conf., central Arkansas, Nov. 18—19, p. 22—25. Potash Sulfur Springs igneous complex intruded folded and faulted Paleozoic rocks. The intrusive is a circular alkalic igneous complex. Outer ring of complex is alkali syenite and fenite. Much of central part of complex is nepheline syenite. Sedimentary rocks in immediate vicinity of Potash Sulfur Springs intrusive range from Ordovician (Bigfork Chert) to Mississippian (Stanley Shale) in age.

At Wilson Springs, Garland County. Wilson Mineral Springs was formerly known as Potash Sulfur Springs.

Potato Mountain Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacramento Geol. Soc. Guidebook Ann. Field Trip June 18—19, p. 12, 14, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, Mount Biedeman, and Silver Hill. Potato Mountain Series occupies more of the area than any of the other series. Consists principally of lavas that range from latite to andesite in composition and pyroclastic deposits. Lava flows are extensive and range up to several tens of feet in thickness individually. Pyroclastic rock, tuff breccia, is subordinate in amount to the lavas. It is well indurated and consists of angular blocks of andesite and latite set in finer grained matrix of rock fragments and volcanic ash.

Makes up high portions of Bodie Hills, generally above 8,000-foot elevation, and extends from its sources in Bodie quadrangle at Potato Peak and Bodie Mountain northward into Bridgeport quadrangle.

Potsdam Sandstone Megagroup

Upper Cambrian and Lower Ordovician: Central North America.

D. H. Swann and H. B. Willman, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 471—483. Potsdam Sandstone of Croixan (Upper Cambrian) and possible early Canadian (Lower Ordovician) age rims Adirondack Mountains. It rests on varied Precambrian rocks and is overlain by alternating dolomite and sandstone beds that in places are as old as Franconian (Middle Croixan) but elsewhere are as young as early Cambrian. Herein proposed that name Potsdam be extended in form of Potsdam Sandstone Megagroup to entire body of sandstone which blankets the Precambrian of the stable continental interior and in turn is covered by dolomites, alternating dolomites and sandstones, or shales of Cambrian or Canadian age. Relation of megagroup of interior to Middle and Lower Cambrian sequences of Appalachians is obscure. Megagroup not exposed in Illinois. All Potsdam deposits in southwestern Illinois are referred to La Motte Sandstone and those in northern Illinois to Mount Simon Sandstone. Consequently, the megagroup is unnecessary in much of Illinois and is justified only near northwestern corner and in neighboring states where several formations above Mount Simon are sandstones. Thus the Eau Claire, Mount Simon, and Galesville which belong to Dresbach Sandstone Group belong to Potsdam Sandstone Megagroup. Comparable situations are present above the Galesville that maintain individuality as they are traced from positions within Potsdam Sandstone Megagroup to positions within contemporaneous dolomite mass (Knox Dolomite Megagroup) on south. Actually boundary must be raised in parts of northwestern Illinois to base of Potosi (St. Lawrence) Dolomite of Trempealeauan age so that Potsdam Megagroup includes not only formations in Dresbach Group but Ironton Sandstone, Franconia Formation, and Arcadia Sandstone at base of Trempealeauan. Term "megagroup" is proposed as formal designation for rock-stratigraphic unit larger than group. Although comparable in size with series and systems, megagroups are defined in terms of lithology and transect boundaries of units that are based on time of deposition.

Potter Hill Granite Gneiss

Mississippian(?) or older: Rhode Island and Connecticut.

Tomas Feininger, 1965, U.S. Geol. Survey GQ Map 403. Consists of fine- to medium-grained orange to pink equigranular to rarely porphyritic very strongly foliated granite gneiss; fine-grained tan equigranular generally massive or very weakly foliated granite of magmatic origin; and interlayered granite gneiss, fine-grained alaskite gneiss, fine-grained equigranular biotite-quartz-diorite gneiss, and albite schist. May be gradational with part of Hope Valley Alaskite Gneiss.

Tomas Feininger, Feb. 1965, Dissert. Abs., v. 25, no. 8, p. 4649. Younger than Escoheag Quartz Diorite Gneiss (new) and older than Hope Valley Alaskite Gneiss.

Type locality: Exposures west of road in village of Potter Hill, Rhode Island.

Potter Hollow Formation (in Hamilton Group)

Potter Hollow Member (of Gilboa Formation)

Middle Devonian: Southeastern New York.

F. W. Fletcher, 1962, New York State Geol. Assoc. Guidebook 34th Ann. Mtg., p. D—4, pl. 4. Strata called Kiskatom by Chadwick (1932) is divided into three units. Lower zone, which loses its red beds rapidly to west and south, is designated Plattekill Formation. Middle zone is called Potter Hollow Formation. Upper red zone is Oneonta Formation.

F. W. Fletcher, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 31 (fig. 4), 32. Basal member of Gilboa Formation. Consists of sequence of thin very light gray protoquartzites, medium-dark-gray crossbedded subgraywackes, brown sandy coquinites, and fossiliferous medium-dark-gray shales. Member traced to M. Gans No. 1 well, 5.7 miles south of type locality, where 218 feet are present and along Catskill Front to Kaaterskill and Plattekill Cloves. At these last localities only thin medium-dark-gray shales mark position of Potter Hollow.

F. W. Fletcher, 1967, New York State Geol. Assoc. Guidebook 39th Ann. Mtg., p. C 3. Referred to as formation. Was originally believed to be an easterly extension of part of Gilboa Formation (Fletcher, 1963). Subsequent field tracing has established that it is an easterly tongue of Cooperstown Formation. Portland Point Limestone of upper Hamilton lies within the Potter Hollow. Overlies Plattekill Formation. Underlies Manorkill Formation.

Type section: Along tributary of Catskill Creek, 1.6 miles southwest of village of Potter Hollow, Durham quadrangle, at an elevation of 2,000 feet. Named after Potter Hollow, Greene County.

Poudre Pass Rhyolite (in Specimen Mountain Volcanics Group)

Oligocene—Miocene: North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Specimen Mountain Volcanics of Wahlstrom (1944, Geol. Soc. America Bull., v. 55, no. 1) raised to group rank to include (ascending) Poudre Pass Rhyolite, Lulu Latite, and Iron Mountain Rhyolite (all new). The Poudre Pass includes the lower ash-fall rhyolites of Lulu and Specimen Mountains. Locally the Poudre Pass rhyolites are composed of vent-opening breccias and agglomerates overlain by finer grained ash beds since indurated to form tuff. Pyroclastics contain features of graded bedding. Ash has accumulated close to source with individual beds deposited with initial dips radially away from source vent. Maximum thickness observed for any one flow 15 to 20 feet. Rocks of group younger than Cameron Pass Volcanics Group (new).

Mount Richthofen-Iron Mountain region, approximately 40 miles south of Wyoming border. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Powhatan Point Limestone Member (of Dunkard Group)

Permian: East-central Ohio.

H. L. Berryhill, Jr., 1963, U.S. Geol. Survey Prof. Paper 380, p. 66—67. At type locality, where member is thickest, consists of three groups of limestone beds separated by shale. Lower bench consists of single bed, middle and upper benches made up of several beds. Clayey shale 3 feet thick lies between lower and middle benches, and 2 feet of shale separates middle and upper benches. Thickness 1½ to 15 feet. Occurs about 265 feet above Washington coal bed, about 140 feet above Jollytown "A" coal bed, and about 65 to 76 feet above Big Run coal bed. In this report, Dunkard group consists of Washington and Greene formations undifferentiated.

Type locality: Prominent outcrops west of Powhatan Point along roadcut just north of saddle where road crosses ridge, near west-central edge of southwestern part of sec. 7. York Township, Belmont County.

Pozas Formation

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip in Puerto Rico Nov. 22—24, p. 3, 9, 10. Includes La Reves Sandstone, Blacho Tuff, and "Rio Bauta" Members (all new). Note 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published.

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), 49—62, pl. 1. Formal proposal of name. A sequence of reddish tuffs, volcanic breccias, conglomerates, and lavas. Thickness about 1,400 m. At base of formation is lens of lava herein called Minguillo Lava Member. Thick stratified sequence above the Minguillo is named Blacho Tuff Member. Upper part is a poorly stratified nonred sequence of volcanic breccia. Overlies Manicaboa Formation (new) with sharp contact in west-central part of Ciales quadrangle north of Cerro Cedro graben. Along north side of graben from vicinity of Quebrada Riachuelo to southwest corner of quadrangle, in fault contact with older rocks. At southeast corner of quadrangle is in juxtaposition with Magüeyes Member of Rio Orocovis Formation that is about 5,000 m stratigraphically below the Pozas. On south side of Cerro Cedro graben, downfaulted against Avispa Lava Member of Río Orocovis. Other outcrops north of Río Grande Manatí fault are in narrow blocks that have been faulted against Río Orocovis and Manicaboa Formations. Rocks of Pozas Formation were referred to as Coamo Formation by Berryhill (1961). Subsequent work has thrown doubt on direct correlation between rocks named Pozas in Ciales quadrangle and those named Coamo in south-central Puerto Rico by Glover (1961).

A. E. Nelson and W. H. Monroe, 1966, U.S. Geol. Survey Bull. 1221—C, p. C9—C12. Formation in Florida quadrangle [this report] has stratigraphic thickness of about 2,000 m. Owing to faulting neither upper nor lower contact is exposed. Formation is in fault contact with older Vista Alegre and Mameyes Formations (both new) to south and with younger Yunes Formation to the northwest; to north, is in fault contact with Avispa Lava Member of Río Orocovis Formation and is unconformably overlain elsewhere to north by middle Tertiary deposits and landslide debris. In Florida quadrangle, outcrop area of Blacho Tuff Member is limited by

Damian Arriba fault, and most of Minguillo Lava Member is concealed by younger deposits; thus, in area of present report, most of Pozas Formation is equivalent to Berryhill's upper breccia member. Here consists primarily of thick sequence of volcanic breccia and associated volcanic conglomerate; also contains deposits of crystal tuff, volcanic sandstone and siltstone, lava flows and flow breccia, lahar deposits and limestone. Several of these units have been mapped separately and include lava beds, limestone lenses, and a limestone body herein named Flor de Alba Limestone Lentil.

Named for extensive outcrops across Cerro Cedro graben in barrio Pozas, Municipio de Ciales. Formation crops out pricipally in an L-shaped area that covers extreme west-central, southwestern, and extreme southern part of quadrangle.

Preachers Formation

Middle and (or) Upper Jurassic: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Composed of 600 to 800 feet of lithic arenite, probably marine. Overlies Gardnerville Formation (new); conformably underlies Veta Grande Formation (new).

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Preachersville Member (of Drakes Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D18. Silty, limy-to-dolomitic, grayish-green, thin-bedded mudstone and thin beds of argillaceous dolomitic limestone. In northern part of Madison County, and more sporadically in Lincoln County, base is marked by as much as 6 feet of fossiliferous limestone containing colonial corals and stromatoporoids. Thickness 55 to 95 feet; 80 feet at type section. Overlies Rowland Member (new); underlies Brassfield Formation.

J. H. Peck, 1966, U.S. Geol. Survey Bull. 1224—B, p. B21, B22, B26. Near Maysville, the Preachersville Member is 25 to 30 feet thick and increases in thickness southward. Measured sections between type locality and Maysville area indicate that the Preachersville in this area is a northern extension of upper part of the member in its type area. Overlies Bull Fork Formation (new). Underlies Brassfield Formation.

G. C. Simmons and W. A. Oliver, Jr., 1967, U.S. Geol. Survey Bull. 1244—F, 13 p. Otter Creek coral bed is useful stratigraphic marker at base of Preachersville Member of Drakes Formation; it separates the Preachersville from underlying Rowland Member of the Drakes in parts of southeast-central Kentucky.

Type section: Measured southward in gully and roadcuts along Kentucky Highway 39 beginning about 2 miles southeast of Preachersville, Lincoln County.

Prescott Granodiorite

Precambrian: North-central Arizona.

M. H. Krieger, 1965, U.S. Geol. Survey Prof. Paper 467, p. 35—40, pl. 1. Crops out in city of Prescott and in several isolated masses in southern and east-central parts of Prescott-Paulden area. The various masses are correlated on basis of similarity in modal, chemical, and normative composition. Intrudes western mass of Government Canyon Granodiorite (new) and also Alder Group. Not in contact with Dells Granite (new). Has been included in Bradshaw Granite (Jaggar and Palache, 1905) which name is herein abandoned.

Named for extensive exposures in western part of city of Prescott.

Prescott Intrusive Complex

Devonian(?): West-central Massachusetts.

Peter Robinson, 1967, Massachusetts Univ. Conf. on Econ. Geology in Massachusetts, Proc., p. 33, 34, 41. Progress report on bedrock geologic mapping. Central, early-formed gabbro surrounded by strongly foliated and lineated biotite quartz diorite, granodiorite, and quartz monzonite. Cuts across axial surface of an early recumbent syncline, but strong tectonic fabric indicates emplacement prior to or during major deformation associated with formation of gneissic domes. Includes Cooleyville Granitic Gneiss (new). Older than Belchertown Intrusive Complex (new).

In Bronson Hill anticline, a complex zone of gneiss domes and recumbent folds. Lies near center of Appalachian tectonic belt of New England. Anticline underwent intense deformation and metamorphism in middle or late Paleozoic time.

Price Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Price sand occurs at depth of 9,930 to 9,950 feet in type well.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Price blanket sand included in McFearin Tongue of Terryville Sandstone (new).

Type well: Atlantic Refining Co., No. 1 Price, sec. 7, T. 18 N., R. 3 W., Grambling field. Reference well: W. C. Feazel Int., No. 1 Ellis, sec. 5, T. 18 N., R. 3 W., Grambling field, Lincoln Parish.

Prices Falls Member (of Clarita Formation)

Silurian: South-central Oklahoma.

T. W. Amsden, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 942—945. Clarita elevated to formation rank and divided into two members Prices Falls, below, and Fitzhugh above. At type section, the Prices Falls consists of 2 feet of green and red, slightly fissile shale, overlain by Fitzhugh Member and unconformably underlain by either Cochrane Formation or Keel Formation. Beds have yielded conodonts that indicate a late Llandoverian age.

Type section: Section at Prices Falls in SW¼NW¼ sec. 33, T. 1 S., R. 2 E. Named from exposures at Prices Falls, about 2 miles east of U.S. Highway 77 in Murray County.

Priest Rapids Member (of Yakima Basalt)

Priest Rapids Basalt Member (of Yakima Basalt)

Miocene, upper: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 5, 8, 23—25, 35, 39. Four flows that overlie Roza Basalt Member (new) at Priest Rapids Dam are referred to collectively as Priest Rapids Basalt Member. Thicknesses based on drill holes at damsite are (ascending) flow no. 1, 30 ± 5 feet; no. 2, 40 ± 5 feet; no. 3, 60 ± 5 feet; and no. 4, 90 ± 10 feet. Flow no. 4 is directly overlain by Ellensburg Formation or by basalt flows interbedded in Ellensburg. Overlies Roza Basalt Member (new) of Yakima. Also includes Quincy diatomite (new). Laval (1956, unpub. thesis) assigns to Priest Rapids Basalt Member a thick sequence of strata measured in many sections in an area of several thousand square miles in south-central Washington, south of Priest Rapids. His section near Mabton includes three "basal Priest Rapids flows," aggregating 216 feet; the Mabton sedimentary interbed, 75 feet; Umatillo flow, about 285 feet; and Sillusi flow, about 100 feet; total thickness 650 to 700 feet. His suggestion that these be considered parts of Priest Rapids Basalt is workable arrangement; any or all of them can be raised to member or formational rank as understanding of the stratigraphy develops.

J. W. Bingham and K. L. Walters, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C87-C90. Name modified to Priest Rapids Member. Geographically extended into Whitman and eastern Franklin Counties. Includes Quincy Diatomite Bed of Mackin (1961) or its equivalent in places. Overlies Roza Member.

J. W. Bingham and M. J. Grolier, 1966, U.S. Geo. Survey Bull. 1224—G, p. G3 (fig. 1), G7 (fig. 4), G9—G11. Consists of four basalt flows with total thickness as much as 220. Includes Quincy Diatomite Bed as thick as 35 feet at base in most of area. Overlies Roza Member. Underlies Saddle Mountains Member. Note on type area.

Type area: Rapids damsite on Columbia River in Yakima County.

Proskey Formation

Oligocene: Western Nevada.

R. L. Rose, 1966, Geol. Soc. America, Cordilleran Sec., Guidebook for Field Trips April 6—11, p. C3. Listed on section showing Cenozoic stratigraphy for southeastern Virginia Mountains. Consists of olive gray claystone. Thickness 300 feet. Underlies Hartford Hill Formation. Overlies unnamed Jurassic metamorphic and granitic rocks.

Present in Truckee Canyon east of Reno.

Prosser Member (of Wenas Basalt)

Pliocene: South-central Washington.

W. N. Laval, 1966, (abs.) Northwest Sci., v. 40, no. 1, p. 39. Wenas Basalt comprises: Lower Member, Prosser Member, and Upper Member.

W. N. Laval, 1966, *in* Fourth Ann. Engineering Geology and Soils Engineering Symposium, Moscow, Idaho, p. 98—99. Formal proposal of name. At all localities examined in Yakima-Wallula Gap-Maryhill area the Wenas Basalt consists of one flow, or two flows and an interlayered sedimentary unit, the Prosser Member. Name is modification of Mason's (1953, unpub. thesis) Prosser Member of Columbia River Basalt. Thickness of

Prosser Member 20 to 100 feet. Main lithologies are pumicites and sandstones similar to those in Selah Formation. Near Kiona, impure diatomite is associated with opal in the Prosser.

Named for exposures south of Prosser on north side of Horse Heaven Hills.

Prosser Creek alluvium member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1962, Sacramento Geol. Soc. Guidebook Ann. Field Trip, June 9—10, p. 61, fig. 2 (map). Informal term applied to alluvium deposited when latite flows along east side of Truckee Basin entered drainage causing widespread aggradation upstream.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Overlies andesite bedrock, Truckee(?) formation, and Lousetown flows that crop out along west side of [Truckee] basin and is in turn overlain by glacial deposits. Maximum thickness about 120 feet. Evidence demonstrates that Prosser Creek alluvium was laid down in response to damming of drainage by Hirschdale flow (new).

Mapped in Prosser Creek area. Also exposed along Prosser Dam Road, Truckee area, north of Lake Tahoe.

Proviso Siltstone Member (of Eau Claire Formation)

Cambrian: Northeastern Illinois (subsurface).

T. C. Buschbach, 1964, Illinois Geol. Survey Rept. Inv. 218, p. 15 (fig. 9), 32—33. Name proposed for fine-grained clastic unit that overlies Lombard Dolomite Member (new). Thickness 150 to more than 300 feet. Occurs between 1,385 and 1,535 feet in type well. Underlies Galesville Sandstone.

Type well: Layne-Western The Wonder Co. No. 11, sec. 10, T. 39 N., R. 11 E., Du Page County. Named for Proviso Township, western Cook County, about 2 miles west of type well.

Pruitt Ranch Limestone Member (of Oil Creek Formation)

Middle Ordovician: South-central Oklahoma.

R. W. Harris and R. W. Harris, Jr., 1965, Tulsa Geol. Soc. Digest, v. 33, p. 144—161. Symposium on the Simpson. Name Pruitt Ranch Limestone Member applied to a limestone at top of the Oil Creek in Criner Hills area. Thickness 90 feet. Predominantly birdseye limestone. Overlies undifferentiated part of Oil Creek. Unconformable with overlying McLish Formation.

Type section: At northern end of Criner Hills, directly west of a small stock pond on Rosabelle Pruitt Ranch, in NW sec. 16, T. 5 S., R 1 E., Carter County. Here strata strike 60° NW and dip 50° to 52° E. Outcrops limited to topographic ridge (and eastern slope) at north end of Criner Hills.

Pryor Member (of Georgetown Formation)

Lower Cretaceous: Southern Texas (subsurface).

J. A. Winter, 1961, Gulf Coast Assoc. Geol. Soc. Trans., v. 11, p. 20—21, 1962, *in* Contributions to the geology of South Texas: San Antonio, South Texas Geol. Soc., p. 86, 92. Name proposed for thick limestone unit overlying McKnight formation (new) and underlying typical Georgetown of San Marcos basin. In type well occupies interval between 2,720 to 3,022 feet (well depth).

Type well: T. P. Cannon No. 1 A. Finley well in northwestern Zavala County.

Puddle Springs Arkose Member (of Wind River Formation)

Eocene, lower: West-central Wyoming.

P. E. Soister, 1966, U.S. Geol. Survey Bull. 1244—A, p. A42—A46. Mainly massive coarse-grained to very coarse grained arkosic sandstone and granite granule-to-boulder conglomerate at top of the Wind River. Thin beds of finer grained feldspathic to arkosic sandstone, siltstone, claystone, and sparse thin beds of carbonaceous shale. Most of fine-grained beds are less than 10 feet thick. Maximum thickness about 400 to 800 feet, but thins to zero by overlap onto the highlands. Three conglomerate beds mapped, East Canyon Conglomerate Bed, Dry Coyote Conglomerate Bed, and Muskrat Conglomerate Bed. Coarse-grained calcareous arkosic sandstone beds a few feet thick mark contact of the Puddle Springs with underlying fine-grained member of the Wind River in vicinity of Puddle Springs. Farther east, toward west flank of Dutton Basin anticline, the base of the Puddle Springs rises by interbedding of arkose with numerous stratigraphically higher fine-grained beds. Between Willow Springs Draw and the anticline, a carbonaceous shale and coal zone 5 to 15 feet thick immediately underlies the Puddle Springs and is base of richest known uranium ore zone of district. East and south of Dutton Basin anticline, and along south edge of area of exposure, the Puddle Springs rests on rocks ranging in age from Late Cretaceous to Mississippian. Farther south it may rest on Cambrian or Precambrian rocks. Just west of Rattlesnake Range, a thick lower fine-grained member may underlie the exposed interbedded arkose and fine variegated beds. Top of Puddle Springs placed at base of lowest of several tuffaceous sandy mudstone beds, 5 to 20 feet thick, which are interbedded with coarse arkosic sandstone beds. The mudstone is similar to that in overlying Eocene Wagon Bed Formation and the zone of interbedding is referred to as upper transition zone of Wild River Formation. Type area designated but no type locality or type section.

Type area: Bounded on west by Puddle Springs Ranch and Coyote Springs, on the east by Willow Springs Draw, on north (base of member) by sec. 19, T. 33 N., R. 90 W., and on the south (top of member) by sec. 8, T. 32 N., R. 90 W., south-central Wind River Basin. Named for exposures near Puddle Springs Ranch.

Pumpkin Buttes Member (of Mesaverde Formation)

Upper Cretaceous: Wyoming.

A. G. Randall, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 12. Gray soft shales containing silt, sand, and mica. Shales locally carbonaceous. Bentonite and carbonized wood impressions common. Thickness 150 to 250 feet. Name credited to T. E. Purcell (1960, unpub. thesis).

Named after Pumpkin Buttes in Townships 43 and 44 N., Ranges 75 and 76, western Campbell County, north-central Powder River basin.

Pungo River Formation

Miocene, middle: Eastern North Carolina (subsurface).

J. O. Kimrey, 1964, Southeastern Geology, v. 5, no. 4, p. 195—205. Composed of interbedded phosphatic sands, silts and clays, diatomaceous clays, and phosphatic and nonphosphatic limestones. Dips gently to east in Beaufort County; thickness ranges from featheredge, a few miles east of city of Washington to more than 110 feet in southeastern part of county. Between depth of 224 and 276 feet in type core hole. Unconformably overlies Castle Hayne Limestone; unconformably underlies Yorktown Formation.

Type core hole: Near Belhaven, Beaufort County. Coordinates of core hole are long 76°34′59″ W., lat 35°35′58″ N. Land surface elevation 10 feet above sea level. Named for Pungo River in eastern Beaufort County.

Punta Gorda Anhydrite

Lower Cretaceous: Florida (subsurface).

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 17 (fig. 8), 36. Name applied to distinctive beds of Trinity age. Name credited to Applin and Applin (in press).

P. L. Applin and R. O. Vernon, 1965, U.S. Geol. Survey Prof. Paper 447, p. 39—43, pl. 6. Formal proposal of name. Name introduced for lithologic unit that has been penetrated in beds of Trinity age. Composed chiefly of anhydrite and contains lesser amounts of irregularly interbedded limestone, dolomite, and dark shale. Occurs at depths of 11,690 to 12,157 feet in type well. Name selected by Louise Jordan.

Type section: In Humble Oil and Refining Co. Lowndes Treadwell 1 A, sec. 17, T. 42 S., R. 23 E., Charlotte County. Named for city of Punta Gorda, about 6 miles north of Treadwell well.

Punta Papayo Member (of Parguera Limestone)

Upper Cretaceous: Puerto Rico.

C. C. Almy, Jr., 1965, (abs.) Houston Geol. Soc. Bull., v. 8, no. 3, p. 16. Composed of mudstones containing abundant open-ocean microfauna, minor calcarenite, slump structures, and uncommon bedded chert. Gradational contact with underlying Bahia Fosforescent Member (new). Underlies Isla Magüeyes Member (new). Early-Late Campanian.

Punta Melones-Ensenada area, southwestern part of island.

Purdy Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Purdy sand occurs at depth of 9,610 to 9,645 feet in type well. Term Purdy new in this report.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Purdy blanket sandstone included in Vaughn Tongue (new) of Terryville Sandstone (new).

Type well: Socony Mobil Oil Co., No. 2 Purdy, sec. 30, T. 18 N., R. 1 E., Calhoun field. Reference well: Arkansas-Louisiana Gas Co., No. 1 Chapman, sec. 32, T. 18 N., R. 1 E., Calhoun field, Ouachita Parish.

Purple Mountain Pumice Breccia

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 393, pl. 1. Two-feldspar rhyolite; stratified; in part welded. Thickness up to 1,000 feet. Underlies Yellowstone tuff (new). Younger than Jackson flows (new).

Named for exposures on Purple Mountain, a peak on north rim of Madison Canyon, Yellowstone National Park. Limited to Madison Canyon and Stonetop Mountain areas.

Pybus Formation

Pybus Dolomite

Permian: Southeastern Alaska

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 36—43, pl. 1. Light-brownish-gray fossiliferous cherty dolomite. Maximum thickness about 1,000 feet. Precise measurement not justified because of numerous strike faults that repeat small folded sections of the dolomite. Overlies Cannery Formation (new); underlies Triassic Hyd Formation (new).

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C25—C26, pl. 1. Discussion of stratigraphy of Keku Islets and neighboring parts of Kuiu and Kupreanof Islands. Because unit is dominantly limestone in Keku Strait area and everywhere contains abundant chert, name is herein changed to Pybus Formation. Conformably overlies Halleck Formation (new) on Kuiu Island and Keku Islets. On Kupreanof Island appears to conformably overlie Cannery Formation. On Kuiu Island, formation is disconformably overlain by Keku Volcanics (new) of Late Triassic age and in Keku Islets and east of Keku Strait by Burnt Island Conglomerate (new) also of Late Triassic age.

Type locality: Pybus Bay, Admiralty Island.

Pyle Mountain Argillite

Upper Ordovician: Northeastern Maine.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. No. 2, p. 16 (table 2), 20—22, pl. 1. Olive-colored argillite. To north unit becomes more calcareous and tends to be grayer in color. Average thickness, estimated from cross-section, about 600 feet. Appears to lie stratigraphically above unit Ovs, which includes rocks of same age as Ribbon Rock member of Meduxnekeag formation in addition to older rocks. Underlies Frenchville formation (new).

Type section: Fossiliferous exposures along road extending across north slope of Pyle Mountain at intersection with Turner Road, Presque Isle quadrangle.

Pyramid Peak granodiorite

Triassic(?)-Jurassic: Northeastern California.

A. A. Loomis, 1966, Jour. Petrology, v. 7, no. 2, p. 221—245. Pyramid Peak granodiorite shown on map in report on contact metamorphic reaction and processes in Mount Tallac roof pendant, Sierra Nevada.

Area of report is Fallen Leaf Lake quadrangle just south of Lake Tahoe.

Pyramid Peak Limestone

Upper Silurian: Southeastern Alaska.

D. L. Rossman, 1963, U.S. Geol. Survey Bull. 1121—K, p. K10 (fig. 2), K16—K17, pls. 1, 2. Mainly light-colored thin-bedded to moderately thick-bedded limestone; some argillaceous beds in upper part. Basal part grades into succession of dark-gray to nearly black thin-bedded limestone 300 to 500 feet thick. Beds are 1 inch to 3 feet thick, but most of rock is made up of beds 2 inches to 1½ feet thick. Calculated thickness 2,200 feet. Overlies Tidal formation (new), may be slight angular unconformity; underlies Rendu formation (new), contact placed where thin-bedded limestone succession changes to an interbedded argillite and limestone succession.

Named from exposures on west side of Pyramid Peak, Mount Fairweather quadrangle, Glacier Bay. Most complete section crops out on lower eastern flank of Black Cap Mountain, 1 mile north of northern shore of Tidal Inlet. Also forms central part of northward-trending spur of 3,082-foot mountain, 2 miles southeast of Tidal Inlet.

Quail Lake Formation

Miocene, upper: Southeastern California.

T. W. Dibblee, Jr., 1967, U.S. Geol. Survey Prof., Paper 522, p. 58—60, pls. A marine and brackish-water sedimentary sequence of shale, sandstone, and conglomerate of late Miocene age. Lower part of formation mostly shale that grades laterally northeastward into sandstone. Conglomerate at base. Upper part nearly all sandstone. Thickness at type section 2,550 feet. Unconformable on Neenach Volcanic Formation (new) and Mesozoic granite. Gradational upward and laterally northwestward into fluviatile beds of Oso Canyon Formation (new). Has been referred to Santa Margarita Formation by some authors.

Type section: Exposed from point 2½ miles N. 60° W. of center of Quail Lake eastward down ridge for 1½ miles, Los Angeles County. Exposed northeast of San Andreas fault, in hills northwest of Quail Lake, and in hills southeast near La Liebre Ranch.

Quarry Mountain Formation

Upper(?) Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 42—52, pls. A, B. Name proposed for high-purity limestones and calcitic dolomites formerly included in "St. Clair Formation" by Huffman (1950, Oklahoma Geol. Survey Bull. 77). Comprises two members, both new: an upper Marble City and a lower Barber. Thickness 154 feet at type locality. Overlies Tenkiller Formation (new); unconformably underlies Devonian or Mississippian strata.

Type locality: On east side of Quarry Mountain, in quarry of St. Clair Lime Co., SE¼SE¼NE¼ sec. 14, T. 13 N., R. 23 E., Sequoyah County.

Quartz Creek Granite

Precambrian: Central Colorado.

A. L. Aldrich and others, 1956, Jour. Geophys. Research, v. 61, no. 2, p. 215—232. Discussion of radioactive ages of minerals from Brown Derby pegmatite and Quartz Creek granite. Age of 1350+100 m.y. for both pegmatite and granite. Also referred to as Quartz Creek pegmatite district.

G. W. Wetherill and M. E. Bickford, 1965, Jour. Geophys. Research, v. 70, no. 18, p. 4669—4686. Earliest isotopic Rb-Sr and K-Ar age determinations in central and southern Rocky Mountain region indicated a widespread occurrence of rocks having mica ages of about 1350 m.y. This was interpreted as representing time of emplacement of these granites and also as time of regional plutonism and metamorphism. In this early work some puzzling results were found. For example, isotopic U-Pb ages on zircons from Quartz Creek granite, although discordant, indicated age values as high as 1700 to 1750 m.y. Subsequent work has yielded many similar results but in addition has resulted in a confusing spread of ages ranging from 900 m.y. to 1700 m.y. The lower values, largely K-Ar, can be interpreted as resulting from loss of argon from biotite. However, occasional higher ages, obtained by U-Pb on zircon and in a few cases by other methods, have raised the possibility that the 1350 m.y. ages are the result a metamorphism subsequent to the original crystallization of the granite. Results of present study suggest that mineral ages previously measured in central Colorado may largely reflect the 1350-m.y. event and that the primary age of much of the basement is 1650 m.y. or older.

Quartz Creek pegmatite district near Gunnison, Colo.

Quartz Mountain Basalt Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 9, 37. Overlies Holdout Member and underlies Burnt Mountain Member (both new). Thickness 54 feet.

Type locality: On slope of Quartz Mountain, SW¼ sec. 32, T. 24 S., R. 43 E., Malheur County.

Quebrada Arenas Limestone Member (of Cibao Formation)

Oligocene, upper, and Miocene, lower: Puerto Rico.

W. H. Monroe, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—334. At type section consists of 30 m of alternating layers of hard finely crystalline limestone and softer chalky limestone. Underlies Miranda limestone member (new). On basis of preliminary fossil studies it is believed that the Cibao below the Quebrada Arenas limestone member is of Oligocene age.

Type locality: 360 m north of southern edge of Manati quadrangle and 3,900 m west of eastern edge. Named from exposures on Route 645 on slope down to Quebrada El Toro from Escuela Quebrada Arenas.

Quiburis Formation (in Gila Group)

Pliocene and Pleistocene: Southeastern Arizona.

L. A. Heindl, 1963, U.S. Geol. Survey Bull. 1141—E, p. E15, E21—23, pls. 1, 3. Name proposed for valley-wide alluvial deposits that now underlie most of San Pedro Valley. Includes two units. Lower unit includes fine-grained deposits exposed in center of valley and the coarser deposits into which they grade laterally. It consists of lake beds of finely laminated very light brown to pinkish mudstone, sandy mudstone with stringers of small pebbles, interbedded tuff, and pumiceous and diatomaceous deposits. Upper unit, recognized only on east side of valley, composed of conglomerate that disconformably overlies lower units, and contains channel-type crossbedding, is poorly sorted, bedded, and consolidated. It extends eastward to Copper Creek fault, along which it has exposed thickness of about 700 feet. Thickness of formation 300 to 700 feet on west side of San Pedro River near Cholla fault where unit overlies Cloudburst formation. Total thickness about 1,700 feet in central part of valley. Relationship between San Manuel formation (new) and Quiburis not shown clearly in any one exposure. The two formations are separated along San Manuel and Cholla faults. On south side of Mammoth and east of Cholla fault, a block of San Manuel lies within the Quiburis. At south end of San Manuel fault the San Manuel formation apparently grades upward into the Quiburis. Overlain disconformably by Sacaton formation (new) in central part of valley and by younger alluvial deposits along San Pedro River and major tributaries.

L. D. Agenbroad, 1967, Dissert. Abs., v. 28, no. 2, sec. B, p. 737. In Redington-San Manuel area, subdivided into two members, Tres Alamos and Redington.

Named for Lake Quiburis, and ancient lake in San Pedro trough, Pinal County. Term "Quiburis" is derived from early Spanish name for San Pedro River, the Rio de San Joseph de Quiburi, and also from name of long-abandoned Indian settlement a few miles south of Benson.

Quincy diatomite (in Priest Rapids Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 7—8, 25, 26, 40. In vicinity of Columbia River only one of Priest Rapids flows extended north of Frenchman Hills. Throughout western part of Quincy Basin this flow rests, not directly on Roza flow (new) but on widespread sheet of diatomite, as much as 20 feet thick, here designated Quincy diatomite. Diatomite bed extends southward across axial part of Frenchman Hills anticline, terminating on its south flank.

Named for occurrence in Quincy Basin.

Quinebaug Formation (in Putnam Group)

Middle Ordovician(?): Eastern Connecticut.

H. R. Dixon, 1964, U.S. Geol. Survey Bull. 1194—C, p. C8—C11. Name given to thick sequence of metamorphosed volcanic and sedimentary rocks directly underlying Tatnic Hill Formation (new). Uppermost part of formation well exposed in steep east-facing cliffs, and contact with overlying Tatnic Hill Formation is at or near top of these cliffs. Base not present in this area, as lowermost rocks are in fault contact with underlying alaskite gneiss and quartzite. Divided into three members: upper and lower (both unnamed) are primarily metavolcanic rocks, and the middle, the Black Hill Member, metasedimentary rocks. Maximum thickness about 7,000 feet above fault in Plainfield quadrangle. Maximum thickness about 5,000 feet in Danielson quadrangle, but only exposed contact is top of formation. No type locality given for unit as a whole. Pre-Pennsylvanian.

Robert Zartman and others, 1965, U.S. Geol. Survey Prof. Paper 525—D, p. D1. Implications of new radiometric ages in eastern Connecticut and Massachusetts. Probably Middle Ordovician or older.

Named for Quinebaug River, which in Plainfield and Danielson quadrangles, flows only over rocks of formation.

Quinn River Formation

Middle Triassic: Northwestern Nevada.

Ronald Willden, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—116. Mentioned in discussion of major westward thrusting of post-Middle Triassic rocks in northwestern Nevada. Consists of silty shale with thin chert and carbonate beds and scattered thin gypsum beds. Thickness about 600 feet. Contains Middle Triassic pelecypods and ammonites.

Ronald Willden, 1964, Nevada Bur. Mines Bull. 59, p. 41—42, pl. 1. Principally silty shale. Basal unit of formation consists of about 10 feet of thin-bedded gray chert interbedded with gray siliceous shale. Above the chert, the formation is principally light-gray to light-brown silty shale with a few beds 1 to 5 feet thick of light grayish-brown to dark-gray limestone and thin beds of brown to dark-gray chert. Gypsum occurs throughout section in beds up to about half an inch thick, lying several inches to several feet apart. Thickness 500 to 600 feet. Formation apparently gradational from a chert-siltstone-sandstone sequence of Permian and Triassic undivided, but top of formation is not exposed. The Quinn River, the underlying chert-siltstone-sandstone unit, and the limestone unit beneath lie on upper plate of a thrust which overrides the Happy Creek Group. A subsidiary thrust, which has a displacement of about 50 feet, cuts across the base of the Quinn River; derivation of name.

Named for exposures on west front of Kings River Range about 6 miles southeast of Quinn River Crossing, Humboldt County.

Rabbit Ears Volcanics

Oligocene and Miocene(?): Northwestern Colorado.

G. A. Izett, 1966, U.S. Geol. Survey Prof. Paper 550—B, p. B42—B46. Extrusive volcanic rocks. Includes lower thin unit of olivine-bearing trachyte flows, Pete Gulch Member, and a thick upper part composed of intercalated tuff, breccia, and lavas of silicia to intermediate composition. Where exposed at Elk Mountain, Corral Peaks, and along lower reaches of East Fork Troublesome Creek, bulk of formation comprises about 800 feet of poorly bedded and sorted breccia and tuff breccia interlayered with tuffs and lavas. In most areas unconformably overlies rugged erosion surface cut on Middle Park Formation and older rocks. Locally overlain by Miocene Troublesome Formation or by Grouse Mountain Basalt (new). Isotopic K—Ar age of 33±3 m.y., or Oligocene, obtained from rhyolite breccia near middle of formation.

Type area: Rabbit Ears Range, Grand County.

Rabbit Lake Formation

Precambrian: Central Minnesota.

R. G. Schmidt, 1963, U.S. Geol. Survey Prof. Paper 407, p. 11, 26—30, 33, 40, 61, pls. 1—8. Largely gray and black partly ferruginous argillite and slate at least 2,000 feet thick. Contains lenses of lean siliceous argillaceous iron-formation. Overlies Trommald formation (new). Covered by glacial drift, top not exposed.

Named for occurrence in vicinity of Rabbit Lake, Crow Wing County.

Raccoon Creek Group

Pennsylvanian (Pottsville-Allegheny): Western Indiana.

C. E. Wier and H. H. Gray, 1961, Geologic map of the Indianapolis 1° by 2° quadrangle, Indiana and Illinois, showing bedrock and unconsolidated deposits (1:250,000): Indiana Geol. Survey. Includes (ascending): Mansfield, Brazil, and Staunton Formations. Overlies Stephensport Group; underlies Carbondale Group. Consists of shale, sandstone, limestone, clay, and lenticular coal beds. Name credited to Wier (in preparation).

H. H. Gray, 1963, Indiana Geol. Survey Spec. Rept. 2, p. 10—12. Discussion of upper Patoka drainage basin. Raccoon Creek Group is about 400 feet thick, of which the uppermost 75 to 100 feet is not exposed in map area of this report. For purposes of this report the group is arbitrarily and informally subdivided into three numbered divisions. The boundaries between these divisions are the tops of the more widely traceable coal beds or the approximate position of the coal bed where the coal is absent. Top of division 2 is Mariah Hill coal. Top of division 1 is top of Pinnick coal. Division 3 is approximately equivalent to combined Brazil and Staunton Formations. Division 2 is essentially the upper part of Mansfield Formation of Gray, Jenkins, and Weidman (1960, Indiana Geol. Survey Bull. 20). Division 1 is lower part of Mansfield Formation in the usage of Gray, Jenkins, and Weidman (1960). Overlies unnamed group top of which is Menard Limestone.

Race Track sandstone

Cretaceous: Northeastern Utah.

L. A. Hale and F. R. Van DeGraaff, 1964, Intermountain Assoc. Petroleum Geologists Guidebook, 13th Ann. Field Conf., p. 131—133. Local name given to prominent hogback-forming sandstone that splits from undivided Mesaverde near the Green River in Spring Creek Gap area. The sandstone projects eastward, gradually thins by gradation to shale at base, and changes into indistinct sandy shale at Clay Basin. Correlates with a sandstone in middle Black Butte Tongue of Mancos Shale.

Present in Spring Creek Gap area between Flaming Gorge Reservoir and Clay Basin.

Raging River Formation

Eocene, middle and upper(?): Northwestern Washington.

J. D. Vine, 1962, Washington Div. Mines and Geology Rept. Inv. 21, p. 7—11, 19. Consists chiefly of fine-grained sandstone, siltstone, and claystone beds characterized by abundant marine fauna. These beds are commonly dark gray, thick bedded, hard, and weather into massive ledges. Interbedded with the harder strata are several units of friable rock as much as 200 feet thick consisting of fine- to coarse-grained sandstone, siltstone, and chert pebble conglomerate. Estimated thickness about 3,000 feet. Lower part of formation complicated by faulting, by intrusion of igneous sills, and by baking and partial recrystallization of rock constituents. Base covered by extensive glacial deposits. Upper contact placed at top of unit of fossil-bearing dark-gray claystone about 160 feet thick that is overlain by gray nonfossiliferous micaceous sandstone. Underlies Tiger Mountain Formation (new) of Puget Group; contact conformable and transitional. Older than Cowlitz Formation and widely separated from it.

Type area: On west flank and south nose of northwest-tranding anticlinal structure whose axis and east flank are covered by glacial debris and alluvial deposits along lower slopes of Raging River valley, King County. Exposed on east side of Tiger Mountain in secs. 9, 10, 15 and 16, T. 23 N., R. 7 E., directly west of valley of Raging River.

Railroad Valley Rhyolite

Oligocene: East-central Nevada.

R. B. Scott, 1965, (abs.) Houston Geol. Soc. Bull., v. 8, no. 4, p. 23. Tertiary rocks in Grant Range consist of 5,000 to 15,000 feet of rhyolitic ignimbrite sheets, nonmarine sediments, and siliceous flows. Major named units are (ascending): Sheep Pass Formation, middle to upper Eocene; Railroad Valley Rhyolite, 36 m.y.; Calloway Well Formation (new), ignimbrites; Stone Cabin Formation, ignimbrites; Windous Butte Formation, ignimbrites, 33 m.y.; Currant Tuff, Needles Range Formation, ignimbrites; Horse Camp Formation, tuffaceous fluvial and lacustrine sediments, Mio-Pliocene.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). As shown on generalized Cenozoic section of Grant Range, Railroad Valley Rhyolite, 0 to 2,700 feet thick, underlies Blind Spring Formation (new) and overlies Sheep Pass Formation. Oligocene.

Grant Range, eastern Great Basin.

Rainbow Lake Schist

Tertiary: Northwestern Washington.

J. B. Adams, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Skagit gneiss in area has been subdivided into three mappable units, McGregor gneiss, Rainbow Lake schist, and War Creek gneiss, which strike approximately N. 30 W. and dip vertically or steeply to northeast.

Area of report is Steheikin-Twisp Pass, Northern Cascades.

Rainier Mesa Member (of Timber Mountain Tuff)

Rainier Mesa Member (of Piapi Canyon Formation)

Rainier Mesa Member (of Oak Spring Formation)

Pliocene, lower or younger: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—96—D—103. Uppermost member of Oak Spring formation. Gray and reddish-brown welded tuff marked by distinct eutaxitic structure; subordinate amounts of black vitrophyre; white, pink, and tan nonwelded tuff at base; overlain by densely welded tuff locally separated by zones of partially welded or nonwelded tuff. Thickness more than 655 feet. Overlies Tiva Canyon member (new). Oak Spring Formation is Miocene(?) or younger.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Reallocated to member status in Piapi Canyon Formation (new). Overlies Tiva Canyon Member. Oak Spring raised to group rank.

J. T. O'Connor, 1963, U.S. Geol. Survey Prof. Paper 475—B, p. B52—B55. Petrographic characteristics of some welded tuffs of Piapi Canyon Formation. Rainier Mesa Member is composite sheet. Contains several multiple-flow cooling units. Some welded tuff, previously thought to belong to cooling unit of Tiva Canyon Member is actually part of Rainier Mesa Member.

D. C. Noble and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D27. Thirsty Canyon Tuff (new) unconformably overlies Rainier Mesa Member of Piapi Canyon Formation.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224—A, p. A44—A51. Piapi Canyon Formation redefined and rank raised to group to include two new formations, Paintbrush Tuff and overlying Timber Mountain Tuff. Rainier Mesa reallocated to member status in Timber Mountain Tuff. Member is overlain by informal members and one formal member (ascending) tuff of Cat Canyon, tuff of Transvaal, and Ammonia Tanks Member (new). Interpretation of potassium-argon dating Pliocene age for Timber Mountain Tuff.

The U.S. Geological Survey currently designates the age of the Rainier Mesa Member of the Timber Mountain Tuff as early Pliocene on the basis of more recent potassium-argon dating.

Type locality: Rainier Mesa, Nye County. Thickest measured section about 1 mile north of Survey Butte. Exposed on Pahute Mesa and southward to Lookout Peak and eastward to Nye Canyon.

Rainstorm Member (of Johnnie Formation)

Precambrian: Southern Nevada.

Harley Barnes, R. L. Christiansen, and F. M. Byers, Jr., 1965, U.S. Geol. Survey Geol. Quad. Map GQ—363. Fine-grained clastic rock with associated carbonates. At type section comprises top 1,025 feet of formation and is composed of a 90-foot-thick lower unit of dark-gray laminated micaceous siltstone, overlain by a 600-foot-thick middle unit of light-red-weathering interlaminated silty limestone and siltstone, which grades upward into a 335-foot-thick upper unit of moderate-brown-weathering laminated siltstone and fine-grained sandstone. Underlies Stirling Quartzite.

J. H. Stewart and Harley Barnes, 1966, U.S. Geol. Survey Bull. 1244—A, p. A37—A38. Rainstorm Member, which consists of pale- to grayish-red laminated limestone and minor amounts of limestone and very fine grained quartzite, has been recognized over extensive area of Great Basin, including Groom area, Nevada Test Site, and Spring Mountains-Death Valley region. Constitutes top 900 feet of Johnnie Formation near Johnnite Wash. A thin and conspicuous grayish-orange-weathering oolitic dolomite occurs about 70 feet above base of member in the Desert Range [this report]. This unit, informally referred to as "Johnnie oolite," is persistent and homogenous. Has been recognized in Nevada Test Site and throughout Spring Mountains Death Valley region.

Type section: On northwest flank of Twinridge Hill, 3 miles west of Rainstorm mine (Nevada central coordinates: N. 878,800 feet, E. 715,500 feet) about 1½ miles south of The Hump, Jangle Ridge quadrangle.

Rainy Drift

Pleistocene (Wisconsin): Northern Minnesota.

R. F. Norvitch, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D130—D131. Predominantly sandy, bouldery till derived from coarsely crystalline rocks. Cary stade. Older than St. Louis drift (new). Forms Vermillion moraine. Altitude ranges from 1,350 feet to 1,550 feet.

Nett Lake Indian Reservation, 35 miles south of Rainy Lake.

Rainy Creek Basalt

Mississippian-Pennsylvanian: Alaska.

A. W. Rose, 1966, Alaska Div. Mines and Minerals Geol. Rept. 20, p. 4—5, figs. 1, 2. A mafic-rich basalt. Typically dark gray, mostly aphanitic, but with sparse coarser areas pseudomorphic after original mafic phenocrysts of either olivine or hypersthene. Mode of origin is puzzling. The combination of fragmental texture with large extent (10 by 5 miles) and thickness (at least 1,500 feet and possibly several times this), lack of perceptible layering or bedding (but with interlayered or included sediments), and aphanitic character do not seem to fit basalt described elsewhere.

Rainy Creek area, Mount Hayes quadrangle, central Alaska Range.

Rainy Creek Igneous Complex

Cretaceous: Northwestern Montana.

A. L. Boettcher, 1966, Clay Minerals, v. 6, no. 4, p. 283—296, 1967; Jour. Geology, v. 75, no. 5, p. 526—553. Rainy Creek igneous complex or Rainy Creek alkaline-ultramafic igneous complex represents a composite of successive intrusions of igneous rocks emplaced into Precambrian Belt Series, probably in middle Cretaceous time. Succession began with emplacement of body of coarse-grained pyroxenite with a core of coarse-grained biotite, which is considered to have formed from accumulation of alkalies and volatiles near roof of the pyroxenite pluton. Following this igneous phase, magnetite pyroxenite intruded a zone of weakness between the biotite pyroxenite and the Belt Series, forming a ring dike surrounding the inner pyroxenite body.

Occurs in vicinity of Libby. Rainy Creek flows across part of pluton.

Ralate Formation

Age not stated: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 11, 12. Tuff, tuffaceous sandstone and siltstone. Interfingers with "Malo" Breccia (new). Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

Ralls Oolitic Limestone Conglomerate physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 23—24. Ralls Conglomerate Physiofacies is a basal unit of Cooper Lithofacies in Ralls County. Bulk of physiofacies consists of light-whitish-gray oolitic limestone containing rounded granules to boulders of oolitic limestone. May also be made up of light gray to reddish-brown oolitic limestone with chert granules and pebbles toward top of exposure. Unit as whole is medium to thick-bedded or massive. Ralls is stratigraphically equivalent, at least in part, to Shiel, Little Shaver Creek, Smithton, and Little Splice Creek Facies. Thickness 2 to 7.5 feet.

Named for occurrence in Ralls County.

Rama Formation (in Unkar Group)

Precambrian (Algonkian): Northwestern Arizona.

J. H. Maxson, 1961, Geologic history of the Bright Angel quadrangle (with geologic map): Grand Canyon Nat. History Assoc. Largely diabases and basalts which were intruded into older rocks in Bright Angel quadrangle as plugs, dikes, and sills following deposition of Dox Formation. A sill, 200 feet thick, occurs in Hakatai Shale of Bright Angel Canyon, and one of about same thickness occurs in the Hakatai at Hindu Amphitheater. A sill, 70 feet thick, occurs in upper part of the Shinumo Sandstone of Bright Angel Canyon. Basaltic fissure flows are 800 to 1,000 feet thick. Nankoweap Formation of Unkar Group; missing in Bright Angel quadrangle.

Inner Gorge of Grand Canyon.

Ramey Gravel

Quaternary: Southwestern Texas.

C. C. Albritton, Jr., and J. F. Smith, Jr., 1965, U.S. Geol. Survey Prof. Paper 479, p. 99—100, pl. 1. Gravels on surfaces of erosion in Sierra Blanca area are named (ascending): Miser, Madden, Gills, Ramey, Balluco. The Ramey consists of limestone, sandstone, quartzite, conglomerate, and extrusive and intrusive igneous rocks. Many basalt pebbles and cobbles southwest of basalt hills near U.S. Highway 80. Thickness 1 to 25 feet.

Type locality: One mile northeast of Ramey Station on Southern Pacific railroad track, Hudspeth County.

Ramey Ridge Complex

Paleozoic: Central Idaho.

B. F. Leonard, 1963, U.S. Geol. Survey Prof. Paper 450—E, p. E93—E97. An arcuate complex of syenite and quartz syenite involved with amphibolite. Rocks of complex are only outcrop of felsic plutonic rocks demonstrably older than Idaho batholith reported in area. Formerly interpreted as a slightly older facies of Idaho batholith. Not conclusively dated, but evidence from geologic relations and lead-alpha determinations on zircon suggests Paleozoic age.

Exposed in Ramey Ridge area, northeast corner of Big Creek quadrangle, Idaho and Valley Counties, Idaho.

Ramsey Formation

Paleocene(?): Western Nevada.

Joseph Lintz, Jr., ed., 1964, Conference on the history of Geology, Guidebook of field trips, August 3—21: Nevada Univ. Mackay School of Mines, p. 3. Dark-olive-green claystone. Thickness 300 feet. Unconformable above unnamed Mesozoic sediments. Unconformable below Hartford Hill Formation.

Type locality and derivation of name not given.

Ramseyburg Member (of Martinsburg Formation)

Middle and Upper Ordovician: Western New Jersey and northeastern Pennsylvania.

A. A. Drake, Jr., and J. B. Epstein, 1967, U.S. Geol. Survey Bull. 1244—H, p. H9—H12. A sequence of alternating beds of claystone slate and light-gray to medium-gray, light-brown- to yellowish-brown-weathering, thin- to thick-bedded graywacke siltstone. Thickness about 2,800 feet. Transitional contact with underlying Bushkill Member (new). Grades into overlying Pen Argyl Member. As herein defined member includes same sequence of rocks called middle sandy member by Behre (1927, Pennsylvania Geol. Survey, 4th ser., Bull. M9) and in addition includes the unit he called Bangor Beds.

Named for representative outcrops along U.S. Highway 46 and Erie Lackawanna Railroad near Pamseyburg, Portland quadrangle, Warren County, N. J. Good exposures present between Slateford, Pa., and Delaware Water Gap in Portland quadrangle and along Bushkill and Little Bushkill Creeks in Wind Gap quadrangle, Northhampton County, Pa.

Ramsey Ranch Member (of Green River Formation)

Eocene: Southwestern Wyoming.

H. W. Roehler, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 140 (chart), 145. Sequence of shallow-water lacustrine beds interbedded with some dark-colored beds of non-red bed fluviatile and paludal origin. Commonly weathers drab gray and forms series of low ridges capped by fossiliferous limestones and sandstones. Composed of gray to black, coquinal limestones, dark-gray to black shales, chocolate-brown fissile shales, green mudstones, and gray fine-grained sandstones. Thickness 920 feet at type section. Strata assigned to the Ramsey Ranch have been found throughout main body of Wasatch Formation from directly below Luman Member to within 70 feet of underlying Fort Union Formation. Luman Tongue (or Member) overlies type section establishing Ramsey Ranch as subdivision of Green River Formation.

Type section: Crops out in valley of Sage Creek in secs. 13, 14, 22, and 23, T. 14 N., R. 105 W., Sweetwater County, about 2 miles southeast of Ramsey Ranch buildings.

Rancheria Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacramento Geol. Soc. Guidebook Ann. Field Trip June 18—19, p. 12, 13, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, Mount Biedeman, and Silver Hill. Rancheria, probably one of earliest deposited, consists principally of pyroclastic deposits and minor lava flows. Several units comprise the pyroclastic deposits; principal one consists of interlayered tuffs and tuff-breccias which are locally sufficiently indurated to form cliffs. An unusual and distinctive feature of the series is boulders of granitic rock which appear to be contained in one particular horizon in the welded tuff breccia. Layers of black and dark-brown glassy, welded tuff are conspicuous. Layers of the welded tuff range in thickness from a few feet to 10 feet and can be traced along their strike for as much as 1,000 feet.

In Mono Basin, Mono County, near Conway Summit.

Rancheria Mountain biotite-augite latite

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Rancheria Mountain biotite-augite latite gave age of 8.9±0.2 m.y.

Sample collected Hetch Hetchy Reservoir quadrangle on north end of Rancheria Mountain.

Ranchester Limestone Member (of Amsden Formation)

Lower and Middle Pennsylvanian: Northwestern Wyoming.

W. W. Mallory, 1967, U.S. Geol. Survey Prof. Paper 554—G, p. G14—G17, pls. Predominantly carbonate rock that is usually gray tan, pink, or purple, dense or finely crystalline, massive and cherty. Characterized by pink to dark-red shale partings or shaly limestone beds that crop out as series of massive ledges, and by chert that commonly litters the red shale slope of underlying Horseshoe Shale Member (new). Thickness 0 to 250 feet. Underlies Tensleep Sandstone. Morrow and Atokan.

Type section: In SE¼ sec. 33, T. 57 N., R. 87 W., on Amsden Creek 4 miles west of Dayton. Reference section: At Tensleep Canyon, west flank of Bighorn Mountains, Washakie County. Name taken from Ranchester (secs. 18—19, T. 57 N., R. 85 W.) 6 miles northeast of Dayton.

Rancho Risco Member (of Cave Creek Formation)

Tertiary: Southeastern Arizona.

P. E. Damon and others, 1967, Arizona Univ. Geochronology Labs. Ann. Prog. Rept. No. C00—689—76 to Research Div. U.S. Atom. Energy Comm., p. 41. Rancho Risco Member of Cave Creek formation listed with units sampled for K-Ar dating to be used as correlation tool and to obtain a chronology of Tertiary events associated with Chiricahua ash-flow field.

Occurs in Portal area, Cochise County.

Ranger Mountains Member (of Antelope Valley Limestone)

Lower and Middle Ordovician: Southeastern Nevada.

F. M. Byers, Jr., and others, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—108. Middle member of Antelope Valley. Overlies Paiute Ridge member (new); underlies Aysees member (new). Consists of silty limestone, olive-gray, mottled yellow and red along silty layers; dominantly very thin bedded; thin-bedded brachiopod-bearing limestone in upper 50 feet. Thickness 215 feet.

F. M. Byers, Jr., and Harley Barnes, 1967, U.S. Geol. Survey Geol. Quad. Map GQ—577. Mapped in Nye County where it is 215 feet thick. Overlies Paiute Ridge Member. Underlies Aysees Member.

Type locality: Ranger Mountains, Clark County.

Raspaldo Formation (in Jacaguas Group)

Paleocene, lower, to Eocene, lower: Central southern Puerto Rico.

Lynn Glover, 3d, and P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—A, p. A32 (fig. 6), A35 (fig. 7), A36. A sequence of dominantly thin-bedded volcaniclastic rocks. Principally tuffaceous mudstone, and tuff. Thickness probably more than 600 m. Base in fault contact with underlying Miramar Formation and top in disconformable contact with Cuevas Limestone. In Coamo quadrangle, grades westward along strike into reworked tuffs of Los Puertos Formation. Microfossils indicate early Paleocene to early Eocene.

Type locality: North of Cerro Raspaldo, about 10 km southeast of Coamo.

Rathbunville School Member (of Baldwin Corner Formation)

Lower Canadian: Eastern New York.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 156, 157. Name given to limestone at top of formation. Thickness 4 to 6 feet. Steves Farm limestone member (new) is in lower part of formation. Term Canadian used as system in this report.

Named for Rathbunville School, Fort Ann area, New York.

Ratlum Mountain Member (of Satans Kingdom Formation)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 36–39, pl. 1. A heterogeneous assemblage of medium-grained nonrusty-weathering garnet-biotite-muscovite-plagioclase-quartz schist, garnet-biotite-plagiocalse-quartz gneiss, amphibole-biotite-plagioclase gneiss, and calc-silicate gneiss, and includes a zone of garnet amphibolite which is locally overlain by garnet-anthophyllite rock. Underlies Breezy Hill Member (new); overlies Rattlesnake Hill formation (new).

Type locality: North of Diters Road on Ratlum Mountain, Collinsville quadrangle. Reference localities: In Satans Kingdom and along gorge of Farmington River south of Route 44 (Satans Kingdom Access area).

Rattlesnake Hill Formation (in Hartland Group)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 30–36, pl. Divided into two informally named members. Lower member is heterogeneous unit composed of medium-grained biotite-plagioclase-muscovite-quartz schist and amphibolite. Thinly to thickly bedded calc-silicate gneiss common at base. Schist is rusty weathering. Upper member fairly homogeneous unit composed of rusty-weathering fine- to medium-grained mica-quartz schist interbedded with thinly to thickly bedded mica quartzite and mica-plagioclase-quartz gneiss. Overlies The Straits Schist Member. Underlies Ratlum Mountain Member (new) of Satans Kingdom Formation (new).

Type locality: Rocks cropping out on northern part of Rattlesnake Hill, Collinsville quadrangle.

Rattlesnake Hill tuff

Oligocene, upper or Miocene, lower: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 20, 22, 36, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon date 33.2±0.7 m.y.

Rattlesnake Hill is in sec. 19, T. 4 N., R. 15 E., Calaveras County.

Rattlesnake Ridge Member (of Ellensburg Formation)

[Pliocene]: South-central Washington.

H. U. Schmincke, 1965, Dissert. Abs., v. 25, no. 11, p. 6542. Lies between Pomona and Elephant Mountain flows of Yakima Basalt. Age not stated.

H. U. Schmincke, 1967, Geol. Soc. America Bull., v. 78, no. 3, p. 321 (fig. 2), 327. Discussion of fused tuff and peperites in south-central Washington. About 3.2 km (2 miles) east of Donald Pass, the Pomona flow (Basalt Member of Yakima) is overlain by Rattlesnake Ridge Member of Ellensburg. Here the Rattlesnake Ridge Member consists of 45m (150 feet) of silt and sand-sized tuffs and arkoses and some quartz-bearing fine-grained conglomerate. Elephant Mountain flow [Basalt Member of Yakima Basalt] overlies the sediments.

Rattlesnake Ridge is south and east of city of Yakima.

Ravena Member (of Coeymans Formation)

Ravena Limestone Member (of Coeymans Formation)

Lower Devonian: Eastern, central, and southeastern New York.

L. V. Rickard, 1962, New York State Mus. Bull. 386, p. 65—68. Name proposed for that part of Coeymans formation present at and east of Cherry Valley. Thickness 20 feet at type locality where it overlies Thacher limestone and underlies cherty Kalkberg. To west of type section consists of very hard, coarse-grained gray or blue crystalline limestones. South of type section at Ravena, across Catskill quadrangle, the Ravena is 10 to 15 feet thick. Southwest of Kingston thickens to 15 to 20 feet in Rosendale quadrangle. Much of overlying Kalkberg was included in the Coeymans (Ravena) at Trilobite Mountain by Shimer (1905, New York State Mus. Bull. 80). Writer [Rickard] believes that west of type section Ravena thickens to it maximum of 100 feet at Cherry Valley.

L. V. Rickard, 1964, New York State Mus. Bull. 396, p. 42—45. Three stratigraphic names are necessary to identify various portions of Coeymans Limestone in Richfield Springs quadrangle. Name Ravena (Rickard, 1962) has been suggested for undivided Coeymens of eastern New York. Part of Coeymans which grades westerly into Olney Member of Manluis is named Dayville. Name Deansboro has been applied to upper part of Coeymans which extends westward into central New York. Name Ravena is used herein for that part of the coarse-ground irregularly bedded and fossiliferous limestones present in eastern quarter of Richfield Springs quadrangle. In this area name Ravena designates the 90 to 100 feet of coarse-grained limestones found in area east of road from Willse Four Corners to East Springfield.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 25, 44, 48. Name modified to Ravena Member. Occurs from Cherry Valley to Albany, N. Y., southwest to New York-New Jersey border and probably into New Jersey. Grades upward into Kalkberg Limestone. Gradational contact with underlying Thacher Member of Manluis in some places, but abrupt where top of Thacher is stromatoporid biostrome as at Trilobite Mountain and Cuddebackville, N. Y. Grades laterally into Shawnee Island Member (new) northeast of Nearpass quarries, New Jersey. Reference section designated.

Type section: Abandoned limestone quarry just south of hairpin turn in road ascending escarpment one-half mile northeast of village of Ravena, just west of Coeymans in Coxsackie quadrangle, New York. Reference section: In southeastern most New York in three abandoned quarries on northwest side of Lime Kiln Road, on southeast slope of Trilobite Mountain, Port Jervis, N. Y.

Rawson Formation (in Conneaut Group)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 264—265. A sandstone, siltstone, and shale unit. Thickness 248 feet at type section. Formation, which is wedged shaped, everywhere overlies Cuba Formation. Underlies and interfingers with Wellsville Formation in Allegany County and underlies Hinsdale Sandstone in Cattaraugus County.

Type section: Exposures along east-flowing tributary of Oil Creek, 0.8 mile south-southwest of Rawson, Cattaraugus County.

Ray Member (of Kibbey Formation)

Mississippian: Central Montana.

R. R. Rawson, 1967, Dissert. Abs., v. 28, no. 3, sec. B, p. 950. Middle limestone member of Mississippian Kibbey Formation in central Montana and Williston Basin was analyzed to determine facies relationships and depositional patterns of carbonates deposited in an ancient epeiric sea. Name Ray Member is given to this unit, which averages 30 feet in thickness and covers an area, mostly in subsurface, of about 60,000 square miles. Member consists of limestone, anhydrite and dolomite. Lies conformably below red sandstones and siltstones and above red siltstones and shales of the Kibbey.

Type locality and derivation of name not given.

Reading Granite

Carboniferous: Eastern Massachusetts.

R. F. Boutilier, 1964, New England Intercollegiate Geol. Conf. Guidebook 56th Ann. Mtg., p. 41—52. South of Route 128 [Field Trip B] rocks mapped as Dedham granodiorite by LaForge (1932) are pink microperthite microcline granites and syenites and are herein described as Reading granite.

Field trip follows Route 93 from Pine Hill, Medford, to Andover.

Readstown Member (of St. Peter Sandstone)

Middle Ordovician: Southwestern Wisconsin.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Info. Circ. 8. Name assigned to basal conglomerate of St. Peter. Underlies Tonti Member. Buschbach (1964) proposed name Kress for the conglomerate, but it is rejected because the type section is taken from a well near the headquarters of Kress Creek in northeastern Illinois rather than from an outcrop.

Named for exposures in vicinity of Readstown, notably the one on east side of Highway 14 and west of the village in center of NE¼ sec. 27, T. 12 N., R. 4 W., Vernon County, Wis.

Reba Member (of Ashlock Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D13. Micrograined limestone at base, overlain by more or less silty medium-grained limestone that at top commonly grades into argillaceous limestone. Thickness 10 to 25 feet. Overlies Terrill Member (new); underlies Rowland Member of Drakes Formation (both new).

Type section: Near Lake Reba on Kentucky Highway 52 about 2 miles east of Richmond, Madison County.

Recess Peak Glaciation

Quaternary: Eastern California.

Clyde Wahrhaftig, 1962, California Div. Mines Bull. 182, p. 42 (table 1). Recess Peak glacial stage named on table showing correlation and characters of glacial stages in Yosemite Valley. Name credited to Birman (1957, unpub. thesis).

J. H. Birman, 1964, Geol. Soc. America Spec. Paper 75, p. 12, 28, 45, 51—53, pl. 1. Report on glacial geology across crest of Sierra Nevada. Formal proposal of name. Younger than Hilgard glaciation and older than Matthes glaciation. Area of best development is in circques and cirque valleys. Evidences of glaciation are recessional moraine arcs, short lateral moraines, and scattered boulders on bare bedrock.

Type locality: Upper part of First Recess, near northern base of Recess Peak, Fresno County.

Recortado Ash Flow

Recortado Mountain Vitrophyre

Miocene: Southern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 73, (table 2). Recortado Mountain vitrophyre listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent area. Age 14.0 ± 0.5 m.y.

Michael Bikerman, 1967, Geol. Soc. America Bull., v. 78, no. 8, p. 1029—1036. Isotopic studies in Roskruge Mountains, Pima County. The Recortado ash flow K-Ar dates average 13 ± 1 m.y., with all determinations within the indicated spread.

In Recortado Mountain vicinity, Roskruge Mountains, Pima County.

Recovery Hill Member (of Judith Fancy Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Mudstone 1,000 feet thick.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 201, pl. 1. Only member of the Judith Fancy to be differentiated in East End Range. Lies about 3,000 feet from base of formation. Blue-gray mudstone and subordinate fine-grained tuffaceous sandstone are normal rock types. Estimated thickness 1,000 feet. Member may possibly be same as Blue Mountain Member (differing mainly in amount of silica present), as both occur at about same distance above base of formation. However, if the Judith Fancy thickens to east, the Recovery Mountain Member would be stratigraphically below the Blue Mountain, which it more than likely is.

In eastern part of island.

Red Bay Formation

Miocene: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 11), 115, 117 (fig. 14), 197—200, pls. 2a, 2b, 2c. Name suggested for sands and clays, and similar deposits, containing the *Yoldia* faunizone and *Arca* faunizone. Thickness 31½ feet at type locality. Overlies Yellow River formation (new); underlies Jackson Bluff formation (new). Choctawhatchee Stage.

Type locality: 900 feet west of center sec. 19, T. 2 N., R. 17 W., on W. D. McDaniel's Farm, Red Bay, Walton County.

Red Bird Silty Member (of Pierre Shale)

Upper Cretaceous: Eastern Wyoming, southeastern Montana, and western South Dakota.

J. R. Gill and W. A. Cobban, 1962, U.S. Geol. Survey Prof. Paper 450—B, p. B—21—B—24. Soft silty shale that weathers light to medium gray and contains numerous limestone concretions that weather light gray, grayish orange, dark yellowish orange, and light brown to moderate yellowish brown or orange brown. Thickness 690 to 745 feet in type area; 725 feet in type section. Unconformably overlies Mitten Black Shale Member; underlies unnamed dark-gray shale member. Member deposited marginal to nearshore marine sandstones that form eastern edges of Judith River Formation of Montana and Parkman Sandstone Member of Mesaverde of Wyoming. East of Black Hills is replaced by Crow Creek and Gregory Members of Pierre. Name Red Bird can be applied to a 150-mile-wide north-trending belt of rocks that lies east of recognizable limits of Hygiene Sandstone Member of Pierre in Colorado, Parkman Sandstone Member of Mesaverde in Wyoming, and Judith River Formation in Montana, and west of recognized limits of Crow Creek and Gregory Members of Pierre in central South Dakota.

Type section: In NW¼SW¼ sec. 13 and NE¼SE¼ sec. 14, T. 38 N., R. 62 W., Niobrara County, Wyo. Named from Red Bird store, NE¼ sec. 27, T. 38 N., R. 62 W., Niobrara County.

Red Boy Rhyolite

Tertiary, lower: Southern Arizona.

J. A. Thomas, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. Rocks of Early Tertiary age in area include Red Boy rhyolite—a tuff-breccia exhibiting flow structure—basalt and rhyolite dikes and the Fresnal quartz monzonite.

Present in Tascuela area, which comprises about 25 square miles on the west side of the Sierrita Mountains in Palo Alto Ranch and Twin Buttes quadrangles, Pima County.

Red Butte Flow, Basalt

Pliocene, middle: Northeastern Arizona.

M: E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4). Listed on chart showing correlation and relationships of volcanic flows in San Francisco volcanic field.

Red Butte is in Coconino County.

Red Butte Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 9. Basal member of the Deer Butte. Underlies Orlano Spring Member (new).

Type section: SE¼, sec. 22, T. 25 S., R. 43 E., Malheur County. Named for exposures on northwestern side of Red Butte.

Redding Formation

Cretaceous: Northern California.

G. L. Peterson, 1964, Dissert. Abs., v. 24, no. 11, p. 4634. Mentioned in report on regional Cretaceous sequences in northern California and Oregon. Younger than Forbes Formation and older than Hornbrook Formation.

Red Glacier Formation (in Tuxedni Group)

Middle Jurassic: Southern Alaska.

R. L. Detterman, 1963, U.S. Geol. Survey Prof. Paper 475—C, p. C30—C34. Basal formation of Tuxedni herein rank raised to group. Name replaces term lower member of former Tuxedni Formation in older reports. Consists mainly of arkosic sandstone and shale with minor amounts of subgraywacke-type sandstone, conglomerate, and limestone in lower part, and sandy siltstone in upper part. At type locality lower 200 feet is light-brown arkosic sandstone; this is overlain by 200 feet of black silty shale, 200 feet of arkosic sandstone, 1,000+ feet of soft black silty shale in which faults cut out part of section, 720 feet of light-brown arkosic sandstone, 1,060 feet of interbedded sandstone and siltstone, and at top by 1,160 feet of sandy siltstone. Underlies Gaikema Sandstone; contact gradational; unconformably overlies Talkeetna Formation of Early Jurassic age.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 21—24, pls. From exposures on south shore of Tuxedni Bay, formation continues about S. 50° W. in a well-defined belt 1 to 2½ miles wide to valley of Boulder Creek. General structural trend of rock changes abruptly south of Boulder Creek; this change may be in part due to upwelling of magma in Iliamna Volcano. Strike becomes more westerly, and beds are terminated on east slope of volcano by Bruin Bay fault or are covered by lava flows. Good exposures are present in bluffs on south shore of Chinitna Bay between mouth of Gaikema Creek and Marsh Creek tidal flat. Only upper part is present where these beds wrap around end of Tonnie syncline. Beds continue southwest along flanks of Tonnie syncline as far as Low Creek, where they are terminated by intersection of Low Creek cross fault and a branch of Bruin Bay fault. Maximum of about 300 feet is exposed at mouth of Tonnie Creek, where formation was faulted to its present position. Exposed parts of formation range in thickness from 2,000 to 4,500 feet. Overlies Horn Mountain Tuff Member (new) of Talkeetna Formation. Depositional contact with the Talkeetna rarely seen because in most exposures the Red Glacier is in fault contact relationship with older rocks.

Type section: Along both sides of Red Glacier. Upper 3,310 feet exposed along south side, 4½ miles S. 62° E. of Iliamna Volcano; lower 1,230 feet is on north side of glacier, 6½ miles N. 86° E. of Iliamna Volcano, Cook Inlet region. Thickness 1,980 feet at Tuxedni Bay, 18 miles north of Red Glacier; about 6,500 feet thick in subsurface under Iniskin Peninsula.

Red Hill Sandstone and Shale [Member] (of Chinle Formation)

Triassic: Southern Utah.

R. L. Threet, 1963, Intermountain Assoc. Petroleum Geologists Guidebook 12th Ann. Field Conf., p. 109 (fig. 2). Red Hill shale and sandstone shown in upper part of Chinle. This unit, mapped in 1954—55, is now Shurtz tongue of Navajo.

Red House Flow

Pliocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 16 (fig. 13), 17. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many part of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Red House flow is a stage I flow, that is the edge of the flow has been eroded back so far that the original extension of the flow is obliterated. Also, the surface of the flow is so deeply eroded that not only have all the traces of the lava tops been removed, but also most of the vesicular upper portion. Overlies Moenkopi Sandstone.

Flow forms escarpment above Red House Basin.

Redington Member (of Quiburis Formation)

Pliocene: Southeastern Arizona.

L. D. Agenboard, 1967, Dissert. Abs., v. 28, no. 2, sec. B, p. 737. There is lateral facies change within the Quiburis formation. The conglomeratic member interfingers with a central fine-grained member and names Tres Alamos and Redington are proposed for these units.

Redington-San Manuel area, San Pedro Valley.

Red Kidney ironstone member (of Strasburg cyclothem)

See Tuscarawas Shale.

Red Mountains Rhyolite

Pliocene: Northwestern Wyoming.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 390—392, pl. 1. Composed of rhyolite, with subordinate pre-Tertiary sediments. Rhyolite is altered mass of flows and breccias. Unconformably overlain by Yellowstone tuff (new). Age relative to Jackson flows (new) not certain but probably older.

Crops out in Red Mountains, Yellowstone National Park.

Red Plume Quartzite (in Kintla Group of Belt Supergroup)

Precambrian: Northwestern Montana.

M. O. Childers, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 147, 150 (fig. 8), pl. 1. Consists of medium to very thick bedded medium-grained pink and lavender quartzites and sandstones. Sequence of very thick bedded pink quartzites, over 100 feet thick, occurs in upper part of formation; in parts of this unit large-scale crossbedding is prominent. Thickness 791 feet at type section. Overlies Shields Formation (new); underlies unnamed sequence of green argillites and quartzites.

Type section: Base of formation about 600 feet down west slope from summit of Blacktail Mountain; top of formation about 630 feet down east slope. Summit of Blacktail Mountain is at lat 48°17′ N., long 113°28′30″ W., Marias Pass area, Flathead County. Complete section exposed on Red Plume Mountain, but is difficult of access.

Red Rock Formation

Quaternary (pre-Wisconsin): Northeastern Arizona and northwestern New Mexico.

J. W. Blagbrough, 1965, Dissert. Abs., v. 26, no. 3, p. 1589. Consists of two members: Breccia member, composed of large angular boulders of Chuska sandstone and volcanic rocks with average dimensions between 6 and 10 feet and maximum dimensions of about 25 feet; and conglomerate member, consisting of subangular to subrounded boulders with maximum diameters of about 6 feet. Texture, composition, and physiographic setting of outcrops suggest that formation may be either mudflow deposits or possibly pre-Wisconsin drift nourished by plateau glaciers in Chuska Mountains.

Caps erosional remnants of pediment surfaces in Red Rock Valley and on Defiance Plateau.

Redskin Granite

Precambrian: Central Colorado.

C. C. Hawley and others, 1966, U.S. Geol. Survey Prof. Paper 550—C, p. C138—C147. A fine- to medium-grained white to pink mostly massive granite. Younger than Pikes Peak Granite and has been termed a late facies of the Pikes Peak. Redskin stock was termed Tarryall lobe by Hawley (1963, U.S. Geol. Survey open-file report).

Type area: The area occupied by Redskin stock. Named for Redskin Gluch, in northern part of Tarryall 7½-minute quadrangle, Lake George beryllium area, mainly in eastern Park County.

Redwine Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Redwine sand occurs at depth of 10,482 to 10,502 feet in type well. Redwine new in this report.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Redwine blanket sandstone included in Vaughn Sandstone (new).

Type well: Southwest Gas Producing Co., No. 1 Redwine, sec. 11, T. 17 N., R. 3 W., Clay field. Reference well: Arkansas-Louisiana Gas Co., No. 1 Kavanaugh, sec. 22, T. 17 N., R. 3 W., Clay field, Lincoln Parish.

Red Wing Formation

Pennsylvanian-Permian: Colorado.

Herbert Tischler, 1963, Jour. Paleontology, v. 37, no. 5, p. 1054, 1057, fig. 1. Underlies Madera formation. Rests unconformably upon Precambrian rocks and is transitional with overlying Madera. Consists of clastic materials with very few limy beds and very few fossils. Formerly called Deer Creek formation by Bolyard (1959). Name Redwing to be formally proposed by James Rhodes.

J. A. Rhodes, 1965, Dissert. Abs., v. 25, no. 8, p. 4656. Name applied to lowermost of six lithologic and environmental units recognized in Pennsylvanian-Permian rocks in Huerfano Park quadrangle. Characterized by fluviatile deposited first-cycle quartzites and lateritic red beds. Underlies Madera formation that includes May Creek member (new).

Sangre de Cristo and Wet Mountains in Huerfano Park quadrangle.

Redwing Member (of Stockton Hill Formation)

Upper Cambrian: Southeastern Minnesota.

D. E. McGannon, Jr., 1961, Dissert. Abs., v. 21, no. 8, p. 2249. Upper member of Stockton Hill. Overlies Lodi member (redefined and reallocated).

Type section: Exposures on Barn's Bluff in Redwing, Goodhue County.

Redwood Canyon Formation

Upper Cretaceous: West-central California.

J. E. Case, 1963, Dissert. Abs., v. 24, no. 3, p. 1135. Northeast of Chabot fault, 6,000 to 8,000 feet of Upper Cretaceous strata are exposed. These beds were referred to Chico Formation and Oakland Conglomerate Member by Lawson. These beds have been divided into (ascending) Joaquin Miller Formation (new), Oakland Conglomerate, Shephard Creek Formation (new), Redwood Canyon Formation (new), and variegated red and green shale. Redwood Canyon consists of sandstone and shale.

Report discusses geology of part of Berkeley and San Leandro Hills, in San Francisco Bay area.

Reed (Red) Creek Quartz Dioritic Gneiss

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert. Abs., v. 25, no. 12, pt. 1, p. 7205. In thesis area most of underlying rocks were formed under conditions of regional metamorphism and plutonism. The Red (Reed) Creek Quartz Dioritic Orthogneiss was emplaced during regional metamorphism. Subsequently, when metamorphic conditions had retrogressed to those of medium-grade zone, portions of the Reed (Red) Creek Quartz Dioritic Orthogneiss were converted into grandoioritic gneiss by potassium metasomatism. Term Leader Mountain Granodioritic Gneiss is used to designate the latter rocks.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Reeves Limestone Member (of Maitlen Phyllite)

Reeves Limestone Member (of Laib Formation)

Cambrian: British Columbia, Canada, and northeastern Washington.

J. F. Fyles and C. G. Hewlett, 1959, British Columbia Dept. Mines Bull. 41, p. 25—26. In lower part of Laib formation. Conformably overlies Truman member; underlies Emerald member.

R. G. Yates, 1964, U.S. Geol. Survey Misc. Geol. Inv. Map I—412. Geographically extended into Deep Creek area, Stevens and Pend Oreille Counties, Wash., where it is lower member of Maitlen Phyllite. Name adopted here to avoid duplicate names for an identical unit.

Type locality: Exposures on Nelway-Waneta Road a few hundred feet northwest of portal of 1900 level of Reeves MacDonald mine, Salmo Lead-Zinc area, British Columbia.

Regina Member (of San Jose Formation)

Eocene, lower: Northwestern New Mexico.

E. H. Baltz, 1963, Dissert. Abs., v. 23, no. 7, p. 2490. San Jose formation consists of mappable facies named Cuba Mesa, Regina, Llaves, and Tapicitos members. Intraformational angular unconformity between Regina member and older rocks indicates that monocline formed on western side of Nacimiento uplift in early Eocene time. The overstepping Regina beds are folded and faulted.

E. H. Baltz, 1967, U.S. Geol. Survey Prof. Paper 552, p. 48—50, pls. Formal proposal of name. A thick sequence of clay shale and siltstone containing interbedded soft sandstone and hard ledge-forming sandstone. Ranges in thickness from about 600 feet in southeastern part of area to about 1,640 feet in east-central part of area, and about 900 feet at type section in northeastern part of area. Variations in thickness due in part to intertonguing between Regina Member and Cuba Mesa Member and Llaves Member and in part to intramember thickening near axis of San Juan Basin. Regina Member consists partly of the rocks described in stratigraphic sections 1 and 2 by Simpson (1948, Am. Jour. Sci., v. 246, pt. 1; pt. 2), which are part of his composite section of San Jose Formation. At type section the Regina is overlain by Llaves Member.

Type section: In the badlands and steep slopes in SW¼ sec. 31, T. 25 N., R. 1 E., and SE¼ sec. 36, T. 25 N., R. 1 W., San Juan Basin.

Relief Peak Formation

Miocene, upper, and Pliocene, lower: Central eastern California.

D. B. Slemmons, 1966, California Div. Mines and Geology Bull. 190, p. 199—208. Cenozoic volcanic history of Sierra Nevada can be divided into four major episodes: (1) an Oligocene to Miocene period of eruption and deposition of Valley Springs rhyolite tuffs, (2) a late Miocene or early Pliocene period of andesite eruptions resulting in accumulation of mudflows and volcanic sediments of Relief Peak Formation, (3) an early Pliocene period of eruption of latite and quartz latite flows and tuffs of Stanislaus Formation (new), and (4) later eruptions of Pliocene andesites of Disaster Peak Formation (new) and late Pliocene to Quarternary andesites, basalts, and rhyolites. The relief Peak unconformably overlies Valley Springs Formation and is unconformably overlain by Stanislaus Formation. Thickness of formation decreases from crest of range toward western foothills where it contains a Mio-Pliocene flora and underlies latites with ages of about 9 m.y. At type locality sequence is about 3,000 feet thick and is of varied lithology. Sequence includes on north flank of mountain, in secs. 18, 19, and 20, T. 5 N., R. 21 E., about 20 feet of gravel with abundant granitic and metamorphic rocks of Emigrant Basin type, andesitic sands, and near base, much reworked material, including cobbles and sands from underlying Valley Springs Formation. Above these volcanic sediments, section is composed mainly of mudflow breccias and autobrecciated andesitic flows. Formation thins to about 300 feet near Jamestown-Knights Ferry area where it disappears under younger deposits of Great Valley.

Type area: Slopes of Relief Peak, eastern Tuolumne County.

Reliz Canyon Formation

Eocene: Western California.

D. L. Durham, 1963, U.S. Geol. Survey Bull. 1141—Q, p. Q7—Q9, pls. 1, 2, 5. Lower member, about 180 feet thick, consists of fine- to coarse-grained arkosic sandstone and locally is conglomeratic near base. Middle member, as much as 350 feet thick, mainly massive siltstone. Upper member about 1,400 feet thick is massive medium- to coarse-grained arkosic sandstone interbedded with thin units of finer grained sandstone. Formation is undifferentiated where middle member is absent. Unconformably overlies pre-Tertiary basement complex and underlies Vaqueros Formation. Considered Eocene on basis of Foraminifera in middle member; other or younger series could be represented in unit.

D. L. Durham, 1964, U.S. Geol. Survey Bull. 1161—H, p. H5—H6, pl. Formation in Cosio Knob quadrangle is mainly thick-bedded arkosic sandstone that is probably marine. Thickness at least 500 feet. Overlies pre-Tertiary basement complex. Underlies Vaqueros Formation with apparent conformity.

Type locality: Upper Reliz Canyon, Monterey County.

Rendu Formation

Upper Silurian: Southeastern Alaska.

D. L. Rossman, 1963, U.S. Geol. Survey Bull. 1121—K, p. K10 (fig. 2), K17—K21, pls. 1, 2. Consists mainly of thin-bedded limestone and argillite; some argillaceous strata are limy and many limestone strata contain argillaceous material. Many colors including brown, red, yellow, green, blue, black, and white. Intricately folded. Thickness about 2,000 feet. Underlies Black Cap limestone (new), contact appears unconformable; overlies Pyramid Peak limestone (new). Nonfossiliferous.

Typical section: On southwest flank of the 1,978-foot mountain east of Rendu Inlet, Mount Fairweather quadrangle, Glacier Bay. Also recognized along east side of northward-trending range of mountains that contains Black Cap Mountain, in area northeast of Mount Merriam, and on west, north, and northeast sides of Sentinel Peak east of Rendu Inlet.

Renegade Tongue (of Wasatch Formation)

Eocene: Southeastern Utah.

W. B. Cashion, 1967, U.S. Geol. Survey Prof. Paper 548, p. 6—7, pl. 3. A sequence of massive, irregularly bedded brown and gray sandstones and red and gray shales and siltstones that constitute upper part of Wasatch Formation and intertongue with Douglas Creek Member of Green River Formation. Thickness 1,000 feet at type locality. Thins north and northeast owing to intertonguing with Douglas Creek. Northeast of Tenmile Canyon divided into units X and W which are separated by lacustrine beds of Green River Formation. Unit X is predominatly red and gray shale and has minimum thickness of about 7 feet. Unit W is predominantly massive, poorly bedded sandstone. Part, or perhaps all, of Renegade Tongue is middle Eocene.

Type section: On ridge north of Renegade Canyon in T. 19 S., R. 20 E., Grand County. Renegade Canyon is a tributary to Thompson Canyon, just south of mapped area.

Renfro Member (of Borden Formation)

Lower and Upper Mississippian: Southeastern Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224F, p. F19—F21. Dominantly sparsely cherty unfossiliferous light-greenish-gray, yellow- to orange-weathering aphanitic to finely crystalline argillaceous and dolomitic limestone. Attains greatest thickness of about 100 feet a few miles east of Halls Gap; though through most of east-central Kentucky ranges from 25 to 50 feet in thickness. Includes equivalents of Salem and Warsaw Limestones and of Muldraugh Member of Borden Formation. Overlies Wildie or Nada (new) Members. South of Mount Vernon, both Wildie and Halls Gap (new) Members pinch out so that the Renfro rests on Nancy Member (new). Upper contact generally a conspicuous diastem that separates Renfro from St. Louis Member of Newman Limestone.

Type section: Along U.S. Highway 25 beginning about 0.2 mile southeast of village of Roundstone, about 3 miles north of Renfro Valley, Rockcastle County, Wildie quadrangle.

Renton Formation (in Puget Group)

Eocene, upper and Oligocene(?): Northwestern Washington.

H. H. Waldron, 1962, U.S. Geol. Survey Geol. Quad. Map GQ—159. Chiefly fine- to medium-grained arkosic and feldspathic sandstone with lesser amounts of sandy shale, siltstone, coal, and carbonaceous shale. Thickness probably more than 4,000 feet, top not exposed. Overlies Tukwila formation (new). Formation includes Renton coal measures, which were extensively mined at and near Renton in early part of century.

J. D. Vine, 1962, Washington Div. Mines and Geology Rept. Inv. 21, p. 16, 17. Formation, in Taylor Mountain area, consists of feldspathic micaceous fine- to medium-grained sandstone interbedded in upper part with beds of coal, carbonaceous siltstone, and claystone. Top not exposed; at least 2,250 feet of strata estimated. Overlies Tukwila Formation.

Typically exposed in town of Renton, King County, in S½ sec. 17, SW¼ sec. 18, and E½ sec. 19, T. 23 N., R. 5 E., Des Moines quadrangle.

Reserve ash flow

See Moonstone Tuff.

Reubens Hill Formation

Ordovician-Devonian: East-central Massachusetts

J. W. Skehan, 1967, Masachusetts Univ. Conf. on Econ. Geology in Massachusetts, Proc., P. 239-240. Discussion of geology of Wachusett-Marlborough tunnel. Stratigraphic units from southeast to northwest (Shaft C to Shaft A) and (oldest to youngest) Marlboro Formation, Nashoba Formation, unnamed quartzite and conglomerate, Vaughn Hills Formation, Reubens Hill Formation, and Worcester Formation. The Reubens Hill Formation, an unofficial name, consists of calc-silciate granulite, quartzite, and feldspathic gneiss in its lower part and of a distinctive thick sequence of relatively massive to crudely stratified amphibole schist in upper two-thirds. May be in fault contact with Worcester Phyllite. A muscovite granite pluton is intrusive into sequence near boundary between Vaughn Hills and Reubens Hill Formations.

Revelo Shale

Pennsylvanian: Southeastern Kentucky.

R. E. Bergenback and R. L. Wilson, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 4, p. 504 (fig. 2), 507. Made up largely of dark-gray shale that on outcrop is commonly brownish gray and includes interval between top of Crossville sandstone and base of Corbin shale. Thickness 40 feet at type locality. In places disappears where overlying Corbin cuts it out. In Tennessee represented by three formations (ascending): Burnt Mill shale, Coalfield sandstone, and Glenmary shale.

Named for exposures along U.S. Highway 27, at north edge of community of Revelo, McCreary County, Ky.

Revere Loess

Pleistocene: Northeastern Missouri.

J. E. Stone, 1961, Dissert. Abs., v. 21, no. 10, p. 3061. Youngest of three stratigraphic units recognized in area. Overlies Clark silt (new).

Revere is in Clark County.

Revés Member (of Pozas Formation)

Accepted name for unit described as El Revés Member of Coamo Formation by Briggs and Gelabert (1962) and La Revés Sandstone Member of Pozas Formation by Weaver (1964).

Reynolds Oolite (in Smackover Formation)

Upper Jurassic: Subsurface in southern Arkanas and northern Louisiana.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 261 (fig. 5.93), 288. Oolites are widespread adjuncts of Smackover formation, being especially common in upper part where they constitute Reynolds oolite.

F. M. Swain, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 5, p. 779 (fig. 1). Reynolds oolite shown at top of Smackover Formation.

Type locality and derivation of name not stated.

Reynolds Bridge Gneiss

Paleozoic: Western Connecticut.

R. M. Cassie, 1966, Dissert. Abs., v. 26, no. 9, p. 5367. In Thomaston quadrangle, a domal structure is bounded on all sides by the Straits

Schist. Core of dome comprises lower Hartland granulites and schists with scattered layers and lenses of amphibolite and the granitic Reynolds Bridge Gneiss. Formation of the Gneiss unit was effected by metasomatic processes during the post-foliation deformation. Its distribution was controlled by the impermeability of the Straits Schist and by the dilatant crest of the evolving post-foliation anticlinal structure. The Reynolds Bridge Gneiss is thus the granitized equivalent of the contiguous metasediments in the domal core which underlie the Straits Schist.

Present in Thomaston quadrangle, western Connecticut.

Ribbon Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Basal member of formation; underlies Step limestone member (new). Overlies White Pine formation. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

Rib Mountain Quartzite

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 1 (map). Named on location map showing quartzites which may be related to McCaslin quartzite.

Rib Mountain is in southwest Wausu, Marathon County.

Rice Formation

Precambrian(?): Central Kansas (subsurface).

R. W. Scott, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 380—384. The thick sequence of pre-Upper Cambrian feldspathic sandstone and shale in central Kansas can be distinguished from other material in Kansas called "granite wash" and is here named Rice Formation. Typically developed in Rice County where it is reported in 26 wells. Four typical drill holes designated rather than type well. In each of these holes the Reagan Sandstone overlies the Rice and underlies the Arbuckle Group. In basin east of Sixth Principal Meridian, 13 holes penetrate pre-Reagan sedimentary rocks that informally have been called Rice sedimentary group. Rice Formation is here substituted for the Rice sedimentary group.

Typical wells: Continental No. 3 "A" Hodgson, Ellsworth County; Empire No. 13 Rolfs, Ellsworth County; Continental No. 9 Ainworth, Rice County; and Bishop No. 5 Reese, Rice County.

Rice Hill Member (of Bridgeman Hill Formation)

Cambrian: Northern Vermont.

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 28, 29, pl. 1. Limy dolomitic shale, locally grading into shaly dolomite. Overlies Dunham Dolomite Member.

Well exposed on west slope of Rice Hill, Enosburg Falls quadrangle.

Rice Mountain Member (of Dixville Formation)

Ordovician: Northern New Hampshire.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 11 (fig. 3), 31, pl. 1. Consists mainly of silvery-gray to black schists and gray to black quartzites. Thickness about 1,500 feet. Overlies Clear Stream Member (new). Underlies unnamed Siluro-Devonian feldspathic gneiss.

Name taken from exposures on south, west, and north slopes of Rice Mountain, Errol quadrangle.

Rice Point granite

Rice Point red granite

Age not stated: Northeastern Minnesota.

J. A. Dodge, 1881, Minnesota Geol. and Nat. Hist. Survey Ann. Rept. 10, p. 201. Rice Point granite and Rice Point red granite listed in report on chemical analyses of Minnesota rocks.

A. P. Ruotsala and S. P. Tufford, 1965, Minnesota Geol. Survey Inf. Circ. 5, p. 42. Rice Point red granite listed in report on chemical analyses of igneous rocks of Minnesota.

Locality: Rices Point, Duluth, St. Louis County.

Rich Member (of Twin Creek Limestone)

Middle Jurassic: Northeastern Utah, southeastern Idaho, and southwestern Wyoming.

R. W. Imlay, 1967, U.S. Geol. Survey Prof. Paper 540, p. 30—36, pls. Consists mostly of medium-gray shaly limestone that is very soft basally but becomes harder upward, contains some thin beds of limestone near its top, and ranges in thickness from a few feet to about 500 feet. At type section consists of about 425 feet of yellowish-gray shaly limestone that weathers a little darker and is fairly soft in its lower 75 feet but becomes harder and ledge forming upward. Grades abruptly into adjoining members. Overlies Sliderock Member (new). Underlies Boundary Ridge Member (new). Has been called member C by Imlay (1950, Wyoming Geol. Assoc. Guidebook 5th Ann. field Conf.).

Type section: North side of Birch Creek about 8 miles west of Woodruff, Rich County, Utah, near line of secs. 18 and 19, T. 9 N., R. 6 E. Base of section starts about one-half mile west of confluence of Birch Creek and Watton Canyon on west side of westernmost of the three small anticlines that are developed in the Twin Creek Limestone west of middle of sec. 20.

Richards Mountain Fanglomerates

Eocene: Southwestern Wyoming.

H. W. Roehler, 1965, Wyoming Geol. Assoc. Guidebook 19th Field Conf., p. 143 (fig. 1), 144. Shown on figure 1 as Richards Mountain Fanglomerates. Interfingers with main body of Wasatch Formation. Text (p. 144) states that main body of Wasatch at Richards Mountain consists almost entirely of fanglomerates. Northwestward, the fanglomerates in Richards Mountain rapidly change to deep red shales and sandstones along Red Creek and a few miles north of Clay Basin field.

Richards Mountain is in southwestern Sweetwater County.

Richmond Stade, Till

Pleistocene (Illinoian): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6, p. 665, 672, 681 (fig. 3, table 6). All Illinoian drift above deposits of Abington interstadial (new) as herein defined is considered to belong to one recessional stade, herein named Richmond glacial stade.

Type section: Wildman Farm section which is composite of three nearby (0.1 mile) exposures along south bank of small stream in NE¼ sec. 33, T. 16 N., R. 14 E., Wayne County. Named from Richmond, largest town in vicinity.

Rickard Hill Member (of Schoharie Formation)

Devonian: Southeastern New York.

J. H. Johnsen and J. B. Southard, 1962, New York State Geol. Assoc. Guidebook 34th Ann. Mtg., p. A—8, A—10 (fig. 2). Rickard Hill Member of Schoharie Formation. Consists principally of sandy limestone and calcareous sandstone containing many brachiopods and cephalopods. Thickness ranges from thin film, where it wedges out 1 mile southeast of East Springfield, to 6 feet in Schoharie and western Albany Counties. Passes laterally into finer calcareous strata in southern Albany County which are divisible into two subunits (Aquetuck Member and Saugerties Member) in mid-Hudson Valley. Overlies Carlisle Center Member. Thickness 0 to 6 feet. Rickard Hill corresponds to "Schoharie Formation" in Vanuxem (1840). Also spelled Richard Hill. [Johnsen, 1957, Dissert. Abs. 17, no. 10, used term Rickard facies of Schoharie Formation.]

Type locality and derivation of name not stated.

Rickreall Limestone Member (of Yamhill Formation)

Eocene: Eastern Oregon.

E. M. Baldwin, 1964, Oregon Dept. Geology and Mineral Resources Bull. 35 (revised), p. 19—21, geol. map. A lens of impure limestone near base of formation. Thickness 60 to 80 feet. Has been referred to as "Dallas limestone" by many workers.

Well exposed in quarry of Oregon Portland Cement Co., and to lesser extent in quarry on property owned by T. T. Leonard in NW¼ sec. 12, T. 8 S., R. 6 W. Name derived from Rickreall Creek, near Dallas.

Ricky Granite

Age not stated: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Incidental mention in report on Mesozoic geology of southern Pine Nut Range, Douglas County.

Riggins Group

Paleozoic or Mesozoic: Western Idaho.

C. P. Ross, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 63—65. Comprises four units, Fiddle Creek Schist, Lightning Creek Schist, Berg Creek Amphibolite, and Squaw Creek Schist. Exposed along Salmon and Little Salmon Rivers. Name credited to Warren Hamilton (in press).

Warren Hamilton, 1963, U.S. Geol. Survey Prof. Paper 436, p. 16—35, pl. 1. Formal proposal of name. Lying tectonically above and east of Seven

Devils Volcanics and other formations of the Permian and Triassic sequence is thick group of formations of metamorphic rocks, dominantly schists, herein named Riggins Group. Rocks are of low metamorphic grade in northwest; eastward and southward, rank of metamorphism increases progressively through middle and high grades. Riggins Group is in syncline whose axis trends northwestward near town of Riggins. Northwest limb is composed of nonrepeating sequence of distinctive formations; southwest limb is more complex but contains same rock types in same succession. Present sequence is probably at least partly structural rather than stratigraphic. At type section comprises (ascending) Fiddle Creek Schist, Lightning Creek Schist, metaperidotite, Berg Creek Amphibolite, and Squaw Creek Schist (all new). Total thickness about 20,000 to 25,000 feet. The group, represented by Fiddle Creek Schist, continues north of Riggins quadrangle [this report] along Salmon River where it lies tectonically upon Martin Bridge Limestone. Group is progressively cut out northward by intrusive mass of trondhjenite gneiss. Older than Idaho batholith of middle Cretaceous age and presumed to be no older than Cambrian.

Type section: Southwestward-dipping section exposed along Salmon River from Riggins northward to a little beyond edge of Riggins quadrangle.

Riggs Formation (in Halloran Complex)

Precambrian: Southern California.

D. A. Warnke, 1966, Dissert. Abs., v. 26, no. 9, p. 5374. Precambrian Halloran Complex subdivided into following formations: Silver Lake Peak, mostly quartzfeldspathic gneisses; Cree Camp, quartzites and metarhyolites; and Riggs, metamorphosed metadiorite rocks. Complex intruded by metadiorite rocks.

In the Halloran Hills, central Mojave Desert.

Rillito Formation

Tertiary: South-central Arizona.

D. J. Brennen, 1962, Arizona Geol. Soc. Digest, v. 5, p. 46, 54. Voigler (1953, unpub. thesis) used name Rillito Formation for rocks north and east of Tucson that are similar to unit herein termed Pantano Formation. Term Rillito is rejected in favor of older name Pantano. Rillito and Rillito Creek are in Pima County.

Río Bauta Member (of Pozas Formation)

See **Pozas Formation.**

Río de la Plata Sandstone

Río de la Plata Formation

Upper Cretaceous: Puerto Rico.

E. D. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, 61, pl. 1. Río de la Plata Formation overlies Santa Olaya Formation (new) and underlies Figuera Volcanics. Consists primarily or epiclastic debris with minor andesitic basalt and spilite flows. Flows are plagioclase rich with medium-gray matrix and are restricted to western part of Naranjito quadrangle.

The U.S. Geological Survey has adopted the term Río de la Plata Sandstone and designates the age as Upper Cretaceous on the basis of a study now in progress.

The Río de la Plata Sandstone is not the same unit as Río de la Plata Series of Hodge (1920).

Well exposed in valley of Río de la Plata.

Río Indio Limestone Member (of Cibao Formation)

Oligocene or Miocene: Puerto Rico.

W. H. Monroe, 1962, U.S. Geol. Survey Misc. Geol. Inv. Map I—334. Forms two tongues, one above and one below Altamirante Sur sand member (new). Upper tongue consists of nearly white porous limestone composed of tightly cemented shell and limestone fragments; lower tongue is yellow fragmental limestone and yellow granular limestone that is locally cross-bedded. Thickness about 90 m. Underlies Quebrada Arenas limestone member (new); overlies Lares limestone. On basis of preliminary fossil studies it is believed that the Cibao below the Quebrada Arenas limestone member is Oligocene in age.

W. H. Monroe, 1963, U.S. Geol. Survey Geol. Quad. Map GQ—191. Thickness about 100 m in Vega Alta quadrangle. Underlies Quebrada Arenas member.

Named for exposures on Route 645 just west of bridge over the Río Indio, 2,250 m west of eastern edge of Manatí quadrangle. Type locality is in lower tongue of member.

Río Orocovis Group

Río Orocovis Formation

Lower and Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip in Puerto Rico Nov. 22—24, p. 3, 8, 10, 11. Mentioned as both formation and group. Includes Perchas Lava Member and Magüeyes Member (both new).

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, pl. 1. Formation includes (ascending) Magüeyes, Perchas, Avispa (new), and Los Negros (new) Members. Underlies Cerro Gordo Formation (new). May be older or younger than Santa Olaya Formation (new).

H. L. Berryhill, Jr., 1965, U.S. Geol. Survey Bull. 1184, p. 16 (table 1), p. 19—44, pl. 1. Formal proposal of name. Includes great accumulation of massive dense andesitic pillow lava, basaltic pillow lava, subordinate clastic rocks, and lens of reef limestone. Based on composition of pillow lava and abundance of detrital rock, formation is divided into four members (ascending): Magüeyes, basalt tuff, Perchas Lava, and Avispa Lava. Estimated thickness 4,500 m in southeast and central areas; base of formation concealed by faulting. Estimated thickness 2,250 m in belt west and east of Morovis stock where area structure is complex. Underlies Manicaboa Formation (new). General stratigraphic relations to older and younger fossil-bearing rocks elsewhere in eastern Puerto Rico suggest probable Turonian(?) to late Santonian(?) or early Campanian age for formation. In earlier report, Berryhill and others (1960, Am. Assoc. Petroleum Geologists Bull., v. 44, no. 2), rocks now designated as Río Orocovis Formation were included in upper part of Robles Formation as a part of "pillow lava-volcanic breccias facies," which forms eastward—trending belt of outcrop along north side of Puerto Rico anticlinorium from Ciales quadrangle eastward almost to northeast corner of Puerto Rico. Upper Cretaceous.

A. E. Nelson, 1966, U.S. Geol. Survey Bull. 1244—C, p. C3, C6—C11. Río Orocovis formation redefined and raised to group rank to include (ascending) Magüeyes Formation, Perchas Formation, Avispa Formation, and Los Negros Formation (new). Thickness about 3,000 m in Corozal quadrangle [this report]. The Río Orocovis is a major stratigraphic division of Cretaceous System in east-central Puerto Rico. Occupies most of southern half of Corozal quadrangle.

Named for exposures in southeastern part of Ciales quadrangle along and adjacent to valley of the Río Orocovis between localities 1 and 2, plate 1. Crops out principally in southeastern and central parts of quadrangle. Individual areas of outcrop are bounded in large part by faults.

Río Piedras Formation

Eocene: Puerto Rico.

M. Soriano and P. A. Gelabert, 1964, Puerto Rico Dept. Public Works Geol. Inv. Bull. 3, p. 6, 11, map. Unit consists of yellow, brown, and green tuffaceous sandstones and siltstones with some conglomerate lenses. Sandstones and siltstones composed of grains of lava, altered volcanic glass, and quartz. These rocks are well stratified, thinly bedded, extensively jointed, and moderately weathered. Underlies San Sebastian formation. Oldest named unit studied in section.

P. A. Gelabert, 1964, Puerto Rico Dept. Public Works Geol. Inv. Bull. 6, p. 19—20, map. Described in San Juan quadrangle where it forms prominent topographic ridges in southwestern and southeastern corners of quadrangle. Formation consists of thinly bedded siltstone interstratified with thick beds of volcanic wacke and siltstone. Occurs above Figueras [Figuera] formation. Underlies San Sebastian formation.

Present in Bayamon and San Juan quadrangles in northeastern part of island.

Río Prieto Formation

Eocene: West-central Puerto Rico.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254—B, p. B24—B27. An interfingering complex of several members: lapilli tuff and volcanic sandstone, volcanic sandstone and mudstone, algal limestone, and red conglomerate and conglomeratic mudstone. Red conglomerate and conglomeratic mudstone is Miramar Conglomerate Member. Type localities are given for all the members although Miramar is only named member. Entire formation has maximum thickness of 460 m in central part of report area but is no thicker than 20 m in southeastern part. In Jayuya quadrangle formation rests unconformably upon Cretaceous rocks and plutonic rocks, and is overlain conformably by Monserrate Formation. Farther west rests unconformably on Jayuya Tuff (new) and grades laterally (westward) into Monserrate Formation.

Named for exposures in and near the Río Preito in southwestern part of Jayuya quadrangle. Extends westward into Adjuntas quadrangle near the Río Jauco and continues westward to Hacíenda El Banco. Two small exposures present in Barrio Tanáma in northwest part of area.

Río Pueblo Schist (in Ortega Formation)

Precambrian: New Mexico.

J. P. Miller, Arthur Montgomery, and P. K. Sutherland, 1963, New Mexico Bur. Mines and Mineral Resources Mem. 11, p. 9 (fig. 3), 10. A migmatitic quartzite in lower part of lower member of Ortega Formation. A similar migmatitic quartzite was mapped by Just (1937) in Petaca region and termed Petaca Schist.

Noted in vicinity of Río Pueblo Creek and two miles southeast of village of Río Pueblo, Río Arriba County. Also appears in two outcrops northwest of U.S. Hill where its northernmost exposure is in contact with northerly trending exposures of leucogranite.

Ripley Formation

Age not stated: Central Maine.

P. E. Glidden, 1963, Dissert. Abs., v. 24, no. 6, p. 2422. Five formations described (ascending): Vassalboro, Waterville, Dexter (new), Hartland (new), and Ripley (new).

Pittsfield quadrangle.

Rivanna Formation

Precambrian and Lower Cambrian to Lower Ordovician: Northern Virginia.

H. R. Hopkins, 1961, Dissert. Abs., v. 21, no. 7, p. 1911. Five units in mapped area are (ascending) Lynchburg formation, Catoctin greenstone, Rivanna formation, Keswick formation (new), and Boyd Tavern formation (new). The sedimentary rocks were deposited in eugeosynclinal environment. Sequence of deposition broken by Precambrian—Cambrian unconformity and Middle Cambrian unconformity.

Western Louisa County.

Road Canyon Formation

Road Canyon Member (of Word Formation)

Lower Permian (Leonard Series): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1584 (fig. 2), 1586—1587, 1588. Name Road Canyon Member replaces term "First limestone member" of Word Formation (King, 1931, Texas Univ. Bull. 3038). Predominantly bituminous limestone but also contains calcarenite, calcirudite, and biohermal limestone ranging in thickness from 100 feet to more than 300 feet. Overlies Cathedral Mountain Formation (new). Guadalupian.

G. A. Cooper and R. E. Grant, 1966, U.S. Geol. Survey Bull. 1244—E, p. E6, pl. 2. Raised to formation rank and transferred to Leonard Series.

Type section: In end of spur extending southeast from Peak 5779, 2.4 miles due north of Skinner Ranch, Altuda quadrangle, Brewster County. Not present in Road Canyon but exposed on south side of its east entrance.

Road River Formation

Ordovician and Silurian: Northern Yukon, Canada, and eastern Alaska.

D. E. Jackson and A. C. Lenz, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 1, p. 30—45. Name proposed for Siluro-Ordovician graptolitic shales and carbonates of northern Yukon region. At type locality, formation is underlain conformably by Cambrian(?) shales and argillites and overlain disconformably by Devonian Fort Creek Shale. Maximum thickness 8,700 feet; 2,985 feet at type section which apparently represents only upper part of formation.

Michael Churkin, Jr., and E. E. Brabb, 1965, Am. Assoc. Petroleum Geologists Bull., v. 49, no. 2, p. 172—185. In Tatonduk—Nation Rivers area, Alaska, consists of 400 to 900 feet of dark-gray graptolitic shale with lesser amounts of grayish-black laminated chert and very minor amounts of dark-gray limestone, greenish-gray dolomite, black chert arenite, and conglomerate. Disconformably overlies limestone sequence more than 300 feet thick from which Middle and Upper Cambrian trilobite collections have been made. Disconformably underlies McCann Hill Chert (new).

E. E. Brabb, 1967, U.S. Geol. Survey Prof. Paper 559—A, p. A15. Unconformably overlies Hillard Limestone (new). Ranges in age from middle or Late Ordovician (Arenigian or Llanvirnian) to Late Silurian (Ludlovian).

Type section: On north bank of unnamed tributary of Road River (approximately lat 66°44′ N; long 135°46′—48′ W.) which flows eastward to join the Road River, northern Yukon.

Roadside Formation

Upper Cretaceous: Southwestern Arizona

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H10—H11. Consists mostly of volcanic conglomerate and andesitic flows and breccias. Lower part consists of dacitic flows and poorly defined to well-defined beds of material that ranges from pebbly mudstone to boulder conglomerate and breccia. Lower part equivalent to Claflin Ranch Formation of Richard and Courtright (1960, Arizona Geol. Soc. Digest, v. 3). Upper part largely of poorly bedded lenses of angular to subrounded fragments of purplish-gray andesite in matrix of smaller equivalent to Silver Bell Formation of Richard and Courtright. Probably several thousand feet thick in vicinity of Roadside mine where steeply dipping beds are exposed nearly continuously for about 2½ miles along their strike. Appears to be unconformable on Cocoraque Formation (new).

Michael Bikerman, 1967, Geol. Soc. America, Bull., v. 78, no. 8, p. 1029—1036. Isotopic studies in Roskruge Mountains, Pima County. The 108—m.y. age of the whole rock andesite in Cocoraque formation is the first definitely mid-Cretaceous date obtained on volcanic rocks in Tucson-Roskruge area. Position of sample within the Cocoraque formation of Heindl (1965) would place his younger Roadside formation in the Late Cretaceous.

Type locality: Along line from Roadside mine to base of Roskruge Rhyolite on Bell Mountain. Named for exposures in vicinity of Roadside mine between Dobbs Buttes and Coyote Mountains, Papago Indian Reservation.

Roaring Spring Member (of Salona Formation)

Middle Ordovician: Central Pennsylvania.

R. R. Thompson, 1961, Dissert. Abs., v. 22, no. 1, p. 231—232. Characterized by interlayers of laminated and cross-laminated fine-grained calcarenite. Overlies New Enterprise member (new).

R. R. Thompson, 1963, Pennsylvania Geol. Survey 4th ser., Bull. G—38, p. 20, 22—23, 123—124. Formal proposal of name. Thickness 76 feet at type section herein designated. Characterized by interbeds of laminated and cross-laminated fine-grained calcarenites which constitute about 20 percent of member and argillaceous calcilutites which comprise about 60 percent of member. Overlies New Enterprise Member. Underlies Milesburg Member of Coburn Formation.

Type section: At New Enterprise Co. quarry near Roaring Spring, Blair County, and near town of Rodman.

Robe Hill Member (of Cane Valley Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. Middle member of Cane Valley. Thickness 400 feet. Overlies Hope member (new) and underlies Springfield member (new).

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 199—200, pl. 1. Medium- and coarse-grained tuffaceous sandstone interbedded with mudstone. Thickness 400 feet where best exposed. Thins to featheredge to north. Overlies Hope Member. Underlies Springfield Member.

Best exposed in road cut 2,000 feet north-northeast of Robe Hill.

Roberson Sand (in Tokio Formation)

Upper Cretaceous: Subsurface in Louisiana and Arkansas.

S. H. Ogier, 1963, Shreveport Geol. Soc. Ref. Vol. 5, p. 102—103. Roberson sand was defined by Order No. 263—D, on page 201 of the Rules and Regulations of the Louisiana Department of Conservation, Volume 1. [Compiler did not see this reference.] "Adopting rules for the Roberson sand in Redland field, Bossier Parish, Louisiana: Effective December 1, 1957. The Roberson sand of the Tokio formation shall be construed as that sand found between the interval of 3010 — 3030 feet in the Sunray-Mid-Continent Oil Co., G. W. Roberson No. 4 well, located in sec. 28, T. 23 N., R. 12 W." This original definition has been modified by present writer to include entire sandy section within interval of 2997 to 3035 feet. Modification made to facilitate regional correlation, since the revised upper boundary of unit coincides with Brownstown-Tokio contact. In subject well (see above) the boundaries of Roberson sand are quite distinct. Core descriptions of interval show Roberson consists of gray sandy shale underlain by white glauconitic medium-to fine-grained fossiliferous sand containing numerous shale partings. A medium-to coarse-grained sand occurs near base. Overlies Trees City sand (new). Thins and merges with Trees City sand northward in Arkansas. Thickest development of Roberson sand and equivalents occurs south and east of representative well in North Louisiana syncline in southern Webster and Bossier Parishes.

Representative well: Sunray-Mid-Continent Oil Co., G. W. Roberson No. 4 well, in sec. 28, T. 23 N., R. 12 W., Bossier Parish, La.

Robertson River Formation

Precambrian: North-central Virginia.

R. M. Allen, Jr., 1963, Virginia Div. Mineral Resources Bull. 78, p. 11 (fig. 2), 24—25, pl. Name suggested for northeastward-trending exposures of hornblende granite and hornblende syenite that crop out roughly parallel to U.S. Highway 29 throughout Greene and Madison Counties. Formation is about 1½ miles wide in Greene County and crops out on both sides of U.S. Highway 29. Outcrop widens to about 3 miles in vicinity of

Shelby, Madison County, and to northeast of Madison is about 4 miles wide. Robertson River is in contact with Lovingston formation along its northwest border and with Lynchburg formation on southeast. In Brightwood area, Madison County, a zone of Lovingston lies to southeast of Robertson River formation. Southeast of Robertson River—Lynchburg contact, outliers of Robertson River are within the Lynchburg. Contact with Lovingston is gradational. Contact with Lynchburg generally sharp and marked by silicified zone.

Named for exposures along valley walls of Robertson River northeast of Madison.

Robinson Canyon Member (of Chamisal Formation)

Miocene, middle: Western California.

O. E. Bowen, 1965, in Symposium of papers presented at 40th Ann. Pacific Section Am. Assoc. Petroleum Geologists Convention, Bakersfield, Calif., p. 48—67 [1966]. Lower member of Chamisal Formation. At type locality [exposures along Robinson Canyon road to northeast of Chamisal Ridge] member is continuously exposed over half a square mile and is believed to underlie at least 4 square miles, rests on granitic basement rocks, and is conformably and gradationally overlain by Los Tularcitos Member (new). Thickness as much as 450 feet. Bulk of type section is occupied by light-red coarse arkosic sandstone. Sandstone is commonly pebbly and conglomerates are intertongued. Debris of member is predominantly porphyritic granodiorite with lesser Sur Series schist and gneiss. In some areas lenses out and Los Tularcitos Member lies directly on granitic basement. No fossils. Name credited to E. Brown (1962, unpub. rept.).

Named for excellent exposures [type locality] along Robinson Canyon Road to the northeast of Chamisal Ridge in northeast corner of Point Sur quadrangle.

Roby Silt

Pleistocene (Illinoian): Central Illinois.

W. H. Johnson, 1963, Dissert. Abs., v. 23, no. 11, p. 4316; H. B. Willman, H. D. Glass, and J. C. Frye, 1963, Illinois Geol. Survey Circ. 347, p. 2 (fig. 1), 6. Roby Silt includes lacustrine deposits that lie strategraphically between Jacksonville and Buffalo Hart drifts.

Town of Roby is in Christian County.

Rockabema Quartz Diorite

Ordovician: Northeastern Maine.

E. B. Ekren and F. C. Frischknecht, 1967, U.S. Geol. Survey Prof. Paper 527, p. 8—11, pl. 1. Two stocks of quartz diorite measuring 8 miles by 3 miles and 2 miles by about 1 mile, respectively, are present in north-central part of Island Falls quadrangle. The quartz diorite, herein named Rockabema Quartz Diorite, intrudes strata of Grand Pitch and Shin Brook Formations and spillite lavas; it is intensely sheared and brecciated. Boulders of quartz diorite that are petrographically very similar to the rock in the stocks are present in the conglomerate beds that crop out east of Patten and Bear Brook. The stocks are therefore considered to be younger than early Middle Ordovician and older than Silurian.

Type locality: Along northeast and north shore of Rockabema Lake, Island Falls quadrangle. Also crops out in vicinity of Pleasant Lake, and Hastings Brook in T. 6 N., R. 6 W., and in Moro and Merrill Townships, R. 6 W.

Rock Creek Flow (in Columbia River Basalt)

Miocene, lower: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 21—22, fig. 18. Member of "Lower" Basalt of Columbia River Basalt [Group] overlies Eagle Creek Interbed (new). Typically 350 feet thick. Colonades of the flow made up of columns 5 to 6 feet in diameter and 50—660 feet in length. Middle Cenozoic.

Jane Gray and L. R. Kittleman, 1967, Am. Jour. Sci., v. 264, no. 4, p. 257—291. Geochronometry of Columbia River Basalt and associated floras of eastern Washington and western Idaho. Within the Lower Basalt Member of Columbia River Basalt in Clearwater Embayment, Bond (1963) named two members, Eagle Creek Interbed and overlying Rock Creek Flow. Rock Creek unit may be overlain by as many as three unnamed flows of Lower Basalt, although locally, the Rock Creek Flow may form top of Lower Basalt sequence. Radiometric date of 21.3 m.y. on the Rock Creek Flow provides an approximate age both for the underlying Eagle Creek Member and for an unnamed sedimentary unit at Potlatch Creek that is intercalated in Lower Basalt. Age limit for Eagle Creek Member is minimum; without knowing more than the approximate strategraphic relationship of the Rock Creek Flow to the fossiliferous rock at Potlatch Creek, it is not possible to know whether the 21.3 m.y. is a minimum or maximum age for the Potlatch Creek fossil assemblage. Plant assemblages associated with the Lower Basalt in Idaho appear to be of Miocene age. Lower Miocene.

Named for exposure about 2,000 feet beneath surface of Camos Prairie in bottom of Rock Creek Canyon where it crops out down stream from mouth of Grove Creek County.

Rock Creek Quartz Diorite Gneiss

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. Uniform-textured flaser gneiss locally banded with layers rich in biotite and hornblende, and with alternate quartz and plagioclase layers. Name credited to D. L. Schmidt (1958, U.S. Geol. Survey open-file rept.).

In long Valley district, Boise Basin.

Rockian Glaciation, Drift

Rockian deglaciation, advance

Pleistocene: Wisconsin and Illinois.

R. F. Black, 1962, (abs.) Geol. Soc. America Spec. Paper 68, p. 137. With possible exception of clastic traditionally assigned to Windrow formation of Cretaceous age, no Pleistocene deposits older than Wisconsin Stage are recognized in Wisconsin. Earliest recognized ice invasion, Rockian, advanced simultaneously westward from Lake Michigan lobe and eastward from Des Moines lobe about 30,000 years ago, according to three carbon-14 dates from each lobe. That advance destroyed a spruce forest on residual soil and apparently covered entire slate. None of the events between Rockian advance and the well-dated Two Creeks Interstadial of 11,000 to 12,500 years B.P. is dated in Wisconsin Rockian deglaciation that is characterized by extensive stagnation features and is correlated with Farmdalian interstadial of Illinois, dated about 22,000 to 28,000 years ago.

R. F. Flint, 1963, Science, v. 139, no. 3553, p. 402—404. Rockian glaciation listed on chart showing present status of the stratigraphy of Wisconsin stage in four selected regions.

Named after Rock River in southern Wisconsin and northern Illinois.

Rock Rabbit Formation (in Missoula Group)

Precambrian (Belt Series): Montana.

E. S. Perry, 1962, Montana Bur. Mines and Geology Bull. 26, p. 21 (fig. 11). Shown at top of Missoula Group in list of geologic formations in Montana.

Type locality and derivation of name not stated.

Rockview Member (of Axemann Limestone)

Lower Ordovician: Central Pennsylvania.

J. A. Lees, 1965, Dissert. Abs., v. 26, no. 2, p. 985. Lower member of formation in area. Characterized by predominance of calcarenite interbedded with dolomite. Thickness 250 feet. Underlies Half-Moon Hill Member (new).

J. A. Lees, 1967, Pennsylvania Geol. Survey, 4th ser., Bull. G—52, p. 16—17, 42—45, 47—50. Formal proposal of name. Underlies Half-Moon Hill Member. Overlies Nittany Limestone. Contact between the two members poorly exposed so that exact thickness of member is not known, but is estimated at about 250 feet. Member subdivided into upper and lower calcarenite beds separated by middle unit of pelmatozoan beds. Upper calcarenite beds, commonly in 3-inch to 1-foot layers, are 80 to 100 feet thick and are composed of interlayered pelmatozoan calcarenite, lithic calcarenite, and fine-grained calcarenite, interspersed with lesser amounts of calcilutite and dolomite. A 10- to 12-foot oolitic sequence present at base. The pelmatozoan calcarenite beds, commonly in 1- to 2-foot layers, are 60 to 70 feet thick except at Benner Pike section where they are about 100 feet.

Type section: Located about 6 miles northeast of State College, Centre County, about 9,500 feet west of long 77° 45′ W., and 10,000 feet north of lat 40° 50' N., in a quarry about 100 yards southeast of Route 26. Named for exposure in a quarry of Rockview Penitentiary.

Rockway Dolomite Member (of Irondequoit Limestone)

Silurian: Ontario, Canada, and western New York.

W. J. Kilgour, 1963, Geol. Soc. America Bull., v. 74, no. 9, p. 1127—1141. At type locality is dense to compact fine-grained buff to gray dolomite which weathers buff. Mostly massive with a few gray shale breaks. Three to 15 inches of blocky brown shale at base. At most localities a 3- to 12-inch dolomite limestone bed occurs at top of member overlying a thin gray to brown shale. Thickness 12 feet at type locality. Occurs at base of formation. Overlies Merritton Limestone Member (new) of Reynales at its [Rockway] type locality. Overlies Hickory Corners Limestone Member (new) of Reynales from Middleport, N. Y., to Niagara Gorge. West of gorge disconformably overlies Merritton Limestone. At Woolverton Road west of Grimsby, overlies Thorold Sandstone disconformably. At Limehouse, Ontario, overlies Cabot Head Shale. Has been considered upper part of Reynales Formation.

Type locality: In Fifteen Mile Creek at Rockway, Ontario.

Rocky Coulee Basalt Member (of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 8, 9—11. Basal member of Yakima Basalt. Underlies Museum Basalt Member (new). Thickness in Vantage-Priest Rapids area 200±10 feet.

Type locality: At mouth of Rocky Coulee, just west of Vantage, Kittitas County. Well exposed in highway cut on east side of Columbia River about 1 mile south of Vantage.

Rocky Peak Member (of Brigham Quartzite)

Cambrian: Southeastern Idaho.

A. S. Keller, 1967, Dissert. Abs., v. 28, no. 7, sec. B, p. 2746. Name proposed for member of Brigham Quartzite.

Area is behind Bannock thrust in parts of Montpelier and Preston quadrangles.

Rocky Point Formation

Lower Cretaceous: Southwestern Oregon.

J. G. Koch, 1963, Dissert. Abs., v. 24, no. 4, p. 1572. Early Cretaceous in Klamath province is represented by one of thickest, coarsest, and most complete Lower Cretaceous (Valanginian) sequence known on West Coast. Sequence is herein subdivided into basal Humbug Mountain Conglomerate (new) and gradationally overlying Rocky Point Formation.

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 30 (fig. 2b), 31 (fig. 3), 33 (fig. 4), 36, 48, 49 (fig. 17). Formal proposal of name. Myrtle Group of Imlay (1959, Am. Assoc. Petroleum Geologists Bull., v. 43, no. 12), whose type locality is along South Umpqua River near Days Creek, consists of Upper Jurassic Riddle Formation and Lower Cretaceous Days Creek Formation. Rocks of like age in Port Oxford-Gold Beach area were designated by these names. Koch (1963) recognized lithologic differences and renamed the coastal rocks (ascending) Otter Point Formation, Humbug Mountain Conglomerate, and Rocky Point Formation. The Rocky Point is dominated by rhythmically interstratified dark-gray to black mudstone and graded sandstone associated with conglomerate that, unlike the older Cretaceous unit, is finer, much less abundant, richer in chert, and confined largely to the basal parts of graded beds. Formation is thicker, 6,000 feet, and has few calcareous rocks than the correlative inland type Days Creek Formation.

Type section: At Rocky Point in NW¼ sec. 15, T. 33 S., R. 15 W., Port Orford-Gold Beach area, southwestern Oregon Coast.

Rodin (Roden) Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Rodin (Roden) flow listed as a thick flow with steep fronts. In general in stage III and stage IV flows there is considerable variation in thickness. Some are 10 to 20 feet thick and others 75 to 100 feet thick.

Roden Crater is south of Wupatki and west of Little Colorado River a little north west of Grand Falls.

Romanzof Granite

Upper Devonian(?): Northeastern Alaska.

G. E. Sable, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2417. Romanzof Granite, exposed in Okpilak batholith and Jago stock is mostly light-gray quartz monzonite to granite with perthitic microcline, albite-oligoclase, and partly chloritized biotite. Gneissic, gneissoid, and schistose textures are common. Lead-alpha ages of zircons are Paleozoic. K-Ar ages of biotite are Cretaceous. Field realationships suggest pre-Kayak(?) (Upper Devonian) granite emplacement with later superimposed orogenic effect.

In Romanzof Mountains of Brooks Range.

Rome Beds

Pliocene: Eastern Oregon.

E. M. Baldwin, 1964, Geology of Oregon, Ann Arbor, Mich., Edwards Brothers, Inc., p. 137. Mid-Pliocene beds of upper Owyhee River are exposed near Rome. They are nearly horizontal tuffaceous sediments 400 to 500 feet thick and are capped by persistent thin sheet of basalt. Frequently referred to as "Rome Beds" but term Rome is preoccupied. Beds appear to be in same stratigraphic position as Thousand Creek Formation (Merriam, 1910). They may be generally equivalent to beds in Grassy Mountain Formation and Kern Basin Formation.

Root Pond Quartzite Member (of Orwell Formation)

Middle Ordovician: Vermont.

C. G. Doll, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. Massive quartz sandstone, near Benson and West Haven, that overlies Orwell limestone.

Roricks Glen Member (of Rhinestreet Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. A black-shale sequence and uppermost recognizable tongue of Rhinestreet. Contains widely spaced beds of black shale separated by thin-bedded dark-gray shales and siltstone. Thickness 40 feet at type locality. Overlies Beers Hill Member (new).

Named for exposures at Roricks Glen Scout Camp on southern bank of Chemung River at Elmira, Chemung County.

Rosa Member (of Yakima Basalt)

See **Roza Member** (of Yakima Basalt).

Rosario Beds

Recent: Puerto Rico.

J. D. Weaver, 1962, (abs.) Caribbean 3d Geol. Conf. (Programme), April 2—11, Kingston, Jamaica, p. 41. Thick dark-red deposits covering top of ridge of Las Mesas. These beds have been described as residual laterite but are now believed to be sedimentary deposits. Deposits are related to series of high level erosion surfaces.

Las Mesas Ridge, Mayaguez.

Rosario Formation[1]

Upper Cretaceous: Baja California, Mexico, and southern California.

Original references: Anon. [C.H. Beal] 1924, Bol. d. Petrol (Mexico), v. 17, no. 6, p. 421, Manuel Santillán and Tomás Barrera, 1930, Anales del Instituto Geologia d. Mexico, v. 5, p. 10—14, F. M. Anderson and G. D. Hanna, 1935, California Acad. Sci. Proc. 4th ser., v. 23, no. 1, p. 7.

E. D. Milow and D. B. Ennis, 1961, Geol. Soc. America Cordilleran Sec. Field Trip Guidebook, 57th Ann. Mtg. p. 24, 26. Term Rosario formation geographically extended into San Diego County, Calif. Consists of five unnamed members. Thickness about 1,800 feet. Overlies Alisitos formation (also extended from Mexico); underlies Delmar formation.

Named for development near town of Rosario quadrangle, Baja California, Mexico.

Roseberry Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Roseberry sand occurs at depth of 9,150 to 9,188 feet in type well. Correlation of Roseberry, Sexton, Tucker, and Taylor sands is difficult downdip from type area because sands merge into massive sandstone bar of Schuler.

Type well: Magnolia Petroleum Co., No. 1 Roseberry unit, sec. 29, T. 23 N., R. 9 W., Shongaloo field. Reference well: Stanolind Oil and Gas Co., No. 1 Beene unit, sec. 5, T. 22 N., R. 9 W., Webster Parish.

Rosebud Member (of Trowbridge Formation)

Upper Jurassic: East-central Oregon.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 61, pls. 1, 3. Dominantly hard faintly laminated dark mudstone with characteristic pencil fracture. Two horizons of ellipsoidal calcareous concretions, each 1 to 3 feet in diameter, occur 20 to 40 feet above base in type locality. Thickness 400 to 500 feet except southwest of Sheep Creek, where it is progressively onlapped by overlying Officer Member (new).

Type locality: In type area of Trowbridge Formation on spur along line between SW¼ sec. 28 and SE¼ sec. 29, T. 17 S., R. 28 E., in vicinity of Rosebud Creek, Grant County.

Rosedale Sandstone

Miocene, upper: Southern California (subsurface).

B. D. Martin, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 3, p. 441—456. An anomalous sequence of strata, principally sandstones and pebble conglomerates, at least 1,200 feet thick, occurs within widespread lower Fruitvale Shale. Some interbeds of siltstone occur, but because of preponderance of coarser material, total unit is called sandstone. Name Rosedale is proposed because of proximity to Rosedale oil field. Rosedale Sandstone appears to represent sedimentary fill within Late Miocene submarine canyon. Name Rosedale Channel proposed for the erosional feature. Base of Rosedale rests either on earlier lower Fruitvale or on Round Mountain Siltstone. Upper boundary limited by lower Massive Sandstone Member of Stevens Sandstone.

Name derived from Rosedale oil field, near Bakersfield. Sandstone is about 7 miles west of Bakersfield, T. 29 S., R. 26 E., Mount Diablo base and meridian. It trends generally north-south through eastern half of township.

Rose Run Sandstone Member (of Chepultepec Dolomite)

Lower Ordovician: Eastern Kentucky (subsurface).

W. H. McGuire and Paul Howell, 1963, Oil and gas possibilities of the Cambrian and Lower Ordovician in Kentucky: Lexington, Kentucky, Spindletop Research Center, p. 2—2 (table), 2—12. A thick well-developed quartzose sandstone at top of lower sandy unit of the Chepultepec. Thickness 68 feet in well on Rose Run Iron Co. property. Named by Freeman (1949, Am. Assoc. Petroleum Geologists Bull. 33, no. 10).

Named from well drilled by Judy and Young on property of Rose Run Iron Co., Bath County. Property is drained by Rose Run Creek.

Roskruge Rhyolite

Roskruge Volcanics

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U.S. Geol. Survey Bull. 1194—H, p. H1, H13, H14. A variable sequence of rhyolitic flows, tuffs, agglomerates, and intercalated lenses and dacitic andesitic flows. In some areas divided into Pescadero Member (new) and Dobbs Buttes Member (new). Where the Roskruge is composed of intertonguing flows, and pyroclastic and sedimentary units, it is not subdivided. Flows commonly pinkish to reddish gray, lenticular, and range from a few tens to about 300 feet in thickness. Thickness of formation as much as 4,000 feet in central part of Roskruge Mountains. Rests on tilted beds of Roadside Formation (new) and older deposits; overlain unconformably by late Tertiary volcanic and alluvial deposits.

Michael Bikerman, 1967, Geol. Soc. America Bull., v. 78, no. 8, p. 1029—1036. Isotopic studies in Roskruge Mountains. Overlying the mid-Cretaceous sequence, Cocoraque and Roadside formations of Heindl (1965), is thick series of brightly colored ash flows and volcanic breccias called Roskruge rhyolite by Heindl but here termed Roskruge volcanics in deference to their varied rock types. The formation, primarily quartz-latitic to rhyodacitic composition, forms main portion of Roskruge Mountains. The volcanics are made up of two ash-flow sheets intercalated with air-fall tuffs and breccias and capped by thick flows of volcanic breccias and flows. Lower ash-flow sheet is named Viopuli ignimbrite. Upper sheet is a more extensive and thicker unit, composed of two or more separate ash flows forming a single cooling unit, or possibly a composite sheet.

Type locality: Exposures in Roskruge Mountains, Papago Indian Reservation.

Rough Ridge Member (of Packsaddle Formation)

Precambrian: Central Texas.

R. V. McGehee, 1964, Dissert. Abs., v. 24, no. 7, p. 2870. Overlies Sandy Creek Member (new).

Southeastern Llano uplift.

Round Pond facies (of Appleton Formation)

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Facies characterized by finger-sized white chiastolite metacrysts that commonly have intermediate pink zones around cruciform cores. Chiastolite-bearing units are intercalated with chiastolite-free metasedimets 5 to 10 inches thick. Chiastolite-bearing Round Pond facies grades southward into a sillimanite-bearing gneiss. Although unmapped, the western shore Sennebec Pond is known to be underlain by Round Pond facies. Farther north beneath the bridge at Appleton the Round Pond facies has become a phyllite, but the very large chiastolite metacrysts persist. Ghent phyllite (new) is inferred to be equivalent to the chiastolite- bearing lustrous gray phyllite of Round Pond facies in riverbed at Appleton Center. May be stratigraphic equivalent of Vaughan Neck gneiss (new).

Known to extend from Round Pond northward to Sennebec Pond, northwestern Knox County marble belt.

Roundstone Bed (in Cowbell Member of Borden Formation)

Mississippian: Southeast-central Kentucky.

G. W. Weir, J. L. Gualtieri, and S. O. Schlanger, 1966, U.S. Geol. Survey Bull. 1224—F, p. F15. Name applied to lower siltstone tongue of the Cowbell. Upper tongue named Conway Cut Bed. The siltstone tongues pinch out a few miles southwestward within Nancy Member (new).

Named for outcrops along Roundstone Creek about 3 miles south of Berea.

Roundtop Mountain Greenstone

Precambrian: Southwestern Wyoming.

R. W. Bayley, 1965, U.S. Geol. Survey Geol. Quad. Map GGQ—458. Mapped in South Pass City quadrangle. Includes chlorite schist, chlorite-actinolite schist, and hornblende schist, probably all derived from ellipsoidal basalt. Thickness at least 5,000 feet. In fault contact with Miners Delight Formation (new). On map explanation occurs above Goldman Meadows Formation (new).

R. W. Bayley, 1965, U.S. Geol. Survey Geol. Quad. Map GQ—460. Formal proposal of name. Includes ellipsoidal greenstone, chlorite schist, chlorite-actinolite schist, and hornblende schist, probably all derived from ellipsoidal basalt. Thickness at least 5,000 feet. Overlies Goldman Meadows Formation (formal proposal). Type locality stated. Fault contact with Miners Delight Formation (formal proposal).

Type locality: Roundtop Mountain, secs. 30 and 31, T. 30 N., R. 99 W., Miners Delight quadrangle. Fremont County.

Round Valley Peak Granodiorite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1532. Notably equigranular and medium grained. Biotite and hornblende are evenly distributed in discrete euhedral crystals. Younger than Wheeler Crest Quartz Monzonite (new) and older than quartz monzonite similar to Cathedral Peak Granite. Intrusive relations with Tungsten Hills Quartz Monzonite (new) are less certain, but Tungsten Hills Quartz Monzonite believed to be younger.

Type locality: Both sides of upper Rock Creek east-central Sierra Nevada, near Bishop. Forms mass in northwest corner Mount Tom quadrangle and adjoining three quadrangles. Underlies a little more than 18 square miles within Mount Tom quadrangle; total area about 40 square miles. Named for Round Valley Peak, a high point along Wheeler Crest.

Rowland Member (of Drakes Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U.S. Geol. Survey Bull. 1224—D, p. D17. Chiefly grayish-green dolomite or limy sparsely glauconitic silty mudstone. Thickness 40 to 60 feet. Underlies Preachersville Member (new); overlies Reba Member of Ashlock Formation (both new).

Type section: Roadcuts along U.S. Highway 27 on outskirts of Stanford, about 1.2 miles west of Rowland, Lincoln County.

Royal Gorge Rhyolite (in Middlebrook Group)

Precambrian: Southeastern Missouri.

W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 30, 31. A dull light-brownish-purple porphyritic rhyolite with small red feldspar phenocrysts.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Middlebrook group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Sample collected in E½SE¼SW¼ sec. 14, T. 33 N., R. 3 E., Madison County. Royal Gorge feature is in T. 33 N., R. 3 E., Iron County.

Roza Member (of Yakima Basalt)

Roza Basalt Member (of Yakima Basalt)

Miocene, upper: South-central Washington, and northeastern Oregon.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 5, 8, 21—23, 26. Overlies Frenchman Springs Basalt Member (new). At type locality overlies Squaw Creek diatomite (new) of Frenchman Springs Basalt. Underlies Priest Rapids Basalt Member (new). Thickness in Roza-Squaw Creek area 100±10 feet.

J. W. Bingham and K. L. Walters, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C87—C90. Name modified to Roza Member. Geographically extended into Whitman and eastern Franklin Counties. Consists of two flows in Devils Canyon where it is about 160 feet thick and of one flow in Yakawawa Canyon where it is about 80 feet thick. A good horizon marker. In area of present report overlies Frenchman Springs Member and underlies Priest Rapids Member.

J. W. Bingham and M. J. Grolier, 1966, U.S. Geol. Survey Bull. 1224—G, p. G8—G9. Consists of two basalt flows and has thickness of over 200 feet where both flows are present. Lower flow is key stratigraphic marker throughout Columbia Basin Irrigation Project area. This flow is relatively uniform in thickness and composition. It has been identified as far north as Coulee City in the Grand Coulee, as far south as Pendleton, Oreg., as far west as vicinity of Goldendale, and as far east as Colfax, an area of over 20,000 square miles. Overlies Frenchman Springs Member. Underlies Priest Rapids Member.

Type locality: Scarp on east side of Yakima River opposite Roza Station, Kittitas County.

Rubidoux Mountain granite or leucogranite

[Cretaceous]: Southern California.

P. O. Banks and L. T. Silver, 1962, (abs.) Geol. Soc. America Spec. Paper 68, p. 5—6. Name applied to leucogranites from Rubidoux Mountain. Samples of the leucogranites and granite have been used in a number of geochemical studies involving extensive mineralogical and petrographic observations.

P. O. Banks and L. T. Silver, 1964, (abs.) Am. Geophys. Union Trans., v. 45, p. 108. Zircon results on Mount Rubidoux leucogranite suggest age of granite is 120+5 m.y.

Occurs on Mount Rubidoux [Rubidoux Mountain], Riverside County.

Rush Creek Member (of Rushford Lake Formation)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 272—273. Mostly gray silty shale with thin interbeds of sandstone and siltstone. Thickness about 54 feet. Separated from underlying Caneadea Shale by Alfred Station Coquinite Member (new) of Rushford Lake or by Rushford Sandstone Member. Underlies Scholes Formation (new).

Type section: About 300 feet south of Rushford Lake and Caneadea Storage Dam on Caneadea Creek. Named from exposures along Rush Creek in Allen Township, Allegany County.

Rush Creek Member (of Woodbine Formation)

[Upper Cretaceous]: North-central Texas.

C. F. Dodge, 3d, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1575. Two new member names proposed for the Woodbine. Rush Creek below and Arlington above.

Area of report is Tarrant County.

Rushford Lake Formation (in Canadaway Group)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 271—273. Overlies Caneadea Shale and underlies Scholes Formation (new) of Canadaway Group to north and Machias Formation of Conneaut Group to south. At type section, two thick sandstone units are present and are separated by 73 feet of shale and siltstone and sandstone interbeds. Geometry of these sand bodies differs markedly. The younger sand, which is Scholes Formation, is blanketlike; the older sandstone (Rushford Sandstone) is shoestring sand, which laterally gives way to persistent coquinite bed (Alfred Station Coquinite, new). Third member of formation, the Rush Creek (new), overlies both the shoestring sand and the coquinite. Thickness 152 feet at type section.

Type section: About 300 feet south of Rushford Lake and Caneadea Storage Dam on Caneadea Creek.

Russell Ranch Formation

Pre-Tertiary: South-central Washington.

D. A. Swanson, 1967, Geol. Soc. America Bull., v. 78, no. 9, p. 1081 (fig. 2), 1082 (table 1). Discussion of Yakima Basalt of Tieton River area. The basalt overlies rocks ranging in age from pre-Tertiary to early or middle Miocene. G. C. Simmons (1950, unpub. thesis) applied name Russell Ranch formation to pre-Tertiary tonalite- trondhjemite pluton, argillite and graywacke, and greenstone. Rocks are highly sheared, faulted, and folded along north-northwest axes. Deeply weathered and eroded before overlying rocks were deposited.

Mapped in vicinity or Blue Slide, North Fork Ahtanum Creek, and Darling Mountain, Tieton River area, Yakima County. Pre-Tertiary tonalite formed steptoe at least 900 feet high between Blue Slide and Darling Mountain.

Ryder Drift

Pleistocene: North Dakota.

W. A. Pettyjohn, 1967, North Dakota Geol. Survey Misc. Ser. 30 (Guidebook 18th Ann. Field Conf. Friends of the Pleistocene), p. 127—128. Referred to as Ryder drift sheet. Ryder dead-ice moraine is separated from Martin dead-ice moraine by trenches partly filled with collapsed outwash, by relatively small uncollapsed outwash aprons, or by perched outwash. Not possible to distinguish end moraines of Ryder and Martin dead-ice deposits in Ward County as has been shown by some earlier workers. Evidence suggests that Makoti, Ryder, and Martin moraines are nearly same age.

Ward County.

Rye Cove Limestone

Middle Ordovician: Southwestern Virginia.

W. B. Brent, 1963, Virginia Div. Mineral Resources Rept. Inv. 5, p. 4 (table 1), 6 (table 2), 24—25, pl. 1. Dark fine- to medium-grained cherty limestone and gray calcilutite. Thickness 200 to 220 feet. Overlies Lincolnshire limestone; underlies Rockdell limestone. Contains equivalents of Elway and Five Oaks limestones and Lincolnshire formation; some beds in upper part may be Rockdell limestone.

Type section: About 0.8 mile southwest of Brick Church and 0.2 mile southeast of Carter Cemetery, Rye Cove area, Clinchport quadrangle, Scott County.

Rye Patch Formation

Pleistocene: Western Nevada.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 7, 8—9. Defined as deposits of an ancient Pleistocene lake that existed in approximate area which was subsequently inundated by Lake Lahontan, and which are younger than the Humboldt Valley Soil and older than the Cocoon Soil. Maximum thickness about 30 feet. Most conspicuous feature is resistant calcium carbonate-cemented bed of pebble gravel in middle part that crops out on west side of Humboldt River a few feet above level of Rye Patch Dam spillway. This bed, 5 to 8 feet thick, is shallow-water deltaic deposit. Beneath gravel bed is zone, 5 to 15 feet thick, of lacustrine silt, clay, and locally sand and vitric volcanic ash. Overlying the cemented gravel bed is zone, about 12 feet thick, or lacustrine silt and clay with intercalated thin bed of colluvium. Overlies Lovelock Formation (new). Underlies Paiute Formation.

Type locality: Exposures within a quarter-mile radius of Rye Patch Dam in bluffs of Humboldt River valley, Pershing County.

Rye Patch-Cocoon Stage

Pleistocene: Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. [For explanation see Sehoo-Toyeh Stage.] Rye Patch-Cocoon Stage was preceded by Lovelock-Humboldt Valley Stage and followed by Eetza-Churchill Stage.

Type area: Bluffs along Humboldt River near Rye Patch Dam, Pershing County, Nev.

Sabana Hoyos Member (of Maravillas Formation)

Sabana Hoyos Limestone Member (of Cariblanco Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U.S. Geol. Survey Misc. Geol. Inv. Map I—335. A lenticular limestone unit at top of formation. Thickness as much as 30 m at type locality. Occurs above Pio Juan limestone member (new).

J. D. Weaver, Ed., 1964, Geol. Soc. America Guidebook Puerto Rico Field Trip Nov. 22—24, p. 15. Referred to a Sabana Hoyos Limestone Member of "Maravillas" Formation.

Type locality: At south edge of Sabana Hoyos, a community in south-central part of Coamo quadrangle. Also crops out on ridge just northwest of Cerro Santa Ana at San Diego, and in two places along fault that runs westward from San Diego.

Sabinas Series or Epoch

Upper Jurassic: Gulf Coast Province.

W. E. Humphrey, 1956, Notes on the geology of northwest Mexico: Corpus Christi Geol. Soc., 41 p. Name used to include all Upper Jurassic strata in northeast Mexico. Includes Zuloaga group below and La Casita group above. Underlies Coahuila series.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 287—297. Sabinas series as used herein includes two provincial stages, Zuloaga and La Casita.

Named for Sabinas Gulf along eastern margin of Mexican geosyncline.

Sacagawea Ridge Glaciation, Till

Pleistocene: Northwestern Wyoming to southwestern Colorado.

G. M. Richmond, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D132—D136. Name Sacagawea Ridge Till applied to middle of three pre-Bull Lake tills. Thickness of till 65 to 81 feet at type section where it underlies Dinwoody Lake Till and overlies conglomerate of Tertiary age; 30 feet thick on Cedar Ridge. Disconformably overlies Cedar Ridge Till (new); disconformably underlies Dinwoody Lake Till (new). The three tills may be equivalent to Rocky Flats Alluvium (oldest), Verdos Alluvium, and Slocum Alluvium of Denver Basin, which in turn are correlated with Nebraskan, Kansas, and Illinoian Glaciations of midcontinent region. For purposes of correlation in Rocky Mountain region, terms Cedar Ridge Glaciation, Sacagawea Ridge Glaciation, and Dinwood Lake Glaciation are proposed from type localities of their respective tills.

G. M. Richmond, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C137—C143. Quaternary stratigraphy of Durango area, San Juan Mountains, Colo. End moraine of type Durango Till (Atwood and Mather, 1932, U.S. Geol. Survey Prof. Paper 166). Some of Atwood and Mather's (1932, U.S. Geol. Survey Prof. Paper 166) Durango moraines are of Bull Lake age, but their type Durango moraine represents the youngest of the three pre-Bull Lake glaciations, the Sacagawea Ridge Glaciation. Florida Gravel is outwash of Sacagawea Ridge age and may represent two glacial advances.

Type section: Sacagawea Ridge on north side of Upper Dinwoody Lake, center sec. 31, T. 5 N., R. 5 W., Fremont County, Wyo.

Sacaton Formation (in Gila Group)

Pleistocene: Southeastern Arizona.

A. L. Heindl, 1963, U.S. Geol. Survey Bull. 1141—E, p. E15, E23—E25, pls. 1, 3. Name proposed for alluvial deposits consisting predominantly of poorly consolidated sand and gravel exposed extensively along steep bluffs above flood plain of San Pedro River and its tributaries. In central part of valley base of formation is marked by conspicuous bouldery channel fill as much as 20 feet thick. On west side of valley, formation above its basal bed is composed of unconsolidated granule to pebble conglomerate. On east side of valley, formation is less well developed than on west side and consists mostly of gravel deposits composed of volcanic materials. Maximum thickness about 25 feet along axis of valley. Thins progressively outward toward mountains. Lies disconformably on Quiburis formation (new).

Named for exposures in vicinity of Sacaton Ranch, about 12 miles southeast of Mammoth, Pinal County.

Sacramento Pass Volcanics

Tertiary: Eastern Nevada.

J. H. Schilling, 1965, Nevada Bur. Mines Rept. 10, p. 74. Sacramento Pass Volcanics mentioned in report on isotopic age determinations of Nevada rocks. Age 27 m.y. (+4 or —2 m.y.). Refers to Armstrong (1963, unpub. thesis).

Location: SW¼ sec. 3, T. 14 N., R. 69 E., White Pine County, east of Sacramento Pass, Snake Range.

Saddle Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 27, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Saddle flow is stage III flow, that is, the edge of the flow is visible, and the present surface rough but the lava tops have been broken down and cannot be recognized. South Sheba (new) is superposed on Central Sheba Flow (new) and also on the flow from Saddle. Not known whether Central Sheba flow lies above the Saddle flow or not.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 53. According to Damon (1966, Geochronology Labs., Washington) paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II and all of stage III, IV, and V basalts were extruded during the last 0.85 m.y.

Saddle Cone is north of Walnut Creek and south of road to Grand Falls.

Saddleback Mountain Formation

Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., p. 104 (table 1), 107—108. Forms bulk of major syncline in Dixfield quadrangle. Most common rock is cycically bedded pelite and sandstone. North from Dixfield quadrangle, formation is traced across a fault and granodiorite pluton into Bear Hill Formation of Moench (1963). To east and northeast of Dixfield quadrangle, formation is sandwiched by Severy Hill Formation (new) on southeast and Temple Stream Formation (new) on northwest. This triple layer is traced as far as Kennebec River in center of Anson Formation. Assigned Devonian age based on its lithologic similarity to Seboomook Formation and similarity of Littleton trilogy (gneiss-calcilicate (Boott)-well bedded with the Woodstock-Peru-Saddleback Mountain section. Listed in table 1 as an unpublished and unofficial stratigraphic name. [This may or may not be same unit as Saddleback Mountain Member of Hovey Formation or Pavlides, 1962.]

Type locality and derivation of name not stated.

Saddleback Mountain Member (of Hovey Formation)

Lower Silurian(?): Northeastern Maine.

Louis Pavlides, 1962, U.S. Geol. Survey Prof. Paper 362, p. 13—16, pl. 1. Consists mostly of devitrified glass, chiefly keratophyre, but contains minor amounts of other rocks. Thickness 0 to 4,000 feet. In lower part of formation.

Louis Pavlides, 1964, U.S. Geol. Survey Bull. 1194—B, p. B3. Name Saddleback Mountain Member herein abandoned; such volcanic rocks are considered to be unnamed volcanic lenses of uncertain stratigraphic position within Nine Lake Formation (new) of Hovey Group.

Named for exposures on Saddleback Mountain, west of Number Nine Lake, and on northwesternmost hill of Hedgehog Mountain, Maple and Hovey Mountains area, Aroostook County.

Saddle Mountain Andesite

Oligocene: East-central Nevada.

Robert Scott, 1966, Am. Jour. Sci., v. 264, no. 4, p. 275 (fig. 2). Discussion of variations within ignimbrite cooling units. Generalized Cenozoic section of Grant Range lists following Oligocene formations (ascending): Railroad Valley Rhyolite; Blind Spring formation (new); Calloway Well Formation; Saddle Mountain Andesite, 0 to 250 feet thick; Stone Cabin Formation; local andesite flows; Currant Tuff; Windous Butte Formation; Forest Home Ignimbrite (new); Needles Range Formation; and Shingle Pass Formation.

Grant Range is in Nye County.

Saddle Mountain Diorite

Jurassic: Southwestern Oregon.

R. H. Dott, Jr., 1965, Jour. Geophys. Research, v. 70, no. 18, p. 4694 (table 3). K-Ar analysis on hornblende from Saddle Mountain diorite gave apparent isotopic age of 285 ± 25 m.y.

J. G. Koch, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 53. Discussion of radiometric dating of diorite units in southwestern Oregon. Seemingly anomalous dates have been obtained from some hornblende concentrates, for example, the 285 ± 25 m.y. date for Saddle Mountain diorite.

G. A. Davis, 1966, California Div. Mines and Geology Bull. 190, p. 48. Hornblende dates of 285 m.y., 275 m.y., and 215 m.y. are cited by Dott (1965) for Saddle Mountain Diorite, Pearse Peak Diorite, and a mafic rock in southwestern Oregon, respectively. The dates appear to be anomalously old for rocks apparently intrusive into the western Jurassic subprovince, but their striking similarity to dates on Pit River Diorite and Salmon Hornblende Schist (286 to 218 m.y.) lends them credence. Dott (1965) suggested that the dike rock and Saddle Mountain Diorite may be crustal material brought up along fault zones in the ultramafic rock with which they are associated. Field relationships of Pearse Peak, however, are described by Dott as inconsistent with this explanation. An alternative explanation for Pearse Peak pluton is that dioritic basement rocks of Palezoic age were remobilized and intruded to higher crustal levels during Late Jurassic orogeny. This possibility would be in accord with the younger biotite-defined age for Pearse Peak pluton (141 to 145 m.y.) and other radiometric evidence for Late Jurassic metamorphism and igenous intrusion in southwestern Oregon area.

Saddle Mountain is 3 miles north of Collier Butte which is in Curry County, Oreg.

Saddle Mountains Member (of Yakima Basalt)

Saddle Mountains Basalt Member (of Ellensburg Formation)

Miocene, upper: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 26, 27. A flow that is believed to be continuous over most of area (Vantage-Priest Rapids) and that was called "Wenas Basalt" in earlier reports is here designated Saddle Mountains Basalt Member. Overlies Beverly Member (new).

J. W. Bingham and M. J. Grolier, 1966, U.S. Geol. Survey Bull. 1244—G, p. G11—G12. On basis of general lithologic similarity, name Wenas Basalt, as used by Smith (1903, U.S. Geol. Survey Geol. Atlas Folio 86) for flows in his Ellensburg Formation, was used for similar rocks in the Sentinel Gap-Saddle Mountains area by Taylor (1948, U.S. Geol. Survey open-file Rept.) on on Columbia Basin Irrigation Project area. Because the formations are not mapped across the intervening distance the Vantage-Priest Rapids area is considered separate from Yakima River valley, and name Saddle Mountains Member is assigned to all basalt flows overlying Priest Rapids Member in Sentinel Gap area. At type locality, Saddle Mountains Member consists of one flow. One of Saddle Mountains flows (the Pomona flow) and underlying vitric tuff (a part of Beverly Member of the Ellensburg) exposed on the Saddle Mountains have been correlated by Schmincke (1965, Geol. Soc. America Spec. Paper 82) with basalt and sedimentary rocks mapped by Smith in Ellensburg and Mount Stuart quadrangles and by Waters (1955, Geol. Soc. America Bull., v. 66, no. 6) in Yakima East quadrangle. Also, reconnaissance observations along Wenas Valley have revealed that in Kelley Hollow, Smith (1903) included basalt of Frenchman Springs Member of Yakima with that mapped as Wenas Basalt. Name Wenas Basalt is abandoned and name Saddle Mountains Member is substituted for all flows above Priest Rapids Member in Yakima River valley. Eastward and southward from Sentinel Gap, the Saddle Mountains Member includes several previously unrecognized flows, rather than a single flow overlying the Beverly Member of the Ellensburg. Dillers' logs show that Beverly Member is discontinuous laterally so that the Saddle Mountains Member rests disconformably on Priest Rapids Member or Roza Member rather than on the Beverly in parts of south-central Washington. Hence, the Saddle Mountains Basalt Member of Mackin (1961), considered by him to be part of the Ellensburg, is herein renamed Saddle Mountains Member and reassigned to Yakima Basalt, regardless of whether it overlies or is intercalated in Beverly Member of Ellensburg. At its type locality the Saddle Mountains basalt flow is black, dense, very fine grained, and sparsely porphyritic.

Type locality: Scarp on east side of Sentinel Gap, between Vantage and Priest Rapids.

Sage Hen Adamellite

Jurassic or Cretaceous: Eastern California.

D. O. Emerson, 1966, Geol. Soc. America Bull., v. 77, no. 2, p. 136. Similar to McAfee Adamellite (new). The four adamellites—Sage Hen, Cottonwood, Leidy, and McAfee—correspond to Boundary Peak Granite.

R. G. Strand, 1967, Geologic map of California, Mariposa sheet (1:250,000): California Div. Mines and Geology. Mapped in White Mountains with Mesozoic granitic rocks.

Present in southern part of Mount Barcroft quadrangle.

Saginaw Porphyry

Tertiary, upper(?): Southeastern Arizona.

J. E. Kinnison, 1959, Arizona Geol. Soc. Guidebook 2, p. 147, 149 (fig. 28). Named on map legend.

Fault extending northeast from Saginaw Hill, Pima County, is occupied by Saginaw porphyry dike.

Saginaw Bay Formation

Mississippian and Pennsylvanian: Southeastern Alaska.

L. J. P. Muffler, 1967, U.S. Geol. Survey Bull. 1241—C, p. C20—C21, p. 1. A heterogeneous sequence of sedimentary and volcanic rocks. Divided from oldest to youngest, into four informal members: a volcanic member, black chert member, chert and limestone member, and silty limestone member. Thickness of volcanic member not definitely known. Chert and limestone member at least 400 feet thick. Silty limestone member about 300 feet thick. Apparently overlain conformably by Halleck Formation (new).

Type locality: Long inlet near head of Saginaw Bay and adjacent shore of bay to the south. Crops out in north part of Kuiu Island and Keku Islets. Supplementary section: Outcrops on southeast side of the cove 3.4 miles southeast of triangulation station Corn at tip of Cornwallis Peninsula.

St. Catharine Formation

St. Catherine Formation

Lower Cambrian: Vermont.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. St. Catherine formation consists of purple, gray-green, and varigated slate and phyllite containing minor interbeds of white to green quartzite; locally albitic. Includes Bomoseen graywacke member and Zion Hill quartzite member.

E-an Zen, 1963, Am. Jour. Sci., v. 261, no. 1, p. 92—94; C. G. Doll and others 1963, Am. Jour. Sci., v. 261, no. 1, p. 94—96. Discussion of geologic map of Vermont.

E-an Zen, 1964, U.S. Geol. Survey Bull. 1174, p. 71—72. Name St. Catherine credited to Shumaker (1960, unpub. thesis). As shown by Doll others, includes two large groups of rocks: (a) Rocks that are demonstrably Lower Cambrian or that underlie demonstrated Lower Cambrian rocks without visible stratigraphic break. These rocks tend to occur within "slate belt" west of Taconic Range in Vermont, and correspond to Zen's Bull Formation and Biddie Knob Formation as well as their equivalent and correlative strata. (b) Green argillites of main Taconic Range, with exception of small areas classified with Brezee formation. These rocks have not yielded fossils and are separated from fossiliferous rocks of adjacent slate belts by major thrust faults. Correlation of these rocks with those of first group may be subject to revision. Synonymy given.

R. B. Shumaker and J. B. Thompson, Jr., 1967, Vermont Geol. Survey Bull. 30, p. 14—22, 86—87, pl. 1. Formal proposal of name St. Catharine Formation. The St. Catharine has two dominant lithologies: a lower section of green phyllites with thin stringers of fine-grained white-weathering quartzite; and an upper section of purple and green slates, phyllites, and fine-grained chlorite schists. Purple slates of formation occur only in western one-third of quadrangle. [Pawlet]. Eastward, metamorphism has raised the grade of the rocks to green chlorite-muscovite phyllites and fine-grained schists. Castleton Conglomerate and Zion Hill Quartzite are distinctive but thin members of formation. Lower stratigraphic contact of formation not exposed in northern Taconics, for everywhere it is believed to be faulted. Upper contact conformable with overlying West Castleton Formation. Total thickness not known, but minimum of 1,500 feet estimated from exposures within quadrangles. In easternmost occurrences, occurs above Netop Formation (new). Tentatively assigned to Lower Cambrian. Type section given.

Type section: Typically exposed on the east and west sides of Lake St. Catharine, Pawlet quadrangle. Well exposed along Route 30 at base of St. Catharine Mountain. Formation crops out in western chain of hills which include such mountains as Moosehorn, Haystack, and the Pattern, and is exposed in anticlines near Pawlet, Rupert, and Lake St. Catharine.

St. David Formation

Pliocene, upper to Pleistocene (late Kansan): Southeastern Arizona.

R. S. Gray, 1965, Dissert. Abs., v. 26, no. 2, p. 984. A fine-grained sequence of fluviatile and lacustrine sediments composed chiefly of silt and clay with some fine sand, fresh-water limestone, and water-laid pyroclastic units. Age based on vertebrate fossils is considered late Pliocene to late Kansan.

R. S. Gray, 1967, Jour. Sed. Petrology, v. 37, no. 2, p. 984. A fine-grained proposal of name. A complex assemblage of rocks having a variety of lithologic characteristics. Sediments are composed chiefly of silts and clays with fine sands, fresh-water-laid pyroclastic units, and paleosols. Dip of beds is 25" to 30" north, or down the San Pedro Valley. Thickness of 600 feet of formation exposed from 3,600 feet to 4,200 feet in elevation. Total thickness much greater as shown by logs of wells in vicinity. Entire formation not exposed in any one section. Exposed part of formation subdivided into lower red-bed division, a middle carbonate-enriched (white zones) division. Formation nearly everywhere covered by a sequence of reddish-orange fine to coarse gravels and coarse sands which in the field was termed "granite wash."

Type locality: In badlands topography along east and west sides of San Pedro Valley near St. David and Benson Cochise County. Type section: Includes section CR—1 through section CR—4, exposed in secs. 24 through 27, T. 18 S., R. 21 E., Cochise County. Supplemental sections: Section PR—1 through section PR—3 located in secs. 27 and 28, T. 17 S., R. 20 E., Cochise County.

St. George Formation

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Consists of basal Seven Tree quartzite member (new), Union marble member, biotite and schists and biotite-quartz gneisses above and below the marble. In southern part of area the biotite-rich metasediments are characterized by cranberry-red alamandite. In North Appleton area the biotite-rich metasediments are represented by minor amounts of tan and green phyllites. Underlies Appleton formation (new). Intruded by East Union norite (new).

Formation underlies most of southeast part of map area and in a central swath in the northern part, parallel to and slightly east of St. George River, northwestern Knox County marble belt.

St. Joe Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies Highland limestone member (new); underlies Sub Jordan limestone member. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

Bingham mining district, Oquirrh Mountains.

St. Joe Valley Basalt

Pliocene, upper, or Pleistocene, lower: Northern Idaho.

Wakefield Dort, Jr., 1967, Northwest Sci., v. 41, no. 4, p. 141–151. Discussion of late Cenozoic volcanism in St. Joe Valley, Idaho. Name St. Joe Valley Basalt given to unit under discussion in this area. Younger than Columbia River Basalt.

St. Joe River Valley is in Idaho Panhandle.

St. Johns Bentonite Bed (in Cook Mountain Formation)

Tertiary: North-central Louisiana.

C. O. Durham, Jr., 1964, Louisiana Geol. Survey Geol. Bull. 41, p. 18–26. A discontinuous but widespread bentonite bed in upper clay and silt of the Cook Mountain. Name credited to Jones (1962, unpub. thesis, pl. 3).

Type locality and derivation of name not given.

St. Kevin Granite

Precambrian: Central Colorado.

Ogden Tweto and R. C. Pearson, 1964, U. S. Geol. Survey Prof. Paper 475–D, p. D28–D31. Comprises four main facies—(1) trachytoid hybrid, (2) normal, (3) granodioritic, and (4) fine grained. Each has variants and each intergrade. Normal facies is light-gray to light-pink even-grained to markedly porphyritic biotite-muscovite granite or quartz monzonite. Rocks herein called St. Kevin Granite have been called Silver Plume Granite (Stark, 1935, Jour. Geology, v. 43, no. 1) or Silver Plume(?) Granite (Behre, 1953, U. S. Geol. Survey Prof. Paper 235). This correlation with the Silver Plume Granite of Front Range assumes an identity that has not been proved. The two granites have in common only that they are both muscovite-biotite granites that have trachytoid porphyritic facies and that each is youngest major Precambrian granite in its respective area.

R. C. Pearson and others, 1966, Geol. Soc. America Bull., v. 77, no. 10, p. 1109–1120. Whole-rock Rb-Sr isochron age on St. Kevin Granite establishes it as 1390+ 60 m.y. old.

Occurs in small batholith plutons in northern Sawatch Range and part of adjoining Mosquito Range near Leadville. Named from St. Kevin Lake and adjoining St. Kevin mining district.

St. Lawrence Lowland Drift

Pleistocene: Northern New England.

L. A. Sirkin, 1967, Rev. Paleobotany and Palynology, v. 2, nos. 1—4, p. 210 (fig. 3), 215. St. Lawrence Lowland Drift mentioned in discussion of Herb Zone spectra.

St. Louis Drift

Pleistocene (Wisconsin): Northeastern Minnesota.

R. F. Norvitch, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D130—D131. Mostly gray to buff pebbly calcareous clay till that contains abundant shale and limestone pebbles. Thinly mantles western part of Vermillion moraine up to 1,400 feet and occurs as isolated patches of ground moraine in low areas. Mankato stade. Younger than Rainy drift (new).

Area is Nett Lake Indian Reservation, 35 miles south of Rainy Lake.

Salamonie Dolomite

Silurian (Niagaran): Northern Indiana.

A. P. Pinsak and R. H. Shaver, 1964, Indiana Geol. Survey Bull. 32, p. 24—29. Comprises, in northern Indiana, the rocks overlying Brassfield Limestone as recognized herein and underlying Waldron Formation. In northern two to three tiers of Indiana Counties, where Waldron cannot be recognized, the Salamonie is overlain by dolomitic rocks herein referred to Salina Formation. In much of northern third of Indiana the Salamonie is divisible into three members (unnamed). Lower corresponds to basal chert and impure rocks in type area. It is light-gray and tan dense to fine-grained argillaceous dolomite and dolomitic limestone. Chert abundant. Middle member corresponds to upper rock in type section. It is light-gray to white granular porous vuggy dolomite having secondary dolomite rhombohedrons and sparry dolomite. Upper member, not present in type area, consists of gray, tan, and brown limestone and dolomite that wedge out southward in central Indiana. Thickness 135 feet at type section where top has been removed by erosion. Two counties west of type area, in high places on Cincinnati Arch where entire unit is present, average thickness is about 90 feet. Increases in thickness northward to more than 200 feet in flanking part of Michigan Basin and northwestward to 180 feet near Illinois State line. Southwest of type area, rocks equivalent to lower part of Salamonie are called Osgood Formation and rocks equivalent to upper part of Salamonie are called Laurel Limestone. Name Salamonie Dolomite replaces northern Indiana term Osgood-Laurel of older reports. Two principal reference sections designated as well as two additional reference sections.

J. F. Howard and L. H. Balthaser, 1966, in a survey of Indiana geology with road logs for two field trips: Bloomington, Ind., Sigma Gamma Epsilon, Rho Chapter, p. 41—42. In southern Indiana, the Salamonie is subdivided into the Osgood Member and Laurel Limestone Member. In north, the Laurel and Osgood members are much more dolomitic and are difficult to differentiate.

Type section: Exposure in Rockledge Products, Inc., quarry and in core of Indiana Geological Survey drill hole 44, near Portland, Jay County, Ind., NW¼NW¼ sec. 30, T. 23 N., R. 14 E., that penetrated to Ordovician rocks from the floor of that quarry. Principal reference section: Exposure in H and R Stone Co. quarry near Ridgeville, Randolph County. Second principal reference section: Rocks cored in Northern Indiana Public Service Co. Carl Wyneken No. 1. well near Wallen, Allen County. Additional reference sections: (1) Indiana Geological Survey drill hole 72 in Kokomo, Howard County; (2) Indiana Geological Survey drill hole 96 near Yorktown, Delaware County.

Saligvik Gravel

Tertiary or Quaternary: Northwestern Alaska.

R. H. Campbell, 1967, U. S. Geol. Survey Prof. Paper 395, p. 57—58, pl. 1. A relatively continuous deposit of unconsolidated gravel and sand that occurs at relatively high altitude (as much as 350 feet) along east flank of Saligvik Ridge. Deposit trends north-northeast. Southern half forms wedge-shaped apron along flank of Saligvik Ridge and includes cutbank exposures at head of Kiligvak Ridge. Northern half forms long, low ridge bounded on east by center of Saligvik Valley and on west by Saligvik Creek. Extends both north and south of low divide that separates Ogotoruk and Saligvik Valleys. More than 35 feet thick in some places. Younger than Ilyirak Gravel (new). Assigned Tertiary or Quaternary age.

Type locality: Cutbank exposures at head of Kiligvak Creek. Named for Saligvik Ridge, Chariot site, Lisburne Peninsula.

Saline Valley formation

Lower Cambrian: East-central California.

C. A. Nelson, 1962, Geol. Soc. America Bull., v. 73, no. 1, p. 140 (fig. 2), 142, 143. In type section, basal member is composed of medium- to coarse-grained quartzitic sandstone, locally becomes vitreous quartzite, capped by persistant blue-gray arenaceous limestone. Upper member is succession of quartzitic sandstone, limestone, and gray-green and black shale. Thickness 850 feet. Overlies Harkless Formation (new); underlies Mule Spring Formation (new). Eastward to area of Magruder Mountain and Goldfield, Nev., the Saline Valley as a formational unit is missing.

J. H. Stewart, 1965, U. S. Geol. Survey Bull. 1224—A, p. A61, A66 (fig. 14), A68. Geographically extended into Last Chance Range area, Inyo County. As exposed in Cucomungo Canyon is about 750 feet thick and consists, in lower part, of pinkish-gray and grayish-red-purple quartzite, and in upper part of gray limestone and greenish-gray siltstone, a few layers of sandy limestone near base, and a layer of quartzite near top. Lower part similar to upper part of Harkless Formation and two are sometimes hard to distinguish. Conformably underlies Mule Spring Limestone.

J. H. Stewart, 1966, U. S. Geol. Survey Prof. Paper 550—C, p. C72. Correlation of Lower Cambrian and some Precambrian strata in southern Great Basin, California and Nevada. The Saline Valley Formation is a laterally variable sequence of quartzite, sandstone, sandy limestone, limestone, and siltstone. The quartzite units in lower part of formation are considered to be tongues of Zabriskie Quartzite. The amount of quartzite (tongues of the Zabriskie) in the Harkless and Saline Valley Formations decreases to north in White-Inyo Mountains area, and Harkless and Saline Valley Formations may be almost entirely siltstone in northwestpart of White-Inyo Mountains.

Named from exposures [type section] along the Waucoba Spring section, overlooking Saline Valley to the south. The Waucoba section is that described by Walcott (1908, Smithsonian Misc. Colln., v. 53, no. 5) east of Waucoba Springs, on Saline Valley road, east of Inyo Range, Inyo County, Calif.

Saline Valley Shale Member (of Blue Hill Shale)

Upper Cretaceous: Western Kansas.

D. E. Hattin, 1962, Kansas Geol. Survey Bull. 156, p. 20. Suggested that Blue Hill Shale Member of the Carlile be redefined to include all beds between Fairport and the Niobrara and be rank raised to formation and termed Blue Hill Shale. Also suggested that name Saline Valley Shale Member be applied to lower, or shale and concretion division, of the Blue Hill. However, this classification has not been adopted by the Kansas Geological Survey.

Type locality: In Saline River valley, in SW¼ sec. 29, and SE¼SE¼ sec. 30, T. 11 S., R. 16 W., Ellis County.

Salisbury Formation (in Columbia Group)

Pleistocene: Southeastern Maryland (subsurface).

H. J. Hansen, 3d, 1966, Maryland Geol. Survey Rept. Inv. 2, p. 8—16, figs. 7, 9. Term Salisbury aquifer was introduced by Heindl and Otton (1963, U. S. Geol. Survey open-file rept.) to describe post-Miocene water-bearing sands and gravels of Salisbury well field area. Rasmussen and Slaughter (1955, Maryland Dept. Geology, Mines and Water Resources Bull. 16) divided same sediments into two geologic "formations" designating them Beaverdam Sand of Pleistocene age and the "red gravelly" sand of Pliocene(?) age. Latter unit was tentatively correlated with high-level Pliocene terrace gravels (Brandywine Formation) cropping out west of Chesapeake Bay. In this report the Beaverdam facies and the "red gravelly" facies are herein considered subdivisions of the newly defined Salisbury Formation. The "red gravelly" facies is as much as 190 feet thick and the Beaverdam facies as much as 115 feet thick. Underlies Walston Clay. Overlies Yorktown and Cohansey Formations. Sangamon.

Type wells: Well Wi—Cf 147, in Allen Co. Orchard south of Naylor Mill Road, and well Wi—Ce159 in Salisbury well field.

Sally Mountain Conglomerate

Silurian: Northwestern Maine.

R. S. Naylor and A. J. Boucot, 1965, Am. Jour. Sci., v. 263, no. 2, p. 161—162, fig. 2. Contains subrounded clasts of metamorphic and crystalline rocks averaging 4 to 6 inches in diameter and angular clasts of sandy limestone averaging about 6 inches in diameter in matrix of sand-sized quartz and feldspar in almost equal proportions. Thickness 500 to 1,200 feet. Sally Mountain conglomerate and Foxs Camp formation (new) were deposited on quartz monzonite of Somerset Island basement complex and are overlain by Seboomook formation. Name credited to Albee and Boudette (in preparation).

Jackman area, northwestern Maine.

Salmon Creek Schists and Gneisses

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert. Abs., v. 25, no. 12, pt. 1, p. 7205. Most of rocks in thesis area were formed under conditions of regional metamorphism and plutonism. In Salmon Creek Schists and Gneisses and in Summit Creek Trondhjemitic Gneiss regional metamorphism reached sillimanite zone conditions. Salmon Creek unit was almost entirely derived from supracrustal rocks. Not as intensively granitized as Summit Creek unit.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Salmon Peak Formation

Lower Cretaceous: Southwestern Texas.

F. E. Lozo and C. I. Smith, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 285—307. Proposed as replacement for so-called "Georgetown Limestone" as applied in Maverick basin of Rio Grande embayment. Thickness about 380 feet at type section. In type area of Uvalde and Kinney Counties, divisible into two parts: a lower, 305-foot unit of thick-bedded white globigerinid lime mudstone with large irregular masses of chert in upper half, and an upper, 75-foot unit of worn shell-fragment grainstone crossbedded near top with scattered caprinid fragments throughout. Upper grainstone unit, a tongue of Devils River lithofacies, is replaced southward by the mudstone. At outcrop, the Salmon Peak disconformably overlies McKnight Formation, and basal bed is conglomerate with pholad-bored pieces of thin-bedded fecal pellet McKnight grainstone in lime mudstone matrix. Upper contact is immersion surface underlying lower Del Rio (West Prong beds of Greenwood, 1956).

Type section and type locality: Type section from two localities. Lower part from the 320-foot maximum exposed at Chalk Bluff on Nueces River, Uvalde County, about 14 miles southeast of Salmon Peak. Upper 75 feet, incompletely exposed in type area, is described from cored interval (depth 86 to 161 feet) on George Pardi Diamond P Ranch (cf. Chalk Bluff quadrangle), 8 miles southeast of Chalk Bluff. Characteristically exposed in vicinity of Salmon Peak, Turkey Mountain quadrangle, 19 miles northeast of Brackettville, Kinney County.

Salt Creek Wells Member (of Rock Springs Formation)

Upper Cretaceous: Southwestern Wyoming.

W. B. Douglass, Jr., and T. R. Hazzard, 1961, Wyoming Geol. Assoc. Guidebook, 16th Ann. Field Conf., p. 81—86, pls. 1, 2, 3. Name applied to two upper littoral marine sandstones in the formation. Upper sand recognized by its white cap. Lower sand is brown. Top of upper sand marks top of Rock Springs formation. These two sands are separated by unnamed tongue of Baxter shale.

Crops out continuously from base of Black Butte Mountain in sec. 8, T. 18 N., R. 103 W., Sweetwater County. Highway 430 and Salt Wells Creek cross its outcrop at this location. Can be traced from outcrop on Black Butte Mountain through fault system to Highway 30 and north to Superior. Also present along northern flank of Uintas between the Green River and Clay Basin.

Salt Spring Slate

Upper Jurassic: East-central California.

L. D. Clark, A. A. Stromquist, and D. B. Tatlock, 1963, U. S. Geol. Survey Geol. Quad. Map GQ—222. Chiefly slate derived from siltstone; includes tuff, graywacke and petromict (polymict) conglomerate, and schistose metavolcanic rock.

L. D. Clark, 1964, U. S. Geol. Survey Prof. Paper 410, p. 29—30, pls. 1, 8. Name applied to dominantly epiclastic rocks that overlie and intertongue with Gopher Ridge volcanics (new). Black sericite slate dominates formation, but graywacke and tuff are widespread and thin conglomerate layers occur in some places. Slate is exposed in continuous belt throughout length of area mapped. North of Stanislaus River, slate forms single formation that overlies Gopher Ridge volcanics (new). Underlies and intertongues with Copper Hill volcanics (new). The Salt Spring has been mapped as Mariposa by previous geologists.

Type section: Exposures in Cosumnes River near Michigan Bar Bridge, Amador County. Named for Salt Spring Valley, which lies immediately east of Gopher Ridge, Calaveras County. Poorly exposed in Salt Spring Valley.

Salyer Formation

Miocene, upper: Southestern Nevada.

F. G. Poole, W. J. Carr, and D. P. Elston, 1965, U. S. Geol. Survey Bull. 1224—A, p. A36—A44. A sequence of lava flows, volcanic breccia, tuff, and sandstone. Divided into 10 informal units. Maximum exposed thickness about 2,000 feet in type area. Underlies Wahomonie Formation (new). Late Miocene.

Type section: A composite of partial sections in area from Cane Spring to Mount Salyer to Hampel Hill, Nevada Test Site, Nye County. Units 1 to 3, in north-trending ridge near head of Mara Wash about 1¼ miles south of Cane Spring; units 4, 5, 9, 10, northeast-trending ridge about half a mile southeast of Cane Spring; unit 6, about 1 mile northeast of Hampel Hill; units 7 and 8, about three-fourths mile west of Mount Salyer. Only part of unit 9 is present on ridge half a mile southeast of Cane Spring; a well-exposed section extending for about half a mile northeast from Mount Salyer also is considered type locality for this unit. Covers area of about 300 square miles.

Sand Bridge Formation

Pleistocene, upper: Southeastern Virginia.

R. Q. Oaks, Jr., and N. K. Coch, 1963, Science, v. 140, no. 3570, p. 979—983. Sandbridge [Sand Bridge] Formation consists of dune and beach sand in east; lagoon clay and clayey sand in west. Maximum thickness 20 feet. Overlies Londonbridge Formation (new); underlies Dismal Swamp peat (new). Radiocarbon age about 40,000 years.

N. K. Coch, 1965, U. S. Office Naval Research, Geography Branch Tech. Rept. 6, p. 62—74. Sand Bridge Formation divided into an homogeneous lower member and an upper member composed of several different mappable facies. Oaks (1965, unpub. thesis) described type sections of upper and lower members of formation at boring PA—26. Reference sections in Inner Coastal Plain herein designated. Lower member occurs as thin layer, 3 to 6 feet thick, beneath Churchland Flat, where it overlies Norfolk Formation, except where it has been lost through erosion during deposition of clay-sand facies of upper member. Wisconsin.

Named for community of Sand Bridge, Princess Anne County. Board on Geographic Names prefers double name rather than single name as used by Oaks and Coch (1963). Reference sections: Upper member, sand facies, exposure in borrow pit, just east of Shingle Creek where creek crosses U. S. Highway 13-58-460, 0.9 mile west of Magnolia, north side of road; clayey-sand facies, exposure at Wilkersons Landing, northeast shore of Nansemond River 1.75 mile southwest of Nansemond River Bridge (route 17), Nansemond County; lower member and upper member (silty-sand facies), plastic-tube boring southside of road leading to Bennetts Creek Nike Base, just off State Road 626, 0.85 mile south of U. S. Highway 17; upper member, silty-clay facies, exposure in hand-auger boring in drainage ditch, 300 feet southeast of intersection of State Highway 10-31 and State Road 704.

Sanders Group

Mississippian: Indiana.

N. M. Smith, 1965, Indiana Geol. Survey Rept. Prog. 29, p. 7—11, table 1. Defined as including all rocks above base of Leesville Member of Harrodsburg Limestone of Stockdale (1929) and below top of Salem Limestone of Cumings (1901). Overlies Borden Group as modified in this report and underlies Blue River Group. Thus Sanders Group contains Salem Limestone and upper part of Harrodsburg Limestone of Hopkins and Siebenthal (1897). Thicknesses: 145 feet along Ohio River; 110 feet in central Washington County; 165 feet in southern Monroe County.

Type locality: Vicinity of Sanders, Monroe County. Town is in SW¼ sec. 34, T. 8 N., R. 1 W. Present continuously along outcrop belt which extends from south tip of Harrison County along Ohio River 123 miles south of Indianapolis northward to within 3 or 4 miles of common intersection of Fountain, Montgomery, and Parke Counties, about 60 miles north-northwest of Indianapolis.

Sand Hollow Flow (in Frenchman Springs Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 8, 13—17. Flow in middle part of Frenchman Springs Basalt Member (new). Above Gingko flow (new) and below Sentinel Gap flow (new). In some areas underlies Roza Basalt Member (new). Field term for unit, "double-barreled" flow expresses jointing habit that is its distinctive feature; in cliff exposures on east side of Columbia Valley north and south of Sand Hollow the colonade, consisting of regular prismatic columns 4 to 6 feet in diameter and 20 to 30 feet in height, is almost exactly matched by columnar zone 30 to 40 feet thick near top of flow. The entabulature, consisting of one or more tiers of small columns, is about 30 feet thick.

Named for occurrence in Sand Hollow between Vantage and Priest Rapids.

San Diego Tuff Member (of Maravillas Formation)

San Diego Lapilli Tuff Member (of Coamo Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U. S. Geol. Survey Misc. Geol. Inv. Map I-335. Consists of greenish-weathering tuff breccia. Basal member of Coamo formation. Appears to be conformably upon Cariblanco formation. Commonly overlain by thin- to medium-bedded tuffaceous siltstone and sandstone of the Coamo except at Cerro Santa Ana, where it is overlain directly by Santa Ana limestone member (new). Thickness 125 m north of San Diego to about 225 m south of Coamo.

J. D. Weaver, 1964, Geol. Soc. America Guidebook Puerto Rico Field Trip, Nov. 22—24, p. 15. Referred to as tuff member of Maravillas Formation. Stop 6 on road log notes that a N45°W fault places the San Diego Tuff Member on the northeast in juxtaposition with coarse conglomerate Cariblanco Formation on the southwest.

Named for outcrops in vicinity of San Diego in northwestern part of Coamo quadrangle just northwest of Cerro Santa Ana.

Sand Mountain Flows

Recent: West-central Oregon.

G. J. Benson, 1965, Ore Bin v. 27, no. 2. Sand Mountain flow is overlapped by lava flows from Belknap Crater. About 3,000 years old.

Occurs in vicinity of Sand Mountain, Linn County.

Sandridge Member (of Wicomico Formation)

Pleistocene, lower: Eastern South Carolina.

D. J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS—12. Upper Wicomico divided into five members: Toney Bay, Dean Swamp, Sandridge, Wassamassaw Swamp, and Four Hole. The Sandridge consists almost entirely of well-sorted angular to subspherical fine-grained quartz sand. Thin discontinuous coarse-grained sand lenses encountered. No significant structures noted. Represents a sand bar and barrier island.

Named for Sandridge, Eutawville quadrangle.

Sands Granite

Jurassic(?): Southern California.

D. F. Hewett, 1956, U. S. Geol. Survey Prof. Paper 275, p. 49—50, pl. 1. On fresh fracture is a light-gray holocrystalline rock made up of feldspar, quartz, and minor biotite. Weathered surface is distincly brownish, owing to thin coating of desert varnish.

R. A. Barca, 1966, California Div. Mines and Geology Map Sheet 7. Mapped in northern part of Old Dad Mountain quadrangle. About 1 square mile of unit forms the low hills along western side of Cowhole Mountain where it intrudes Goodsprings Dolomite and Sultan Limestone and is cut by numerous northwest-trending andesite dikes. Mineralogically a quartz monzonite but name Sands Granite retained. Jurassic(?).

Confined to several townships in southwest corner of Ivanpah quadrangle, south, north, and east of Sands on Union Pacific Railroad, and to belt about 5 miles long near Mountain Pass on Highway 91, San Bernardino County.

Sand Wells Formation

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U. S. Geol. Survey Bull. 1194—H, p. H11—H12. Mostly gray quartzite, maroon mudstone, muddy sandstone, and gray-green arkose. Basal unit massive red rhyolite flow capped by distinctive red conglomerate. Cut by mafic and felsic dikes, sills, and small plugs. Near Sand Wells only lower 1,000 feet exposed. In South Comobabis at least 6,100 feet thick. Overlaps flows of Nolia Volcanic Formation (new) east of village of Sand Wells. Away from North Comobabi Mountains, passes under Tertiary volcanic rocks and alluvium.

Type locality: Along wash that passes along south side of village of Sand Wells. Reference localities: Along washes that trend north-northwest from the village and are ½ to 1½ miles north of it. Named from exposures at village of Sand Wells in the North Comobabis, Papago Indian Reservation.

Sandy Creek Member (of Packsaddle Formation)

Precambrian: Central Texas.

R. V. McGehee, 1964, Dissert. Abs., v. 24, no. 7, p. 2870. Overlies Honey Creek Member (new); underlies Rough Ridge Member (new).

Southeastern Llano uplift.

Sandy Hook Dolomite and Dolomitic Limestone physiofacies (of Callaway lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Callaway lithofacies of Cedar City formation (new) divided into four physiofacies: Lupus sandstone, Mineola crinoidal or arenaceous limestone, Sandy Hook dolomitic limestone or dolomite, and Calwood limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 37—39. Litholigically, the Sandy Hook Dolomite and Dolomitic Limestone physiofacies consists of dolomitic limestone, silty to arenaceous dolomite or dolomitic sandstone. There are four lithologic phases which interfinger with one another. Sandy Hook facies interfingers with most of physiofacies of Cooper Lithofacies and therefore is stratigraphically equivalent to the Cooper in part. Thickness as much as 24.5 feet.

Type section: SW¼SE¼SE¼NW¼ sec. 13, T. 46, N., R. 14 W., in an abandoned quarry about three-fourths of a mile southeast of Sandy Hook, Moniteau County, along Missouri River bluffs and Missouri Pacific Railroad (Centertown quadrangle). Facies crops out in Moniteau, Cole, Boone, Callaway, Montgomery, Warren, Lincoln, Pike, Ralls, and Marion Counties.

Sandy Point Basalt

Pliocene: Northwestern Arizona and southeastern Nevada.

P. E. Damon and others, 1965, Arizona Univ. Geochronology Labs. Ann. Prog. Rept No. C00—689—50 to U. S. Atom. Energy Comm., p. 40, 41, 42—43 (table 22). Sandy Point basalt gave age of 2.6 ± 0.9 m.y. Sandy Point basalt lies above Colorado gravels and below beds tentatively correlated with Chemehuevi lake beds.

Sandy Point basalt was collected on south side of Sandy Point on banks of Colorado River.

Sandy River Mudstone

Pliocene, lower(?): Northwestern Oregon.

D. E. Trimble, 1963, U. S. Geol. Survey Bull. 1119, p. 10 (fig. 4), 26—28, pl. 1. Name applied to mudstone, siltstone, claystone, and sandstone beds that overlie Rhododendron formation and underlie Troutdale formation. Maximum exposed thickness between 200 and 300 feet in valley of Buck Creek; inferred thickness about 725 feet based on well log. Age as determined from flora of upper contact zone is probably early Pliocene. Rocks formerly were considered to be lower part or member of Troutdale formation (Trimble, 1957, U. S. Geol. Survey Geol. Quad. Map GQ—104).

H. G. Schlicker and R. J. Deacon, 1967, Oregon Dept. Geology and Mineral Industries Bull. 60, p. 23. Sandy River Mudstone named by Trimble (1963) is included in Troutdale Formation as used in this report.

Type area: Along Clackamas River in Boring quadrangle downstream from point of contact with Rhododendron formation, which is about 0.4 mile downstream from River Mill Dam, Boring quadrangle. Named for exposures along Sandy River.

San Francisquito Formation

Paleocene and Eocene (?): Southeastern California.

T. W. Dibblee, Jr., 1967, U. S. Geol. Survey Prof. Paper 522, p. 44—46, pls. A marine sedimentary sequence of clay shale, sandstone and conglomerate. Interbedded shale and sandstone and shale predominant in lower part and sandstone in upper part. Thickness in San Francisquito Canyon 6,900 feet. About 4,000 feet in Big Rock Creek. In Cajon Creek about 1,500 feet present where it is unconformably overlain by Punchbowl Formation. Underlies Vasquez Formation. Unconformable on pre-Tertiary gneissic rocks in San Francisquito Canyon area. Has been referred to Martinez Formation to west.

Type section: Exposed down San Francisquito Canyon from contact with gneissic rocks a quarter of a mile north of juncture with Cherry Canyon to contact with overlying Vasquez Formation at junction with Bee Canyon in Bouquet Reservoir quadrangle, Mohave Desert.

Sanhedrin Formation

Upper Jurassic-Lower Cretaceous: Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Mudstone, sandstone- conglomerate. Thickness 20,100 feet. Includes Gillaspy, Briscoe, and Bidwell tongues (all new). Underlies Wintun formation (new); base of section in area studied.

In Elk Creek-Fruto area, Glen County.

San Isabel Granite

Precambrian: South-central Colorado.

R. E. Boyer, 1962, Geol. Soc. America Bull., v. 73, no. 9, p. 1056, 1059 (table 1), pl. 3. Name applied to granite in San Isabel batholith. Two facies: most common in coarse porphyritic granite; less common is medium-grained phase.

Named for San Isabel batholith in Wet Mountains.

San Joaquin Mountain basalt

Pleistocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 36, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenzoic history of the Sierra Nevada. Potassium-argon age 3.1 ±0.1 m.y. Figure 12 mentions basalt San Joaquin Mountain.

In Devils Postpile quadrangle.

San Manuel Formation (in Gila Group)

Teritary, middle(?): Southeastern Arizona.

L. A. Heindl, 1962, Arizona Geol. Soc. Digest, v. 5, fig. 3, 1. San Manuel Formation listed with late middle(?) Tertiary units in résumé of Cenozoic geology of Arizona.

L. A. Heindl, 1963, U. S. Geol. Survey Bull. 1141-E, p. E16-321, pls. 1, 3. Formal proposal of name. Basal formation in Gila group. Composed principally of conglomerate whose fragments range in size from boulders several feet in maximum dimension to pebbles. Formation is restricted to west side of San Pedro Valley and includes most of the exposures between San Manuel fault and Precambrian quartz monzonite at northwest end of Santa Catalina Mountains. Formation undifferentiated southeast of line between the quartz monzonite in sec. 28, T. 9 S., R. 16 E., and San Manuel fault in sec. 1, T. 9 S., R. 16 E. North of this line formation divided into (ascending) local conglomerate member, Kannally and Tucson Wash members (both new). Overlies Cloudburst formation; underlies Quiburis formation (new). Where Kannally member is absent, formation rests on Precambrian quartz monzonite.

Named for San Manuel mine near Red Hill, Pinal County. No well-defined type section.

Santa Ana Limestone Member (on Maravillas Formation)

Santa Ana Limestone Member (of Coamo Formation)

Upper Cretaceous: Puerto Rico.

Lynn Glover, 3d, 1961, U. S. Geol. Survey Misc. Geol. Inv. Map I—335. At type locality, member is medium-light gray to light-olive-gray limestone composed largely of shell fragments in matrix of clayey to tuffaceous limestone. Thickness about 30 m at type locality where it overlies San Diego lapilli tuff member (new) and is overlain by a wedge of tuff breccia that thins southward. South of Coamo, member is split by tongue of sandstone that contains some pebble conglomerate.

The U. S. Geological Survey currently classifies the Santa Ana as a member of the Maravillas Formation on the basis of a study now in progress.

Type locality: Outcrops on and near Cerro Santa Ana, a peak about 3 km east-northeast of Coamo in Coamo quadrangle. Also exposed about 3 km west-northwest of type locality near the Rio Coamo and from the much-faulted area south of Coamo to point about 1 km west of Sabana Hoyos.

Santa Cruz Mudstone

Miocene, upper: Western California.

J. C. Clerk, 1966, Dissert. Abs., v. 27, no. 4, sec. B, p. 1184. In area the two younger sequences are products of two separate and successive marine cycles of sedimentation. The younger cycle was initiated in late

Miocene (Mohnian or Delmontian) time and produced a transgressive basal sandstone unit, the Santa Margarita Sandstone, and an overlying organic mudstone unit, previously mapped as "Monterey Shale" west of Ben Lomond Mountain, but herein differentiated and named Santa Cruz Mudstone.

Felton-Santa Cruz area, west of San Andreas fault in Santa Cruz County.

Santa Elena Limestone

Lower Cretaceous: Southwestern Texas and northern Mexico.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65-51, p 12—33, pl. 1. A thick-bedded hard cherty gray escarpment-forming limestone. Thickness 730 feet in Texas and about 900 feet in Mexico. Overlies Sue Peaks Formation (new); underlies Del Rio Clay.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 47—48, pls. Formal proposal of name. In Big Bend Park, the Santa Elena is a hard light-gray or white limestone when fresh but weather to dark gray or shades of brown. Finely crstaline in beds as much as 10 feet thick. Thickness about 740 feet at type section. Overlies Sue Peaks Formation. Underlies Del Rio Clay. Meager fossil collection indicates Washita age.

Type section: Upper half of sheer canyon wall at mouth of Santa Elena Canyon, Big Bend National Park, Brewster County, Tex. Formation also caps most of Mesa de Anguila and Mariscal and Christmas Mountains and is widely distributed in the Sierra del Carmen.

Santana Tuff (in Bofecillos Group)

Oligocene or younger: Southwestern Texas and northern Mexico.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 17 (table 6), 27. Group comprises (ascending) Chisos Formation, Mitchell Mesa Tuff, Fresno Formation (new), Santana Tuff, and Rawls Formation. Thickness 350 feet on Santana Mesa; 10 to 30 feet on Tascotal Mesa. Santana Tuff and Rawls Formation believed to be younger than any volcanic rock in Big Bend National Park. The Santana crops out as thin ledge between Rawls and Tascatol Formations near southeastern and Tascotal Mesa escarpment. Pinches out near Wire Gap. Erickson (1953, Geol. Soc. America Bull. 64, no. 12, pt. 1) included the Santana ledge in Tascotal Formation. The Tuff pinches out in Three-dike Hill west of Bofecillos, but crosses the Rio Grande and crops out several miles to south in Mexico.

Type locality: Santana Mesa, Presidio County.

Santa Olaya Lava

Santa Olaya Formation

Cretaceous: Puerto Rico.

E. G. Lidiak, 1965, Geol. Soc. America Bull., v. 76, no. 1, p. 60, 61, pl. 1. Formation consists mainly of massive or pillow flows interlayered with pyroclastic tuffs and breccias. Overlies Cerro Gordo Formation (new); Underlies Río de la Plata Formation. May be older or younger than Río Orocovis Formation.

The U. S. Geological Survey has modified name Santa Olaya Formation to Santa Olaya Lava on basis of recent studies in Puerto Rico.

Formation extends from eastern part of Corozal quadrangle eastward into Aquas Buenas quadrangle.

Santa Teresa Granite

Tertiary: Southeastern Arizona.

F. S. Simons, 1964, U. S. Geol. Survey Prof. Paper 461, p. 9 (table), 62—66, pl. 1. A montonously uniform very pale red to very pale red purple or grayist-pink equigranular rock. Intrudes Pinal Schist and Laurel Canyon Granodiorite (new), both Precambrian, and is in fault contact with these rocks and probably with Goodwin Canyon Quartz Monzonite (new). Overlain unconformably by older alluvium.

Forms peaks of Santa Teresa Mountains, Klonydke quadrangle. Granite forms a single large mass than extends from Waterfall and upper Buford Canyons northward to South Fork of Goodwin Canyon. About 17 square miles, or 7 percent of quadrangle, is underlain by Santa Teresa Granite.

Santee Till

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 39, 59. Condra and Reed (1950, Nebraska Geol. Survey Bull. 15A) recognized till in northeastern Nebraska which they classified as Illinoian because of its occurrence above Pearlette Volcanic Ash bed of Sappa Formation and because it exhibited "weathering characteristics" intermediate between those of the Kansan and Wisconsian tills. Recently a locality has been found where the Sangamon Soil has been preserved above this Illinoian till, possibly developed in a thin representative of the Late Illinoian Loveland Formation. This till is herein named Santee Till and assigned to Medial Illinoian. Thickness about 40 feet at type locality. At type locality and at Sunny Hill School, unconformably overlies Fullerton Formation. Can be traced eastward and southeastward to localities where the till rests on Sappa Formation including Pearlette Volcanic Ash bed. Believed to be younger than Clarkson Till (new). Periglacial fluviatile equivalent of the Santee is Beaver Creek Formation (new).

Type locality: Roadcut, 3 miles southeast of Santee in SE¼SE¼NW¼ sec. 29, T. 33 N., R. 4 W., Knox County. Forms moraine which trends from type locality southeastward to west of Coleridge, and the exposure where Sangamon Soil is developed above it or in its upper part is at the Sunny Hill School in NE cor. sec. 35, T. 30 N., R. 1 W., Cedar County.

San Vicente Member (of Boquillas Formation)

Upper Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—61, p. 12—33, pl. 1. Gray and a bluish-gray chalk and gray to buff argillaceous flaggy limestone. Thickness 330 to 400 feet; locally thins to 130 feet. Includes Udden's (1907) lower Terlingua Beds. Upper member of formation. Overlies Ernst Member (new). The two members are separated by erosion surface, but the beds above and below the diastem are very similar and it is difficult to distinguish between them unless the rocks are fossiliferous. *Coilopeceras* sp. zone is helpful in locating top of the Ernst. Underlies Pen Formation (new).

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 64—71, pls. Formal proposal of name. In this report Udden's (1907) Terlingua Beds are divided into San Vicente Member of Boquillas Formation and Pen Formation. San Vicente Member as used in this report, designates a flaggy chalk-marl unit, the upper member of the Boquillas Formation. Member is mostly 350 to 400 feet thick in Big Bend National Park but thins locally to 130 feet. Consists of gray thin- to medium-bedded, chalky and argillaceous limestone flags interbedded with gray or yellowish-gray platy marl or soft gray marl. Some limestone layers as much as 12 to 18 inches thick, but most beds are only 2 to 6 inches thick. Thickness 331 feet at type locality. Basal 6 inches is conglomerate that rests upon the *Coilopoceras* beds of Ernst Member. Fossils indicate an Austin age.

Type locality: About 2 miles northwest of old village of San Vicente immediately east of U. S. Geological Survey benchmark elevation 1,881. Name is from old village of San Vicente in Big Bend National Park, which was itself named for Presidio de San Vicente, an ancient military outpost built by Spaniards in seventeenth century.

Saratoga Springs Group

Upper Cambrian (Croixian): New York.

D. W. Fisher, 1962, New York State Mus. Sci. Service Geol. Survey, Map and Chart Ser: No. 2. Croixian strata rim Adirondack Mountains where shelf quartz sandstones (Potsdam) grade seaward through dolomitic sandstones and quartzose dolomite (Theresa) into purer dolomites (Little Falls). Locally, limestones and oolites with biostromal algal reefs of *Cryptozoon* (Hoyt) flank Adirondacks on south and southeast. These facies collectively constitute Saratoga Springs Group. Thickness of succession about 300 feet in type locality; 400 feet in Mohawk Valley; 700 feet in southern Champlain Valley; over 1,000 feet in northern Champlain Valley; 500 feet north of Adirondacks; less than 200 feet in St. Lawrence Valley.

Type locality: Saratoga Springs region.

Sardis Formation

Upper Cretaceous: Western Tennessee.

E. E. Russell, 1965, Dissert. Abs., v. 26, no. 4, p. 2139. Transgressive infralittoral, very glauconitic quartz sands. Unconformably overlies Coffee Sand; conformably underlies Demopolis Formation.

E. E. Russell, 1966, Tennessee Div. Geology Geol. Quad. Map GM 12-NE. Formal proposal of name. Includes the very glauconitic sands, argillaceous glauconitic sands, and glauconitic sandy clays that underlie the marls and calcareous clays of Demopolis Formation and overlie the sparsely glauconitic sands and clays of Coffee Formation. Both boundaries conformable. Lower boundary, exposed at type section, marked by thin irregular ferruginous sand and sandstone in top of Coffee Formation. Upper contact, not well exposed at type locality, is gradational. Thickness about 40 feet at type locality. Thins southward into Alcorn County, Miss., where it merges with lower part of Coon Creek Formation.

Type section: In roadcut 0.4 miles south of Sardis, southwest of Hurricane Creek, at 387, 400 N., 1,317,000 E, Tennessee Coordinate system. Named for town of Sardis, Henderson County.

Sarvent lava complex

See **Ohanapecosh Formation.**

Satans Kingdom Formation (in Hartland Group)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p 36—40, pl. 1. Comprises two members: Ratlum Mountain and Breezy Hill (both new). Overlies Rattlesnake Hill Formation (new); underlies Slashers Ledges Formation (new).

Type locality: Outcrops in Satans Kingdom, in Napaug State Forest, Collinsville quadrangle. Formation constitutes much of outcrop between Cherry Brook Valley and Jones Mountain and underlies most of the hills, such as Ratlum Mountain, Garrett Mountain, and Bee Mountain in center of quadrangle.

Sattley tuff

Miocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1) 20, 21, 22, 36. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Rhyolite tuff. Overlies basement rock. Underlies andesite mudflow breccia. Potassium-argon age 28.1 ± 0.6 m.y. Indicated age Miocene.

Sattley is on Highway 49, in T. 20 N., R. 14 E., Sierra County.

Saucelito Member (of Santa Margarita Formation)

Miocene, upper, and Pliocene, lower: Southern California.

C. A. Hall, Jr., 1962, California Univ. Pubs. Geol. Sci., v. 40, no. 2, p. 58 (fig. 7), 61 (table 2), 62, figs 5, 6, map. 1. Upper member of formation. An alternating sequence of sandy siltstone or siltstone and arkosic arenite and wacke, which locally contains stringers of chert pebbles. Overlies Phoenix member (new).

C. A. Hall, Jr., and C. E. Corbato, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 562 (fig. 2), 572, 573. Described in Nipomo quadrangle, San Luis Obispo County. Subdivided into four units. Total thickness 1,900 feet. Overlies Phoenix Member. Underlies Careaga Formation.

Type locality and derivation of name not stated. Original report discusses Phoneix-Saucelito Creeks area, San Luis Obispo County.

Saude Member (of Spearfish Formation)

Saude Formation

Triassic: Subsurface in western North Dakota and South Dakota.

D. L. Zeiglar, 1955, North Dakota Geol. Soc. Guidebook, Sept. 14, 15, 16, 17, p. 49—55. Formation is predominantly reddish-orange siltstone and very fine grained sandstone with varying amounts of medium-to coarse-grained sandstone interbeds. Conformably overlies Pine salt and conformably underlies Dunham salt.

W. G. Dow, 1967, North Dakota Geol. Bull. 52, p. 10-13, pls. Upper red mudstone unit of the Spearfish, termed Saude Formation by Zeiglar (1955), is herein reduced to member status and placed in Spearfish Formation. Base of the Saude is extended to include a persistent anhydrite and salt unit and an equally persistent sandy siltstone unit formerly included in underlying Pine Salt by Zeiglar. Thickness ranges from featheredge along its periphery to over 350 feet in western North Dakota to 500 feet in South Dakota. Occurs between depths of 6,290 and 6,610 feet, mechanical log depth, in type section herein designated. Overlies Pine Salt Member and extends beyond limits of the Pine Salt and rests unconformably on older Paleozoic rocks to east and north. In some areas lies directly on Belfield Member (new). Overlain by lower evaporite member of Piper Formation.

Type section: Interval between 6,290 and 6,610 in Amerada Petroleum Corp., Pederson, Cater No. 1 well, NE¼SW¼ sec. 21, T. 158 N., R. 95 W., Williams County. N. Dak. Name Saude derived through popular usage.

Savin Schist (in Milford Group)

Ordovician: Connecticut.

C. E. Fritts, 1965, U. S. Geol. Survey, Bull. 1224—A, p. A31. Burger (1962, unpub. thesis) made threefold division of Milford Chlorite Schist. [Title of Burger's thesis is "Stratigraphy and Structure of the Milford Group, New Haven quadrangle, Connecticut".] Burger gave name Savin Schist to a southeastern unit consisting mainly of chloritic phyllite similar to that exposed near Savin Rock in New Haven quadrangle. This unit extends southeastward across northwest corner of Woodmont quadrangle, where it is interpreted as low-grade Derby Hill Schist.

H. R. Burger, 3d, 1967 Connecticut Geol. and Nat. History Survey Rept. Inv. 4, p. 2 (fig. 2), 3, 4 (fig. 3), 5-8. Formal proposal of name. Proposed for rocks exposed in extreme southwestern part of New Haven quadrangle, extending from Veterans Hospital to Bradley Point. Rocks mapped by Fritts (1965) as unnamed member of Derby Hill Schist in southeastern Ansonia and eastern Milford quadrangles are identical to those mapped by present author as Savin Schist in New Haven quadrangle and should be designated as Savin Schist. Two distinct units recognized in Savin Schist in New Haven quadrangle. Lowermost unit is fine-grained evenly laminated quartz-muscovite-chlorite-albite schist. Upper unit contains several different rock types, most abundant being essentially an albite-muscovite-chlorite-quartz schist. Thickness about 2,500 feet. Under lies Allingtown Volcanics. [Milford Group not used in this report.]

Probably named for Savin Rock in New Haven quadrangle.

Sawkill Stage

Lower Devonian (Ulsterian): New York.

L. V. Rickard, 1964, New York State Mus. Sci. Service Geol. Survey, Map and Chart Ser., no. 4. Proposed for stage extending from base of Esopus Shale to base of Edgecliff Limestone and characterized by fauna of Esopus and Schoharie Formations. Follows Deerpark Stage and followed by Southwood Stage (new). Combined Sawkill and Southwood Stages are equivalent to Onesquethaw Stage of Cooper and others (1942) as modified by Dennison (1961).

Type section: Exposure of Esopus Shale and Schoharie Formation along Esopus Creek at Glenerie Falls, Catskill quadrangle.

Sawmill Creek Member (of Middlesex Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Uppermost member of Middlesex Formation. Consists of black shale with minor amounts of dark gray shale and thin siltstone. Overlies Johns Creek Member (new); underlies Sonyea Formation.

Type section: In Sawmill Creek, 8 miles north of Watkins Glen, Schuyler County. Traced to vicinity of Delhi, 80 miles east.

S Bar S Formation (in Lahontan Valley Group)

Pleistocene: Southwestern Nevada.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 11, 13. Defined as entirely subaerial sediments, contemporaneous and intertonguing with Eetza Formation, that overlie Paiute Formation and Cocoon Soil with moderate or no unconformity, and underlie Wyemaha Formation with local unconformity. Consists of alluvium, some colluvium, and very minor eolian sand. Deposits in formation were informally designated (Morrison, 1961, U. S. Geol. Survey Prof. Paper 424-D, 1964, U. S. Geol. Survey Prof. Paper 401) as alluvium and colluvium of Eetza age.

Type area: Bluffs of Truckee River valley in secs. 15 and 16, T. 21 N., R. 24 E., Washoe County. Named for S Bar S Ranch on west side of type area.

Scales Formation (in Maquoketa Group)

Scales Member (of Maquoketa Formation)

Upper Ordovician (Cincinnatian): Northwestern Illinois and Wisconsin.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 135-136. Name applied to unit which in many reports has been referred to as lower brown shale member of lower shale zone of Maquoketa Formation. Lower part of formation commonly consists of brown to black shale. In some areas it is calcareous and interbedded with dark-gray to brown argillaceous limestone, and in others it consists of dark-brown sandstone, siltstone, and shale. Somewhat higher, the shale is generally medium gray and contains varying proportions of interbedded limestone, but in places this interval is also largely dark colored. This variable interval is differentiated as Elgin Member in areas where it is separated from Fort Atkinson Limestone above by 10 to 20 feet of light- to medium-gray or greenish-gray shale that is referred to the Clermont Member. Frequently this differentiation cannot be made. In Thebes area, Alexander County, the Scales is largely dark-brown sandstone and shale (the Thebes Sandstone Member) 75 to 100 feet thick, overlain by greenish-gray shale (Orchard Creek Shale Member) 20 to 30 feet thick. Thickness of formation commonly 75 to 100 feet but ranges from 50 to 175 feet. Present throughout area of Maquoketa Group. Unconformably overlies Dubuque, Wise Lake, and Dunleith Formations of Galena Group. In southwestern Illinois overlaps and truncates Cape Limestone. Appears to be conformable to overlying Fort Atkinson Formation. Edenian or probably Maysvillian in age, rather than Richmondian as long classified.

H. B. Willman and others, 1967, Geologic map of Illinois (1:500,000): Illinois Geol. Survey. Listed on map legend as Scales Shale in Maquoketa.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Shown on stratigraphic column as Scales Member of Maquoketa Formation. Cincinnatian.

Type section: Railroad in Scales Mound in which 30 feet of Scales Formation overlies 10 feet of Dubuque Dolomite. Top of formation is exposed about 5 miles farther east in another railroad cut, SW SW SW 15, 29N-3E, Elizabeth quadrangle, where 20 feet of Fort Atkinson Limestone overlies 18 feet of Scales Formation. Named for town of Scales Mound, Jo Daviess County, Ill.

Scenic Drive Formation (in El Paso Group)

Canadian (Cassinian): New Mexico and Texas.

R. H. Flower, 1964, New Mexico Bur. Mines and Mineral Resources Mem. 12, p. 149. Consists of basal sandy dolomite, sand-free dolomite, and 200 feet of thin-bedded limestones at El Paso. Essentially $B_2$6 of Cloud and Barnes (1946, Texas Univ. Bur. Econ. Geology Pub. 4621). Canadian treated as system in this report.

Scholes Formation (in Canadaway Group)

Scholes member (of Sixtown Creek formation)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G-39, p. 270-271. Term Scholes member used as informal designation for lower member of Sixtown Creek formation. Member is a 130-foot sequence of nonfossiliferous massively bedded sandstones and gray shales. Designation of member rank applicable only where Scholes is overlain by shale member of Sixtown Creek formation. Elsewhere, especially in central Allegany County, the Scholes attains formation rank. Thickness about 237 feet at type section. Overlies Caneadea Shale; underlies Machias Formation and in some areas Rushford Lake Formation (new).

Typical section: About 300 feet south of Rushford Lake and Caneadea Storage Dam on Caneadea Creek. Named for Scholes, Allegany County.

Schoonover Formation or Group

Mississippian: Northeastern Nevada.

J. J. Fagan, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 595—612, pl. 1. Name proposed for chert-clastic-volcanic rock sequence in Bull Run and Wildhorse quadrangles north and west of McAfee Peak. Subdivided into (ascending) Dorsey Creek, Fry Creek, Mines Creek, Harrington Creek, Cap Winn, Ott Creek, Frost Creek, and Bailey Creek Members, as well as a lower and an upper unnamed member. Maximum thickness about 9,000 feet. Unconformably overlies Ordovician strata. Formation structurally complex; axial planes of larger folds generally incline toward north and northwest; Schoonover considered to have been thrust from that direction in late Mississippian or post-Mississippian time prior to Miocene. Dating of thrusting as well as correlation of Schoonover with other rocks largely dependent upon Mississippian age of brachiopods in Dorsey Creek Member. About 8,000 feet of formation is younger than Dorsey Creek fossil zone, so upper parts of formation may be younger than Mississippian.

Michael Churkin, Jr., 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 8, p. 1616 (fig. 4). Schoonover Group, Carboniferous, listed on correlation chart.

Name derived from Schoonover Creek, Bull Run quadrangle, Elko County.

Schrader Glaciation

Pleistocene: Alaska.

G. W. Holmes and C. R. Lewis, 1959, (abs.) Canadian Oil and Gas Industries, v. 12, no. 12, p.55, 1961, *in* Geology of the Arctic, First Internat. Symposium Proc., v. 2: Toronto, Canada, Univ. Toronto Press, p. 857—859. Represented by ridged lobate end moraines, some of which enclose Lake Schrader. These moraines marked by a few shallow ponds and low hillocks, and by widely distributed, well-developed assortment of frost features. Less extensive than preceding Chamberlin glaciation (new). Followed by Peters glaciation (new).

G. W. Holmes and C. R. Lewis,1965, U. S. Geol. Survey Bull. 1201—B, p. B14—B15, pl. 1. Formal proposal of name. Largest ice mass of this glaciation flowed down valley now occupied by Lake Peters, pushed through basin of Lake Schrader, and split into three lobes. Younger than Chamberlin Glaciation and older than Peters Glaciation.

Named for Lake Schrader, Brooks Range.

Schwertner Member (of Dessau Formation)

Cretaceous: Central Texas.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121—1123. Basal member of Dessau formation. Name credited to Durham (1957).

Present in type section of Austin Group at Austin.

Sconondoa Member (of Lockport Formation)

Middle Silurian: New York.

D. H. Zenger, 1962, Dissert. Abs., v. 23, no. 6, p. 2097. Entire Lockport sequence between Clyde and Oneida is represented by Sconondoa Member which is about 150 feet thick at Clyde and 75 feet thick at Oneida.

D. H. Zenger, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2249—2253. Consists of two facies informally designated as limestone facies and dolomite facies. Overlies Rochester Shale; underlies Vernon Shale. Grades into Ilion Member in Syracuse area.

D. H. Zenger, 1965, New York State Mus. Bull. 404, p. 88—95. Detailed discussion of the limestone and dolomite facies. To west, the limestone facies grades into Oak Orchard and upper Penfield Members; to east, it interfingers with dolomite facies before both pass into Ilion Member. The conformable Rochester-dolomite facies contact is exposed at Canaseraga Creek in Chittenango quadrangle. There, the Rochester grades upward into the dolomite through a 2-foot transition zone of interlaimated dolomite and mudstone. Lower contact with Herkimer is exposed farther east along Sconondoa Creek, where lowermost Sconondoa consists of an alternation of shale and dolomite. These shales represent the beginning of the eastward transition to the Ilion Member. The contact is set just above the uppermost crinoidal dolomite. An irregularly bedded, pyritic and hematitic, crinoidal stratum is present near top of the Herkimer at Sconondoa Creek just east of Vernon. This bed represents a local condensation. However, because there are beds of Herkimer-like lithology in lowermost Sconondoa at both of these localities it is believed that the contact is gradational. Upper contact with Vernon not exposed.

Type section: Composite of three exposures along Sconondoa Creek in eastern part of Oneida quadrangle: discontinuous section exposing lower and middle part of member, beginning south of Route 5 in village of Vernon and extending south-southwest to point 0.2 mile north of Oneida Road, SE 1/9 Oneida quadrangle; section extends west for about one-half mile form William Street in Sherrill and outcrops in abandoned quarry north of creek and 0.1 mile west of Elmwood Place, S 1/9 Oneida quadrangle; abandoned quarry 0.1 mile west of Morgan Road, 0.45 mile south-southeast of the four corners at Scondonoa, C 1/9 Oneida quadrangle.

Scotch Cap Sandstone (in Ludlow Formation)

Scotch Cap Sandstone (in Ludlow-Cannonball Member of Lance Formation)

Paleocene: Northwestern South Dakota.

W. V. Searight, 1934, South Dakota Geol. Survey Rept. Inv. 21, p. 28—31. A sandstone lying above the Hillen coal zone and below the Bison coal and Bison silts (new) in Ludlow-Cannonball succession in Perkins County. Fairly uniform lithologically. Bed is massive and composed of fine, silty, micaceous light-gray or light-buff sandstone. Thickness 5 to 36 feet. Upper Cretaceous.

A. F. Agnew and P. C. Tychsen, 1965, South Dakota Geol. Survey Bull. 14, p. 165—166. Sandstone in Ludlow Formation. Paleocene. Mapped in three quadrangles of central Perkins County, apparently local.

Name derived from the cap of a conspicuous butte of this name in NE¼NW¼ sec. 23, T. 18 N., R. 12 E., 1½ miles west of area. Typically exposed in area along topographic feature known as Rocky Butte Ridge lying diagonally across sec. 14, T. 18 N., R. 13 E.

Scott Peak Formation (in White Knob Group)

Mississippian: Central Idaho.

O. K. Huh, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 34, 35 (fig 2), 39—42. Term White Knob raised to group status to include four newly named formations (ascending): Middle Canyon, Scott Peak, South Creek, and Surrett Canyon. The Scott Peak is 2,250 feet thick at type section and consists of three distinctive members: a lower cyclic member about 650 feet thick, a middle massive member of mixed crystalline limestone 850 feet thick, and an upper cyclic member 750 feet thick. Contacts with overlying and underlying formations sharp and distinctive.

Type section: At East Canyon, in western side of southern Lemhi Range, near Howe. Section begins at entrance of the canyon and continues up into the first small tributary canyon on the east side. Named for excellent but completely folded exposures at Scott Peak, Beaverhead Range.

Scottsburg Member (of Menard Limestone)

Mississippian (Chesterian): Northwestern Kentucky and southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 5 (fig. 2), 19, pl. 1. Consists of massive dark-grayish-brown sublithographic limestone with minor shale partings. Fossiliferous. Thickness 30 to 40 feet. Separated from overlying Allard Member (new) by 10 to 20 feet of gray shale. Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 38—40, 81, pl. 1. Name formally proposed in this report for the middle "massive Menard" of the three major limestone members of Menard Limestone of Elviran age. Separated from upper or Allard Limestone Member by 15 to 30 feet of shale, and from lower or Walche Limestone Member by 3 to 30 feet of shale. North of limits of Walche Member this shale is included in Waltersburg Formation and Scottsburg becomes lowest unit of Menard. Thickness about 32 feet at type section, but upper part obscured by both slumping and faulting and only lower 16 feet well exposed.

Type section: Exposed in Walche's cut on Illinois Central Railroad 3 miles northeast of Scottsburg and 3,500 feet west of Claxton in southwest corner of 19-H-21, 6,400 feet from south line and 8,600 feet from east line of H-21, Princeton East quadrangle, Caldwell County, Ky.

Scottsmore Quartzite

See Bridgeman Hill Formation.

Scranton Mountain Member (of Taine Mountain Formation)

Pre-Triassic: Northwestern Connecticut.

R.S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 17, 20—21, pl. 1. Fairly homogeneous unit composed of medium-grained garnet-plagioclase-quartz-biotite-muscovite schist, with subordinate mica-plagioclase-quartz gneiss and thin cak-silicate gneiss. Characteristically rusty-weathering. Overlies Wildcat Member (new). In contact with either overlying Whigville Member (new) of Taine Mountain formation or Bristol Member of Collinsville Formation.

Type locality: In outcrops on western side of Scranton Mountain along Tunxis Trail, Collinsville quadrangle.

Seaforth Gneiss

Precambrian: Southwestern Minnesota.

S. S. Goldich, 1961, Minnesota Geol. Survey Bull. 41, p. 129, 134—135. Structurally resembles Morton gneiss. Locally pegmatitic and cut by gray aplite. K-A age 2.4 m.y.

Occurs near Seaforth in Minnesota River valley.

Seal River Formation

Recent: Southeastern Alaska.

G. M. Haselton, 1967, Dissert. Abs., v. 28, no. 6, sec. B, p. 2480. The deposit of the late Neoglacial ice advance is the Glacier Bay Formation. This advance may have started by 3000 year B. P. By late 16th or early 17th century, ice had reached the mouth of Glacier Bay. Since 1794, ice has retreated 70 to 100 km up Muir Inlet and Glacier Bay, respectively. Modern outwash (Seal River Formation) is once again filling the inlets as glaciers continue their retreat.

In Muir Inlet in northeastern corner of Glacier Bay National Monument.

Searsburg Conglomerate Member (of Readsboro Formation)

Precambrian: Southern Vermont.

J. W. Skehan, 1961, Vermont Geol. Survey Bull. 17, p. 24 (fig. 5), 45—48, pls. 1, 3. Term proposed for series of schistose conglomerate beds exposed locally along angular unconformity in Searsburg. Name is used for distinctive series of blue and white quartz-pebble conglomerates; thin glassy, white, gray, and buff quartzites; micaceous white quartzites; coarse feldspathic arkose conglomerates; and coarse albite schists. Thickness 0 to 175 feet. Basal member of Readsboro formation (redefined); underlies Readsboro schist member (redefined).

Well exposed 0.1 mile south of Somerset-Searsburg township line and 0.3 miles east of East Branch of Deerfield River, Wilmington-Woodford area.

Sebago Granite

Upper Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 80—84. Mentioned in discussion of spatial relations of structure in metamorphic rocks Songo Granodiorite in Bryant Pond quadrangle. Hanley (1939, unpub. thesis) described Sebago batholith in Poland quadrangle.

Type locality and derivation of name not stated.

Sebascodegan Formation

Silurian-Devonian: Northwestern Maine.

A. M. Hussey, 2d, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip A, p. 4—12, road log. Name "Sebascodegan" Formation applied to rocks exposed on Sebascodegan Island. Name used herein for convenience of discussion. Formal establishment of name will appear later. Consists of felsic volcanics (equivalent of Cushing Formation), bedded amphibolite, massive amphibolite, rusty garnet-rich biotite-quartz schist, and rusty schist member. Underlies Cape Elizabeth Formation of Casco Bay Group.

Named for exposures on Sebascodegan Island.

Sehoo Formation (in Lahontan Valley Group)

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—112. Consists of three tongues of lacustrine gravel to clay and tufa, separated by tongues of Indian Lakes formation (new). Each tongue locally differentiated as a member of the formation and records separate lake cycle of Lake Lahontan. Lower tongue (member) extends to 4,370 feet altitude, within 10 feet of highest Lahontan beach; middle tongue, the dendritic member (named after characteristic tufa), extends to as high as 4,180 feet altitude; upper tongue (member) extends to maximum altitude of about 3,990 feet. Thickness as much as 96 feet. Overlies Wyemaha formation (new) and middle Lake Lahontan soil with slight or no disconformity; underlies Turupah formation (new), local disconformity.

R. B. Morrison, 1964, U. S. Geol. Survey Prof. Paper 401, p. 41—63. Detailed description of formation. The Sehoo records the late deep-lake period of Lake Lahontan. At type locality, herein designated, the typical lithologies of highland shore occurrences of all members of the Sehoo are represented, overlying both eolian sand of Wyemaha formation and gravel of Eetza formation. Sehoo-Wyemaha boundary is generally clearly marked and conformable or only slightly disconformable. Intertongues with subaerial Indian Lakes formation. In some areas underlies Turupah formation, youngest formation in Lahontan Valley group, or Fallon formation.

Type locality: In saddle between Schoo Mountain and Eetza Mountain, at west end of Wyemaha Valley in E½ sec. 21, T. 18 N., R. 30 E., Carson Desert, near Fallon, Churchill County.

Seehoo-Toyeh Stage

Pleistocene: Great Basin.

R. B. Morrison and J. C. Frye, 1965, Nevada Bur. Mines Rept. 9, p. 24—25, figs. 6, 7. Proposal of provincial time-stratigraphic standard for middle and late Quaternary successions of Great Basin. Each of the stages and substages is bounded by a geosol; its upper boundary is top of main geosol and it extends downward through intervening deposits to top of next lower geosol. Main geosols were formed during main interlacustral-interglacial intervals. Stage includes interval of time represented by deposits laid down during main lacustral-glacial interval plus the following interval of interlacustral-interglacial deposition and of weathering during which next overlying main geosol formed. Stages are named after lacustrine formations and geosols of Lake Lahontan area, using name of oldest named formation in the stage followed (after a hyphen) by the name of the next overlying main geosol. Sehoo-Toyeh Stage subdivided into Bonneville-Graniteville Substage (older) and Draper-Midvale Substage. Preceded by Eetza-Churchill Stage and followed by Recent Fallon Stage.

Type area: In bluffs along Truckee River north of Wadsworth, Washoe County, Nev.

Seldovian Stage

Oligocene(?) and Miocene: Alaska.

J. A. Wolfe, D. M. Hopkins, and E. B. Leopold, 1966, U.S. Geol. Survey Prof. Paper 398—A, p. A14—A17. Three time-stratigraphic units can be recognized within Kenai Formation on basis of fossil leaf floras they contain. Seldovian Stage is proposed for a provincial time-stratigraphic unit that encompasses all plant-bearing strata in Alaska and in adjoining parts of same ancient floristic province that are of approximately same age as those parts of Kenai Formation represented in type section along Cjuitna River and near Capps Glacier and in the reference section near Seldovia Point. Succeeded by Homerian Stage (new).

Named after Seldovia Point because strata of Kenai Formation exposed in sea cliffs ½ to 3 miles east of Seldovia Point on the south shore of Kachemak Bay contain an especially rich flora that includes most of the elements upon which recognition of the Seldovian Stage is based.

Seligman Member (of Toroweap Formation)

Permian (Leonardian): Northwestern Arizona.

J. E. Sorauf, 1963, Dissert. Abs., v. 24, no. 2, p. 702. Lowermost member of formation. Underlies Brady Canyon Member (new) which is overlain by Woods Ranch member (new). Laterally replaced by Coconino Sandstone. The three members represent transgression, maximum extension, and regression of Toroweap sea, respectively.

Whitmore area, Mohave County.

Selmier Member (of New Albany Shale)

Upper Devonian and Lower Mississippian: Southeastern Indiana.

J. A. Lineback, 1965, Dissert. Abs., v. 25, no. 11, p. 6538. Greenish-gray dolomitic mudstone. Overlies Morgan Trail Member (new) and underlies Blocher Member (revised).

Type locality and derivation of name not stated.

Sentinel Gap Flow (in Frenchman Springs Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 20, p. 8, 13—14, 17, 21, 40. Uppermost named flow in Frenchman Springs Basalt Member (new). Overlies Sand Hollow flow (new). Thickness 125±10 feet at Sentinel Gap. Consists of solid basalt characterized by disorderly joint patterns, but containing irregularly distributed masses of pillow palagonite. Thins northward and pinches out completely within Vantage-Priest Rapids area. Overlain by Roza Basalt Member (new).

Named for Sentinel Gap between Priest Rapids and Vantage.

Seven Tree Quartzite Member (of St. George Formation)

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Metaquartzite underlies ridge between Union Town Green and Route 17. On hill underlying town cemetery at northwest corner of Seven Tree Pond, metaquartzites contain occasional greenish-yellow to brown-weathering pyritiferous, graphite-rich schistose interbeds; similar interbeds occur in the quartzites at Union Center and on Route 17 east of junction with Route 131. On cemetery hill, individual beds are tightly folded, and the thicker quartzite beds are boudinaged; deformation has been so severe on the southwestern corner of hill that pieces of a boudinaged metadolerite dike(?) at least 13 feet thick have been rotated out of line of strike. Along southeast side of Sennebec Pond the Seven Tree quartz gneisses crop out on Seven Island and in Seven Tree Pond, and fine-grained gray and white somewhat feldspathic thinly banded quartzite rocks containing a few percent sulfides and other dark minerals occur along the southeast shore of the pond. Despite different deformational textures and a slightly variable mineralogy, the quartzitic metasediments from Route 17 to Seven Tree Pond are considered correlative and are here named Seven Tree quartzite. Along southeast side of Sennebec Pond the Seven Tree quartzite is fine grained, gray and white, somewhat feldspathic, contains a few percent of sulfides and calcsilicate minerals, and has 1-mm banding. In North Appleton area a 400-foot sequence of quartzite and intercalated black phyllite rocks have been traced along strike 2.3 miles. The white to buff weathering aphanitic gray quartzite units are 7 to 200 feet thick. The stratigraphic sequence at North Appleton (consisting of this quartzite interval, a 75-foot thick marble 1,000 to 1,500 feet to west, and lustrous phyllites west of the marbles) is similar to the more metamorphosed sequence in Union, thus inferring that the North Appleton and Union Marble belts are correlative.

Occurs in northwestern Knox County marble belt.

Seventy Six Basalt

Miocene, upper(?): Northeastern Nevada.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M8—M9, pl. 1. Black to dark-gray medium- to fine-grained porphyritic basalt. Occurs as sills, laccoliths, and slightly transgressive sheets, possibly also as flows. Sills are as little as 6 feet thick, but locally expand to laccolithic masses 200 feet thick. Intrudes Dead Horse tuff in masses along divide between Copper Basin and Seventy Six Creek and cuts Meadow Fork formation (new) in cirques southwest, northwest, and northeast of Marys River Peak. Does not intrude Danger Point tuff (new) or Jarbidge rhyolite.

Type locality: Seventy Six Creek, in southern part of Jarbidge quadrangle, Elko County.

Severy Hill Formation

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 107, figs. 1, 2, road log. Composed of sulfidic rusty-weathering quartzite, muscovite schist, and mica schist. In west part of Dixfield quadrangle forms discontinuous patches above Peru Formation (new). Listed as an unpublished and unofficial stratigraphic name.

Formation is continuous from south part of Dixfield quadrangle, across Farmington quadrangle, and into southeast part of Kingfield quadrangle.

Sevier clays

Quaternary: West-central Utah.

Necip Güven and P. F. Kerr, 1965, Selected Great Basin playa clays: U.S. Air Force Cambridge Research Lab. Sci. Rept. 4, 35 p. Mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and Animas clays indicate that mica-type clay minerals, illite, vermiculite, and montmorillonite are prominent in the playa crusts.

Lower Sevier Playa (Wah Wah Valley) is light gray to white, smooth, and forms hard porcelain-like pavement when dry.

Sexton Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Sexton sand occurs at depths of 8,990 to 9,010 feet in type well. Correlation of Sexton, Roseberry, Tucker, and Taylor sands is difficult downdip from type area because sands merge into massive sandstone bar of Schuler.

Type well: Magnolia Petroleum Co., No. 1 Sexton unit, sec. 32, T. 23 N., R. 9 W., Shongaloo field. Reference well: Stanolind Oil and Gas Co., No. 1 Beene unit, sec. 5, T. 22 N., R. 9 W., Webster Parish.

Seymour Canal Formation (in Stephens Passage Group)

Upper Jurassic and Lower Cretaceous: Southeastern Alaska.

R. A. Loney, 1964, U.S. Geol. Survey Bull. 1178, p. 11 (table 1), 55—56, pl. 1. A thick sequence of dark-gray slaty argillite and thin-bedded volcanic graywacke; locally contains thick lenticular bodies of conglomerate and massive graywacke. Thickness 4,000 to 8,000 feet. Disconformably overlies Hyd Formation (new); conformably underlies Brothers Volcanics (new).

E. H. Lathram and others, 1965, U.S. Geol. Survey Bull. 1181—R, p. R23, R24, pl. 1. Included in Stephens Passage Group (new). Rocks mapped as Symonds Formation by Barker (1957) are herein mapped as Seymour Canal Formation and name Symonds Formation is herein abandoned. Future mapping may prove Shelter Formation to be a member of Seymour Canal. Disconformably overlies Triassic rocks. Along most of Glass Peninsula, the Seymour Canal is overlain by Douglas Island Volcanics in normal stratigraphic sequence, and contact is conformable and gradational.

Type locality: Mouth of Seymour Canal in northeast part of Pybus-Gambier area, Admiralty Island. Formation forms eastern and southeastern border of area. Crops out in broad belt which bends sinuously through Pybus Bay from Elliott Island northeastward to Point Pybus, and thence beneath waters of Stephens Passage. Reappears in eastern Gambier Bay, where it forms nearly rectilinear belt of outcrops trending north-northwest and extending almost continuously along shores of Seymour Canal for distance of about 40 miles north of Gambier Bay.

Shadscale Formation

Middle Cambrian: West-central Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 9 (table 4), 19—21, pl. 1. Lower one-fourth consists of about 60 feet of dolomite overlain by about 70 feet of siltstone. Upper three-fourths is gray limestone interbedded with green shale. Thickness 518 feet at type section. Base of formation marked by unit of orange-brown-weathering dolomite which overlies Busby quartzite. Upper boundary placed at top of highest shale bed. Most commonly upper shale is covered, and upper contact is placed at base of massive gray limestone that marks base of Trailer limestone (new).

Type section: On east side of Dugway Range on ridge 0.6 mile north of Trailer Wash, Juab County. Named for exposures near Shadscale Canyon. Also crops out at four other localities: (1) small patches 1.2 miles east of Dugway Pass, (2) in band along west side of south end of Fandangle Canyon, (3) along ridge 1.4 miles south-southeast of Four Metals mine, and (4) in several patches on west side of Dugway Range west of south end of Kellys Hole.

Shadygrove Formation (in Conococheague Group)

Upper Cambrian: South-central Pennsylvania.

D. B. MacLachlan and S. I. Root, 1966, Pennsylvania Geologists Guidebook 31st Ann. Field Conf., p. 8 (table 1), 11 (table 3). Pure light-colored limestones; stromatolitic in part. Abundant pinkish limestones and cream-colored cherts. Thickness 650 feet. Overlies Zullinger Formation (new). Underlies Staufferstown [Stoufferstown] Formation of Beekmantown Group.

Southeastern Franklin County.

Shagg Pond Formation (in Woodstock Group)

Silurian to Lower Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table 1), p. 27—33, pls. 1, 2. Coarse-grained rusty-weathering migmatitic gneiss and biotite granulite; light fraction consists of pegmatitic quartz and plagioclase whereas dark fraction consists mainly of coarse two-mica-sillimanite schist. Thickness about 3,000 feet. Overlies Thompson Mountain formation (new); underlies Billings Hill formation (new). In fault contact with Moody Brook formation (new).

Jeffery Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Field Conf., p. 111 (map), 112 (fig. 2). Included in Woodstock Group (new).

Type locality: Shagg Pond, Bryant Pond quadrangle. Well exposed along road to Redding.

Shainin Lake Drift

Pleistocene: Northern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 452. Shainin Lake drift mentioned in discussion of late Pleistocene glacial chronology of north-central Brooks Range.

Shake Flat Quartz Monzonite

Cretaceous(?): Southern California.

H. P. Taylor, Jr., and Samuel Epstein, 1962, Geol. Soc. America Bull., v. 73, no. 4, p. 474. Listed with rocks analyzed in study of oxygen isotopic data. Coarse-grained, inequigranular, and unaltered; average grain size of 2 to 5 cm. Somewhat porphyritic with microcline microperthite crystals abundant.

Collected from Southern California Edison tunnel at Mammoth Pool damsite on San Joaquin River, Sierra Nevada Mountains.

Shale Wall Member (of Seabee Formation)

Upper Cretaceous: Northern Alaska.

Helen Tappan, 1962, U.S. Geol. Survey Prof. Paper 236—C, p. 107. Fossils collected from Shale Wall member along Ayiyak River. Underlies Ayiyak member.

R. L. Detterman, R. S. Bickel, and George Gryc, 1963, U.S. Geol. Survey Prof. Paper 303—E, p. 269—275. Formal proposal of name. An incompetent shale unit in lower part of formation. Thickness 1,385 feet at type section. Here basal beds have been cut out by fault. Underlies Ayiyak member.

Type section: West bank of Nanushuk River at camp W-June 25—47. Section extends 2½ miles along the river.

Shallow Creek Quartz Latite

Oligocene: Southwestern Colorado.

T. A. Steven and J. C. Ratté, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D54—D63. Name applied to group of lava flows and volcanic breccias that crop out in drainage basins of Rat Creek, Miners Creek, and Shallow Creek. Maximum thickness 600 to 700 feet in type area. Rocks included in Shallow Creek Quartz Latite were originally described by Emmons and Larsen (1923, U.S. Geol. Survey Bull. 718) under informal name hornblende quartz latite. This unit marked base of their Piedra Group and they believed that it was separated from underlying Alboroto rocks by erosional unconformity. Larsen and Cross (1956, U.S. Geol. Survey Prof. Paper 258) called same rocks hornblende rhyolitic latites and agreed with earlier stratigraphic interpretations. Present study shows that Shallow Creek Quartz Latite intertongues laterally with upper members of gradational sequence in Bachelor Mountain Rhyolite, and that supposed unconformity between rocks included by Emmons and Larsen (1923) in their Alboroto and Piedra Groups does not exist. Middle or upper Tertiary.

The U.S. Geological Survey currently designates the age of the Shallow Creek Quartz Latite as Oligocene on the basis of a study now in progress.

Type area: Along northern flank of Shallow Creek drainage basin, west of Creede, San Juan Mountains.

Sharpners Pond Tonalite

Middle(?) Paleozoic: Northeastern Massachusetts.

R. O. Castle, 1965, Dissert. Abs., v. 25, no. 9, p. 5211. Andover Granite and Sharpners Pond Tonalite together comprise up to 90 percent of Acadian(?) subalkaline intrusive series cropping out in area.

R. O. Castle, 1965, U.S. Geol. Survey Prof. Paper 525—C, p. C74—C80. Formal proposal of name. Sharpners Pond Tonalite is adopted for the generally melanocratic plutonic rocks west of long 71°00′W. and northwest of Middleton and Topsfield centers formerly mapped as Salem Gabbro-Diorite. Divided into following facies: (1) hornblende diorite, (2) biotite-hornblende tonalite, and (3) biotite tonalite. As shown on map, Sharpners Pond occupies at least 40 to 50 square miles of northeastern Massachusetts; it may occupy as much as 90 square miles if rocks to northeast mapped as Salem Gabbro-Diorite and Newburyport Quartz Diorite ultimately are found to belong to the Sharpners Pond. Andover Granite and Sharpners Pond Tonalite belong to continuous plutonic series. Type locality designated.

Type locality: Sharpners Pond, about 4¼ miles west of Topsfield, Essex County.

Sharpsboro Member (of Dutchtown Formation)

Middle Ordovician (Champlainian): Eastern Missouri and southwestern Illinois.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13 (fig. 2), 36 (fig. 12), 55. Consists principally of argillaceous dark-brown and black lithographic to fine-grained dense limestone and dolomite that is somewhat silty and sandy at various intervals and is slightly oolitic. Some layers of lighter colored medium-grained limestone and medium-grained calcarenite present in lower part in type area. In Illinois, beds of light-colored sandy dolomite resembling overlying Joachim Formation present locally near top. Thickness 67 feet in well near Mound City, Pulaski County, Ill.; 105 feet in Midwest Dairy Co. well at Cape Girardeau, Mo.; at type section, 10½ feet. Overlies Gordonville Member. Equivalent to middle and upper Dutchtown members of McQueen (1937).

Type section: Geiser quarry on north side of State Highway 75, 1¼ miles east of Dutchtown, SW¼SW¼NW¼ sec. 20 projected, T. 30 N., R. 13 E., Cape Girardeau quadrangle, Cape Girardeau County, Mo. Named for Sharpsboro on St. Louis-San Francisco Railroad, in Cape Girardeau County, 5½ miles southeast of type section.

Shastina pyroxene andesite

Recent: Northwestern California.

R. G. Strand, 1964, Geologic map of California, Weed sheet (1:250,000): California Div. Mines and Geology. Dark gray or black andesitic basalt rich in bright green granules of pyroxene. These lavas are "identical" with the early flows of Shasta and it is not certain that they originated from Shastina vent (Williams, 1949, California Div. Mines Bull. 151). Mapped with Recent volcanic rocks.

Mount Shasta area.

Shaw Member (of Snowshoe Formation)

Shaw Formation

Middle Jurassic: East-central Oregon.

L. W. Vigrass, 1961, Dissert. Abs., v. 22, no. 5, p. 1588. Gray shale, 500 to 1,000 feet thick. Overlies Basey formation, gradational contact; underlies Bernard formation (new), angular unconformity.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 85, p. 57, pls. 1, 3. Formal proposal of name Shaw Member of Snowshoe Formation. Gray shale with minor limestone and sandstone intercalations. Thickness about 750 feet; top nowhere exposed. Conformably overlies Basey Member.

Typically exposed near mouth of Shaw Creek in sec. 24, T. 17 S., R. 26 E.

Shawnee Island Member (of Coeymans Formation)

Lower Devonian: Northeastern Pennsylvania, western New Jersey, and southeastern New York.

A. G. Epstein and others, 1967, U.S. Geol. Survey Bull. 1243, p. 21—25, measured sections. Contains a biohermal and nonbiohermal facies. More prevalent nonbiohermal facies consists of medium-gray fine- to medium-grained argillaceous and arenaceous slightly limonitic irregularly bedded limestone which has weak fracture cleavage and weathers medium-light-tannish gray. Biohermal facies is a very coarse grained to coarse-grained medium-light-gray to light-pinkish gray slightly limonitic unbedded to crudely bedded biogenic limestone that weathers light gray and forms large speheroidal blocks upon weathering. Member grades up into Kalkberg Limestone northeast of Wallpack Center, N. J. Southwest of Wallpack Center the Kalkberg is more arenaceous and grades into the Shawnee Island Member. Kalberg is replaced from above by Stormville Member of Coeymans Formation, so that in western part of Stroudsburg quadrangle, chert beds and nodules occur in the Stormville conglomerates. The Stormville disconformably overlies Shawnee Island Member southwest of Wallpack Center, N. J. Northeast of Peters Valley, N. J., Shawnee Island is underlain locally by Thacher Member of Manlius. Southwest of Peters Valley, the Peters Valley Member (new) of the Coeymans intervenes between the Depue (new) and the Shawnee Island and grades up into the latter. Northeast of Nearpass quarries, New Jersey, the Shawnee Island Member grades laterally into Ravena Member (of the Coeymans). This transition takes place over distance of 3 miles along strike between Nearpass quarries and Trilobite Mountain, N. Y. For mapping purposes an arbitrary cutoff northeast of Nearpass quarries was used to separate these two members. Thickness of member variable because of its disconformable relation with overlying Stormville Member and as result of local bioherms. Thickness at type section 56.1 feet.

Type section: In cut along northwest side of road, 0.6 mile southwest of Shawnee on Delaware, Pa., in Bushkill quadrangle. Reference section: In woods on northeast side of secondary road along ascent of Wallpack Ridge in Pennsylvania, immediately southwest of where the Delaware River cuts through the ridge, in Flatbrookville quadrangle.

Shawtown Formation

Shawtown Member (of Eau Claire Formation)

Upper Cambrian: Southern Wisconsin.

G. O. Raasch and Louis Unfer, Jr., *in* D. F. Merriam, ed., 1964, Kansas Geol. Survey Bull. 169, v. 2, p. 427—440. Discussion of transgressive-regressive cycle in Croixan sediments (Upper Cambrian), Wisconsin. Name Shawtown Formation tentatively proposed to designate the "Upper" or marine Mount Simon, after that district of city of Eau Claire in which Mount Washington (Eau Claire type locality) is located. Footnote (p. 435) states that Shawtown is new name proposed for basal member of Eau Claire Formation. At Mount Simon the unit is 13 feet thick, and underlies 10 feet of *Obolus*-bearing Eau Claire sandstone which forms peak of bluff. Fauna consists of worm borings and comminuted fragments of phosphatic brachiopods.

Type locality: Mt. Simon Bluff in north part of city of Eau Claire. Supplementary type: Mount Washington.

Shay Mountain Complex

Age not stated: Southern California.

R. S. MacColl, 1964, Geol. Soc. America Bull., v. 75, no. 9, p. 809—810, 818, pl. 1. Where least deformed, consists of alternating layers of biotite-quartz schist and quartzite. Most of complex consists of migmatites, gneisses, and granulites derived from the schist and quartzite. Complex composes nearly entire metamorphic area south of Rattlesnake Mountain pluton and a small part of second metamorphic area 8 miles west of Rattlesnake Mountain. Is in contact with the pluton for about 3 miles, extending west and southwest from Coxey Ranch and following south side of Mill Creek Canyon. Relative ages of Shay complex and White Mountain complexes are not known. White Mountain complex is at least in part Mississippian.

Names for occurrence in vicinity of Shay Mountain in San Bernardino Mountains, San Bernardino County.

Sheepcreekian Age

Miocene: Western North America.

R. W. Wilson, 1960, Kansas Univ. Paleont. Contr., Vertebrata, art. 7, p. 1—92. Discussion of age and correlation of early Miocene rodents and insectivores from northeastern Colorado. Fauna discussed in this report come from "Quarry A" in Martin Canyon area, Logan County. Figure 5 shows three charts showing some proposed correlations of North American provincial ages with European standards. Sheepcreekian is listed on a chart credited to Schultz and Stout, Stout, from various sources. The Sheepcreekian is placed in upper part of Hemingfordian above the Marslandian (new) and below the Valentinian (new). It is correlated with part of the Vindobonian and Sarmatian of Europe. Present writer places the Sheepcreekian in lower half of the Hemingfordian below the Mascallian (new) and above the Marslandian in upper part of the Arikareean.

C. B. Schultz and T. M. Thompson, 1961, Nebraska Univ. State Mus. Spec. Pub. 2, p. 8 (fig. 3). On correlation chart of the Miocene and Pliocene of the central Great Plains, the Sheepcreekian is placed at the top of the Hemingfordian above the Marslandian and below the Pliocene Valentinian.

M. C. McKenna, 1965, Am. Mus. Novitates no. 2228, 21 p. Wilson (1960) introduced without definition the time terms Harrisonian, Marslandian, Sheepcreekian, and Mascallian, and redefined the Arikareean and Hemingfordian Land-Mammal ages by moving the boundary between these two time units to include in the Arikareean "Quarry A" in northeastern Colorado and certain correlated deposits. The time terms Marslandian and Sheepcreekian, used without definition by Schultz and Stout (1961) are not equivalent to the inadequately defined Marslandian and Sheepcreekian of Wilson. Wilson's proposal is unacceptable because the geochron of the Marsland Formation (= "Upper Harrison beds" of Peterson, 1906) is part of the original basis of the Hemingfordian Land-Mammal age. It should be noted that Schultz and Stout's Sheepcreekian is a division of their "Hemingfordian", not the Hemingfordian of Wood and others (1941, Geol. Soc. America Bull., v. 41, no. 1). Schultz and Stout's "Hemingfordian", like the Hemingford Group, extends to the end of what they recognize as Miocene time in Nebraska, correlated by them with the end of Sarmatian time in Europe. Relationships of these time terms to the Land-Mammal Age term Barstovian (Wood and others, 1941) have not been elucidated by Schultz and Stout. The application of a rigorous system of stratigraphic and biostratigraphic nomenclature has long lagged for the continental Tertiary, and loose usage has often proliferated without adequate definition. Meanings of such terms as "Barstow fauna", "John Day fauna", "Loup Fork", "Sheepcreekian," "middle Marsland", "Arikaree time" and so forth are not clear because they have not been defined adequately in and are used differently by various authors. Many time, rock, and faunal terms, and combinations of these terms, utilized for the Miocene of Nebraska and nearby states mean different things to different authors because the basic data necessary for definition have not been adequately published or are passed on among small groups of geologists and paleontologists mainly by oral tradition. On the other hand, many time, rock, and faunal units were originally given a rigorous or adequate definition which has lapsed into a loose or ambiguous usage by later workers by repeated modification without definition.

The Sheep Creek Formation is named for Sheep Creek, Sioux County, Nebr.

Shelburne Till

Pleistocene: Northern Vermont.

D. P. Stewart, 1961, New England Intercollegiate Geol. Conf. Guidebook 53d Ann. Mtg., sec. 5, p. i. Older than Burlington till (new). Believed to be same age as Malone till in St. Lawrence Valley.

First studied in Shelburne area, Crittenden County.

Shelleburg Canyon Formation

See **Apache Canyon Formation (in Bisbee Group).**

Shelly mud

Recent: Florida.

William Spackman and others, 1964, Geol. Soc. America Guidebook for pre-convention field trip Nov. 16, 17, 18. Named on sectional profile through Florida Bay and Whitewater Bay.

Shephard Creek Formation

Upper Cretaceous: West-central California.

J. E. Case, 1963, Dissert. Abs., v. 24, no. 3, p. 1135. Northeast of Chabot fault, 6,000 to 8,000 feet of Upper Cretaceous strata are exposed. These beds were referred to Chico Formation and Oakland Conglomerate Member by Lawson. These beds have been divided into (ascending) Joaquin Miller Formation (new), Oakland Conglomerate, Shephard Creek Formation (new), Redwood Canyon Formation (new), and variegated red and green shale. The Shephard Creek Formation consists of shale and sandstone.

Report discusses geology of part of Berkeley and San Leandro Hills, in San Francisco Bay area.

Sherman Creek Member (of Catskill Formation)

Upper Devonian: Southeastern Pennsylvania.

J. L. Dyson, 1967, Pennsylvania Geol. Survey, 4th ser., Topog, and Geol. Survey Atlas A-137 cd, p. 35—36, pl. 1. Grayish-red to brownish-red shales, siltstones, and fine-grained sandstones with some gray fine-grained sandstone interbeds. Thickness 3,500 feet. No complete section available as type section. Type area designated. Overlies Irish Valley Member. Underlies Clarks Ferry Member.

Type area: Outcrop area between Duncannon (SE subquad, Duncannon quadrangle) and Shermans Dale (C subquad, Shermans Dale quadrangle) where Sherman Creek cuts across the unit in several meanders. Named for exposures along meander banks of Sherman Creek north of Cove Mountain and west of Duncannon.

Sheyenne Valley Formation or Drift

Pleistocene: Southeastern North Dakota.

D. A. Block, 1966, Dissert. Abs., v. 27, no. 6, Sec. B, p. 1979. In northern half of Barnes County, a till of indeterminant age composed of gray, dense, stony clay is mapped as a lithostratigraphic unit and assigned name of Sheyenne Valley Formation. Where exposed, it is capped by a boulder pavement that separates it from the overlying buff till.

T. E. Kelly and D. A. Block, 1967, North Dakota Geol. Survey Bull. 43, pt. 1, p. 19—22. Oldest drift exposed in Barnes County. Base not exposed in type locality. Underlies Kensal-Oakes drift. Thickness about 90 feet. Block (unpub. thesis) reported Sheyenne Valley rested directly on Pierre shale.

Type section: South half of SE¼ sec. 24, T. 141 N., R. 59 W., Barnes County. Most completely exposed in small area along valley walls of Sheyenne River.

Shiel Clay physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek breciated limestone, Smithton limestone, and Clifton Clay sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trâns., v. 60, no. 1, p. 22—23. A basal unit of Cooper Lithofacies. Maximum measured thickness 15.5 feet about a mile northeast of town of Marion, Cole County. Consists of green clay-shale, which southeast of Lupus is very arenaceous and contains piles and lenses of dark-brownish-gray limestone pebbles and cobbles. Overlies and interfingers with Lamine River Facies. Overlain by and interfingers with Little Shaver Creek Facies. Overlain and underlain by Smithton Facies. Overlies and underlies Ralls Conglomerate Facies. Overlies St. Peter, Cotter-Jefferson City, and Kimmswick Formations of Ordovician age. Underlies Grassy Creek Shale of Upper Devonian age.

Best exposed in vicinity of town of Shiel, Ralls County, especially in quarry of Central Stone Co. at Huntington, about 1.5 miles northeast of Shiel.

Shields Formation (in Kintla Group of Belt Supergroup)

Precambrian: Northwestern Montana.

M. O. Childers, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 147, 149 (fig. 7), pl. 1. Consists of thin-bedded bright-red maroon siltstones, sandstones, quartzites, and shales. Thickness 2,251 feet at type section. Overlies Shepard Formation, contact placed where gray calcareous and dolomitic rocks grade into red and maroon siltstones and quartzites. Underlies Red Plume Quartzite (new), contact sharp but conformable. Term Kintla Formation (Willis, 1902, Geol. Soc. America Bull., v. 13) retained and used in broader sense as a group name to include Shields Formation and Red Plume Quartzite.

Type section: Located along ridge between Mount Shields and Blacktail Mountain, lat 48°17′ N., long 113°29′ W., southwest Marias Pass area.

Shimer Dolomite Bed (in Blaine Formation)

Shimer Dolomite Bed (in Van Vacter Gypsum Member of Blaine Formation)

Permian: North-central Texas.

Robert Roth, 1945, Geol. Soc. America Bull., v. 56, no. 10, p. 900. Dolomite bed in Blaine Formation consists of blocky buff dolomite. Thirty-four inches above base is a 5-inch bed of fine gray-buff grits cemented with selenite. Basal 14 inches is very lenticular gray-buff granular locally oolitic dolomite. Thickness 3.97 feet. About 5 feet below top of Blaine in measured section. Overlies unnamed red-brown shale.

E. C. Pendery, 3d, 1963, Am. Assoc. Petroleum Geologists Bull., v. 47, no. 10, p. 1832 (fig. 3), 1836. Investigations have revealed that definitions of Blaine of Texas are not equivalent to original definition of Blaine in Oklahoma. Suggestions made to correct nomenclature regarding the "Blaine of Texas." Van Vacter Gypsum Member of Blaine was named for exposures on Van Vacter Ranch in Oklahoma. Van Vacter consists of alternating gypsums, shales, and dolomites with gypsum predominating in Oklahoma, and shales and dolomites in north-central Texas. Several persistent dolomites occur within Van Vacter stratigraphic interval, some of which have member status. The "Cedartop," Acme, and Shimer Dolomites have been named from localities in Texas. These units should be referred to as "Beds" because they occur within the Van Vacter. The Shimer is similar to the Acme although it is of limited area extent. Dog Creek-Blaine boundary in Texas is placed at gypsum overlying Shimer Dolomite Bed where present. Outside area of Shimer deposition, contact is usually designated at top of gypsum overlying Acme Dolomite Bed.

Roth's measured section B starts in center of sec. 2, B. S. and F. Survey, then west to center of sec. 1, B. B. B. and C. Survey, King County, Tex. [This is called type section by Pendery.]

Shin Brook Formation

Lower or Middle Ordovician: Northeastern Maine.

R. B. Neuman, 1964, U.S. Geol. Survey Bull. 1181—E, p. E1—E8. Consists of bedded waterlaid volcanic sandstone and conglomerate, massive porphyritic rocks that are probably crystal tuffs, and volcanic breccia. Bedded rocks range from fine-grained siltstone to coarse-grained conglomerate. Full thickness of formation not known. At type section 904 feet was measured, of which 304 feet is exposed. The 900 feet of measured section probably represents only a fraction of total thickness of Shin Brook in this vicinity. Northwest of segment of Grand Pitch Formation brought up by faulting, the Shin Brook crops out for 1,500 feet along the brook and on adjacent bluffs. These exposures are almost entirely conglomerate, strongly deformed with flattened fragments of variety of rocks, largely volcanic in origin but with some slate and a little quartzite. Overlies Grand Pitch Formation. Underlies metadiabase. Formation lies in large steep-limbed, doubly plunging syncline and in two smaller synclines to southeast. Fossils described.

Type section: Measured along Shin Brook in SW¼, T. 6 N., R. 7 W., Penobscot County (Shin Pond quadrangle). Section starts at old bridge abutment at foot of old road leading west from temporary bench mark 878 feet, or 6,300 feet N. 62° W., from SW cor. T. 6 N., R. 7 W. Rocks northwest of measured section are intensely deformed gray slate and quartzite of Grand Pitch Formation, in faulted segment.

Shingle Limestone (in Pogonip Group)

Ordovician: East-central Nevada.

H. E. Kellogg, 1963, Geol. Soc. America Bull., v. 74, no. 6, p. 693, pl. 1. A thick sequence of thinly to thickly bedded cliff-forming calcisiltite. Thickness 1,148 feet. Base of formation is prominent and persistent 390-foot thick limestone which forms second prominent hogback at Shingle Pass and a conspicuous cliff in lower west front of Egan Range of Lund. Top of Shingle Limestone is highest resistant limestone beneath poorly exposed Kanosh Shale. Canadian and Chazyan.

A. L. Brokaw and D. R. Shawe, 1965, U. S. Geol. Survey Misc. Geol. Inv. Map I-449. Mapped in Ely SW quadrangle, White Pine County, where it is base of section studied. Underlies Kanosh Shale.

Named for exposures along main ridge south of west entrance to Shingle Pass, sec. 25, T. 8 N., R. 62 E., Lincoln County.

Shingle Creek Conglomeratic Quartzite (in McCoy Creek Group)

Precambrian: Central northeastern Nevada.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 296, 298—299 (pl. 1), 300—301. A massive cliff-forming unit about 500 feet thick. Bedding generally distinct but locally poorly defined; crossbedding relatively rare. Quartzites are gray and brownish gray in medium and moderately dark and more rarely in light shades. Overlies Strawberry Creek Formation (new); underlies Osceola Argillite (new). Drewes (1958, Geol. Soc. America Bull., v. 69, no. 2) mapped about 200 feet of quartzite as lowest exposed part of Prospect Mountain Quartzite, below an unnamed slate member; latter is Osceola Argillite and underlying quartzite is Shingle Creek Quartzite, according to classification herein proposed.

Well exposed in upper Willard Creek-Strawberry Pass area and in Shingle Creek where base is not exposed, northern part of Southern Snake Range.

Shirttail Canyon Formation (in Calaveras Group)

Upper Paleozoic: California.

D. R. Chandra, 1961, California Div. Mines Spec. Rept. 67, p. 12 (footnote). Name used by Chandra in unpublished thesis for unit herein called Tightner formation.

Placer County.

Shoals Lithofacies (of Mansfield Formation)

Lower Pennsylvanian: Southwestern Indiana.

H. H. Gray, 1962, Indiana Geol. Survey Prog. Rept. 26, p. 29—33, 38—39. Three lithofacies recognized in the Mansfield: Shoals, Bloomfield, and Cannelton. These three diagnostic rocks make up a little more than half of formation. Shoals Lithofacies characterized by cross-stratified sandstones. Principal areas of Shoals Lithofacies appear to trend nearly normal to outcrop of formation, thus separating Bloomfield from Cannelton Lithofacies. Thickness 45 feet in Lawrence County; about 70½ feet in Crawford County.

Named for town of Shoals, Martin County.

Shochary Ridge Member (of Martinsburg Formation)

Ordovician: Eastern Pennsylvania.

E. F. McBride, 1962, Jour. Sed. Petrology, v. 32, no. 1, p. 41 (fig. 2), 42, 71—72. Willard and Cleaves (1939) applied term Shochary sandstone to fossiliferous graywackes of Shochary Ridge, Lehigh County. At Shochary Ridge these fossiliferous graywackes are interbedded with gray shale at stratigraphic top of formation. Willard (1943, Geol. Soc. America Bull., v. 54, no. 8) applied term Shochary sandstone to the widespread upper sandy part of Martinsburg throughout Great Valley in Pennsylvania. In present report term Shochary Ridge Member is applied only to the fossiliferous graywacke and interbedded shale from the ridge. Thickness about 300 feet. Apparently transitional downward into the gernerally unfossiliferous flysch.

Preserved only in erosional remnant in 7-mile-long Shochary Ridge, Lehigh County.

Shoenberger Member (of Nittany Dolomite)

Ordovician: Central Pennsylvania.

A. R. Spelman, 1965, Dissert. Abs., v. 26, no. 4, p. 2139. Middle member of formation. Overlies Big Spring Member and underlies Etna Furnace Member (both new).

In vicinity of Bellefonte, Centre County.

Shotgun Member (of Fort Union Formation)

Paleocene: Central Wyoming.

W. R. Keefer, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 8, p. 1310—1323. Name proposed for drab-colored sequence of strata that constitutes upper part of Fort Union Formation in vicinity of Shotgun Butte. Characterized by uniformly bedded soft claystone, siltstone, and shale with minor amounts of sandstone and carbonaceous shale. Typical colors: gray, olive-drab, buff, brown, and tan, with some zones of pale red and purple. Thickness 2,830 feet at type section. Strata of Shotgun represent marginal deposition; strata representing offshore unit are herein named Waltman Shale Member. Where thickest, the Shotgun and Waltman are essentially contemporaneous units, and there is nearly complete lateral gradation between the two lithologic types. At many places both members are present and thin transitional zones of interbedded sandstone, black micaceous shale, carbonaceous shale, and coal directly underlie and overlie the Waltman. Lower zone is transgressive series and is included in lower part of Fort Union and upper zone is regressive series and is included in overlying Shotgun Member. Contact between Shotgun and lower part of Fort Union conformable. Underlies Indian Meadows Formation, in some areas contact is conformable, in others angular discordance.

Type section: West side of Shotgun Butte, secs. 21, 26, 27, and 28, T. 6 N., R. 1 E., Fremont County, Wind River Basin. Outcrop completely circles Shotgun Butte, and extends southward toward Little Dome anticline, a distance of about 6 miles. Also well exposed in vicinity of Twin Buttes, which lie about 8 miles east of Shotgun Butte.

Shotgun Butte Member (of Fort Union Formation)

Probably lapsus for **Shotgun Member** (of Fort Union Formation)

Shumagin Formation

Upper Cretaceous(?): Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 63—67, 183, 187, pt. 2, maps. Consists of dark-gray interbedded subgraywacke and graywacke sandstones and conglomerates, black to dark-gray siltstones, shales, and slates. All rocks show characteristics of flysch deposits. Thickness impossible to determine accurately; relatively undeformed strata dipping northwestward north and south of Falmouth Harbor indicate at least 10,000 feet of strata. This is minimum figure, actual thickness may be several times this figure. No sedimentary rocks younger or older than Shumagin noted on Shumagin or Sanak Islands.

Named for occurrence on Shumagin Islands.

Shumuray Ranch Basalt

Pliocene (Hemphillian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 5 (fig. 4), 20. Microporphyritic, trachytic to pilotaxitic, intersertal and intergranular to ophitic. Thickness 50 to 150 feet. Contains several flow units. Underlain by thin unnamed volcaniclastic strata that are underlain by Wildcat Creek Welded Ash-Flow Tuff (new) and by basalts of Grassy Mountain Formation. No overlying rocks known.

Type locality: In S½ sec. 30, T. 23 S., R. 39 E., near Shumuray Ranch, NW¼ sec. 29, T. 23 S., R. 39 E., Malheur County.

Shurtliff Member (of Hilliard Shale)

Upper Cretaceous: Southwestern Wyoming.

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 14, 15 (fig. 2). Name proposed for 800 feet of alternating sandstone and shales occurring about 2,200 feet above base of the Hilliard. Overlain by about 2,500 feet of Hilliard Shale in type area.

Typically exposed near Hilliard Ranch, west of Frontier, in sec. 27, T. 22 N., R. 116 W., Uinta County.

Shwin Formation

Middle Cambrian: Central Nevada.

James Gilluly, 1965, Geol. Soc. America Spec. Paper 80, p. 31 (table). Report on volcanism, tectonism, and plutonism in western United States. Name listed in table. Credited to Gilluly and Gates (in press).

James Gilluly and Olcott Gates, 1965, U. S. Geol. Survey Prof. Paper 465, p. 9 (table 1), 11—14, pls. Formal proposal of name. Principally chloritic argillite, metadolerite, greenstone, chloritic phyllite, black limy slate, mottled shaly limestone, limy mudstone, and calc-phyllite. Locally formation is complexly even isoclinally folded, beds are commonly sheared out, and interlayering of metavolcanics and limy mudstone may indeed be wholly mechanical rather than depositional. Estimated thickness 1,500 to 2,000 feet. All contacts of formation with others are faults (with possible exception of one north of Hancock Canyon with dolomite correlated with El Dorado Dolomite, and even this is sheared).

Well exposed on and east of Shwin Ranch, from which formation is named, on south slope of the ridge between Goat Canyon and the North Fork of Mill Creek, northern Shoshone Range, Lander County.

Sierra Blanca Volcanics

Tertiary: Central New Mexico.

T. B. Thompson, 1964, New Mexico Geol. Soc. Guidebook 15th Field Conf., p. 76—78. Basal unit is volcanic breccia consisting of rounded to angular hornblende andesite and andesite fragments in matrix of reddish-brown to maroon hornblende andesite. Succeeding volcanic rocks consist of dark-gray to purplish-gray andesite, hornblende andesite, and andesite breccia. Uppermost flow at Nogal Peak section is porphyritic hornblende andesite consisting of andesine phenocrysts in matrix of plagioclase and pyroxene with traces of magnetite, apatite, and cristobalite. Thickness 3,340 feet in Nogal Peak area. Rests unconformably on McRae Formation (Cub Mountain of Bodine, 1956) of Tertiary age.

Continuous exposures present throughout much of steep western slope of Sierra Blanca, Lincoln County.

Sierra Buttes Formation

Devonian(?): Northern California.

V. E. McMath, 1966, California Div. Mines and Geology Bull. 190, p. 173—183. Revision of stratigraphy in Taylorsville area. Name Sierra Buttes Formation proposed for Turner's quartz porphyry of the Sierra Buttes (1894, U. S. Geol. Survey Ann. Rept. 14; 1896, U. S. Geol. Survey Ann. Rept. 17; 1897, U. S. Geol. Survey Geol. Atlas, Folio 37), Diller's metarhyolite (1908, U. S. Geol. Survey Bull. 353), and Diller's quartz porphyry (1895, U. S. Geol. Survey Geol. Atlas, Folio 15), and metarhyolite series of Durrell and Proctor (1948, California Div. Mines Bull. 129, pt. L). Excluding dikes and sills, formation consists principally of bedded quartz keratophyre breccia, tuff, and perhaps some flows, whose gross chemical composition is probably closer to dacite than to rhyolite. Minor chert, slate, and rare limestone with fragments of marine fossils also present. Thickness 4,000 to 5,000 feet but decreases to less than 1,000 feet in northwest part of lower plate of thrust. In lower plate, underlies Taylor Formation and overlies Shoo Fly Formation with angular unconformity. In upper plate of thrust overlies Grizzly Formation and underlies Taylor.

Representative section exposed in vicinity of Long Lake and Wades Lake 7 miles northwest of the Sierra Buttes. The Sierra Buttes, the highest and most distinctive peaks composed of this formation, are in the south part of Downieville 30-minute quadrangle.

Sierra del Carmen Limestone

See Del Carmen Limestone.

Sierra Nevada Tuff

[Cenozoic]: North-central California.

J. N. Faick, 1963, Econ. Geology, v. 58, no. 5, p. 711. Listed in report on technology of natural pozzolans.

Silkmill Run Member (of Pocono Formation)

Mississippian: Central Pennsylvania.

F. M. Swartz, 1965, Pennsylvania Geol. Survey, 4th ser., Bull. G-50, p. 20. A. D. Leonard (unpub. thesis) termed the upper and lower divisions of the Pocono at Jim Thorpe, Bear Mountain Member and Silkmill Run Member, respectively. These members likewise were found in ridges along the rim of the Northern Anthracite Field, where they are overlain by body of calcareous sandstone designated Abrahams Creek Member.

Sillusi Flow (in Priest Rapids Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 25. Flow about 100 feet thick in Priest Rapids Basalt Member (new) of Yakima Basalt. Name credited to Laval (1956, unpub. thesis).

W. N. Laval, 1966, *in* Fourth Ann. Engineering Geology and Soils Engineering Symposium: Moscow, Idaho, p. 95. In eastern part of Toppenish Ridge and Horse Heaven Hills the Priest Rapids Member includes Basal flows, Mabton interbed, and the Upper (Umatilla, and Sillusi) flows. Both flows are well exposed upstream from McNary Dam in the walls of Wallula Gap.

Sillusi flow crops out on south face of Sillusi Butte near McNary Dam.

Sil Murk Formation

Tertiary, middle(?): Southern Arizona.

L. A. Heindl and C. A. Armstrong, 1963, U. S. Geol. Survey Water-Supply Paper 1647—A, p. A10-A21. Composed of sedimentary member overlain by a volcanic member. Sedimentary member composed of two facies. Lower facies is predominantly brick-red thinly bedded arkosic sandstone. This facies grades upward through zone of moderately indurated fanglomerate, composed of interbedded pebbly sandstone and conglomerate, into upper facies, a gray boulder conglomerate that forms ridges. Total exposed thickness of sedimentary member at least 1,500 feet; maximum exposed thickness of volcanic member about 175 feet. Overlies crystalline rocks. Base and top not exposed in area of this report [Gila Bend Indian Reservation] but are exposed in Gila Bend Mountains about 6 to 10 miles north of Sil Murk. There the lower sandstone facies is locally absent; the volcanic member is intercalated between clastic deposits; and top of formation is a conglomerate similar to the gray boulder conglomerate exposed at south end of Gila Bend Mountains.

Named for exposures 2 to 4 miles northwest of village of Sil Murk, Maricopa County, in southwestern part of Gila Bend Mountains.

Sil Nakya Formation

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U. S. Geol. Survey Bull. 1194—H, p. H12—H13. Thick sequence of interbedded welded tuff, tuff-agglomerate, conglomerate, and finer sedimentary materials. Basal unit is massive lavender-gray welded tuff composed of rhyolite, quartz latite, or dacite; other welded tuff or tuff-agglomerate units are maroon to gray and contain sand-to granule-sized fragments of clear quartz. Welded tuff units 400 to 2,000 feet thick. Top unit is a 1,000-foot-thick brown pebble to boulder conglomerate having fragments of welded tuff and agglomerate from underlying units. Thickness at least 8,000 feet of which 6,400 feet is welded tuff. Top of formation either in fault contact with the Sand Wells Formation (new) or covered by alluvium. Appears to be deposited on epidotized conglomerate referred to Roadside Formation (new).

Type section: Along a northeast-trending wash that heads 1¼ miles east-southeast of village well at Sil Nakya in Sil Nakya Hills, Papago Indian Reservation. Strata form steep, fairly smooth ridges, and the sedimentary strata are exposed either in valleys between the ridges or on dip slopes.

Silver Bell Complex

Cretaceous: Southeastern Arizona.

B. N. Watson, 1964, Dissert. Abs., v. 25, no. 3, p. 1853. Consists of andesite and dacite porphyries in forms of flows, intrusions, hot lahars, cold lahars, intrusion breccias, and autoclastic breccias.

In eastern part of Silver Bell Mountains, Pima County.

Silver Bluff Formation

Pleistocene: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 43 (fig. 11). Named on chart. Listed above Pamlico Formation and below Lake Flirt Marl.

Silver Hill Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacramento Geol. Soc. Guidebook Ann. Field Trip June 18—19, p. 12, 14—15, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, Mount Biedeman, and Silver Hill. The Silver Hill Series consists of lava flows and interbedded tuff-breccias. Lavas are hornblende andesite and are in flow units that are as much as 500 feet thick. Tuffs and tuff-breccia layers range in thickness from tens of feet to, at least 400 feet. Lava flows and pyroclastic rocks of Silver Hill Series have been intensely altered in vicinity of the gold and silver deposits. Though limited in its extent, the Silver Hill Series, is famous because it is the locus of gold and silver mineralization which made Bodie, now a ghost town, a roaring camp in the late 1800's.

Covers the area of Silver Hill and Bodie Bluff—an area about 3 miles long and three-quarters of a mile wide, Mono County.

Silver Lake Peak Formation (in Halloran Complex)

Precambrian: Southern California.

D. A. Warnke, 1966, Dissert. Abs., v. 26, no. 9, p. 5374. Precambrian Halloran Complex subdivided into following formations: Silver Lake Peak, mostly quartzfeldspathic gneisses; Cree Camp, quartzites and metarhyolites; and Riggs, metamorphosed metadiorite rocks. Complex intruded by metadiorite rocks.

In the Halloran Hills, central Mojave Desert.

Silvies Member (of Snowshoe Formation)

Middle Jurassic: East-central Oregon.

W. R. Dickinson and L. W. Vigrass, 1965, Oregon Dept. Geology and Mineral Industries Bull. 58, p. 49—51, pls. 1, 3. A thick lens of volcaniclastic strata characterized by abundant intercalations of andesitic sandstone and conglomerate. Between the graywacke and conglomerate sequences, which individually attain thicknesses in excess of 100 feet, are sequences of laminated volcaniclastic siltstone similar to strata of unnamed middle member in type locality of the Snowshoe. At type locality about 1,500 feet of strata are exposed within the member; upper and lower contacts placed at highest and lowest ledges of massive andesitic sandstone or conglomerate. Extent of member to east not known; to west grades laterally by intertonguing to finer grained volcaniclastic strata comprising middle member of type Snowshoe.

Type locality: Embraces four quarter-sections surrounding juncture of secs. 21, 22, 27, and 28, T. 16 S., R. 27 E., where Silvies River and a small tributary from west have cut steep-sided well-exposed canyons across strike of unit.

Simcoe Lavas

Tertiary: Southern Washington.

R. C. Newcomb, 1967, U. S. Geol. Survey Prof. Paper 575-B, p. B90. "Simcoe lavas" mentioned in report on Dalles-Umatilla syncline, Oregon and Washington.

In Horse Heaven anticline north of Glendale Wash.

Sims lava

Recent: Western Oregon.

E. M. Taylor, 1965, The Ore Bin, v. 27, no. 7, p. 138. Name applied to lava flows from Sims Butte.

Sims Butte is about 6½ miles south of Belknap Volcano in Belknap Lava Field, Three Fingered Jack and North Sister area.

Sinker Creek Basalt Member (of Brown Creek Formation)

Pliocene, middle: Southwestern Idaho.

N. R. Anderson, 1965, Dissert. Abs., v. 26, no. 4, p. 2131. Overlies older volcanics of area.

In Oreana quadrangle in foothill country of Owyhee Mountains and southern margin of Snake River Plain.

Sinnipee Group

Ordovician: Southwestern Wisconsin.

M. E. Ostrom, 1965, Wisconsin Geol. and Nat. History Survey Inf. Circ. 6, (also Tri-State Geol. Soc. Guidebook 29th Ann. Field Conf.), p. 4, 53. Name tentatively proposed to include (ascending) Platteville Limestone, Decorah Shale, and Galena Dolomite. Uncomformable above Ancell Group. Underlies Maquoketa Shale. Swann and Willman (1963) used name Ottawa Megagroup for this sequence. Name Ottawa considered unacceptable. Champlainian.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Discussion of Paleozoic stratigraphic nomenclature for Wisconsin. Name Sinnipee Group is being proposed by Wisconsin Geological Survey, in a study now ready for publication, for carbonate rocks above the Glenwood Member of St. Peter Formation as herein defined and below Maquoketa Shale in upper Mississippi valley area. Includes Platteville, Decorah, and Galena Formations. [Ancell Group not used in this report.]

Name taken from Sinnipee Cemetery which is at top of bluff north of Sinnipee Creek in Grant County. In this bluff nearly all of the rocks from top of Glenwood Member of St. Peter Sandstone into Stewartsville Member of Galena Formation are exposed.

Siruk Glaciation

Pleistocene: Northern Alaska.

T. D. Hamilton, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1983. Youngest of three glaciations in Alatna Valley. Preceded by Alatna Glaciation (new). Subdivided into four stades. Siruk Creek [stade] moraines, oldest and most extensive deposits of the glaciation, form an acurate belt which extends 30 miles south of mountain front. Later Chebanika Stade followed by Helpmejack and Iniakuk Stades.

Alatna Valley originates near north flank of central Brooks Range and extends southeast through this mountain belt into the Koyukuk lowlands.

Sitka Graywacke

Sitka Group

Upper Jurassic and Lower Cretaceous: Southeastern Alaska.

H. C. Berg and D. W. Hinckley, 1963, U. S. Geol. Survey Bull. 1141—O, p. O12—O14, pl. 1. Name Sitka Group applied to thick sequence of slate, graywacke, and conglomerate in vicinity of Sitka. Highly deformed. At least several thousand feet thick. Overlies Kelp Bay Group (new). Older than Edgecumbe Volcanics (new).

R. A. Loney and others, 1963, U. S. Geol. Survey Misc. Geol. Inv. Map I-388 (with separate text). Dark-gray medium- to thick-bedded medium-grained graywacke dominates formation, which is here called Sitka Graywacke instead of Sitka Group.

Type area: Vicinity of Sitka. Forms discontinuous belt along southwest sides of Chichagof and Baranof Islands. Crops out from Old Sitka southeastward to Silver Bay, forms large parts of Krestof, Partofshikof, and Kruzof Islands, and makes up smaller islands near Sitka.

Six Flags Limestone (in Woodbine Formation or Eagle Ford? Formation)

Upper Cretaceous: Northeastern Texas.

G. H. Norton, 1965, *in* The Geology of Dallas County—a symposium: Dallas, Tex., Dallas Geol. Soc., p. 57—58, 59. Detrital limestones having considerable content of sand as well as broken fossil material. Overlies Tarrant; underlies Little Elm tongue (new) of Templeton member of Woodbine. Currently regarded as base of Eagle Ford in subsurface of Dallas County. Since in this area only a few feet of section is involved, it matters little, in practical way, whether it is included in Eagle Ford or as top bed here of Woodbine sequence (that is, top of Tarrant member).

Type locality: West of Eagle Ford type locality at Dorothy Siding in Tarrant County, and at Johnson Creek locality in Dallas County. Well exposed less than 1 mile south of amusement area known as Six Flags Over Texas, along Highway 360, south of Dallas-Fort Worth Turnpike.

Sixmile Creek Formation (in Bozeman Group)

Miocene-Pliocene: Southwestern Montana.

G. D. Robinson, 1967, U. S. Geol. Survey Misc. Geol. Inv. Map I—486. Main part of member consists of coarse light-colored tuffaceous fanglomerate and shard-rich sandstone basin deposits with subordinate amounts stream silt, pond limestone, and airlaid rhyodacite volcanic ash 0 to 4,000 feet thick. Also mapped is a member, 0 to 1,000 feet thick, consisting of rounded sand and gravel, and an orange-red member, 0 to 800 feet thick, consisting of fanglomerate and sandstone with orange-red clay matrix. As shown on map legend, is unconformable above Dunbar Creek Formation. Early Miocene to late Pliocene on basis of vertebrate fossils.

Type locality: Exposures in parts of secs. 9, 10, 11, 12, 13, 14, and 15, T. 5 N., R. 3 E., Toston quadrangle. Named for Sixmile Creek, which flows westward from Big Belt Range to join Missouri River a mile downstream from Toston village.

Sixtown Creek formation (in Canadaway Group)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 269—270. Sixtown Creek formation (informal usage) is wedge-shaped body and thins south from depositional center in northeastern Cattaraugus and northwestern Allegany Counties, where it is about 400 feet thick. Formation is nonfossiliferous and is northern time stratigraphic complement of Machias wedge. Divided into an older sandstone member (Scholes member, new) and younger shale member (unnamed). Overlies Rushford Lake Formation (new). Underlies Cuba Formation and interfingers with Machias Formation.

Type locaity and derivation of name not given.

Skeleton Gulch Andesite (in Cameron Pass Volcanics Group)

Eocene(?): North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Group comprises three formations: Skeleton Gulch Andesite, Zimmerman Andesite, and Michigan Basalt (all new). Stratigraphic relationships of these units not exactly clear. Skeleton Gulch Andesites are associated with the andesite plug on the east side of Mount Richthofen.

Mount Richthofen-Iron Mountain area, about 40 miles south of Wyoming border. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Skilak Stade

Pleistocene: Southern Alaska.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1). Naptowne Glaciation includes four stades (ascending): Moosehorn, Killey, Skilak, and Tanya.

Karlstrom, (1960, 1964) used term Skilak advance. However, terms advance and readvance are not accepted as part of formal stratigraphic nomenclature.

Name derived from Skilak Lake which is surrounded by moraines making up the third belt of Naptowne morainal complex, Cook Inlet region.

Skillman Flat tuffs

Miocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1) 20, 21, 22, 37. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Rhyolite tuff. Rests on basement rock. Overlain by andesine mudflow breccia. Indicated age Miocene. Potassium-argon age 22.8 ± 0.5 m.y.

Skillman Flat is in SE cor. sec. 24, T. 17 N., R. 10 E., in Allegany quadrangle.

Skinner Ranch Formation

Lower Permian (Leonard): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1583—1586, 1587. A sequence of calcarenites and calcirudites. At type section, formation is 509 feet thick, and consists almost wholly of clastic limestone. Here the Skinner Ranch unconformably overlies Lenox Hills Formation. Extends east and west from type section. Toward east merges with Hess Formation. Well developed in mountain (5,280 feet) west of Iron Mountain, where it consists mostly of calcarenites and calcirudites with thick beds of limestone-pebble conglomerate in lower part. Here it is 345 feet thick. In Hill 5201, divisible into three members because it is unevenly split by shale wedge. Members resulting from this cleavage are (ascending) Decie Ranch, Poplar Tank, and Sullivan Peak (all new). Formation was described by King (1931, Texas Univ. Bull. 3038) as Hess Formation in his section 16, beds 1 to 11. Leonardian Series.

G. A. Cooper and R. E. Grant, 1966, U. S. Geol. Survey Bull. 1244-E, p. E4—E5, pls. 1, 2. In Dugout Mountain includes Dugout Mountain Member (new) which overlies Sullivan Peak Member.

Type section: On west knob of Leonard Mountain about 1 mile northwest of Benchmark 5860, Hess Canyon and Altuda quadrangles, Brewster County. Name Skinner Ranch appears on Altuda (15′) quadrangle on King's 1931 map. Skinner Ranch is now called Iron Mountain Ranch.

Skunk Spring Limestone Member (of Chainman Formation)

Carboniferous: Eastern Nevada and western Utah.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978. Chainman, about 2,000 feet thick at Utah-Nevada boundary, is herein subdivided into six lithostratigraphic members which intertongue with each other. They are (ascending): Needle Siltstone; Skunk Spring Limestone, a marker bed about 15 feet thick; Camp Canyon; Donner; Willow Gap Limestone; and Jensen.

Type locality and derivation of name not stated.

Slabtown Granite (in Musco Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Musco group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Slabtown village is just northwest of Fredericktown, T. 33 N., R. 6 E., Madison County.

Slana Basalt

Triassic(?): South-central Alaska.

D. H. Richter, 1967, Alaska Div. Mines and Minerals Geol. Rept. 30, p. 3 (table), 7—9, fig. 2. Dark-green, grayish-green, brown, maroon, and purple amygdaloidal basalts. Top of unit locally consists of basalt-limestone breccia or conglomerate. Thickness 6,000 to 8,000 feet. Overlies Permian Nankomen Formation with suggestion of slight angular unconformity. Underlies Jack limestone (new). Definitive age assignment must await results of fossil studies from Jack limestone. In this report Slana is considered an informal name.

Basalt extends in continuous belt, about 3 miles wide, throughout map area from headwater region of Slana River southeast to beyond Mentasta Pass, in eastern Alaska Range between Chistochina and Tok Rivers.

Slashers Ledges Formation (in Hartland Group)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 40—43, pl. 1. Uppermost formation in Hartland Group. Informally divided into two members—kyanite schist member and rusty schist member. Overlies Satans Kingdom Formation (new).

Type locality: On eastern limb of northward-plunging synform just south of Slashers Ledges and extends northwest from point marked "550" on the 550-foot contour line (pl. 1), perpendicular to stratigraphic contacts. Crops out east and west of Slashers Ledges, which are located west of Route 44 and southeast of Jones Mountain, Collinsville quadrangle. Reference locality: On west limb of northward-plunging antiform and extends northeastward from where contact between rusty schist and kyanite schist members crosses the antiform. Formation trends northeastward from Nepaug to western side of Breezy Hill along a belt varying in width from 1,500 to 4,000 feet.

Slate Creek Granodiorite Porphyry

Mesozoic: Alaska.

A. W. Rose, 1967, Alaska Div. Mines and Minerals Geol. Rept. 28, p. 11 (table 4), 12, fig. 1. Appears to occur as discontinuous lenses and dikes in an east-west trending brecciated zone in argillite. May be related to the gold placers.

On east side of Slate Creek, upper Chistochina River area, Mount Hayes quadrangle.

Slick Rim member

Local name for **Slick Rock Member** (of Entrada Formation).

Slick Rock Member (of Entrada Sandstone)

Jurassic: East-central Utah and west-central Colorado.

J. C. Wright, D. R. Shawe, and S. W. Lohman, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 11, p. 2057—2070. Proposed that the earthy siltstone formerly called Carmel Formation in east-central Utah and west-central Colorado be included in Entrada Sandstone and named Dewey Bridge Member. The overlying massive sandstone is named Slick Rock Member. Underlies Moab Member. Composed of light-brown or light-buff, and light-reddish-brown, pink, or salmon-colored, chiefly very fine to fine-grained sandstone. Thickness about 100 to 120 feet at type section, as far west as Cry Valley, San Juan County, Utah, and as far north as Colorado National Monument just west of Grand Junction; thins to less than 50 feet eastward and southward from Slick Rock and southeastward from Grand Junction, as much as 360 feet near Cane Springs, Utah.

E. B. Ekren and F. N. Houser, 1965, U.S. Geol. Survey Prof. Paper 481, p. 8—10. Described in Ute Mountains area, Colorado, where it is 70 to 80 feet thick and consists of orange to light-pink sandstone in lower part that grades to white and pale-brown sandstone in upper part. Includes 6-foot-thick ledge at top that may correspond to lower part of Bilk Creek Sandstone Member of Wanakah Formation. Overlies Dewey Bridge Member. Underlies Summerville Formation.

Type section: One mile west of old town of Slick Rock on northwest side of Corral Draw, almost at center of north edge of sec. 36, T. 44 N., R. 19 W., New Mexico principal meridian. Town of Slick Rock is in western part of San Miguel County, Colo. Town derives its name for rocks (now included in member) that are prominently exposed in vicinity and have long been known throughout area as the "slick rock" or "slick rim."

Slide Creek Gravel

Pliocene(?): Northeastern Nevada.

R. R. Coats, 1964, U.S. Geol. Survey Bull. 1141—M, p. M12—M13, pl. 1. Coarse poorly sorted gravel, with some boulders as much as 4 feet across. Unconformably overlies Jarbidge rhyolite and apparently interfingers locally with Pole Creek dacite. Seems to be overlain unconformably by Jenny Creek tuff (new).

Type locality: On west side of ridge to east of Slide Creek Canyon, near east edge of Jarbidge quadrangle, Elko County.

Slide Creek Member (of Strawberry Volcanics)

Miocene, middle: Eastern Oregon.

T. P. Thayer, 1957, Internat. Geol. Congress, 20th, Mexico, 1956, sec. 1, pt. 1, p. 231—245. Name applied to Columbia River type flows in lower part of Strawberry volcanics (new). Believed to be equivalent to Columbia River basalt at Picture Gorge.

Name derived from valley of Slide Creek 3 miles east of Strawberry Mountain, Grant County.

Sliderock Member (of Twin Creek Limestone)

Middle Jurassic: Southwestern Wyoming, southeastern Idaho, and northwestern Utah.

W. R. Imlay, 1967, U.S. Geol. Survey Prof. Paper 540, p. 22—30, pls. Consists of dark fossiliferous medium- to thin-bedded limestone from 20 to nearly 300 feet thick. At type section lower 12 feet of member consists of hard oolotic limestone that overlies soft red siltstone. Upper 73 feet consists of black to medium-gray very fossiliferous compact thin- to medium-bedded limestone that is more resistant than the overlying shaly limestone. Underlies Rich Member (new). Overlies Gypsum Spring Member [rank reduced and reallocated to member status in Twin Creek by Oriel (1963, U.S. Geol. Survey Oil and Gas Inv. Map OM-212)].

Type section: On west side of Grade Creek at junction with Sliderock Creek in NE¼ sec. 10, T. 25 N., R. 118 W., Lincoln County, Wyo.

Slim Buttes Formation

Eocene, upper (Duchesnean): South Dakota.

C. L. Malhotra and E. R. Tegland, 1960, South Dakota Acad. Sci. Proc., v. 38, p. 263—274. Massive medium to very fine grained sandstone which varies in color throughout area. Predominantly white, but light green, red brown, yellow, and lilac in places. Conglomerate present at top locally. Green channel fill sandstone present at top in area of Finger Butte in sec. 35, T. 17 N., R. 9 E. Thickness as much as 39 feet. Underlies Arikaree formation. Overlies Ludlow formation. Has been mapped as Chadron. No true Chadron believed to crop out in area.

P. R. Bjork, 1965, Geol. Soc. America, Spec. Paper 82, p. 319-320. Restudy of Slim Buttes Formation demonstrates that it is flood-plain accumulation and not lacustrine deposit as described by Malhotra and Tegland (1960). Deposited on irregular erosion surface of Ludlow Formation (lower Paleocene). Overlain by Chadron Formation (lower Oligocene). Thickness 0 to 55 feet. Vertebrate fossils suggest latest Eocene (Duchesnean) age.

Type section: Slim Buttes, Harding County. Standard section: In NW¼SE¼ sec. 11, T. 16 N., R. 8 E.

Smithton Dense Limestone physiofacies (of Cooper lithofacies of Cedar City Formation)

Middle Devonian: Central and northeastern Missouri.

G. H. Fraunfelter, 1965, Dissert. Abs., v. 25, no. 7, p. 4079. Cooper lithofacies of Cedar City formation (new) divided into seven physiofacies: Lamine River conglomerate, Shiel clay, Ralls oolitic limestone conglomerate, Little Shaver Creek laminated limestone, Little Splice Creek brecciated limestone, Smithton limestone, and Clifton City sparritic limestone.

G. H. Fraunfelter, 1967, Illinois Acad. Sci. Trans., v. 60, no. 1, p. 27—29. Physiofacies consists of limestone, light to dark grayish tan or tannish gray, medium reddish gray or medium bluish gray pinkish tan, very clastic, dense to sublithographic, medium to thick bedded or massive, in part vermicular with vermicules vertical, oblique, or horizontal to bedding planes. Maximum thickness 25 feet.

Named from outcrops in Pettis and Cooper Counties within an area 3.5 miles north and 2.5 miles east of Smithton, Pettis County. Facies is well exposed in abandoned quarry along north side of U.S. Highway 50 about 3 miles northeast of Smithton, Pettis County. Also crops out in Saline, Pettis, Cooper, Morgan, Moniteau, Cole, Boone, Callaway, Montgomery, Pike, Ralls, and Marion Counties.

Smoky Member (of Nopah Formation)

Smoky Member (of Windfall Formation)

Upper Cambrian: Southwestern Nevada.

Harley Barnes and A. R. Palmer, 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—101 (fig. 1872), C—103. Member of Windfall. Overlies Catlin member.

Harley Barnes and F. M. Byers, Jr., 1961, U.S. Geol. Survey Prof. Paper 424—C, p. C—104—C—105. Upper member of Windfall formation at Nevada Test Site. Dolomite is predominant but stratigraphic sequence may be dolomite at one locality and limestone at another. Thickness 1,070 feet. On Paiute Ridge lower 920 feet is chiefly dolomite and upper 150 feet is cliff-forming, massive-splitting, thin-bedded limestone with smaller amounts of slope-forming thin-bedded limestone. Large and small stromatolites conspicuous in member. Overlies Catlin member; underlies Goodwin limestone.

R. L. Christiansen and Harley Barnes, 1966, U.S. Geol. Survey Bull. 1244—A, p. A49—A52. Reallocated to member status in Nopah Formation geographically extended into Nevada. Uppermost member of Nopah. Overlies Halfpint Member (new). Use of name Windfall inappropriate at Nevada Test Site. Note on type locality.

Harley Barnes and R. L. Christiansen, 1967, U.S. Geol. Survey Bull. 1244—G, p. G19. Member of Nopah described in Groom district, Nevada, where it is 670 feet thick. Overlies Halfpint Member. Contact is sharp. Underlies Goodwin Limestone of Pogonip Group. Contact gradational through about 50 feet.

Type locality: On Paiute Ridge in Halfpint Range. Named after Smoky Hills at north end of Yucca Flat, Nye County. Well exposed in Smoky Hills and on Paiute Range.

Smoot Formation (in Gannett Group)

Jurassic and Cretaceous: Western Wyoming and southeastern Idaho.

J. A. Eyer, 1965, Dissert. Abs. 25, no. 10, p. 5860. Uppermost formation in group. Consists of red mudstones, siltstones, and calcareous nodular beds which also contain charophytes and fresh-water ostracods. Overlies Draney Limestone. Conformably overlain by Cretaceous, marine lower Tygee Member of Bear River Formation.

Town of Smoot is in Lincoln County, Wyo.

Smyrna Mills Formation

Silurian: Northeastern Maine.

Louis Pavlides and W. B. N. Berry, 1966, U.S. Geol Survey Prof. Paper 550—B, p. B53—B54. Contains wide variety of sedimentary rocks that differ greatly in abundance. Slate, siltstone, quartzite, and quartz graywacke in the unit include both calcareous and noncalcareous types. Because of close folding and lack of stratigraphic sections free from structural complications, it is not possible to obtain measured thickness of formation. Estimated thickness at least 6,000 feet. Overlies Meduxnekeag Formation. Silurian (early Llandovery through early Ludlow).

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, p. A55. Carys Mills Formation (new) of Meduxnekeag Group conformably underlies and grades into Smyrna Mills Formation in Houlton and Smyrna Mills quadrangles.

Type locality: Along North Branch of Mattawamkeag River from town of Smyrna Mills to mouth of Dudley Brook, Aroostook County.

Snake Hills Formation (in El Paso Group)

Canadian (Demingian): New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Largely barren thin-bedded limestones. Overlies Mud Springs Mountain formation (new); underlies McKelligon formation (new). Canadian treated as a system in this report.

Well exposed in Snake Hills southwest of Deming.

Snake Meadow basalt

[Pliocene]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 37, fig. 12. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 3.3 ±0.1 m.y. Figure 12 mentions basalt at Snake Meadow.

Snake Meadow is in southwest corner of Devils Postpile quadrangle, Madera County.

Snehumption Subporphyritic Granodiorite or unit

Mesozoic or Tertiary: Northern Washington.

M. J. Hibbard, 1965, Am. Jour. Sci. v. 263, no. 3, p. 246 (fig. 1), 250, 260 (table 4). Granite rocks along 49th parallel in Okanogan Range of northern Washington were first studied by Daly (1912, Canada Geol. Survey Mem. 39). A part of Daly's Okanogan Composite Batholith restudied for this report on origin of some alkali feldspar phenocrysts and their bearing on petrogenesis. Snehumption Subporphyritic Granodiorite or unit is adjacent to Horseshoe Mountain Porphyritic Leuco Quartz Monzonite (new).

Snow Canyon Formation (in Valmy Group)

Ordovician: Northeastern Nevada.

Michael Churkin, Jr., and Marshall Kay, 1967, Geol. Soc. America Bull., v. 78, no. 5, p. 651—668, pl. 1. Valmy Formation raised to group rank and subdivided to include (ascending) Snow Canyon Formation, McAfee Quartzite, and Jacks Peak Formation (all new). A sequence of predominantly chert and volcanic rock. At type area is predominantly thin-bedded medium-dark-gray to dark-gray chert. Several interbeds of limestone. Thickness about 1,200 feet. Graptolites found in only a few localities. Base of formation not exposed.

Named for exposures in Snow Canyon, northern Independence Range, Elko County.

Snow Creek Formation (in Keechelus Volcanic Group)

Oligocene, lower: Washington.

P. E. Hammond, 1964, Dissert. Abs., v. 24, no. 7, p. 2869. Thickness 3,600 to 4,800 feet. Uppermost formation in Keechelus Volcanic Group. Overlies Stampede Tuff (new). Underlies Cougar Mountain Formation (new).

West-central Cascade Range.

Snow Creek trondhjemite

Cretaceous: Northwestern Nevada.

J. G. Smith, 2d, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 236. Plutonic units were intruded into older rocks during the Cretaceous. From oldest to youngest they are: Cove Camp syenodiorite (new); Corral Creek quartz monzonite (new); fine grained quartz monzonite; Snow Creek trondhjemite; and Pole Canyon granodiorite (new).

Area of report is southern Pine Forest Range, Humboldt County.

Snowline Sandstone lithosome (in Beaverhead Formation)

Upper Cretaceous: Southwestern Montana.

R. T. Ryder, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 63—70. Beaverhead Formation divided into 11 lithosomes. [For list see Divide Limestone Conglomerate lithosome.] Approximate maximum thickness of Snowline Sandstone lithosome 6,000 feet. Consists mostly of calcareous salt and pepper sandstone with some limestone fragments.

Snowline is in Beaverhead County.

Snow Peak Lavas

Miocene, middle: West-central Oregon.

Wallace Eubanks, 1962, (abs.) Ore Bin, v. 24, no. 2, p. 26. Basalt caps Mehama Volcanics and is capped by Fern Ridge Tuff.

Present in Thomas Creek area, Linn County.

Snowshoe Mountain Quartz Latite

Oligocene: Southwestern Colorado.

J. C. Ratté and T. A. Steven, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D49, D50. Mentioned in discussion of magmatic differentiation in a volcanic sequence related to Creede caldera.

T. A. Steven and J. C. Ratté, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D54—D59. Name given to mass of quartz latite ash-flow tuffs, mostly densely welded, that constitutes most of core of Creede caldera. Sum of several partial sections indicates formation is at least 4,000 feet and perhaps more than 6,000 feet thick. Larsen and Cross (1956, U.S. Geol. Survey Prof. Paper 258) believes mass of quart latite under Snowshoe Mountain was local accumulation, possibly a single large flow within upper rhyolitic latite member of their Alboroto Rhyolite. Present study shows Snowshoe Mountain Quartz Latite to be youngest major ash-flow unit in central San Juan Mountains, and it is thus more equivalent to upper part of Piedra Rhyolite of Larsen and Cross (1956). Middle or late Tertiary.

T. A. Steven and J. C. Ratté, 1965, U.S. Geol. Survey Prof. Paper 487, p. 39—41, pls. Intertongued breccias containing fragments of Wason Park Rhyolite indicate that at least upper 2,000 feet of Snowshoe Mountain Quartz Latite, and possibly all Snowshoe Mountain rocks, are younger than the Wason Park. Thus the Snowshoe Mountain Quartz Latite is possibly time equivalent or a partial time equivalent of Rat Creek and Nelson Mountain Quartz Latites in northern part of Creede district.

The U.S. Geological Survey currently designates the age of the Snowshoe Mountain Quartz Latite as Oligocene on the basis of a study now in progress.

Type area: Snowshoe Mountain which forms highest part of caldera core, south of Creede, central San Juan Mountains.

Snowslip Formation (in Missoula Group of Belt Supergroup)

Precambrian: Northwestern Montana.

M. O. Childers, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 144, 146 (fig. 4), pl. 1. Consists predominantly of quartzites and argillites, with conspicuous basal unit of sandy argillite breccias. Main unit of formation consists of about 1,400 feet of argillites and quartzites. Thick sequences of dominantly green rocks alternate with equally thick reddish ones. Conspicuous features are ripple marks, mud cracks, and crossbedding. Stromatolite zone (*Collenia undosa*) in lower part. Decreases in thickness northward from 1,600 feet in Marias Pass area to about 500 feet in central Glacier Park; not a mappable unit at International Boundary. Overlies Siyeh Formation, contact placed at upper limit of recurrent carbonate-rich rocks typical of Siyeh; underlies Shepard Formation, contact placed where dull-red medium-grained quartzites grade into calcareous shales and argillites of the Shepard Belt Supergroup.

The U.S. Geological Survey currently classifies the Snowslip as a formation in the Missoula Group of the Belt Supergroup on the basis of a study now in progress.

Type section: On ridge between Snowslip Mountain and Mount Shields, lat 48°16′30″ N., long 113°31′ W., Marias Pass area, Flathead County.

Snug Harbor Siltstone Member (of Naknek Formation)

Upper Jurassic: Southern Alaska.

R. L. Detterman and J. K. Hartsock, 1966, U.S. Geol. Survey Prof. Paper 512, p. 51—5 pls. Dominantly massive to thin-bedded dark-gray to black siltstone. Calcareous thin-bedded gray sandstone is minor constituent of section. Thickness 720 to 860 feet with thickest part at type section. Underlies Chisik Conglomerate Member. Overlies Pomeroy Arkose Member.

Type section: Exposed in sea cliffs along southwest shore of Chisik Island. Section starts about 1,000 feet north of extreme southern tip of the island and continues north along the shore for 3,200 feet in strata that dip 19°—20° SE., Iniskin-Tuxedni region. A small indentation of the coastline has been known for many years as Snug Harbor.

Soapstone Formation

Mississippian (Chesterian): Northeastern Utah.

C. A. Arnold and Walter Sadlick, 1962, Michigan Univ. Mus. Paleontology Contr., v. 17, no. 11, p. 242—255. Name proposed for chiefly Chesterian strata of dominantly dark-gray, "black," soft fissile clayey shale with minor amounts of gray limestone and siltstone. Average thickness about 300 feet; maximum thickness about 550 feet. Overlies Humbug Formation; underlies Round Valley Formation. Flora discussed. Correlation of unit has been controversial subject. Crittenden (1959, Intermountain Assoc. Petroleum Geologists Guidebook 10th Ann. Field Conf.) correlated unit with Doughnut Formation which seemingly is correlative to both Great Blue and Manning Canyon Formations. Sadlick (1959, Intermountain Assoc. Petroleum Geologists Guidebook 10th Ann. Field Conf.) correlated unit in question with Manning Canyon Formation based mainly on lithologic similarity (dominance of dark-gray clayey shale) and on fact that both Manning Canyon Formation and Uinta Mountain "black" shale seemingly were no older than medial Chester. If Soapstone Formation correlates with Manning Canyon Formation, name Manning Canyon may have priority.

Type locality: In N½ sec. 31, T. 3 S., R. 9 E., Wasatch County. Name derived from Soapstone Basin.

Sod House Tuff (in Pony Trail Group)

Mesozoic: North-central Nevada.

L. J. P. Muffler, 1964, U.S. Geol. Survey Bull. 1179, p. 26—32, pl. 1. Predominantly altered white silicic ash-flow tuff. Thickness 0 to about 1,000 feet; 300 feet at type locality. Appears to pinch out to southwest and to thin abruptly northeastward from Big Pole Creek. Locally unconformable on Big Pole Formation (new). Underlies Frenchie Creek Rhyolite (new). Cut by Lower Cretaceous(?) plutons.

Type section: Pony Trail Canyon in Frenchie Creek and Pine Valley quadrangles. Named for Sod House Creek which drains part of an extensive area of poor outcrops of formation.

Soetmelk Member (of De Forest Formation)

Quaternary: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, and G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 6, p. 473—487. Basal member of formation. Has basal calcareous sand and gravel layer 6 to 24 inches thick overlain by massive calcareous silt-loam sediments with discontinuous intercalated sand lenses. Terminated upward by black organic horizon 3 to 6 inches thick. If organic horizon at top is absent, member cannot be differentiated visually from overlying Watkins member (new). Colors range from grayish green to dark grayish green or greener. Maximum thickness about 10 feet. Overlies Kansan till and Sangamon(?) alluvium and is inset below, but not overlain by Tazewell loess. Base of member may be Tazewell or younger. Deposition took place from Tazewell to post-glacial time. End of deposition roughly synchronous with advance of the Valders in Wisconsin.

Type section: Thompson Creek, 100 yards east of country road between secs, 13 and 14, in SW¼ sec. 13, T. 80 N., R. 43 W., Harrison County. Named after Soetmelk Branch, a tributary of Thompson Creek.

Solano Diabase and Hornblendite

Tertiary(?): Northwestern California.

C. E. Weaver, 1949, California Div. Mines Bull. 149, p. 55 (fig. 3), 59. Small masses of igneous rock penetrating shales of Knoxville age in Carquinez quadrangle. Composed predominantly of hornblende and subordinate amounts of augite and plagioclase. Fine-grained and diabasic facies common. In places lies in contact with both the Knoxville and Eocene sandstone. On table of igneous rocks of Coast Ranges, is placed above Sulphur Springs Mountain andesite and below "Tolay" volcanics (not exposed in area of report).

J. B. Koenig, 1963, Geologic map of California, Santa Rosa sheet (1:250,000): California Div. Mines and Geology "Solano diabase" mapped with Tertiary basaltic rocks. Pre-middle Eocene; probably Mesozoic.

Occurs in Carquinez quadrangle in American Canyon on line between Solano and Napa Counties in secs. 21 and 28, T. 4 N., R. 3 W., and in some areas south of Sulphur Springs Mountain.

Songo Granodiorite (in New Hampshire Magma Series)

Upper Devonian: Western Maine.

I. S. Fisher, 1962, Geol. Soc. America Bull. 73, no. 11, p. 1395—1420, pl. 1. Medium-grained gray biotite granodiorite. The Songo is post-Littleton as it cuts bedding, contains Littleton inclusions, and is unmetamorphosed. Cut by Speckled Mountain Quartz Monzonite (new) and by pegmatites.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 50—53, 80, pl. 1. Geographically extended into Bryant Pond quadrangle where it underlies much of western and central parts of quadrangle. Reconnaissance indicates that the granodiorite extends into northwest corner of Fryeburg quadrangle and northwestern corner of Norway quadrangle. Discussion of spatial relations of structure in metamorphic rocks to Sebago Granite (new). In fault contact with Moody Brook formation (new).

First described in Bethel quadrangle where it occurs in one principal body, the Albany pluton, which underlies about 70 square miles in southeastern part of the quadrangle.

Sonora Pass biotite-augite latite

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Sonora Pass biotite-augite-latite gave age of 8.8±0.2 m.y. [Probably part of Eureka Valley Member of Stanislaus Formation as defined by Slemmons (1966).]

Sample collected from Dardanelles Cone quadrangle, 9020-foot elevation on north-south trending ridge 1,500 feet south of Bald Peak.

Sonora Pass rhyolite

Miocene, lower: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Sonora Pass rhyolite gave age of 25.7±0.5 m.y. [Probably part of Relief Peak Formation as defined by Slemmons (1966).]

Sample collected from Dardanelles Cone quadrangle, 7300-foot elevation, 300 feet east and 2,000 feet north of southwest corner sec. 1, T. 5 N., R. 19 E., Sonora Pass area.

Sourdough Basin Basalt Member (of Deer Butte Formation)

Miocene, upper, and Pliocene: Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History, Bull. 1, p. 9. Overlies Burnt Mountain Member and underlies Mitchell Butte Member (both new).

Type locality: On northern side of Dry Creek inlet N½ sec. 24, T. 23 S., R. 43 E., Malheur County. Named for exposures on southwestern side of Sourdough Basin.

Southard Dolomite Bed (in Dog Creek Shale)

Permian (Guadalupean): West-central Oklahoma.

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, p. 52, 58—60, pl. 1. Name given to a 3- to 4-inch-thick light-gray dense dolomite that occurs about 80 feet above base of Dog Creek Shale, or 45 feet above Watonga Dolomite Bed (new). Underlies unnamed reddish-brown clay shale 80 to 100 feet thick in upper part of Dog Creek Shale. Cragin (1897) gave name Chapman Dolomite to this same bed plus a few higher dolomites in same area, designating Chapman's Amphitheatre of Salt Creek Canyon area as type locality.

Type section: On and near State Highway 51A in SW¼SW¼ sec. 10, T. 18 N., R. 12 W., 1 mile south of Southard, Blaine County.

South Creek Formation (in White Knob Group)

Mississippian: Central Idaho.

O. K. Huh, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 34, 42—44. Term White Knob raised to group status to include four newly named formations (ascending): Middle Canyon, Scott Peak, South

Creek, and Surrett Canyon. The South Creek is a thin-bedded alternation of fine-grained dark limestone with chert (3 to 6-inch beds) and clayey silty dark fissile limestone in beds 1 to 2 inches thick. The chert occurs in nodules, interbeds, and incomplete replacements of limestone strata. Thickness 300 feet at type section. Has consistent thickness across region of between 300 to 400 feet. Contacts predominantly sharp, but not well preserved or exposed.

Type section: In tributary to East Canyon, directly overlying Scott Peak Formation. Named after South Creek, a permanent stream draining part of Lemhi Range, 4 miles northwest of type section.

Southgate Diorite

Tertiary: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert. Abs., v. 23, no. 2, p. 604. After deposition of Upper Cretaceous sedimentary rocks, region was folded, faulted, and intruded by igneous rocks. Two small stocks (Fountain gabbro and Southgate diorite) were intruded along axial planes of several younger folds and sedimentary rocks adjacent to intrusions were contact metamorphosed to a pyroxene hornfels facies.

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 219—220. Hornblende and plagioclase are essential minerals and are present in about equal abundance. Augite, magnetite, and apatite are accessory minerals. Probably intruded at shallow depth after folding of sedimentary rocks.

Present in area of Southgate, Punnett Point, Sight, and Sallys Fancy. Cuts across East End Range from north to South. In center of range is about three-fourths of a mile in width. North and south parts covered by alluvium, hence its length is unknown.

Southington Mountain Schist

Southington Mountain Schist Member (of Hartland Formation)

Cambrian(?) and Ordovician(?): South-central Connecticut.

C. E. Fritts, 1962, U.S. Geol. Survey Prof. Paper 450—D, p. D32—D33. Includes all metasedimentary and metavolcanic rocks above Straits Schist (new) and below Derby Hill Schist (new). Interlayed medium-grained paragneiss and fine- to medium-grained muscovite schist predominate. Characterized by ribbonlike banding. Thickness of bands ranges from less than 1 inch to several tens of feet, but commonly only a few inches. Includes metasedimentary rocks formerly included in Prospect Gneiss, in upper part of The Straits Schist Member of Hartland Formation of Rodgers and others (1959), and western part of Orange Phyllite. Occupies position comparable to that of rocks mapped above Hoosac Schist as Pinney Hollow, Ottauquechee, and Stowe Formations, undifferentiated, near domes in southeastern Vermont (Doll and others, 1961, Centennial geologic map of Vermont: Vermont Geol. Survey).

R. M. Gates and C. W. Martin, 1967, Connecticut Geol. and Nat. History Survey Quad. Rept. 22, p. 25—26, pl. 1. Name Southington Mountain schist was applied by Fritts to rocks previously included in upper part of The Straits Schist member of the Hartland. In present report [Waterbury quadrangle] the Southington Mountain is rank reduced to member status in Hartland formation. The Southington Mountain schist is found only in small area in northeast corner of quadrangle. Overlies The Straits Schist member.

Type locality: Near New Britain Reservoir on Southington Mountain, Southington quadrangle.

South Mound Shale Member (of Seminole Formation)

Pennsylvanian (Missouri Series): Southern Kansas.

C. R. Singler, 1965, The Compass, v. 42, no. 2, p. 63—72. Includes beds from top of Hepler Sandstone Member to base of Checkerboard Limestone. Consists of gray-to-brown shale which is micaceous and silty at some localities. Thin lignitic coal near middle of member in Labette County. Thickness as much as 10 feet. Name credited to P. A. Emery (unpub. thesis).

J. M. Jewett, P. A. Emery, and D. A. Hatcher, 1965, Kansas Geol. Survey Bull. 175, pt. 4, p. 1—11, pl. 1. Formal proposal of name. Thickness at type section herein designated 7.8 feet; at type section of Tacket Formation 10 feet.

Type section: Near center of SE¼SW¼ sec. 2, T. 33 S., R. 18 E., south of Mound Valley, Labette County. Name derived from town of South Mound in southeastern Neosho County.

South Pass Formation

Miocene, upper, to Pliocene, middle: Western Wyoming.

H. D. Zeller, and E. V. Stephens, 1964, U.S. Geol. Survey Mineral Inv. Field Studies Maps MF 292, 293, 294, 295, 296. Mapped in Fremont and Sweetwater Counties. Thickness 0 to 200 feet.

N. M. Denson, H. D. Zeller, E. V. Stephens, 1965, U.S. Geol. Survey Bull. 1224—A, p. A27—A29. Name South Pass Formation used herein for a generally conglomerate sequence of rocks that includes beds of sandstone, limestone, and volcanic ash. Combined average thickness about 350 feet. Unconformably overlies rocks of early and middle Miocene, early and middle Eocene, and Precambrian ages. Fills pre-existing valleys and forms pediments and coalescing alluvial fanlike deposits along both flanks at southern end of Wind River Mountains. Comstock's (1874) names South Pass Group and South Pass Beds were never formally defined and have not been used by other geologists working in area. A section of the rock sequence showing stratigraphic and structural relations is exposed along Continental Divide near South Pass. Believed that name South Pass, given by Comstock to these beds, should be retained as a formation name. Type area designated.

Type area: Around South Pass in Tps. 28 and 29 N. and Rs. 98 through 103 W., Fremont County.

South Piney Sandstone

Middle Ordovician: Wyoming.

P. W. Goodwin, 1964, Dissert. Abs., v. 25, no. 2, p. 1149. Name applied to Middle Ordovician sandstone previously known as "Harding equivalent." Correlation with Harding Sandstone of Colorado indicated. To east and northeast, becomes Winnipeg Formation but exact stratigraphic relationships not known.

Named from exposures on east flank of Bighorn Mountains at South Piney Creek.

South Rim Formation (in Big Bend Park Group)

Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, plates, figs., road logs. Lava flows, ash beds, tuff, flow breccia, irregularly bedded sandstone and conglomerate. Thickness 1,000 to 1,500 feet. Includes (ascending) Wasp Spring Flow (new), Lost Mine Rhyolite (new), and Burro Mesa Riebeckite Rhyolite Members. Uppermost formation in group. Rests everywhere on erosion surface cut on older rocks. In contact with rocks from 408 feet above Tule Mountain Trachyandesite Member of Chisos Formation down to Pen Formation (new) in Terlingua group.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 137—151, pls. Formal proposal of name. Uppermost formation in Big Bend Group. Composed of thick lava and flow breccia bodies, conglomerate, sandstone, tuff, and tuffaceous mudstone. Comprises (ascending) Brown rhyolite member (informal), Wasp Spring Flow Breccia Member, Lost Mine Rhyolite Member, and Burro Mesa Riebeckite Rhyolite Member. Thickness about 275 feet to 1,000 feet. Unconformable on older rocks and is in contact with rocks that range from highest part of Chisos Formation down to Pen Formation. On west side of Burro Mesa the rocks in middle of South Rim sequence overlie highest Chisos Formation, 408 feet above top of Tule Mountain Trachyandesite. Elsewhere on Burro Mesa, the same South Rim units are in contact with the Tule Mountain Trachyandesite itself. At Goat Mountain, the middle and upper South Rim Formation was deposited in canyon that trenches the Chisos Formation to a level below the top of the Bee Mountain Basalt. A similar but wider channel is preserved at Kit Mountain and farther southwest the upper South Rim Formation lies directly on Javelina Formation. The South Rim has not been precisely dated. It overlies Chisos Formation which is probably upper Eocene or Oligocene. Fossils have not been found. Potassium-argon age determination of Burro Mesa Member indicated approximately 30 m.y. Average age of 29.4 m.y. has been obtained from analysis of two samples. This suggests an Oligocene age for entire extrusive sequence and perhaps late Oligocene for Burro Mesa Member.

Type locality: South Rim of Chisos Mountains where most of the lava-flow breccia units are prominent. Big Bend National Park, Brewster County.

South Sheba Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 9, 26, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Listed with flows that are thick with steep fronts. A stage III flow in which the edge of the flow is visible, and the present surface rough but lava tops have been broken down and cannot be recognized. This flow is superimposed on the Central Sheba Flow (new) and also on the Saddle flow (new).

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 53. According to Damon (1966, Geochronology Labs., Washington) paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II and all of stage III, IV and V basalts were extruded during the last 0.85 m.y.

South Sheba cone is north of Walnut Creek on road to Leupp. The South Sheba flow traveled about 2 miles.

South Turkey Hill Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. South Turkey Hill flow listed with flows that are thick with steep fronts. The stage III and stage IV flows show considerable variation in thickness. Some are 10 to 20 feet thick and others 75 to 100 feet.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 53. According to Damon (1966, Geochronology Lab., Washington) the paleomagnetic data together with the K-Ar dating can be interpreted as indicating that Colton's late stage II, all of stage III, IV, and V basalts were extruded during the last 0.85 m.y.

Turkey Hills Craters are just east of Flagstaff on Highway 66.

Southwood Stage

Middle Devonian (Erian): New York.

L. V. Rickard, 1964, New York State Mus. Sci. Service Geol. Survey, Map and Chart Ser., no. 4. Name proposed for stage extending from base of Edgecliff Limestone to top of Tioga bentonite. Follows Sawkill Stage (new). Followed by Cazenovia Stage. Combined Sawkill and Southwood Stages are equivalent to Onesquethaw Stage of Cooper and others (1942) as modified by Dennison (1961).

Type section: Exposure in Onondaga County Prison Quarry, half a mile south of County Penitentiary at Jamesville, Tully quadrangle.

S. P. Lava Flow

Recent: East-central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 29, 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. S. P. Flow listed with flows that are thick and have steep fronts. S. P. Flow is a stage IV flow—lava tops still in tact but displaced by frost action. Flow from the S. P. Crater is 30 to 50 feet thick and present surface is composed of blocks of basalt fractured by frost action. Flow is about 4½ miles long.

C. A. Hodges, 1962, Plateau, v. 35, no. 1, p. 15—36. Consists of loosely associated polyhedral blocks. Thickness 150 to 200 feet at its north termination. Older than Bonito and Kana-a lava flows associated with Sunset Crater.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 9 (fig. 7), 37, 53. According to Damon (1966, Geochronology Labs., Washington) paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II and all of stage III, IV, and V basalts were extruded during last 0.85 m.y.

S. P. cinder cone and flow are at north boundary of San Francisco volcanic field, 32 miles north of Flagstaff on U.S. Highway 89, and about 6 miles west of U.S. Highway 89 via a ranch road, Coconino County. Flow stretches due north from base of cone a distance of about 4.5 miles and forms spectacular topographic feature, contrasting vividly with surface of Permian Kaibab Limestone over which it has flowed.

Spechty Kopf Member (of Catskill Formation)

Spechty Kopf Member (of Pocono Formation)

Upper Devonian and Lower Mississippian: Eastern Pennsylvania.

H. H. Arndt, G. H. Wood, Jr., and J. P. Trexler, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C32—C35. At top of formation. Consists of 0 to 2,400 feet of gray and olive conglomerate, sandstone, siltstone, and shale interbedded with lesser amounts of red sandstone, siltstone, and shale. Underlain by Buddys Run Member in section north of Shamokin and by Cherry Ridge Member in section north of Cressona.

J. P. Trexler, G. H. Wood, Jr., and H. H. Arndt, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C36—C39. Beds formerly included in informally named gray member of Catskill Formation are included in unit here named Spechty Kopf Member. Maximum thickness in type locality about 2,400 feet. Lower 500 ± feet consists chiefly of gray and gray-green sandstone, shale, and fine to coarse quartz-pebble conglomerate with a few intercalated thin red beds. Upper 1,900 ± feet consists of almost equal amounts of gray and olive-gray sandstone and fine conglomerate, and red beds. Lower contact with red beds of underlying main body of Catskill Formation is not well exposed in type area. It is gradational and placed arbitrarily at horizon where gray- and olive-hued beds characteristic of Spechty Kopf predominate over red beds characteristic of main body of Catskill. Underlies Beckville Member (new) of Pocono Formation. Probably correlates with beds in northeastern Pennsylvania that were included in Elk Mountain Sandstone and Mount Pleasant Red Shale (Willard and others, 1939, Pennsylvania Geol. Survey, 4th ser., Bull. G—19).

J. L. Dyson, 1967, Pennsylvania Geol. Survey 4th ser., Topog. and Geol. Atlas 137 cd, p. 38, 39, map. Described in southern half of New Bloomfield quadrangle where it is reallocated to member status in Pocono Formation. The Spechty Kopf is lower 200 feet of formation and is sandstone with some conglomerate and minor red bed and siltstone interbeds. Presence of minor red beds in member serves to show that it is transitional between the Pocono and Catskill Formations.

Type locality: East to northeast of Spechty Kopf hill in headwaters of Powell Creek, Stone Cabin Run, and East Branch of Rattling Creek, all in Lykens quadrangle.

Speckled Mountain Quartz Monzonite (in New Hampshire Magma Series)

Upper Devonian: Western Maine.

I. S. Fisher, 1962, Geol. Soc. America Bull. 73, no. 11, p. 1395—1420, pl. 1. Fine to medium-grained white to light-gray biotite-muscovite-quartz monzonite. Locally exhibits distinct layering that resembles relict bedding of metasedimentary rocks. Younger than Songo Granodiorite (new).

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 52—54, pl. 1. Geographically extended into Bryant Pond quadrangle where it is present mainly in small bodies throughout the metamorphic rocks. One large body present in vicinity of Rumford Corner, just south of Androscoggin River. Commonly occurs around borders of Songo granodiorite.

Type locality: Speckled Mountain in Bethel quandrangle where it occurs as small dikes, sills, and irregular bodies throughout the metasedimentary rocks.

Spellman Formation (in Beekmantown Group)

Lower Ordovician: New York.

D. W. Fisher and others, 1961, Geologic map of New York (1:250,000): New York State Mus. Sci. Service Geol. Survey Map Chert Ser., no. 5. Named on map legend.

D. W. Fisher, 1962, New York State Mus. Sci. Service Geol. Survey Map and Chart Ser., no. 3. Name introduced for fossiliferous limestones and dolomitic limestones that constitute "type" Beekmantown at Spellman Ledge at Beekmantown, N.Y., in Rouses Point quadrangle. Thickness about 25 feet, neither top nor bottom exposed. Limits set somewhat vaguely, lithologically. Medial Canadian age (*Lecanospira* zone).

Named for exposures at Spellman Ledge, 1.5 miles south of Spellman Road at Beekmantown, in Rouses Point quadrangle. Well exposed at Willsboro on Bouquet River and in field exposures, 4 miles south-southeast of Fort Ann.

Spice Valley Member (of Mansfield Formation)

Pennsylvanian: Southwestern Indiana.

J. A. Sunderman, 1964, Dissert. Abs., v. 24, no. 7, p. 2873. Consists of three facies: (1) kaolinite facies made up of brown plastic clay in beds up to 4 or more feet thick; (2) iron ore facies—goethite bands and nodules and interstitial brown plastic clay in beds up to 4 feet thick; and (3) halloysite facies of white to light-brown to black clay in beds up to 9 feet thick. At base of formation.

Named from Spice Valley Township, Lawrence County.

Spider Mountain Schist

Age not stated: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Consists of low-grade schist and calcareous mica schist and is, on basis of lithology and structural position, correlative with Cascade River schist (new). Crops out as synclinal erosional remnants overlying Magic Mountain gneiss (new).

Area south of Cascade Pass, northern Cascade Mountains.

†Split Rock Formation

Miocene, lower and middle: Central Wyoming.

J. D. Love, 1961, U.S. Geol. Survey Bull. 1121—I, p. I—2——I—25. A thick and widespread succession of light-gray to tan poorly cemented quartz sandstone with lesser amounts of conglomerate, claystone, limestone, tuff, and pumicite. No single complete section typical of formation as a whole is exposed and description is based on more than 20 surface sections supplemented by electric logs and well cuttings. Formation divided into four lithologic sequences: lower porous sandstone, 0 to 500+ feet; clayey sandstone, 100 to 300 feet; silty sandstone, 0 to 500 feet; and upper porous sandstone, 0 to 1,000+ feet. Unconformably overlies Oligocene and older rocks (White River formation in many places); unconformably underlies Moonstone formation (new).

N. M. Denson, 1965, U.S. Geol. Survey Bull. 1224—A, p. A70—A74. Recent studies indicate that most of rocks originally assigned to Split Rock Formation in Granite Mountains area are laterally equivalent and remarkably similar lithologically and chemically to rocks in eastern Wyoming and western Nebraska described and first assigned by Darton (1899) to Arikaree Formation. Upper part of Split Rock at its type locality includes rocks lithologically similar to lower part of Ogallala and it is assigned to that part of the Ogallala. In other areas lower part of Split Rock includes upper part of White River Formation (Oligocene). Term Split Rock Formation is not regionally useful or meaningful and is herein abandoned.

Type locality: Section of part of upper porous sandstone sequence at site of "Split Rock local fauna" SW¼SW¼NW¼ sec. 36, T. 29 N., R. 90 W., Fremont County. Strata strike N. 80° E., dip 4° S. Named from Split Rock (sec. 18, T. 29 N., R. 89 W., Natrona County), a cloven peak in Granite Mountains.

Spragueville Formation

Silurian: Northeastern Maine.

Louis Pavlides, 1966, U.S. Geol. Survey Bull. 1244—A, p. A55—A57. Consists chiefly of gray to pale-olive-green calcareous siltstone and silty limestone. Estimated thickness about 4,000 feet. Conformably overlies Carys Mills (new) gradationally and underlies Perham Formation in Presque Isle region. Was termed upper member, nubbly limestone, of Aroostook Limestone by White (1943, U.S. Geol. Survey Bull. 940—E). Aroostook Limestone herein abandoned.

Type locality: Exposures near community of Spragueville, Aroostook County.

Springfield Member (of Cane Valley Formation)

Upper Cretaceous: St. Croix, Virgin Islands.

J. T. Whetten, 1962, Dissert Abs., v. 23, no. 2, p. 604. Uppermost member of Cane Valley. Thickness 600 feet. Overlies Robe Hill member (new).

J. T. Whetten, 1966, Geol. Soc. America Mem. 98, p. 185 (fig. 3), 200, pl. 1. Consists of mudstone and fine-grained tuffaceous sandstone lithologically indistinguishable from underlying Hope Member. Thickness about 600 feet where best exposed.

Best exposed in road metal quarry at Estate Springfield.

Springs Road Sandstone

Lower Cretaceous: West-central California.

R. L. Rose and I. R. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 40 (strat column), 41, geol. map. Consists of medium-grained gray-brown lithic biotitic wacke with interbedded thin layers of silty mudstone and occasional lenses of conglomerate. Mudstone most abundant in upper part. Thickness 300 feet. Overlies Center Peak formation. Grades upward into Lower Oak Flat shale. Apparently Anderson (1941, unpub. ms) and Popenoe and others (1960, Geol. Soc. America Bull., v. 71, no. 10) included this sandstone in Center Peak conglomerate and considered it to be of Albian age.

Name derived from road that leads to Coalinga Mineral Springs from Highway 198, east-central Priest Valley quadrangle. Crops out southeast of this road along northeast side of Center Peak Ridge.

Springwater Formation

Pleistocene, lower(?): Northwestern Oregon.

D. E. Trimble, 1963, U.S. Geol. Survey Bull. 1119, p. 10 (fig. 4) 46—50, pl. 1. Bouldery cobble gravel and mudflow deposits; interstratified mudflow deposits locally form large part of unit. Weathered to depth of about 75 feet; mostly saprolite with red soil capping. More than 100 feet thick; maximum thickness of more than 200 feet inferred from indirect evidence at one locality. Unconformably overlies Boring lava and Troutdale formation. Overlain by loess. Probably younger than Walters Hill formation. Gresham formation (new) occupies position within valleys cut in the Springwater. Treasher (1942, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. 7) included much of Springwater in Troutdale formation. No fossils. Considered to be of early(?) Pleistocene age mainly on basis of relative degree of weathering.

Named for community of Springwater, about 2 miles south of Estacada, Clackamas County.

Sprinkle Formation

Upper Cretaceous: Central Texas.

Keith Young, 1965, Texas Univ. Bur. Econ. Geology Circ. 65-3, p. 2—4. Name proposed for formation formerly referred to as "Lower Taylor Marl" or the "unnamed formation" of Schuchert (1943, Stratigraphy of the Eastern and Central United States: New York, John Wiley and Sons). A greenish-gray to brownish-gray unctuous montmorillonitic claystone, slightly calcareous in lower 20 or 30 feet. Thickness as much as 340 feet in Travis County. Thickens to northeast (East Texas Embayment) and to southwest (Gulf Coast Basin). Thins to southwest and pinches out near San Antonio by the overlapping Pecan Gap-Anacacho transition. Gradational with underlying Big House Chalk. The Sprinkle, a clay lithosome of Austin Chalk, thickens basinward both by the increasing thickness of each bed and also through lateral replacement by Big House Chalk, Burditt Marl, and Dessau Limestone in the deeper basins. Table 2 shows interfingering relationship with Big House, Burditt, and Dessau, and also as overlying Jonah Formation. Most characteristic fossil is *Exogyra ponderosa* s. 1.

Type locality: Along Little Walnut Creek, about one-half mile below bridge on old Austin-Manor Highway, Travis County. Sprinkle is an extant but nonoperating station on Missouri-Kansas-Texas Railroad north of northern city limits of Austin.

Sprole Silt

Pleistocene: Northeastern Montana.

R. B. Colton, 1963, U. S. Geol. Survey Misc. Geol. Inv. Map I—367. Yellowish-gray-brown, or reddish-brown, clayey, plastic, thin-bedded, and locally limonitic silt. Lower half is well-stratified silt and clay and contains pebbles; bedding less pronounced in upper half. In some areas has little structure and resembles loess. Thickness 60 to 100 feet; thins to west. Overlies Wiota Gravels and underlies till, both of Wisconsin age. No fossils. Age determined on basis of stratigraphic position.

Type locality: Exposure 2 miles northwest of Sprole, a siding on Great Northern Railroad, NW¼SW¼ sec. 3, T. 27 N., R. 51 E., Roosevelt County.

Spruce Top Greenstone

Ordovician(?) to Devonian(?): Northeastern Maine.

Louis Pavlides, 1962, U. S. Geol. Survey Prof. Paper 362, p. 24—28, pl. 1. Name applied to dark-green metamorphic aphanites and phanerites with either basaltic or diabasic aspects. Contacts between the Spruce Top of Silurian(?) age and enclosing sedimentary rocks are not exposed in area; therefore, whether the greenstone is a flow or sill must be inferred largely from indirect evidence. Believed that parental rocks of Spruce Top were emplaced as sills after Meduxnekeag and Hovey formations (both new) had formed but prior to regional metamorphism of area.

Louis Pavlides, 1965, U. S. Geol. Survey Bull. 1206, p. 6 (table 1), 34—36, pl. 1. Described in Bridgewater quadrangle, Aroostook County. Thickness as much as 1,500 feet. Age of Spruce Top Greenstone uncertain. Originally assigned to Silurian(?) because of its apparent relationship to other rocks in Howe Brook quadrangle. It is now known to be restricted mostly to rocks of Ordovician(?) or Silurian(?) in the Bridgewater (Dunn Brook Formation) and Howe Brook quadrangles. May be of about same age as these rocks or may have been intruded into them at any time after they formed. If indeed the Spruce Top occurs mostly as sills, it could not have been emplaced as such after Lower Devonian because it is folded conformably with the enclosing sediments. This episode of folding (Acadian orogeny) appears to have occurred near close of Lower Devonian(?) age.

Named after Spruce Top, a small conical hill three-fourths mile north of fire tower on Number Nine Mountain, Aroostook County. Occurs as large and distinct, apparently concordant masses.

Squaw Creek Schist (in Riggins Group)

Paleozoic or Mesozoic: Western Idaho.

C. P. Ross, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 63, 65. Thickness 1,000 to 1,200 feet. Name credited to Warren Hamilton (in press).

Warren Hamilton, 1963, U. S. Geol. Survey Prof. Paper 436, p. 17, 27—34, pl. 1. Formal proposal of name. Structurally highest formation in Riggins Group (new). Consists of gray schists, metamorphosed from sedimentary rocks that were in turn derived chiefly from volcanic sources. Thickness about 6,000 feet on north limb of Riggins syncline where its structure is simplest. Overlies Lightning Creek Schist (new) both north and south of Riggins, although the two formations are generally separated by ultramafic rocks. East of Riggins, Berg Creek Amphibolite (new) lies between the two schists.

Type section: Along Little Salmon River from Riggins to Captain John Creek. Named for tributary to Little Salmon River near its mouth. Schists are exposed in broad central part of Riggins syncline and underlie large area about town of Riggins.

Squibnocket Cliff Peat

Recent: Massachusetts.

J. G. Ogden, 1963, Am. Jour. Sci., v. 261, no. 4, p. 344—353. Consists of beach sand, fibrous peat, gyttja, silty peat, white gravel, clay till, stumps, and wood. Radiocarbon dates from clay gyttja at base of deposit show radiocarbon ages from 12,300 to 12,700 B. P. Pollen stratigraphy discussed.

Squibnocket Cliff peat section is on wave-cut cliff on property of Ralph Hornblower. Cliff forms south-east facing promontory of town of Gay Head on island of Marthas Vineyard.

Staley Pasture Tuff (in Mount Belknap Volcanic Group)

Tertiary: South-central Utah.

M. W. Molloy and P. F. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 2, p. 220, 227 (fig. 11), pl. 1. Light-gray mottled tuff at base of Mount Belknap sequence on eastern slopes of Tushar Range. Contains lenses of dense white rhyolite [Kimberly] as much as 50 feet thick. More than 700 feet thick in high mountain area. In Clear Creek same unit forms base of Joe Lott tuff and is at least 200 feet thick. Lies below Gold Mountain tuff (new).

Named for occurrence in Staley Pasture, Tushar uranium area, near Marysvale, Piute County.

Stampede Tuff (in Keechelus Volcanic Group)

Eocene, upper-Oligocene, lower: Washington.

P. E. Hammond, 1964, Dissert. Abs., v. 24, no. 7, p. 2869. Unconformably overlies Eagle Gorge Andesite (new), Huckleberry Mountain (new), and "Naches" Formations. Middle formation of group.

West-central Cascade Range.

Stams Mountain Volcanic Complex

Recent: Central Oregon.

M. W. Higgins and A. C. Waters, 1967, Ore Bin, v. 29, no. 3, p. 38 (fig. 1). Discussion of Newberry Caldera. Stams Mountain volcanic complex shown on map just south Newberry volcano.

Area is south of Bend and northeast of Crater Lake.

Standard Peak Andesite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 70, 75. Intrudes Wiggins formation. In thin section, is seriate porphyritic with cryptofelsitic to microgranular groundmass of plagioclase, microlites, and quartz.

Crops out as the conical summit of Standard Peak in southern Absaroka Mountains.

Stanislaus Formation

Pliocene, lower: Central eastern California and western Nevada.

D. B. Slemmons, 1966, California Div. Mines and Geology Bull. 190, p. 199—208. Cenozoic volcanic history of the central Sierra Nevada can be divided into four major episodes: (1) an Oligocene to Miocene period of eruption and deposition of Valley Springs rhyolite tuffs, (2) a late Miocene to early Pliocene period of andesite eruptions resulting in accumulation of mudflows and volcanic sediments of Relief Peak Formation (new), (3) an early Pliocene period of eruption of latite and quartz latite flows and tuffs of Stanislaus Formation, and (4) later eruptions of Pliocene andesites of Disaster Peak Formation (new) and late Pliocene to Quaternary andesites, basalts, and rhyolites. Latites now assigned to Stanislaus Formation were divided into three units by Ransome (1898, U. S. Geol. Survey Bull. 89) and Slemmons (1953, unpub. thesis). The three units, now considered to be members, are (ascending) Table Mountain Latite, Eureka Valley, and Dardanelles. Formation attains maximum thickness of more than 1,500 feet near Sonora Pass, thins southwestward to where, in Table Mountain area near Sonora, it consists of a single augite latite flow only 299 feet thick. Unconformity which separates latites of Stanislaus from underlying Relief Peak andesites is generally one of low relief, and may indicate only short hiatus in deposition. Unfossiliferous. Potassium-argon dates give ages of from 8.8 to 9.3 m.y. Formation may prove to be of singular importance in deciphering structural and geomorphical development of central Sierra Nevada, for they seem to form the only well-defined stratigraphic and time marker that extends from under the Great Valley, across the range, and into the eastern part of Basin and Range province. Because the Stanislaus predates by a short interval most of the Sierra Nevada uplift and the development of the present Basin and Range topography by faulting, it not only provides a measure of fault displacements but also a means of correlating between the two provinces. Source of at least part of formation is indicated by occurrence of more than 20 augite latite dikes recognized between Dardanelles Cone and Sonora Pass. Thickest sections are between Sonora Pass and Pinecrest which suggests that there may be other sources to the west of the present divide.

Type locality: Bald Peak-Red Peak ridge which separates Clarks Fork and Deadman Creek branches of the Middle Fork of Stanislaus River. Named for its conspicuous development along the various tributaries of Stanislaus River.

Stanislaus Meadow Adamellite

Jurassic-Cretaceous: Eastern California

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend of western half of Markleeville quadrangle.

J. B. Koenig, 1963, Geologic map of California, Walker Lake sheet (1:250,000): California Div. Mines. Jurassic-Cretaceous. Name credited to Parker (unpub. thesis).

Stanislaus Meadow is in Alpine County.

Staples Pond Formation

Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., p. 104 (table 1), 108. Thinly bedded to massive calcareous sandstone and minor slate. Listed in table 1 as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not stated. Area of report is Buckfield and Dixfield quadrangles.

Starcke Limestone

Silurian: Central Texas.

V. E. Barnes and others, 1966, Science, v. 154, no. 3752, p. 1007—1008. Silurian out crops, not previously recorded from central Texas, have been identified from Llano uplift, where they occur in collapse structures within Lower Ordovician Honeycut Formation of Ellenburger Group. The formation herein named Starcke Limestone is a pinkish-gray granular limestone and contains fossils of probable Wenlock age.

Type locality: On C. H. Dean Ranch in Burnet County, 4,000 feet south-southwest of Max Starcke Dam. It is 900 feet south of Flatrock Creek, 250 feet from west boundary of Dean Ranch, and 100 feet from mouth of shallow northward-flowing drain which empties into a drain flowing directly into Flatrock Creek.

Starlight Formation

Pliocene, lower or middle: Southeastern Idaho.

W. J. Carr and D. E. Trimble, 1963, U. S. Geol. Survey Bull. 1121-G, p. G7—G15, pl. 1. Mainly rhyolitic friable bedded tuff, subordinate amounts of marl, sandstone, and conglomerate, and locally, much basalt and basaltic tuff. In places divisible into three members by middle unit which is vitric-crystal tuff, widely, but not continuously, distributed in this part of Idaho. Thickness probably more than 800 feet. Unconformably underlies Neeley formation. Includes some rocks formerly mapped as Salt Lake formation.

Type area: Starlight Creek, about 10 miles southeast of American Falls in Arbon quadrangle.

Star Mountain Rhyolite

Age not stated: Western Texas.

D. L. Gibbons, 1964, Dissert. Abs., v. 25, no. 3, p. 1844. Massive, featureless, dense, very finely crystalline rhyolite.

Occurs in Davis Mountains, 100 miles east of El Paso.

Starved Rock Sandstone Member (of St. Peter Sandstone)

Middle Ordovician (Champlainian): Illinois, Iowa, and Missouri.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13, 36, 46—47, 225. Consists of sandstone that closely resembles underlying sandstone in Tonti Member (new), but is consistently coarser grained. In western Illinois and around margins of formation in north-central and northeastern Illinois the sandstone is partly silty, locally fine grained, and contains tongues of Glenwood sandstones, but maintains its character as a coarse-grained unit. Thickness normally 60 to 90 feet; 235 feet in well near Joliet. Between McDonough and Scott Counties, western Illinois, and in southeastern Missouri the Starved Rock Sandstone rests on Tonti Sandstone with sharp contact. North of McDonough County the Starved Rock conformably overlies Kingdom Sandstone; grades northward into Glenwood Formation and tongues of Starved Rock-type sandstone are present locally in Loughridge Member (new) of Glenwood and more rarely on top of Harmony Hill Member; grades southward into Joachim and Dutchtown Formations.

Type section: Exposures at Starved Rock, French Canyon, and Lovers' Leap in Starved Rock State Park, LaSalle County, Ill., W½NW¼ and NW¼NW¼SW¼ sec. 22, T. 33 N., R. 2 E., Ottawa quadrangle.

Steamboat basaltic andesite (in Lousetown Formation)

Pleistocene: Central western Nevada.

D. E. White, G. A. Thompson, and C. H. Sandberg, 1964, U. S. Geol. Survey Prof. Paper 458—B, p. B35, B36. Informal name applied to dark lava flows of basaltic aspect possessing a characteristic texture distinguishable from the Lousetown Formation. Although included in Lousetown Formation they are thought to be intermediate in age between lava flows at type locality of Lousetown and McClellan Peak Olive Basalt (Pleistocene) of Virginia City quadrangle.

Robert Schoen and D. E. White, 1967, U. S. Geol. Survey Prof. Paper 575—B, p. B1110. Steamboat basaltic andesite of Lousetown Formation was erupted in early Pleistocene time followed immediately by domes of pumiceous rhyolite of the Steamboat Hills Rhyolite.

Present in eastern part of Steamboat Hills and in thermal area, Washoe County.

Steamboat Point Member (of Bighorn Dolomite)

Ordovician: Wyoming.

P. W. Goodwin, 1964, Dissert. Abs., v. 25, no. 2, p. 1149. Bighorn Dolomite subdivided into (ascending) Lander Sandstone, massive Steamboat Point, thin-bedded blocky Leigh, and heterogeneous Horseshoe Mountain (new) Members.

Bighorn Mountain and Black Hills area.

Stegall Rhyolite

Precambrian: Southeastern Missouri.

F. G. Snyder and R. E. Wagner, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 88. Incidental mention in report on Precambrian sequence in St. Francois Mountain area.

Stegall Mountain is in T. 28 N., R. 3 W., Shannon County.

Steinhatchee dolomite member (of Crystal River Formation)

Eocene: Florida.

H. S. Puri, J. W. Yon, Jr., and W. R. Oglesby, 1967, Florida Div. Geology, Geol. Bull. 49, p. 95—97. Tan granular impure dolomite and dolomitic limestone. This dolomite occurs stratigraphically in basal part of Crystal River Formation and is exposed as a continuous outcrop for 3 miles along coast of Gulf of Mexico around Cow Creek. Forms continuous bench, about 1 to 4 miles wide, between Horse Shoe Beach and town of Steinhatchee. Occurs as a Silver Bluff shelf at elevations less than 10 feet. Excellent contact with Crystal River Formation present at fall on Steinhatchee River where 4 feet of chalky coquinoid limestone of Crystal River overlies 2 to 3 feet of tan granular dolomite. Dolomite member extends into Taylor County to west but additional drilling will be needed to establish relationship of this rock with other stratigraphic units. Until further subsurface studies on stratigraphy are made in these and adjoining coastal counties, this unit is herein used as an informal rock unit.

Exposed in southeastern Dixie County between Horse Shoe Beach and town of Steinhatchee and along as far north as the Falls north of Rocky Creek. Forms a fall line on Steinhatchee River, NW¼NE¼ sec. 32, T. 8 S., R. 10 E., Dixie County.

Stella Lake Quartzite (in McCoy Creek Group)

Precambrian: Central northeastern Nevada.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 298—299 (pl. 1), 302—303. Separated from Prospect Mountain Quartzite (restricted). White to light gray and weathers white in contract to brownish weathering overlying Prospect Mountain Quartzite. Thickness 700 to 800 feet at type locality. Overlies Osceola Argillite (new).

Type locality: South of Stella Lake, northern part of Southern Snake Range.

Step Limestone Member (of Butterfield Formation)

Pennsylvanian (Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10, pl. 5. Overlies Ribbon Limestone member and underlies Billiard Ball limestone member (both new). Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, 33. Welsh's local names such as Billiard Ball and Step should be used with caution

Bingham mining district, Oquirrh Mountains.

Stephens Passage Group

Upper Jurassic and Lower Cretaceous: Southeastern Alaska.

E. H. Lathram and others, 1965, U. S. Geol. Survey Bull. 1181—R, p. R9 (table 1), R22—R24, pl. 1. Name given to sequence of slate, graywacke, conglomerate, and augite-bearing volcanic flow breccia that comprises Seymour Canal Formation and Douglas Island Volcanics (redefined) which includes Brothers Volcanics. Thickness unknown, but may exceed 10,000 feet. Underlies Kootznahoo Formation (new) with angular unconformity. Unconformably overlies Hyd Formation.

Type locality: Stephens Passage, the waterway between Admiralty and Douglas Islands. Forms well-defined northwest-trending belt exposed along eastern slopes and shores of Admiralty Island, and bordered on east by Gastineau Channel fault and southern Stephens Passage. Extends from Shelter Island in northwest to Pybus Bay in southeast.

Step Ridge Member (of Highland Peak Formation)

Middle Cambrian: Southeastern Nevada.

C. W. Merriam, 1964, U. S. Geol. Survey Prof. Paper 469, p. 43—45, pls. 1, 2, 5. Exhibits wide range of lithologic types, from white and dark-gray dense lithographic limestones to mottled oolitic limestones. Most prevalent and distinctive type is striped oolitic variety to which name "tiger stripe limestone" is given. Commonly a dull medium-bluish gray, these oolitic limestones are generally crossbedded, showing long sweeping forset beds. Mottling common in all phases of the Step Ridge; where rock is very light gray, patches are darker gray, or the converse is true. Bedding obscure or thick and outcrops generally massive. Bluebird structure common. In vicinity of Churndrill Valley, the Step Ridge is divided into three mappable units which from bottom to top are called unit *a*, unit *b*, and unit *c*. Units *a* and *c*, the thinner subunits, consist mainly of light-gray and white massive lithographic limestones. Unit *b* forms most of member and is characterized by large lenticular bodies of crossbedded tiger-stripe oolitic limestone. Unit *a* is "Highland Peak D" of Wheeler and Lemmon (1939, Nevada Univ. Bull., v. 33, no. 3, Geology and Mining ser., no. 31). Units *b* and *c* are approximately equivalent to Wheeler and Lemmon's "Highland Peak E". Thickness about 740 feet at Step Ridge; 775 feet at Warm Spring. Conformably overlies Burnt Canyon Member; conformably underlies Condor Member. Preoccupied name "Newport lime" has been used for this unit by mining companies.

Type area: Along Step Ridge, Pioche mining district, Lincoln County. Occupies large areas in northern Ely Range, where it makes prominent geomorphic features.

Stevens Mountain Rhyolite

Cretaceous(?): Southern Arizona.

J. A. Thoms, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. Stevens Mountain rhyolite is youngest unit in Cretaceous(?) sequence in area. Consists of 1,000 feet of conglomerates overlain by equally thick sodic extrusive rocks. The Cretaceous(?) sequence and Late Cretaceous leucogranite are unconformably overlain by Cretaceous-Tertiary Demetrie formation (new). Overlies Ox Frame volcanics.

Present in Tascuela area, which comprises about 25 square miles on the west side of the Sierrita Mountains in Palo Alto and Twin Buttes quadrangles, Pima County.

Stevens Ridge Formation

Stevens Ridge Rhyodacite

Oligocene or Miocene: Central Washington.

A. C. Waters, 1961, Northwest Sci., v. 35, no. 2, p. 39, 48—51, 56. Composed almost entirely of rhyodacite ash-flow deposits, with subordinate epiclastic rock toward top. Formation, deposited on surface of considerable relief, reaches thickness of about 3,000 feet in Mount Rainier National Park. Unconformably overlies Ohanapecosh formation (new); concordantly underlies Fifes Peak formation. Name credited to Fiske, Hopson, and Waters (in press). Included in Keechelus andesite series by Smith and Calkins (1906).

R. S. Fiske, C. A. Hopson, and A. C. Waters, 1963, U. S. Geol. Survey Prof. Paper 444, p. 17—25, pl. 1. Formal proposal of name. Consists of ash flows and volcanic clastic rocks. Thickness 450 to about 3,000 feet. Unconformably overlies Ohanapecosh Formation; underlies Fifes Peak Formation, concordant and presumably conformable.

P. E. Hammond, 1964, Dissert, Abs., v. 24, no. 7, p. 2869. Mount Catharine Tuff and its correlative, Stevens Ridge Rhyodacite, rest unconformably upon pre-Tertiary crystalline rocks and upon Puget Group, Ohanapecosh and Guye Formations.

Named for Stevens Ridge, a prominent spur just north of Stevens Canyon, in south-central part of Mount Rainier National Park. Crops out at many scattered localities in the park.

Steves Farm Limestone Member (of Baldwin Corner Formation)

Lower Canadian: Eastern New York.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 156—157. Name given to a light-gray limestone at base of formation. Thickness not more than 12 feet. Rathburnville School limestone member (new) is at top of formation. Canadian is used as system in this report.

Named from Steves Farm, 2½ miles northeast of East Granville, Washington County, N. Y.

Stewarts Point Member (of Gualala Formation)

Upper Cretaceous: Northwestern California.

C. M. Wentworth, Jr., 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 237. Two synchronous members distinguished in the Gualala (herein rank reduced to formation): Anchor Bay and Stewarts Point. The Stewarts Point is characterized by gray-white arkose rich in potassium feldspar.

Gualala area, Northern Coast Ranges.

Stingy Creek Member (of Ashlock Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U. S. Geol. Survey Bull. 1224—D, p. D12—D13. Silty limestone and limy siltstone. Fossiliferous. Thickness 5 to 15 feet. Transitional for a few feet with overlying Terrill Member (new). Northeast of Richmond cannot be separated from underlying part of formation.

R. C. Greene, 1966, U. S. Geol. Survey Geol. Quad. Map GQ—479. Mapped in Richmond South quadrangle, Madison County, where it is 11 to 13 feet thick, overlies Gilbert Member and underlies Terrill Member.

Type section: Along U. S. Highway 27, beginning beneath bridge just west of mouth of Gilberts Creek and about 500 feet southwest of Ashlock Cemetery, Lincoln County, about 4 miles northeast of Stanford and 1 mile west of Gilbert. Named for exposures in roadcuts on Kentucky Highway 39 near Stingy Creek.

Stinking Spring Conglomerate

Tertiary, middle: East-central Nevada.

H. E. Kellogg, 1964, Geol. Soc. America Bull., v. 75, no. 10, p. 955—956, pl. 1. Conglomerate, sandstone, and clay unit. Rounded to subrounded pebbles, cobbles, and boulders in a slightly calcareous matrix of light-brownish-gray sandstone and siltstone form projecting ledges or cliffs above intervening slopes of varicolored clay and sandstone. Grades upward into soft tuff and tuffaceous sedimentary rock, and upper contact in many places is drawn at highest occurrence of conglomerate float. Thickness 420 feet just north of Stinking Spring but wedges out northward and southward. Southeast of Willow Spring (sec. 10, T. 10 N., R. 63 E.), formation is 679 feet thick and includes boulders derived from rocks as old as Eureka Quartzite. Replaced by post-Sheep Pass Formation exotic blocks of Shingle Pass area.

Named from exposures northeast of Stinking Spring, sec. 7, T. 10 N., R. 63 E., White Pine County.

Stockade Wash Member (of Paintbrush Tuff)

Stockade Wash Member (of Piapi Canyon Formation)

Stockage Wash Member (of Oak Spring Formation)

Miocene, upper: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U. S. Geol. Survey Prof. Paper 424-D, p. D-96—D-103. Member of Oak Spring formation. Lenticular beds of white, pale-gray, and pale-brown nonwelded to partially welded tuff; most of member contains nonstratified orange and tan pumice fragments as much as one-half inch long; local calcite cement; base zeolitic in places. West of Tippipah Spring are contorted layers and closely spaced polygonal joints. Thickness 0 to 290 feet. Overlies Survey Butte member (new); underlies Topopah Spring member (new). Oak Spring formation is Miocene(?) or younger.

F. G. Poole and F. A. McKeown, 1962, U. S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Reallocated to member status in Piapi Canyon Formation (new). Overlies Survey Butte Member; underlies Topopah Spring Member. Oak Spring raised to group rank.

P. P. Orkild, 1965, U. S. Geol. Survey Bull. 1224—A, p. A44—A51. Piapi Canyon Formation redefined and raised to group rank to include two new formations, Paintbrush Tuff and overlying Timber Mountain Tuff. Stockade Wash reallocated to member status in Paintbrush Tuff. Interpretation of potassium-argon dates gives age of Paintbrush Tuff as Miocene(?) and Pliocene.

The U. S. Geological Survey currently designates the age of the Stockade Wash Member of the Paintbrush Tuff as late Miocene on the basis of more recent potassium-argon dating.

Type locality: Stockade Wash, Nye County. Extends from southern part of Rainier Mesa southward to Tippipah Spring and westward to Fortymile Canyon.

Stockton Hill Formation

Upper Cambrian: Southeastern Minnesota.

D. E. McGannon, Jr., 1961, Dissert. Abs., v. 21, no. 8, p. 2249. Includes (ascending) Lodi member and Redwing member (new). Overlies St. Lawrence member of Franconia. In the Lodi and Redwing members several thin, distinct, lithic units are traceable for distances as great as 200 miles.

Type section: Outcrops along Minnesota Highway 38, 2 miles east of Stockton, Winona County.

Stonehouse Canyon Member (of Tyler Formation)

Lower Pennsylvanian: Central western Montana.

E. K. Maughan and A. E. Roberts, 1967, U. S. Geol. Survey Prof. Paper 554-B, p. B9, B12—B14, pls. Tyler Formation divided into two members based largely on color and partly on lithology. Lower member, Stonehouse Canyon, includes those strata composed predominantly of dark-gray rocks. These are beds 18—26 of Easton's (1962, U. S. Geol. Survey Prof. 348) section at Alaska Bench which are here designated as type section. Thickness about 288 feet. Conglomeratic sandstone, less than half a foot thick at base of Stonehouse Canyon Member in Stonehouse Canyon, thickens gradually westward and rests on successively older limestone and shale beds of Heath Formation. In Stonehouse Canyon this conglomerate is 322 feet above base of the Heath; but about 2-1/3 miles west of State Road 25, the conglomerate is 10 feet thick and lies about 60 feet above base of Heath.

Type section: Along prominent cliff forming west end of Alaska Bench from NE¼SW¼ sec. 25, T. 13 N., R. 19 E., to the SW¼ sec. 36, T. 13 N., R. 19 E., and thence continued to the NE¼ sec. 1, T. 12 N., R. 19 E., Fergus County. Reference section: Stonehouse Canyon in secs. 29, 31, 32, T. 11 N., R. 21 E., Golden Valley County.

Stone Lake Shale Member (of Altamont Formation)

Pennsylvanian: Northeastern Oklahoma.

P. A. Chenoweth, 1966, Oklahoma Geology Notes, v. 26, no. 7, p. 196. Type section (subsurface) of Oologah Limestone designated and described. The Oologah is conformably overlain by dark-gray to coaly black bed of carbonaceous to phosphatic shale here assigned to Nowata Formation. The contact is uneven and sharp. Travis (1942, unpub. thesis) regarded this dark phosphatic shale as an equivalent of Stone Lake Member of Altamont Formation (Alcock, 1942, unpub. thesis). An 18-inch bed of dense limestone above the share was equated with the Tina Limestone Member of the Altamont. In type well of Oologah Limestone, unit 41 is a carbonaceous share unit about 6 inches thick. This is base of the Nowata Shale and possibly corresponds to Stone Lake Member of Travis.

Type locality and derivation of name not stated.

Stono Granite (in Musco Group)

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Musco group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Stono Mountain is in T. 35 N., R. 4 E., St. Francois County.

Storff Formation

Silurian(?): Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 19—20, 36 (table 1), pl. 1. Black to brown thin-bedded phyllites and slates with interbedded argillaceous limestones. Thickness about 3,900 feet. Overlies Chellis Limestone (new); underlies Van Duzer Limestone (new); both contacts apparently conformable.

Named after Storff Creek which flows down western slope of Bull Run Mountains in northern part of Bull Run quadrangle, Elko County. Exposed in wide east-west band which crosses northern part of Bull Run Mountains.

Stoughton Member (of Stony Mountain Formation)

Stoughton Beds

Upper Ordovician: Subsurface in Manitoba and Saskatchewan, Canada, and northern North Dakota.

Saskatchewan Geological Society, 1958, Report of the Lower Palaeozoic Names and Correlations Committee: Regina, Saskatchewan, Saskatchewan Geol. Soc., p. 8. Two facies included in Stoughton beds; a dark-gray calcareous shale and highly fossiliferous shale and highly fossiliferous limestone sequence confined to southwestern Manitoba, southeastern Saskatchewan, and northern North Dakota, and a laterally equivalent dolomite or dolomitic limestone elsewhere. Beyond the depositional edge of the argillaceous beds [Stony Mountain Shale] the Gunton and Stoughton sequences coalesce into unbroken sequence of carbonates (undifferentiated Stony Mountain Beds). Stoughton Beds reach maximum thickness of about 100 feet in eastern North Dakota. Stoughton Beds equate with Stony Mountain Shale member as defined by Porter and Fuller (1958, Am. Assoc. Petroleum Geologists Bull. 43, no. 1) in the near-outcrop Manitoba subsurface.

C. G. Carlson and W. P. Eastwood, 1962, North Dakota Geol. Survey Bull. 38, p. 3 (fig. 2), 7. Basal member of Stony Mountain Formation. Underlies Gunton Member.

Type locality: Imperial-Canadian Superior Stoughton No. 3—27 (Lsd. 3, sec. 27, T. 8, R. 8 W., 2d mer., Saskatchewan) between 7,768 feet and 7,816 feet.

Stouts Creek Rhyolite (in Van East Group)

Precambrian: Southeastern Missouri.

F. G. Snyder and R. E. Wagner, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 13, 14, 15, W. C. Hayes and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 28, 29, W. C. Hayes, P. D. Proctor, and J. A. Martin, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 39. Noted in road logs. A purple rhyolite. In contact with Silvermine granite, Magee granite, Knoblick granite, and Butler Hill granite. Intrudes Carver Creek granite porphyry.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 83 (table 1). Included in Van East group (new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Specimens collected from SW cor. W½ lot 3 W., T. 33 N., R. 4 E. Stouts Creek is in Iron County.

Straight Canyon Formation

Upper Cambrian: Northwestern Utah.

M. H. Staatz and W. J. Carr, 1964, U. S. Geol. Survey Prof. Paper 415, p. 9 (table 4), 27—28, pl. 1. Consists chiefly of gray and pinkish-gray limestone and some tan-weathering gray dolomite. Lower contact is at bottom of first gray limestone or dolomite bed above reddish-brown quartzite that marks top of Lamb dolomite. Upper contact at top of zone of yellow or red limestone and dolomite and at base of first massive white limestone bed of Fera limestone (new). Thickness 369 feet at type section.

Type section: On east side of Dugway Range on ridge 1 mile south of Straight Canyon, Tooele County. Also exposed along east side of Dugway Range from Dugway Pass to canyon 1½ miles north of Fera and in discontinuous band 1 to 2 miles west of south end of Fandangle Canyon.

Straits Schist

Cambrian: Southwestern Connecticut.

E. E. Fritts, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D32—D36. A relatively clean pelitic formation which overlies Waterbury Gneiss unconformably and underlies Southington Mountain Schist (new). Straits Schist is lower part of unit named The Straits Schist Member of Hartland Formation by Rodgers and others (1959).

C. E. Fritts, 1963, U. S. Geol. Survey GQ—199, 1963, U. S. Geol. Survey GQ—200. Mapped in Mount Carmel and Southington quadrangles.

Type locality: Mount Carmel quadrangle.

Strawberry Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 29, 34. Discussion of Basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almot to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Strawberry flow is a stage IV flow, that is, a flow in which lava tops are still intact but have been displaced by frost action. Not much erosion. Other flows in this stage are S. P. lava flow, Marcou flow, and Merriam flow.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 53. According to Damon (1966, Geochronology Labs., Washington) Paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II and all of stage III, IV, and V basalts were extruded during the last 0.85 m. y.

Strawberry Crater is east of O'Leary Peak.

Strawberry Volcanics

Miocene, middle and upper, and Pliocene, lower: Eastern Oregon.

T. P. Thayer, 1957, Internat. Geol. Congress, 20th, Mexico, 1956, sec. 1, pt. 1, p. 231—245. As a whole Miocene rocks in Strawberry Mountain are so different from Columbia River basalt and are so extensive that they merit a name. They are named herein Strawberry volcanics, because they exhibit a wide variety of volcanic features. Columbia River type flows in lower part of Strawberry volcanics are herein referred to as Slide Creek member. If Slide Creek member is equivalent to Columbia River basalt at Picture Gorge, the Strawberry volcanics as a whole are equivalent to basalts at Picture Gorge and Mascall formation. Around north and west sides of Unity Basin the Ironside formation (Smith and Packard, 1919), which contains Miocene and Pliocene fossils lies on flows of Strawberry volcanics. Columbia River basalt, Mascall formation, and Strawberry volcanics are bevelled and overlain by fanglomerate, boulder, gravel, and welded rhyolite tuff which constitute Rattlesnake formation (Merriam, 1901). Upper half of about 6,500 feet of lavas exposed in northern slopes of Strawberry Mountain believed to be middle and upper Miocene and lower half Eocene to Miocene.

C. E. Brown and T. P. Thayer, 1966, U. S. Geol. Survey Misc. Geol. Inv. Map I—447. Strawberry Volcanics mapped in Canyon City quadrangle. Middle Miocene through lower Pliocene.

Type locality: Higher parts of Strawberry Mountain between Indian Creek and John Day faults. Strawberry Mountain is in Grant County.

Strawberry Creek Formation (in McCoy Creek Group)

Precambrian: Central northeastern Nevada.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 297—300. Quartzites, argillites, and metasiltstones. Thickness about 750 feet near head of Strawberry Creek. Overlies Willard Creek Quartzite (new); underlies Shingle Creek Quartzite (new).

Type area: Vicinity of Strawberry Peak, northern part of Southern Snake Range. Where best exposed on northside of upper Strawberry and upper Willard Creeks where its rocks are altered by contact metamorphism.

Streeter Drift

Pleistocene (Wisconsin): North Dakota.

Lee Clayton, 1961, North Dakota Acad. Sci. Proc., p. 13 (fig. 2). Named on correlation chart.

J. L. Rau and others, 1962, North Dakota Geol. Survey Bull. 36, pt. 1, p. 28—29. Consists chiefly of end moraine, dead-ice moraine, and outwash. Bordered on south by Burnstad drift and on west by Long Lake drift. Till 12 to 30 feet thick.

Lee Clayton, 1962, North Dakota Geol. Survey Bull. 37, p. 63. "Streeter drift" of Clayton (1961) and "Streeter Drift" of Rau and others (1962) included in Burnstad Drift.

J. P. Bluemle and others, 1967, North Dakota Geol. Survey Bull. 51, pt. 1, p. 11—14. Streeter drift (drift of Streeter Phase) covers about 30 percent of Wells County, almost entirely in southern part. Drift consists of till of the Streeter end moraine and the dead-ice moraine north of it as well as associated gravel of collapsed outwash and ice-contact ridges. Also includes deposits of lake sediments within dead-ice moraine. Streeter is oldest surface drift in Wells County. Upper Burnstad drift is probably only slightly older than Streeter drift.

Named for town of Streeter in southwest Stutsman County.

Stroubles Formation

Mississippian: Western Virginia.

B. N. Cooper, 1961, Geol. Soc. America Guidebook Cincinnati Mtg. p. 62, (also Virginia Polytech. Inst. Eng. Ext. Ser., Geol. Guidebook 1). Youngest bedrock formation on Saltville thrust block is body of red shale, siltstone and sandstone that has for many years been known as Maccrady formation. The red-bed sequence in Pulaski—New River area is at least 1,200 feet thick. Any overlying beds above highest red beds are overthrust Cambrian limestone and shales. Name Maccrady not applicable because red beds of Pulaski—Blacksburg area range up to beds of at least early Chester age. Overlies Price Formation.

B. N. Cooper, 1963, Geol. Soc. America Southeastern Sec. Guidebook Ann. Mtg., p. 22, (also Virginia Polytech. Inst. Eng. Ext. Ser., Geol. Guidebook 2), Thickness 1,590 feet along New River between Goodwins Ferry, Giles County, and Belspring, Pulaski County. Overlies Price Formation.

Type locality and derivation of name not given.

Stuart City Formation (Atascosa Group)

Lower Cretaceous: Southern Texas (subsurface).

J. A. Winter, 1961, Gulf Coast Assoc. Geol. Soc. Trans., v. 11, p. 15—23, 1962, *in* Contributions to the geology of south Texas: San Antonio, South Texas Geol. Soc., p. 93. Name proposed for rocks of Atascosa group (new) in Stuart City reef trend. No type well designated because data of wells that have penetrated the entire section are not available for study. Objections can be raised for this procedure of giving rocks of reef trend formational status without having any data for support. Writer [Winter] feels that, after having seen some confidential material, he is justified in his conclusion.

Stuart Fork Formation

Pre-Upper Jurassic: Northern California.

P. W. Lipman, Sept. 1962, Dissert. Abs., v. 23, no. 3, p. 994. In southeastern Trinity Alps, rocks of central metamorphic belt of Klamath Mountains were folded, metamorphosed, and intruded by ultramafic and granitic plutons in a short interval of Late Jurassic time. Metasedimentary rocks previously included in Abrams Formation of Hershey (1901) actually comprise two differing units separated by Salmon Formation. Quartzites and phyllites lying structurally below Salmon Formation are named Stuart Fork Formation. Unit structurally above the Salmon is named Grouse Ridge Formation.

G. A. Davis and P. W. Lipman, 1962, Geol. Soc. America Bull., v. 73, no. 12, p. 1547—1552. Revised structural sequence in southern Klamath Mountains. Dominant rock types of Stuart Mountain Formation are: phyllitic quartzites derived from rhythmically bedded cherts, and graphitic quartz-mica phyllites that were originally carbonaceous cherts and shales. In type area the Stuart Fork occupies core of isoclinal antiform (Stuart Fork antiform) which plunges southward at low angle; unit has elongate outcrop pattern, about 2 miles wide and 15 miles long, parallel to axial plane trace of fold. Along Coffee Creek to north, also in core of south-plunging isoclinal antiform, is narrow belt of rocks in which Abrams post office site is located. This belt is correlated with Stuart Fork formation on basis of similar rock types, including distinctive graphitic phyllites, and repetition of the same sequences of overlying units (*e. g.* Salmon, Grouse Ridge formations). Even though the Stuart Fork, Salmon, and Grouse Ridge units form constant structural sequence for at least 30 miles along central metamorphic belt, they may not define a true stratigraphic sequence. Not only is definite evidence lacking on their absolute or relative ages, but Stuart Fork may be separated from overlying rocks by major fault. Term Abrams abandoned. Salmon Formation retained as originally defined by Hershey.

W. P. Irwin, 1964, U. S. Geol. Survey Prof. Paper 501—C, p. C3. Discussion of late Mesozoic orogenies in ultramafic belts of northwestern California and southwestern Oregon. Central metamorphic belt is separated from eastern Paleozoic belt by ultramafic rocks. These rocks of central metamorphic belt are chiefly Salmon Hornblende Schist and Abrams Mica Schist of Hershey (1901). Some of rocks originally described by Hershey as part of Abrams Mica Schist are now excluded from central metamorphic belt. These are Stuart Fork Formation of Davis and Lipman (1962). They are exposed in windows in central metamorphic belt and are considered correlative with rocks of western Paleozoic and Triassic belt (Davis and Lipman, 1962).

G. A. Davis and others, 1965, Geol. Soc. America Bull. 76, no. 8, p. 933—966. Discussion of structure, metamorphism, and plutonism in south-central Klamath Mountains. Stuart Fork Formation is distinctive assemblage of interlayered micaceous quartzites and phyllites of metasedimentary origin with associated greenstones. These rocks comprise lowest unit of central metamorphic belt. Two areas of Stuart Fork rocks recognized in central metamorphic belt. Along Stuart Fork of Trinity River in Minersville quadrangle, Stuart Fork rocks from core of complex isoclinal antiform plunging southward. This fold extends northward into Coffee Creek quadrangle. Second area, also exposed in core of complex antiformal fold, is in northwestern Coffee Creek, northeastern Cecilville, and western Etna quadrangles. Lower contact of formation nowhere exposed. Upper contact with Salmon Hornblende Schist has been placed at narrow transition zone or abrupt break between fine-grained metavolcanic rocks and medium-grained hornblende schists. Higher metamorphism in overlying rocks implies that major discontinuity separates the two groups of mafic rocks, either a thrust or an overturned unconformity. Bedding locally preserved in Stuart Fork rocks, but predominant planar surface is metamorphic foliation which parallels axial planes of isoclinal folds. Over large areas folded bedding has been transposed and obliterated along axial plane foliation. All reported stratigraphic thicknesses of metasedimentary rocks now included within Stuart Fork Formation (Hershey, 1901; Hinds, 1933, California Jour. Mines and Geology, v. 29) are structural thicknesses measured normal to axial-plane foliation and are not stratigraphically meaningful. Pre-Upper Jurassic.

Named for exposures along Stuart Fork of Trinity River between Deep and Van Matre Creek tributaries, Klamath Mountains.

Stuyvesant Falls Formation (in Wappinger Group)

Lower Ordovician: Southeastern New York.

D. W. Fisher, 1961, New York State Geol. Assoc. Guidebook 33d Ann. Mtg., p. D9. A sequence of interbedded green fine-textured argillite containing graptolites *Tetragraptus* and *Didymographtus*. At least 400 feet thick at type locality. Overlies Germantown Formation (new); underlies Mount Merino shale of the Normanskill.

D. W. Fisher, 1962, New York State Mus. and Sci. Service Geol. Survey, Map and Chart Ser.: No. 3. Formal proposal of name. At type locality, herein designated, formation consists of at least 400 feet of green shales and green siltstones that underlie Mount Merino black shale and chert and overlie interbedded limestones and black shales of Germantown Formation. Taconic sequence.

Type locality: Along Kinderhook Creek at Stuyvesant Falls, Kinderhook quadrangle. Reference locality: Along Columbis County Route 22, 2.3 miles west of Ghent.

Sub Jordan Limestone Member (of Butterfield Formation)

See Butterfield Formation.

Sue Peaks Formation

Lower Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 12—33, pl. 1. Mostly buff nodular limestone, marl, and shale unit up to about 270 feet thick. Overlies Del Carmen Limestone (new). Underlies Santa Elena Limestone (new).

J. W. Dietrich, 1966, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 28 (with text). In Presidio area, complete sections of formation crop out only along Cibolo Creek south of the east-west fault. Parts of formation crop out along Alamito Creek and lower course of Cienega Creek in northwest Ocotillo quadrangle. Total thicknesses of 76 and 124 feet measured near Cibolo Canyon. Formation thickens southeastward to about 250 feet along Alamito Creek. In all outcrops in Ocotillo quadrangle, the ash-flow tuff member of Morita Ranch Formation overlies Santa Elena Limestone or Sue Peaks Formation.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 40-47, pls. Formal proposal of name. Term Sue Peaks used to designate the soft lithostratigraphic unit that forms a slope separating sheer escarpments formed by Del Carmen Limestone below from Santa Elena limestone above. The Sue Peaks slope is underlain by a soft rock unit normally about 250 feet thick. The lower 75 feet is mostly yellowish-gray and buff marly shale with a few beds of similarly colored thin marly nodular limestone. Above the 75-foot lower shale member is a ledge of massive gray limestone about 20 feet thick. Above the 20-foot ledge are thin gray nodular limestone beds and some yellowish-gray shale. The upper limestone member is terminated at the top by the massive cherty cliff-forming rudistid-bearing limestone of the Santa Elena.

Name is taken from Sue Peaks, highest elevation in the Sierra del Carmen, Big Bend National Park, Brewster County. Rocks crop out in eastern slope of Sue Peaks and other places in the Sierra del Carmen, Mariscal Mountain, Mesa de Anguila, and the Christmas Mountains.

Sugar Bowl Gravel (in Snake River Group)

Pleistocene, upper: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 10, p. 1199 (fig. 1), 1213—1214, pl. 1. At Sugar Bowl hill the gravel forms a 20-foot-thick cap 400 feet above Snake River. Gravel also preserved as gravel-capped knobs and benches elsewhere along this part of Snake River. These gravel deposits are remnants of graded terrace which is essentially parallel to present stream gradient (2 feet per mile) but 400 feet higher. Principal upstream remnants lie about 8 miles east of Glenns Ferry, northeast of Snake River, where they form dissected terrace that covers several square miles. On northern canyon wall 9 miles southeast of Glenns Ferry the Sugar Bowl Gravel lies on eroded Madson Basalt. Older than Thousand Springs Basalt (redefined).

Type locality: The Sugar Bowl, a hill 4 miles northeast of Glenns Ferry, Elmore County.

Sugar Creek Lentil (in Cockfield Formation)

Tertiary: North-central Louisiana.

C. O. Durham, 1964, Louisiana Geol. Survey Geol. Bull. 41, p. 18—26. A glauconite lentil in lower sand of the Cockfield Formation. Name credited to Jones (1962, unpub. thesis, pl. 3).

Type locality and derivation of name not given.

Sugar Loaf Conglomerate

Cambrian: Northern Michigan.

Kiril Spiroff, 1966, [Abs.] Lake Superior Geology Inst., 12th Ann. Mtg., May 6—7 (Michigan Technology. Univ., Sault Ste. Marie, Mich.), p. 25. Boulders making up the conglomerate are up to a foot in diameter and are of weathered granite and red shaly sandstone. They overlie a gray granite and grade into a red horizontal bedded sandstone believed to be of Cambrian age.

A few miles north of Sugar Loaf Peak on shores of Lake Superior is sec. 20, T. 49 N. R. 25 W., about 6 miles north of Marquette, Marquette County, Mich.

Sugarloaf Hill basalt

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 3, p. 380, 387. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Sugarloaf Hill basalt gave age of 9.5 ± .3 m.y. Sugarloaf Hill and Devils Mountain samples may be used to estimate minimum relief and elevation of range in this area during Pliocene.

Sample collected from Shaver Lake quadrangle, sec. 30, T. 9 S., R. 24 E., one-quarter mile N. 35 W. of Sugarloaf Hill.

Sullivan Peak Member (of Skinner Ranch Formation)

Lower Permian (Leonard): Western Texas.

G. A. Cooper and R. E. Grant, 1964, Am. Assoc. Petroleum Geologists Bull., v. 48, no. 9, p. 1583, 1584 (fig. 2), 1585—1586, 1587. Name given to King's (1931, Texas Univ. Bull. 3038) "First Limestone" member of the Leonard. Predominantly conglomerate and boulder beds but with some distinctive bioherms, thick sandstone lenses, and interbedded pinkish chert. Thickness 114 to 250 feet. Overlies Poplar Tank Member (new); locally overlies Decie Ranch Member (new). Underlies Cathedral Mountain Formation (new).

G. A. Cooper and R. E. Grant, 1966, U. S. Geol. Survey Bull. 1244—E, p. E4, pl. 2. Underlies Dugout Mountain Member (new).

Type section: In Hill 5300 above type section of Poplar Tank Member, central Lenox Hills, Altuda quadrangle, Brewster County.

Sulphur Flats Sandstone Member (of Miner Creek Formtaion)

Upper Cretaceous: South-central Montana.

A. E. Roberts, 1963, U. S. Geol. Survey Prof. Paper 475—B, p. B86—B92. A ridge-forming sandstone and tuff unit, 160 feet thick, at base of formation. Contains petrified wood, pollen, spores, and fragments of dinosaur bones.

Type section: Along Miner Creek near Sulphur Flats, in SE¼ sec. 19, T. 2 S., R. 9 E., Park County.

Sulphur Mountain Quartz Diorite

Pre-Jurassic (possibly Upper Permian to Lower Triassic): Northwestern Washington.

A. R. Grant, 1966, Dissert Abs., v. 27, no. 6, sec. B, p. 1981. In Dome Peak area, original geosynclinal sedimentary and volcanic rocks were deposited crystalline basement rocks (Yellow Aster Complex) of pre-Devonian age. The Sulphur Mountain Quartz Diorite intruded the eugeosynclinal sedimentary and volcanic rocks. This pluton is thought to be pre-Cascade metamorphism in age; however, an early Cascade cycle cannot be ruled out.

Dome Peak area is on western flank of Northern Cascades in Chelan, Skagit, and Snohomish Counties.

Sulphur River alluvial terrace

See Sulphur River Formation.

Sulphur River Formation

Pleistocene: Texas.

B. H. Slaughter and B. R. Reed, 1963, Jour. Graduate Research Center, v. 31, no. 3, p. 132—148. Sulphur River Alluvial Terrace, as described by Frye and Leonard (1963, Texas Univ. Bur. Econ. Geology Rept. Inv. 49) was found to consist of two not three units. Lowermost unit is herein named Sulphur River Formation. Age is from 12,000 to 9,000 years B. P. or Late Wisconsin on basis of fossils and radiocarbon dates.

Type locality: At Highway 38 bridge on North Sulphur River immediately north of town of Ben Franklin, Delta County.

Sumas Stade, Drift

Pleistocene: British Columbia, Canada, and northwestern Washington.

J. D. Easterbrook, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1469 (table 1), 1478, pl. 3. Drift consists of till, ice-contact deposits of poorly sorted gravel, and stratified gravel containing lenses of till. Till extends only a few miles south of Canadian boundary and in map area is not in observable contact with older Bellingham glaciomarine drift (new). From stratigraphic relationships in Washington it is not possible to demonstrate continuous transition from Bellingham glaciomarine conditions to deposition of Sumas till and Abbotsford outwash.

J. E. Armstrong and others, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 321—329. Six geologic-climate units proposed for late Pleistocene sequence in southwestern British Columbia and northwestern Washington. They include Olympia Interglaciation and Fraser Glaciation, and four subdivisions of the latter—Evans Creek, Vashon, and Sumas Stades, and Everson Interstade. During final stages of emergence in Fraser Lowland, a valley glacier occupied eastern part of lowland and deposited drift. Climatic episode represented by these deposits is named Sumas Stade. In area covering 250 square miles Sumas Drift overlies glaciomarine deposits of Everson age. Radiocarbon dates from wood in Sumas till suggest that advance of Sumas ice began about 11,000 years B. P.

Name of stade derived from town of Sumas on United States—Canada border in eastern part of Fraser lowland. A 150-foot section of Sumas Drift is designated the type section and consists of advance outwash overlain by till, and is exposed in a gravel pit a few hundred yards west of the town on Canadian side of border. Northwest of town recessional outwash rests on Sumas till.

Sumas Mountain Serpentinite

Jurassic—Cretaceous: Northwestern Washington.

W. S. Moen, 1962, Washington Div. Mines and Geology Bull. 50, p. 9 (table 1), 42—49, pl. 1. Serpentinite and saxonite. Contains chromite stringers. Intruded into rocks of Chilliwack Group (upper Paleozoic). Unconformable contact with Chuckanut Formation.

Main mass of serpentinite underlies area of about 4 square miles on northwestern part of Sumas Mountain, Van Zandt quadrangle, Whatcom County.

Summit Creek Trondhjemitic Gneiss

Age not stated: Northern Washington.

F. J. Menzer, Jr., 1965, Dissert. Abs., v. 25, no. 12, pt. 1, p. 7205. Most of rocks in thesis area were formed under conditions of regional metamorphism and plutonism. In the Salmon Creek Schists and Gneisses and in the Summit Creek Trondhjemitic Gneiss regional metamorphism reached sillimanite zone conditions. Summit Creek unit was at least partially derived from supracrustal rocks and believed to have been much more intensively granitized than Salmon Creek unit.

In Okanogan Range, in western part of Cordilleran geosyncline, immediately west of Okanogan.

Summit Lake Glaciation

Pleistocene: Alaska.

T. L. Péwé and others, 1953, U. S. Geol. Survey Circ. 289, p. 13 (table 1). Term Summit Lake listed on table entitled "Tentative correlation of glacial sequences in Alaska." Big Delta area.

H. W. Coulter and others, 1965, U. S. Geol. Survey Misc. Geol. Inv. Map I—415. listed with glaciations of late Pleistocene.

Summit Lake is near Isabell Pass in northeastern part of Alaska Range.

Sunbeam Formation

Pleistocene, middle and upper: Southeastern Idaho.

W. J. Carr and D. E. Trimble, 1963, U. S. Geol. Survey Bull. 1121—G, p. G26—G27, pl. 1. Alluvial and colluvial deposits of silt and minor interstratified sand and gravel in southeastern part of American Falls quadrangle; mainly below altitude of about 4,750 feet and above American Falls lake beds and younger deposits. Separated from younger deposits by marginal scarp at elevation of about 4,430 feet. Thickness at least 100 feet.

Type area: Series of cuts along Michaud Flats irrigation canal east of American Falls in secs. 22, 23, 24, 27, and 28, T. 7 S., R. 31 E. Named for distribution adjacent to Sunbeam Creek, American Falls quadrangle.

Sunday Canyon Formation

Silurian: Eastern California.

D. C. Ross, 1963, U. S. Geol. Survey Prof. Paper 475—B, p. B75 (fig. 21.1), B83—B84. Contains mixed sequence of calcareous siltstone, calcareous shale, and argillaceous limestone. Typically thin bedded; shaly to flaggy fragments make diagnostic weathered slopes. Graptotites present. Thickness 683 feet at type section. Grades laterally into Vaughn Gulch Limestone (new). Conformably overlies Ely Springs Dolomite; contact poorly exposed. Unconformably underlies Perdido Formation. Decided color break generally separates light-gray to yellowish calcareous shale here assigned to Silurian from dark-gray red-weathering noncalcareous shale assigned to Mississippian Perdido Formation. Upper contact of Sunday Canyon placed at break between calcareous and noncalcareous shales.

Type section: Along Bonanza Gulch, the first east-trending tributary to Mazourka Canyon, north of Water Canyon, Independence quadrangle, Inyo County. Base of section is 9,000 feet N. 58° E. from NE cor. sec. 25, T. 12 S., R. 35 E. Location of section by California grid, zone 4: base of section, 2,272,200; 570,500; top of section, 2,272,100; 570,000.

Sunfish Formation

Upper Devonian: Northern Pennsylvania.

D. L. Woodrow, 1965, Dissert. Abs., v. 26, no. 6, p. 3253. Overlies Towanda Formation.

Area of report is Bradford County.

Sunflower Formation

Permian: Northern Nevada.

K. O. Bushnell, 1965, Dissert. Abs., v. 26, no. 4, p. 2132. a fossiliferous formation that unconformably overlies Lower Cambrian (?) quartzite and undatable calcareous and argillaceous formations. Upper Pennsylvanian and Lower Permian (?).

J. O. Coash, 1067, Nevada Bur. Mines Bull. 68, p. 5 (table 1), 7—12, pl. 1. Formal proposal of name. Divided into three members: lower conglomerate, 100 to 1,910 feet; middle limestone, 296+ to 530 feet; and upper sandstone, 1,460 to 2,000 feet. Overlies Tennessee Mountain Formation (new). Underlines Hammond Canyon Formation (new). Permian.

Named for Sunflower Reservoir which lies at southern extremity of Sunflower Flat, a large open basin in southwestern corner of Rowland quadrangle, Elko County. Well exposed in line of hills extending eastward from Jenkins Peaks, in the southeastern corner of Mountain City quadrangle, along southern border of Rowland quadrangle. Beds dip steeply and are commonly overturned.

Sunny Hills Formation

See Lakewood Formation.

Sunnyside Tar Sands (in Green River Formation)

Eocene: Southeastern Utah.

E. E. Murany, 1964, Intermountain Assoc. Petroleum Geologists Guidebook, 13th Ann. Field Conf., p. 146, 147 (fig. 1). Name applied to large deposit of bituminous sand in what has been called Wasatch Formation because of existence of red beds in exposed sections. Examination of sequence revealed presence of ostracodal-oolitic limestones which are characteristic of lower black shale facies of Green River Formation. Hence all limestones at outcrop at Sunnyside locality are herein included in the Green River. This places Green River boundary lower in the section than that shown by Holmes and others (1948, U. S. Geol. Survey Oil and Gas Inv. Prelim. Map 86).

Exposed in Book Cliffs, north of Sunnyside, Carbon County, Utah.

Sunset Ash

Recent: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 29,36. Sunset Ash mentioned in discussion of lava flows and cinder cones of San Francisco Mountain volcanic field. Sunset Ash has hardly begun to weather.

Area of Sunset Crater.

Sunset Buttes Flows, Basalts

Pliocene, upper(?) or Pleistocene, lower(?): Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 97, 113. Discussion of geomorphology and age of volcanic rocks in northeastern Arizona. Cinder cones on the Sunset Buttes are partly dissected, but their general shapes are still outlined. In contrast, cinder cones associated with lavas of middle Pliocene age in Hopi Buttes volcanic field to northeast have been completely removed. This suggests that flows in Sunset Buttes area are younger than middle Pliocene because both areas have been subjected to similar erosional conditions. Time of eruption of Sunset Buttes flows and cones, based upon geomorphic evidence, is probably late Pliocene or possibly earliest Pleistocene.

Sunset Buttes area, Coconino County.

Sunset Crater Flow, Basalt

Recent: Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, v. 5, p. 104 (fig. 8.4). Discussion of geomorphology and age of volcanic rocks in northeastern Arizona. Sunset Crater flows listed on chart showing correlation of volcanic flows in San Francisco volcanic field.

Sunset Crater is in Coconino County.

Sunshine Flow

Quaternary: Southern California.

T. W. Dibblee, Jr., 1966, U. S. Geol. Survey Misc. Geol. Inv. Map I—472. Mapped in Lavic quadrangle. Consists of basalt lava and basalt pumice. Basalt forms several flows that may total 100 feet, thinning outward to margins. Unconformable on Tertiary and Mesozoic rocks. Presumably Pleistocene.

Basalt lava erupted from at least three small craters northeast of Sunshine Peak, Lavic quadrangle, San Bernardino County.

Sunshine Formation

Cretaceous(?): Southern Arizona.

J. A. Thoms, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. Rocks of Mesozoic age in area include porphyritic granodiorite and diorite of pre-Cretaceous(?) age, more than 10,000 feet of volcanic and sedimentary rocks of Cretaceous(?) age, and a complex stock of leucogranite of Late Cretaceous age. Four formations comprise the Cretaceous(?) sequence: Sunshine formation, Ox Frame Volcanics, Tascuela red beds (new), and Stevens Mountain rhyolite (new). Sunshine formation consists of 700 feet of interbedded pyroclastic and clastic rocks and unconformably overlies Paleozoic rocks. Oldest Cretaceous(?) unit.

Present in Tascuela area, which comprises about 25 square miles on the west side of Sierrita Mountains in Palo Alto Ranch and Twin Buttes quadrangles, Pima County.

Superior dacite ash flow

Miocene: Southeastern Arizona.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 72 (table 2), 73 (table 2). Listed in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Ages 19.9+0.9 m.y. and 19.4 m.y.

Abandoned tunnel, east of Superior on Highway 60-70, Globe-Miami district, Pinal County.

Superior Till

Pleistocene: Central Minnesota.

A. F. Schneider, 1961, Minnesota Geol. Survey Bull. 40, p. 38, 40, 45, 47, 53—54. Name applied to red sandy till of Patrician drift of Leverett (1932); brown sandy till termed Pierz till. Overlies Wadena till.

Surrett Canyon Formation (in White Knob Group)

Mississippian: Central Idaho.

O. K. Huh, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 34, 44—45. Term White Knob raised to group status to include four newly named formations (ascending): Midddle Canyon, Scott Peak, South Creek, and Surrett Canyon. The Surrett Canyon consists of thick massive beds of very dark, fossiliferous, mixed crystalline limestone. Thickness 220 feet at type section. Thickest in Lost River Range, reaching 600 feet at Upper Pahsimeroi. Underlies unnamed light-colored Pennsylvanian quartzites and limestones. Both upper and lower contacts sharp and easily observed in field.

Type section: East Canyon, southern Lemhi Range, near town of Howe. Named for exposures in high wall of Surrett Canyon, in eastern flank of Lemhi Range.

Survant Coal Member (of Linton Formation)

Pennsylvanian: Indiana.

A. M. Burger and others, 1966, Indiana Geol. Survey Guidebook 12, p. 4 (fig. 2). Shown on columnar section of outcropping rocks in field trip area. Present at top of Linton. Name credited to C. E. Wier (rept. in preparation).

Type locality and derivation of name not stated.

†Survey Butte Member (of Piapi Canyon Formation)

†Survey Butte Member (of Oak Spring Formation)

Pliocene, lower, or younger: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—96— D—103. Member of Oak Spring formation. Predominantly pale-gray and brown well-bedded tuff composed chiefly of glass shards and fine and coarse unaltered pumice; generally poorly cemented and friable; beds are tabular and lenticular; some cross beds and channel fillings. Thickness 60 to 750 feet. Thins southward from Rainier Mesa and interfingers with Stockade Wash, Topopah Spring, and Tiva Canyon members (all new). Overlies Grouse Canyon member (new).

F. G. Poole and F. A. McKeown, 1962, U. S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Reallocated to member status in Piapi Canyon Formation (new). Underlies Stockade Wash Member; overlies Grouse Canyon Member of Indian Trail Formation (new). Oak Spring Formation raised to rank of group.

P. P. Orkild, 1965, U. S. Geol. Survey Bull. 1224—A, p. A49. Name abandoned. Rocks in this stratigraphic interval designated bedded tuff in Paintbrush Tuff (new).

Type locality: Survey Butte, Nye County. Thickest on east side of Rainier Mesa; extends from there southward to Tippipah Point, northward about 15 miles, westward to Pahute Mesa, and eastward to Quartzite Mountain.

Susan Duster Limestone Member (of Pioche Shale)

Middle Cambrian: Southeastern Nevada.

C. W. Merriam A. R. Palmer, 1964, U. S. Geol. Survey Prof. Paper 469, p. 22, pls. 1, 4. Name applied to important marker, lying 80 to 100 feet above Combined Metals Member and separated from it by C-shale member. Well-bedded medium- to medium - light-gray limestone with some argillaceous partings. Thickness 5 to 20 feet. Underlies B-shale member.

Named for Susan Duster mine near Pioche Divide on Prince mine road, Pioche mining district, Ely Range. Also present in Highland Range. Well exposed 1,500 to 2,000 feet northeast of summit of Mount Ely in vicinity of West End mine.

Suslota Diorite

Tertiary(?): South-central Alaska.

D. H. Richter, 1966, Alaska Div. Mines and Minerals Geol. Rept. 21, p. 25—26, fig. 2. A large mass of diorite or quartz diorite. Rock is medium grained with subhedral-granular texture and consists principally of saussuritized plagioclase, chloritized hornblende, and quartz.

Exposed on northwest flank of Suslota Mountain, Slana district. Intrusive is over 3 miles long and averages a little less than one-fourth mile wide. Eastern Alaska Range.

Sutter Buttes Vent Tuff

Sutter Buttes Rhyolite Tuff

Pliocene and (or) Quaternary: Northeastern California.

J. L. Burnett and C. W. Jennings, 1962, Geologic map of California, Chico Sheet (1:250,000): California Div. Mines. Sutter Buttes vent tuff is younger than Sutter Formation.

J. N. Faick, 1963, Econ. Geology, v. 58, no. 5, p. 711. Sutter Buttes rhyolitic tuff or peripheral tuff listed in report on technology of natural pozzolans.

Sutter Buttes are in Sutter County, northwest of Marysville.

Swanback Formation (in Dockendorff Group)

Lower Devonian: Northeastern Maine.

A. J. Boucot and others, 1964, Maine Geol. Survey Quad. Mapping Ser. No. 2, p. 16 (table 4), 58—60, pl. 1. Consists of about 75 percent argillite, with minor amounts of interbedded fine-grained quartzite, and about 25 percent of shale. Thickness about 10,000 feet. Occupies southern part of Chapman syncline, cropping out in roughly two-thirds of basin bordered by Hedgehog formation. Considered to be facies of lower part of Chapman sandstone. Name credited to Fletcher (1960, unpub. thesis).

Louis Pavlides and others, 1964, U. S. Geol. Survey Prof. Paper 501—C, p. C33. Outline of stratigraphic and tectonic features of northeastern Maine. At north end of Chapman syncline is Edmunds Hill Andesite that to south interfingers with Chapman Sandstone, which in turn grades southward into Swanback Formation. Brachiopod faunas that occur in Hedgehog Formation, Chapman Sandstone, and Swanback Formation are of late Gedinnian age (Lower Devonian).

Named for Swanback Clearing, a locality in southeast part of Presque Isle quadrangle.

Swan Creek sandstone (in Cotter Formation)

Ordovician: Southwestern Missouri.

J. A. Martin, R. D. Knight, and W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources [Rept.], v. 40, 2d ser., p. 21 (fig. 4), 23. An informal name applied to a 15- to 20-foot thick sandstone in the Cotter in the Springfield area. Discontinuous and often confused with other sandstone beds at different stratigraphic positions in the Cotter.

In Springfield area.

Swanzey Gneiss

Age uncertain: West-central Massachusetts and southern New Hampshire.

Peter Robinson, 1967, Massachusetts Univ. Conf. on Econ. Eology in Massachusetts, Proc., p. 30. Progress report on bedrock geologic mapping.

Coarse-grained gneisses and related rocks below Ammonoosuc Volcanics and Partridge Formation are: Pelham Gneiss, Monson Gneiss, Pauchaug Gneiss (new), Swanzey Gneiss, and Glastonbury Gneiss. Swanzey is similar to Pauchaug but with some zones resembling Monson Gneiss. Age uncertain. As working hypothesis author suggests that at least a part of the rocks exposed below Middle Ordovician in west-central Massachusetts are Precambrian basement. If this hypothesis proves to be correct, then area must have been land during much of Cambrian and Early Ordovician time and may have been source area for sediments os this age deposited farther west.

Exposed in Keene Dome extending into New Hampshire. Keene dome is in Bronson Hill anticline, a complex zone of gneiss domes and recumbent folds, that lies near center of Appalachian tectonic belt of New England. Generalized axis of anticline in Massachusetts runs 3 to 5 miles east of Triassic border fault. The en echelon series of gneiss domes in the anticline are interrupted by the cross-cutting Belchertown Intrusive Complex.

Sweetheart Mountain Member (of Collinsville Formation)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 22, 27—28, pl. 1. Upper member of formation in Collinsville quadrangle. Homogeneous unit composed of medium- to coarse-grained muscovite-biotite-plagioclase-quartz schist. Schist is nonrusty weathering and contains quartz plagioclase stringers and clots that tend to form irregular porphyroblastic masses. Overlies Bristol Member; underlies Hartland Group.

Type locality: Sweetheart Mountain, Collinsville quadrangle. Crops out in type locality of Collinsville Formation.

Sweetwater Lentil (in Edwards Formation)

Lower Cretaceous: Southern Texas.

W. L. Fisher and P. U. Rodda, 1967, Kansas Geol. Survey Spec. Distrib. Pub. 34, p. 56. Incidental mention of Whitehorse lentil, Moffat lentil (new), and Sweetwater lentil in discussion of stratigraphy and genesis of dolomite of Edwards Formation. These are oolitic shoal units locally developed along northern margin of Comanche platform, possibly along and at heads of local embayments of the platform in areas of relatively high tidal velocities.

Sweetwater Creek interbed (in Columbia River Basalt)

Cenozoic, middle: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 24—26, fig. 18. In "Upper" Basalt of Columbia River Basalt [Group]. Underlies 250 feet of basalt and detritus which consists of (ascending) two undifferentiated flows of "Upper" Basalt, the Lawyer Creek Interbed, and Lolo Creek Flow (both new). Stratigraphically above Pine Creek Interbeds (new).

Named for expression in form of an esplanade about 200 feet beneath plateau surface throughout most of canyons of Sweetwater Creek and its tributaries, Nez Perce County.

Switzers Mesa Lava Flow

Pliocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p. 15, 5, 7. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flows occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Switzers Mesa flow listed as an example of a stage I flow in which the edge of the flow has been eroded back so far that the original extension of the flow is obliterated. Also the surface of the flow is so deeply eroded that not only have all traces of the lava tops been removed, but also most of the vesicular upper portion.

H. S. Colton, 1967, Basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 2, 6, 15, 53. Anderson Mesa lava flow, a stage I flow, has K-Ar date of 6.2±1.2 m.y. (Pliocene).

Forms a low escarpment north of Highway 66 and the Santa Fe Railroad, just east of Flagstaff. In the western edge of the Little Colorado River valley, stage I lava flows form rim rock of cliffs of Moenkopi Formation.

Sylvania Adamellite

[Mesozoic]: Southwestern Nevada.

J. H. Schilling, 1965, Nevada Bur. Mines Rept. 10, p. 35. Mentioned in report on isotopic age determinations of Nevada rocks. Age 153 m.y. (±5 m.y.). Name credited to McKee (1962, unpub. thesis). Also called "Uncle Sam" quartz monzonite by Schilling (1962, unpub. thesis).

Location: NW¼ sec. 34, T. 5 S., R. 38 E., Esmeralda County, along Palmetto Wash, just south of State Highway 3. Believed to be part of Inyo batholith. Intrusive body forms core of Sylvania Mountains.

Table Butte Tuff Member (of Leach Canyon Formation)

Miocene: Southwestern Utah and southeastern Nevada.

P. L. Williams, 1967, Dissert. Abs., v. 28, no. 5, sec. B, p. 2003. Moderately welded and contains from 15 to 20 percent lithic fragments. Also made up of 1 to 3 ignimbrites. Contains phenocrysts of plagioclase, quartz, sanidine, and minor biotite. Overlies Narrows Tuff Member (new).

Southwestern Utah and southeastern Nevada.

Table Mountain Latite Member (of Stanislaus Formation)

Pliocene, lower: Central eastern California.

D. B. Slemmons, 1966, California Div. Mines and Geology Bull. 190, p. 199—208. Lowermost member member of Stanislaus. Consists mostly of olivine-augite latite flows including the type locality for latites. Ransome (1898, U. S. Geol. Survey Bull. 89) referred to the "Table Mountain facies" of the latites, and to the "Table Mountain flow". This member is accordingly named for "Tuolume Table Mountain" where it is almost 200 feet thick. The Table Mountain Member has been traced from its type locality at Table Mountain almost continuously (Ransome, 1898;

Slemmons, 1953, unpub. thesis) to its source area near Sonora Pass, where at Sonora Peak and Leavitt Peak there are as many as 40 flows of this same type of latite lava comprising a thickness of 1,500 feet. Member extends eastward from near Knights Ferry, where it emerges from beneath younger volcanics and sediments that mantle the Great Valley. Attains maximum width near Sonora Pass in source area and fans out east of summit area. Conformably underlies Eureka Valley Member (new). Overlies Relief Peak Formation (new). Date for Table Mountain Member is 9 m.y.

Type locality: At Table Mountain, half a mile west of Shaws Flat in Columbia (1:24,000) quadrangle, Tuolumne County.

Table Rock facies (of Ericson Formation)

Upper Cretaceous: Southwestern Wyoming (subsurface).

W. B. Douglass, Jr., and T. R. Blazzard, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 84, 85 (fig. 4). Name applied to lowland facies of formation. Term Ericson Ranch applied to inland facies of formation.

Type section: Interval from 7,004 feet to 8,180 feet in The Texas Co. Table Rock No. 5 Unit in sec. 2, T. 18 N., R. 98 W., Sweetwater County.

Tachilni Formation

Tertiary, upper: Alaska.

H. H. Waldron, 1961, U. S. Geol. Survey Bull. 1028—T, p. 686—687, pl. 79. Sequence of poorly consolidated predominantly marine sedimentary rocks. Thickness about 200 feet at type locality where beds dip northward and are uncomformably overlain by lava flows. Believed to be younger than Belkofski tuff but contact not observed. Presumably overlying rocks are part of Morzhovoi Volcanics (new) but true relation between the two formations not known.

Type locality: Cape Tachilni, Frosty Peak area on western end of Alaska Peninsula, between Cold Bay on east and Morzhovoi Bay on west. Crops out discontinuously along Pacific Coast from west side of Thinpoint Cove at least as far west as Cape Tachilni.

Tacket Formation (in Pleasanton Group)

Pennsylvanian (Missourian): Eastern Kansas.

J. M. Jewett and others, 1964, Geologic map of Kansas (1:500,000): Kansas Geol. Survey. Named on map legend.

C. R. Singler, 1965, The Compass, v. 42, no. 2, p. 63—72. Includes beds between top of Checkerboard Limestone and base of Hertha Limestone. Divided into three unnamed members (ascending): Lower Shale, Middle Limestone, and Upper Shale. Thickness 20 to 55 feet. Corresponds to the "Upper Formation" and the "Unnamed Shale of the Middle Formation" of the Missouri classification. Name credited to P. A. Emery (unpub. thesis). Seemingly equivalent to part of Coffeyville Formation of Oklahoma.

J. M. Jewett, P. A. Emery, and D. A. Hatcher, 1965, Kansas Geol. Survey Bull. 175, pt. 4, p. 1—11, pl. 1 Formal proposal of name. Uppermost formation in Pleasanton Group. In northern part of Pleasanton outcrop belt, Checkerboard Limestone is absent and Tacket is in direct contact with Seminole Formation. In extreme southern Kansas where Hertha

Limestone is absent or recognized only with difficulty, upper boundary of Tacket is defined as occurring at top of zone of black platy shale that locally underlies zone of impure limestone concretions or very thin ledge of fossiliferous limestone recognized as southern continuation of Hertha Limestone. Thickness 15 to 60 feet or more in Kansas. Comprised chiefly of shale a large part of which is carbonaceous and very dark gray or black. Limestone, known as Bourbon flags, and sandstone, called Knobtown, are regarded as facies of Tacket. Type exposure and derivation of name given.

Type exposure: In S sec. 7, and along west side of sec. 17, T. 32 S., R. 19 E., Labette County. Name derived from Tacket Mound, Parsons quadrangle, Labette County.

Tahoe City olivine latite member (of Lousetown Formation)

Pleistocene, lower: Northeastern California.

P. W. Birkeland, 1963, Geol. Soc. America Bull., v. 74, no. 12, p. 1453—1464. Overlies Fir Crags gravel. Basal flow of Tahoe City olivine latites in northeast wall of Upper Truckee Canyon is oldest flow along the canyon as it gives potassium-argon age of 1.9 m.y. Several younger flows overlie dated flow, and their age is not known. Big Chief basalt (new) is probably younger than this dated flow, but is older than Tahoe City flow, cropping out in southwest wall of the canyon. At least 20 flows (or groups of flows) recognized in area. Nine flows (or groups of flows) are named and given informal member status in Lousetown Formation.

Named for occurrence in vicinity of Tahoe City, Truckee area, north of Lake Tahoe.

Taine Mountain Formation

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 17—22, pl. 1. Three members recognized: Wildcat, Scranton Mountain, and Whigville (all new). Formation crops out only in northern part of Bristol dome, where the lower two members are principally confined to Collinsville quadrangle [this report]. Whigville Member is mostly restricted to Bristol quadrangle. Underlies Collinsville Formation.

Type locality: Exposures along Tunxis Trail on southwestern end of Taine Mountain east of Washington Turnpike, Collinsville quadrangle. Also well exposed on eastern side of Wildcat Mountain, Scranton Mountain, Two Buck Ring, and eastern side of Barnes Hill. Whigville Member, Scranton Mountain Member, and upper part of Wildcat Member form a topographic rim surrounding a central basin.

Talisay Member (of Alifan Formation)

Miocene, upper, and Pliocene: Mariana Islands (Guam).

J. I. Tracey, Jr., 1964, U. S. Geol. Survey Prof. Paper 403—A, p. A15 (table), A31—A32 pls. 1, 2. Yellowish-brown or mottled red and green clayey conglomerate in plastic clayey matrix; gray clayey marl containing abundant coral and molluscan skeleton or molds; and dark-gray clayey volcanic detritus or sand with carbonaceous inclusions and thin interbedded peat or lignite. Maximum thickness 30 feet. Basal unit of formation. At type locality is faulted against Alutom formation by small fault within the outcrop, and Alutom probably underlies Talisay a few feet beneath the cut.

Type locality: Excavation behind loading ramp of Naval Ammunition Depot, one-half mile southeast of entrance to Depot, island of Guam.

Tamarack Leuco-adamellite

Jurassic-Cretaceous: Eastern California.

R. B. Parker, 1961, Geol. Soc. America Bull., v. 72, no. 12, pl. 1 facing p. 1789. Named on map legend of western half of Markleeville quadrangle.

J. B. Koenig, 1963, Geologic map of California, Walker Lake sheet (1:250,000): California Div. Mines. Jurassic-Cretaceous. Name credited to Parker (unpub. thesis).

Mapped in vicinity of Tamarack Lake, Alpine County.

Tamarack Canyon Dolomite

Upper Cambrian: Eastern California.

D. C. Ross, 1963, U. S. Geol. Survey Prof. Paper 475—B, p. B75 (fig. 21.1), B77—B78. Dominantly laminated to thick-bedded very light gray to medium-gray dolomite that weathers normally to monotonous dull-gray surface. Thickness 910 feet at type section. Overlies Lead Gulch Formation (new); contact taken as base of dolomite above highest limestone of Lead Gulch; contact may be interfingering. Underlies Al Rose Formation (new). No fossils. Could be Late Cambrian or Early Ordovician or both. Tentatively assigned Late Cambrian age.

Type section: Along bottom of subsidiary canyon of Mazourka Canyon, about 5,700 feet N. 59° E., of SE cor. sec. 36, T. 11 S., R. 35 E., Inyo County. Named for exposures near mouth of Tamatack Canyon. Distribution parallels that of Lead Gulch Formation.

Tamarisk Member (of Rustler Formation)

Permian: Southeastern New Mexico.

J. D. Vine, 1963, U. S. Geol. Survey Bull. 1141—B, p. B6, B9, B11, B14—B16, pl. 1. Consists of about 115 feet of massive gypsum in exposures but is chiefly anhydrite and, locally, gypsum in subsurface, except for bed, 5 feet thick, of siltstone about 20 feet above base. Overlies Culebra dolomite member; underlies Magenta member.

Forms broad expanse of barren outcrop, 2 to 3 miles wide and about 7 miles long, east of Tamarisk Flat, Nash Draw.

Tanglewood Limestone Member (of Lexington Limestone)

Middle and Upper Ordovician: South-central Kentucky.

D. F. B. Black, E. R. Cressman, and W. C. MacQuown, Jr., 1965, U. S. Geol. Survey Bull. 1224—C, p. C21—C23. Name given to extensive irregularly shaped body of bioclastic calcarenite which in Central Blue Grass Region makes up much of upper half of Lexington Limestone. In type section divided into two parts by Devils Hollow Member. Several miles to south where Devils Hollow Member is absent, the Tanglewood extends uninterrupted from Brannon Member to Clays Ferry Formation. Thickness about 61 feet.

The U. S. Geological Survey currently designates the age of the Tanglewood Limestone Member of the Lexington as Middle and Upper Ordovician on the basis of a study now in progress.

Type section: In roadcuts along Interstate Highway 64 on west side of Kentucky River, Frankfort West quadrangle, Franklin County. Base of section at 1,816,000 feet E., 240,000 feet N.; top of section at 1,813,900 feet E., 240,000 feet N. (Kentucky coordinate system, north zone).

Tanners Creek Formation (in Richmond Group)

Upper Ordovician: Southeastern Indiana.

W. T. Fox, 1962, Geol. Soc. America Bull., v. 73, no. 5, p. 626–628. Defined as the alternating thin-bedded fossiliferous limestones and calcareous shales between top of rubbly limestone of Mount Auburn Formation and base of massive argillaceous Whitewater Formation. Name is proposed for strata previously included in Arnheim, Waynesville, and Liberty formations in lower part of Richmond Group. These three formations were originally defined as faunal zones and are indistinguishable from one another. Consists of thin layers of fossiliferous and barren limestone alternating with layers of calcareous shale. Thickness 210 feet at type section.

G. D. Brown, Jr., and J. A. Lineback, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 5, p. 1020. Rocks assigned by Tanner (1962) are herein included at top of Dillsboro Formation (new) because present writers were unable to find a lithostratigraphic boundary regionally corresponding to base of Tanners Creek.

Type section: Exposed in seven railroad cuts on New York Central Railroad along west fork of Tanners Creek between Harmons Station and Guilford, Dearborn County.

Tanya Stade

Tanya Substage

Holocene: Southern Alaska.

S. C. Porter, 1964, Am. Jour. Sci., v. 262, no. 4, p. 458. Tanya substage of Naptowne glaciation, mentioned in discussion of late Pleistocene glacial chronology of north-central Brooks Range.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, in The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1), 361, Naptowne Glaciation includes (ascending) Moosehorn, Killey, Skilak, and Tanya Stades. The last readvance during the Tanya Stade of the Naptowne Glaciation is thought by Karlstrom to have taken place about 6,000 years ago.

Karlstrom (1960, 1964) used term Tanya advance. However, terms advance and readvance are not accepted as part of formal stratigraphic nomenclature.

Named from Tanya Lake, which lies within a belt of moraines deposited by the Tustumena Lake ice lobe of Naptowne age, Cook Inlet region.

Tapicitos Member (of San Jose Formation)

Eocene, lower: Northwestern New Mexico.

E. H. Baltz, 1963, Dissert. Abs., v. 23, no. 7, p. 2490. San Jose formation consists of mappable facies named Cuba Mesa, Regina, Llaves, and Tapicitos members.

E. H. Baltz, 1967, U. S. Geol. Survey Prof. Paper 552, p. 52—54, pls. Formal proposal of name. Composed of maroon and variegated shale and intercalated lenticular sandstone that along with stratigraphically equivalent beds of upper part of Llaves Member (new) is youngest unit of the San Jose. Thickest preserved part of member is about 500 feet. Tapicitos as herein defined is equivalent to most of Largo facies of Simpson (1948, Am. Jour. Sci., v. 246).

Type section: Exposures along State Highway 95 east of upper Gavilan Creek in secs. 1, 2, and 11, T. 25 N., R. 2 W. Named for exposures in upper drainage of Tapicitos Creek near Tapicitos Post Office.

Tarratine Formation (in Moose River Group)

Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U. S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 165—169, pl. 34. Consists chiefly of interbedded dark sandstone, siltstone, and slate but contains Misery quartzite member (new) near top in part of mapped area and a sandy limestone unit, McKenny Ponds limestone member (new), locally at base. Thickness as much as 10,000 feet. Southeast and northwest of trough of Moose River synclinorium the Tarratine thins rapidly and intergrades with Seboomook formation. Southwest of Spencer Lake and northeast from Big Duck Cove, the formation also diminishes rapidly. Underlies Tomhegan formation (new); also overlies part of Seboomook. Oriskany age.

D. W. Rankin, 1965, U. S. Geol. Survey Bull. 1194—F, p. F9, Matagamon sandstone is considered to be a sandstone lens similar to the Tarrantine Formation.

Type section: Along right-of-way of Canadian Pacific Railroad between Tarratine on west side of Misery Ridge and Somerset Junction on east side of the ridge (Brassau Lake quadrangle). Named for Tarratine railroad stop.

Tascuela Red Beds

Cretaceous (?): Southern Arizona.

J. A. Thoms, 1967, Dissert. Abs., v. 27, no. 7, sec. B, p. 2420—2421. Four formations comprise the Cretaceous (?) sequence in the area: Sunshine formation (new), Ox Frame volcanics, Tascuela red beds, and Stevens Mountain rhyolite (new). Tascuela red beds are 2,000 feet thick.

Present in Tascuela area, which comprises about 25 square miles on the west side of Sierrita Mountains in Palo Alto Ranch and Twin Buttes quadrangles, Pima County.

†Tater Top Group

Early Paleozoic: Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 130, geol. map. Subaerially deposited pyroclastics and flows. Thickness about 450 feet. Unconformably overlies both Uwharrie Formation (new) and Albemarle Group (new). Comprises (ascending) Badin Greenstone and Morrow Mountain Rhyolite (both new). Sequence comprises youngest rocks thus far recognized in Caroline slate belt.

The U.S. Geological Survey has abandoned the Tater Top Group and its formations the Badin Greenstone and Morrow Mountain Rhyolite on the basis of a study now in progress.

Named after Tater Top Mountain in Stanly County. Occurs in center and along western flank of Troy anticlinorium in northern part of Albemarle and southern part of Denton quadrangles, and in west-central and southwestern Randolph County.

Tatnic Complex

Triassic (?): Southwestern Maine.

A. M. Hussey, 2d, 1961, Dissert. Abs., v. 22, no. 5. Consists of gabbro which is marginally altered to quartz diorite; anorthositic gabbro which is probably transitional upward from the gabbro; olivine gabbro which is younger than the gabbro and anorthositic gabbro; and poikilitic gabbro which may be a phase of the olivine gabbro and quartz diorite. Intrusive into sediments of Silurian and Devonian age. Other complexes in area are Alfred, Cape Neddick, and Agamenticus.

A. M. Hussey, 2d, 1962, Maine Geol. Survey Spec. Geol. Studies Ser. No. 4, p. 33, 48, 56, pls. 1, 2. Wandke (1922) originally applied name "Berwick quartz diorite" to rocks which in present report are called Tatnic complex. Complex is not situated in town of Berwick but occupies that part of Wells and South Berwick called Tatnic. Dominant phase appears to be gabbro rather than quartz diorite. Hence term Tatnic complex is more appropriate. Five Rock types delineated: (1) gabbro which dioritic tendencies, (2) anorthositic gabbro, (3) olivine gabbro, (4) poikilitic gabbro, (5) quartz diorite, and (6) undifferentiated volcanics. Younger than Agamenticus complex.

Occupies that part of Wells and South Berwick called Tatnic, York County. Approximately 1¼ miles in diameter located at northwestern edge of quartz monzonite of Webhannet pluton in towns of Wells and South Berwick.

Tatnic Hill Formation (in Putnam Group)

Middle(?) Ordovician or older: Eastern Connecticut.

H. R. Dixon, 1964, U. S. Geol. Survey Bull. 1194—C, p. C2—C8. Includes lower member, Fly Pond Member, and Yantic Member (new). The lower member subdivided into three main lithologic units which are gradational into each other and between which no sharp contacts can be drawn. Bates Pond Lentil of Putnam Gneiss which Snyder (1961) mapped in Norwich quadrangle would be in lower member of Tatnic Hill. Pegmatitic and granitic dikes and sills of varying sizes and compositions occur throughout formation but in general are larger and most abundant in Yantic and Fly Pond Members. Total thickness about 5,500 feet in Tatnic Hill area. Overlies Quinebaug Formation (new); underlies Hebron Formation. Pre-Pennsylvanian.

Robert Zartman and others, 1965, U. S. Geol. Survey Prof. Paper 525—D, p. D1, D5. Implications of new radiometric ages in eastern Connecticut and Massachusetts. Tatnic Hill, as well as equivalents and underlying rocks including Quinebaug Formation, is probably Middle Ordovician or older.

Type area: Consists of series of outcrops extending from Connecticut Route 169, on east side of Tatnic Hill, west for 2½ miles to Stetson Road, in southeast corner of Hampton quadrangle. Named for exposures in area of Tatnic Hill in southern part of Danielson quadrangle, where section is more complete and contacts better exposed than elsewhere.

Tatum Limestone Member (of Catahoula Sandstone)

Oligocene(?) and Miocene(?): Subsurface in Mississippi, Florida, and Louisiana.

D. H. Eargle, 1964, U. S. Geol. Survey Prof. Paper 475—D, p. D44, D45—D46. Catahoula Sandstone divided into an upper part, chiefly nonmarine sand and clay, and a lower part termed Tatum Limestone Member, a name introduced to replace "Limestone of the *Heterostegina* zone" or "*Heterostegina* limestone." Consists of sandy limestone,marl, glauconitic calcarenite, and calcirudite. Thickness 163 feet in well 1, from depth of 1,373 to 1,536 feet; 170 feet in well 2, from 1,470 to 1,640 feet. Thins to about 90 feet in southeastern part of area and thickens to 300 feet toward west.

Type section: U. S. Atomic Energy Commission hydrologic test well 1, Tatum dome area, Lamar County, Miss. Well 1 is in NE¼SW¼ sec. 12, T. 2 N., R. 16 W.; datum is 321 feet above sea level. Reference section: Hydrologic test well 2 in SW¼SW¼ sec. 14, T. 2 N., R. 16 W.; datum is 302 feet.

Taylor Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Taylor sand occurs at depth of 8,835 to 8,920 feet in type well. Correlation of Roseberry, Sexton, Tucker, and Taylor sands is difficult downdip from type area because sands merge into massive sandstone bar of the Schuler.

Type well: Ohio Oil Co., and Gulf Refining Co., No. 1 Taylor, sec. 15, T. 23 N., R. 8 W., Haynesville field. Reference well: Stanolind Oil and Gas Co., No. 1 Beene unit, sec. 5, T. 22 N., R. 9 W., Shongaloo field, Webster Parish.

Taylor Stage

Upper Cretaceous (Gulfian): Atlantic and Gulf Coastal Provinces.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 356. Taylor stage is used here as a major subdivision of the Gulf Series in the Atlantic and Gulf coastal province and adjacent areas to include all rocks which can be demonstrated within reason, by whatever evidence is available, to be equivalent in age to the type Taylor and its typical divisions. It overlies the Austin stage and underlies the Navarro stage.

Taylor Canyon Formation

Middle Silurian: Northeastern Nevada.

J. W. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 4, p. 443 (fig. 1), 447—448, pl. 1. Proposed for calcareous, argillaceous quartz siltite, which rests disconformably upon Happy Canyon Formation (new) and is unconformably overlain by Waterpipe Canyon Formation (new). Not possible to determine original thickness. Youngest beds are either at an unconformity as in Smith Creek sequence, or are overthrust by older rocks as in Burns Creek sequence. Thickest section, 1,150 feet, in Burns Creek sequence, is taken as type section. Unit is pale-red to light-olive-gray thin-bedded calcareous, argillaceous quartz siltite weathering grayish orange. Formation in the Smith Creek sequence is exposed north and west of Seetoya Peak. It is overlain unconformably by black siltstone eastward from longitude of Seetoya Peak. Thickness 900 feet in this area.

Type Section: In lower Waterpipe Canyon, Seetoya Mountains, Elko County.

Taylor Ranch Member (of Hess Formation)

Lower Permian (Leonard Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U. S. Geol. Survey Bull. 1244—E, p. E3—E4, pls. 1, 2. As redefined herein Hess Formation includes Taylor Ranch Member. The member includes the "fossil bed" of P. B. King (1931, Texas Univ. Bull. 3038) and the conglomerate that typically occurs just below this level (Ross, 1960, Cushman Found. Foram. Research Contr., v. 11, pt. 4, art. 215). This distinctive unit can be traced for many miles along the mountain front. At type section contains three units: basal conglomerate 2 feet thick; limestone with interbedded fossiliferous shale 33 feet thick; and an upper light-brown fossiliferous limestone 5 feet thick. Underlies Cathedral Mountain Formation. Correlates with upper part of Skinner Ranch Formation farther west.

Type section: On southwest slope of hill that is capped by 5750 contour, lying between and slightly south of the hills marked 5767 and 5821, northwest of the Wolf Camp Hills, Hess Canyon quadrangle, Brewster County. Named for what is now Bill Neal Ranch; former name appears on map by King and King (*in* P. B. King, 1931).

Tea Creek Dolomite (in Bellefonte Group)

Ordovician: Central Pennsylvania.

F. M. Swartz and others, 1955, Pennsylvania Geologists Guidebook 21st Ann. Field Conf., p. F—6, F—14, F—15 (geol. map). At top of Bellefonte group. Thickness 200 feet. Overlies Coffee Run dolomite (new). Consists almost wholly of medium-gray, in part red-flecked dololutite that weathers light, more or less yellowish gray, the weathered surface tending to be deeply gashed by incisions leached along the numerous joints that transect this type of rock. Includes Dale Summit sandstone member (new) near base. Suggested that Dale Summit sandstone may represent inauguration of Chazyan sedimentation. Underlies Milroy limestone (new).

Type section: Along stream in Kishacoquillas Valley, from which name was derived. In area from Bellefonte to Pleasant Gap, Nittany Valley.

Tejas sequence

Paleocene, upper, and younger: North America.

L. L. Sloss, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 94—114. Sedimentary record of North American craton from late Precambrian to present is characterized by six major unconformities. These interregional unconformities subdivide cratonic stratigraphic column into six sequences—major rock-stratigraphic units (of higher than group, mega-group, or supergroup rank) which can be identified, where preserved, in all cratonic interior areas. Sequences are Sauk, Tippecanoe, Kaskaskia, Absaroka, Zuni (new), and Tejas (new). Tejas Sequence is defined as cratonic strata that rest upon an interregional unconformity cut on Zuni Sequence and older strata and extend to include present-day deposits.

Named from Texas, where there is classic development of wedge of Tertiary and Quaternary sediments filling Gulf Coast basin.

Telavirak Formation

Jurassic or Cretaceous: Northwestern Alaska.

R. H. Campbell, 1965, U. S. Geol. Survey Bull. 1194—A, p. A22, A26-A29; 1967, U. S. Geol. Survey Prof. Paper 395, p. 25—26, pls. Rhythmically interbedded sandstone and mudstone, with minor conglomerate and marine turbidites. Thickness not accurately known because of scarcity of exposures, lack of known key horizons, and many structural complexities. Partial section of at least 5,000 feet measured along north tributary of Ogotoruk Creek. Gradational contact with underlying Ogotoruk Formation (new). Contact with overlying Kisimilok Formation (new) appears to be conformable. Formation corresponds to an unnamed informal unit of Jurassic(?) and Cretaceous age of Campbell (1960, U. S. Geol. Survey TEI-753), to the sandstone-mudstone unit of Campbell (1961, U. S. Geol. Survey TEI-779), and to part of strata tentatively assigned in earlier reports (Kachadoorian and others, 1958, U. S. Geol. Survey open-file rept.; Sainsbury and Campbell, 1959, U. S. Geol. Survey open-file rept.) to Tiglukpuk Formation.

Type Locality: Exposures along Ogotoruk Creek and its tributaries, near Chariot test site in vicinity of Cape Thompson.

Telephone Canyon Formation

Lower Cretaceous: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 11—33, pl. 1. A buff nodular limestone and marl unit about 70 feet thick. Underlies Del Carmen Limestone (new); overlies Glen Rose Limestone.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 35-36, pls. Formal proposal of name. At type locality the formation is a soft lithologic unit that lies between the more resistant Glen Rose and the overlying hard, massive, cherty Del. Carmen Limestone. Average thickness about 75 feet. Crops out at several localities in Sierra del Carmen, the southern end of Santiago Mountains, and at mouth of Santa Elena Canyon.

Type Locality: Telephone Canyon where Heath Creek crosses the Sierra del Caballo Muerto Range in the Sierra del Carmen, Big Bend National Park.

Temple Stream Formation

Devonian: Northwestern Maine.

Jeffery Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., p. 104 (table 1), 108. Sulfidic, rusty-weathering quartzite, mica schist, and muscovite schist. To east and northeast of Dixfield quadrangle the Saddleback Mountain Formation (new) is sandwiched by Severy Hill Formation (new) on southeast and by Temple Stream Formation on northwest. Listed in table 1 as an unpublished and unofficial stratigraphic name.

Type locality and derivation of name not given. Area of report is Buckfield and Dixfield quadrangles.

Tenaya Glaciation

Pleistocene (Wisconsin): Eastern California.

R. P. Sharp and J. P. Birman, 1963, Geol. Soc. America Bull., v. 74, no. 8, p. 1079—1086. Two additions proposed to Blackwelder's (1931, Geol. Soc. America Bull., v. 42, no. 4) sequence of four Pleistocene glaciations, Tioga, Tahoe, Sherwin, and McGee of the Sierra Nevada. The younger, Tenaya, lies between Tioga and Tahoe, giving three-fold subdivision to the Wisconsin. The older, Mono Basin, lies between Sherwin and Tahoe and is possibly Illinoian. Moraines now mapped as Tenaya were included within Tioga or Tahoe by earlier workers. Name Tenaya replaces initial name Graveyard (Putnam, 1962).

Probably named for Tenaya Lake in Yosemite National Park.

Tenino sandstone (in McIntosh Formation)

Eocene, upper: Central Washington.

Walter Youngquist, 1961, Annotated lexicon of names applied to Tertiary stratigraphic units in Oregon and Washington west of the Cascade Mountains, with Bibliography: Ann Arbor, Mich., Edwards Brothers, Inc., p. 59-60. A local name applied to upper portion of McIntosh formation which is a well-developed sandstone in vicinity of Tenino. Thickness about 250 feet.

Tenkiller Formation

Middle(?) Silurian: Northeastern Oklahoma.

T. W. Amsden and T. L. Rowland, 1965, Oklahoma Geol. Survey Bull. 105, p. 32—41, 91—93, pls. A, B. Proposed for sequence of evenly bedded crinoidal limestones which overlie Blackgum Formation (new). Overlies Quarry Mountain Formation (new). Thickness 20 feet at type locality; as much as 27 feet in core holes. Tenkiller together with Blackgum were formerly included in lower part of "St. Clair Formation" by Huffman (1958, Oklahoma Geol. Survey Bull. 7). Locally underlies Sylamore Sandstone Member of Chattanooga Formation.

Type locality: At Blackgum Landing on south shore of Lake Tenkiller, SW¼SE¼ sec. 32, T. 14 N., R. 22 E., Cherokee County.

Tennessee Mountain Formation

Cambrian or Ordovician: Northern Nevada.

J. R. Coash, 1967, Nevada Bur. Mines Bull. 68, p. 5 (table 1), 7. Name applied to a thick sequence of highly deformed, interbedded limestone and argillaceous rocks on southwest flank of Tennessee Mountain in Rowland quadrangle. Does not crop out in area of this report [Mount Velma quadrangle].

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p.6 (table 1), 8—9, pl. 1. Described in Rowland quadrangle. Argillaceous rocks are dominant along southern exposures of formation; thinly bedded limestone dominant along northern exposures. Typically the limestone consists of thin beds (0.5 to 1.5 cm thick) of medium-gray aphanitic limestone and silty limestone separated by very thin phyllite laminae. Thin phyllite beds, 10 to 15 feet thick, are locally interbedded with the limestone. Estimated thickness about 5,000 feet of phyllite and 5,000 to 7,000 feet of limestone. Width of outcrop area perpendicular to the general strike is about 3 to 4 miles. Formation is tightly folded, faulted, cut by cleavage, and slightly to highly metamorphosed. Discordant with all surrounding units. Normal faults separate it from Prospect Mountain(?) Quartzite to east; Sunflower Formation and Cenozoic volcanic rocks and alluvium unconformably overlie it to south and west, reprectively; cut off on north by a granitic stock. Main structural trends of formation range from N. 60° E., in southern exposures, to north-south in northern exposures. Tentatively assigned Cambrian and Ordovician Age.

Type section: On Tennessee Mountain where a typical sequence can be observed northeastward from Sunflower Reservoir, across Waterlog Summit, east of Slate Creek, to Tennessee Mountain, Elko County.

Terrill Member (of Ashlock Formation)

Upper Ordovician: South-central Kentucky.

G. W. Weir, R. C. Greene, and G. C. Simmons, 1965, U. S. Geol. Survey Bull. 1224-D, p. D13. Mainly greenish-gray laminated limy or dolomitic mudstone. Thickness 5 to 15 feet. Overlies Stingy Creek Member (new); underlies Reba Member (new).

Type section: Roadcuts along Kentucky Highway 52, beginning about 2 miles east of Richmond, Madison County. Named for outcrops near Terrill, 4 miles south of Richmond.

Terryville Sandstone (in Cotton Valley Group)

Upper Jurassic: Subsurface in northern Louisiana and eastern Texas.

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 148-149, 150. Name proposed for massive sandstone in Cotton Valley Group. Occurs between depths 9,620 and 10,390 feet in type well. Along belt 6 to 10 miles wide from southern Ouachita Parish, through Caddo Parish, La., and farther into Texas, attains maximum thickness of 1,400 feet and immediately underlies Knowles Limestone (new). Laterally equivalent to Hico Shale (new). Includes (descending) Cadeville, Bodcaw, Vaughn, McFearin, and Justiss Tongues. The tongues pinch out into Hico Shale. Overlies Bossier Formation (restricted) that pinches out northward beneath the progressively older sandstone.

W. A. Thomas and C. J. Mann, 1966, Am. Assoc. Petroleum Geologists Bull., 50, no. 1, p. 178—182. From Ouachita Parish westward through southern Caddo Parish, La., the Knowles Limestone is underlain by massive white quartzose Terryville Sandstone which has maximum thickness of about 1,400 feet (426 m). Top and base of the Terryville are regressive toward the south; formation descends stratigraphically and pinches out toward north. Interfingers with and grades northward into overlying and laterally equivalent Hico Shale. Five sandstone tongues—descending order, Cadeville, Bodcaw, Vaughn, McFearin, and Justiss—extend northward from the upper part of massive Terryville and pinchout northward in the dark Hico Shale. Generally the lower sandstone tongues extend farther north than those higher in the section. Oyster beds occur at the pinchout edges of some of the sandstones.

Type well: Arkansas-Louisiana Gas Co., Harriet Lewis No. 1, NW¼NW¼ sec. 17, T. 19 N., R. 4 W., in Terryville Field, Lincoln Parish, La.

Tetuán Formation

Upper Cretaceous: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22-24, p. 13, 25, 27, 28. Tuff, tuffaceous sandstone, and breccia. Shows irregular contact with intrusive rocks of Utado batholith. Footnote 2

(p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

A. E. Nelson and W. H. Monroe, 1966, U. S. Geol. Survey Bull. 1221—C, p. C6—C8, pl. 1. Formal proposal of name. Consists mostly of fine-grained and pale-greenish-gray to olive-green well-bedded tuff. Estimated thickness 1,200 to 1,500 m. Contact with underlying Mameyes Formation (new) conformable. Contact placed at contact of uppermost lava unit of Mameyes with lowermost volcanic sandstone unit of Tetuán Formation. Contact with overlying Alonso Formation placed at top of uppermost thin-bedded tuff of the Tetuán Formation that underlies massive red to reddish-gray volcanic breccia of Alonso. Tetuán extended from western part of map [Florida quadrangle] to northwest-trending Damian Arriba fault where it is in juxtaposition with Yunes Formation. Late Cretaceous (Santonian to Companian). This dating based on fragmentary ammonite that belongs possibly to either *Kossmaticeras* or *Kitchenites*.

R. P. Briggs, 1967, U. S. Geol. Survey Bull. 1254—A, p. A28. Near border of Orocovis and Jayuya quadrangles, Cortorra Tuff (new) rests on Tetuán Formation.

P. H. Mattson, 1967, U.S. Geol. Survey Bull. 1254-B, p. B12. In west-central Puerto Rico, overlies Vista Alegre Formation (new) gradationally and is overlain by Cotorra Tuff west of the Río Toro Negro. Formation is about 1,200 m thick west of the Río Toro Negro, but only about 460 m thick east of the river where upper part apparently interfingers with Malo Breccia.

Type locality: Exposures on east side of Route 140 just north of bridge where the highway crosses the Río Limon and approximately 1 km east of west edge of Florida quadrangle. Named after Barrio Tetuán.

Tewa Group

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U. S. Geol. Survey Water—Supply Paper 1753, p. 18 (fig. 8), 45—59. Name given to rhyolite tuff and the rhyolite and quartz latite domes that constitute the latest eruptive rocks of Jemez Mountains volcanic pile. In Los Alamos area includes Bandelier Tuff, Cerro Toledo Rhyolite (new), Cerro Rubio Quartz Latite (new), and Valles Rhyolite (new).

Area has no distinctive physiographic feature from which to take a name for group. Name Tewa (after Indian tribe of area and by whose name the surrounding mountains were once known) was chosen.

Texas Canyon Quartz Monzonite

Tertiary(?): Southeastern Arizona.

J. R. Cooper and L. T. Silver, 1964, U. S. Geol. Survey Prof. Paper 416, p. 78—81, pl. 1. Name given to granite rock that forms much of eastern half of Little Dragoon Mountains. Outcrop area is roughly 4 by 6½ miles; long axis trends northeast. For about 4½ miles along northwestern side of the stock, the quartz monzonite has invaded Pinal schist and has steep arcuate contact that tends to be concordant with bedding and foliation in the schist. This relatively smooth part of contact ends where quartz monzonite has intruded younger rocks. About 1 mile southwest of Johnson, where quartz monzonite has intruded Apache group, the contact turns to southeast and becomes discordant and irregular. At lower end of

Sheep Basin the quartz monzonite has invaded thrust sheets of Paleozoic and Cretaceous rocks. Large masses of aplite have been intruded along this part of contact. Much of intrusive contact on east and south is concealed by overlapping alluvium. Northeast of Lancha the quartz monzonite cuts folded and thrust-faulted rocks ranging from Pinal schist to Morita and Cintura formations, and contact is discordant and irregular.

Named from exposures in Texas Canyon, Dragoon quadrangle, Cochise County.

Thermal Canyon Series

Precambrian: Southern California.

J. J. W. Rogers, 1961, California Div. Mines Spec. Rept. 68, p. 11. Maclellan (1936, unpub. thesis) studied area south of Joshua Tree National Monument in Little San Bernardino Mountains. His interpretation of geologic history is: first, metamorphism of sediments to form Berdoo series; second, greater metamorphism and migmatization of part of Berdoo series to form Thermal Canyon series; and third, intrusion of Fargo granite. Area studied in this report [western Joshua Tree National Monument] does not contain any large, mappable bodies of rock similar to those delineated as Thermal Canyon series.

Little San Bernardino Mountains, Riverside County.

Third Lake Formation (in East Branch Group)

Silurian: Northern Maine.

A. J. Boucot and J. G. Johnson, 1967, Jour. Paleontology, v. 41, no. 5, p. 1231. Discussion of species and distribution of *Coelospira*. Species collected by Bradford Hall from Third Lake Formation of East Branch Group.

Approximately one-third mile southeast of the small pond north of northeast end of Snake Pond, Spider Lake quadrangle.

Thirsty Canyon Tuff

Pliocene: Southeastern Nevada.

D. C. Noble and others, 1964, U. S. Geol. Survey Prof. Paper 475—D, p. D24—D27. A sequence of rhyolitic ash-flow and air-fall tuffs. Subdivided into five formal members and an informal upper member. Formal members are (ascending) Spearhead, Trail Ridge, Dry Lake, Gold Flat, and Labyrinth Canyon (all new). Complete stratigraphic section nowhere exposed. Unconformably overlies Rainier Mesa Member of Piapi Canyon Formation. In most areas is youngest sequence of volcanic strata, but locally overlain by intermediate to mafic lavas. Dated Pliocene primarily on isotopic evidence.

E. N. Hinrichs, R. D. Krushensky, and S. J. Luft, 1967, U. S. Geol. Survey Geol. Quad. Map-GQ-638. Mapped in Ammonia Tanks quadrangle, Nye County, where it comprises (ascending) Spearhead and Trail Ridge Members. Thickness as much as 250 feet. Overlies Timber Mountain Tuff. Underlies Caldera-fill deposits.

F. M. Byers, Jr., and David Cummings, 1967, U. S. Geol. Survey Geol. Quad. Map GQ-695. Mapped in Scrugham Peak quadrangle, Nye County, where it is as much as 770 feet thick and comprises (ascending) Spearhead and Trail Ridge Members. Underlies volcanic fan gravel. Separated from underlying Timber Mountain Tuff by air-fall and ash-flow tuff as much as 175 feet thick.

Type area: In headward part of Thirsty Canyon. Crops out from Beatty to Goldfield, Nye and Esmeralda Counties.

Thisbe Formation

Miocene-Pliocene: Western Nevada.

Joseph Lintz, Jr., ed., 1964, Conference on the history of Geology, Guidebook of field trips, August 3-21: Nevada Univ. Mackay School of Mines, p. 2. Upper part volcanic and diatomaceous sediments. Lower part dacitic and rhyodacitic lavas and breccias. Thickness 1,200 feet. Unconformable above Chloropagus Formation and below Kate Peak Formation.

Town of Thisbe is in Washoe County.

Thomas Range Rhyolite

See Topaz Mountain Tuff.

Thompson Mountain Formation (in Woodstock Group)

Silurian to Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 11 (table 1), 26-27, pls. 1, 2. Rusty-weathering migmatitic gneiss. Thickness about 500 feet. Lowermost unit in what is herein termed northern sequence in Bryant Pond quadrangle. Lies conformably below Shagg Pond formation (new) in nose of northward-plunging anticline.

Jeffery Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., 57th Ann. Mtg., p. 104 (table 1), 106. Included in Woodstock Group (new). Listed on table above Anasagunticook Formation (new) and below Newton Hill Formation (new).

Present only along eastern border of Bryant Pond quadrangle. Named for exposures along Thompson Mountain.

Thompson Peak Formation

Precambrian(?): Central Idaho.

R. R. Reid, 1963, Idaho Bur. Mines and Geology Pamph. 129, p. 7, 9 (table 1), 12, geol. map. Feldspathic schist, feldspar-rich granofels, and lime-silicate granofels. Oldest rocks in Sawtooth area.

Occurs in vicinity of Thompson Peak. Covers about 10 square miles near Stanley, Custer County.

Thorn Creek Beds

Miocene, middle: Southern Idaho.

D. I. Axelrod, 1964, California Univ. Pub. Geol. Sci., v. 51, p. 93. Thorn Creek flora was collected at locality south of Idaho City, in lower drainage of Thorn Creek. Basal part of section is granite boulder conglemerate about 75 feet thick; faulted against granitic basement. Overlying rocks are chiefly thick crossbedded arkose and arkosic conglomerate interspersed with fine-grained thin sandstones and pumiceous shale, the latter ranging from a few inches up to 3 feet thick. Flora is preserved in thin lens of reddish-brown ashy shale in upper third of the 600-foot section. This section has been referred to Payette formation, but it represents lower part of Idaho group. The formation is herein referred to provisionally as Thorn Creek beds.

Occurs about 10 miles south of Idaho City in lower drainage of Thorn Creek. Formation exposed as asymmetrical syncline, with east flank dipping 60° W., and west flank dipping 5–7° E. West limb truncated by high-angle normal fault that trends northerly.

Thorp Point Member (of Cassin Formation)

Ordovician (Canadian): Western Vermont.

C. W. Welby, 1961, Vermont Geol. Survey Bull. 14, p. 71—77, 246—250, pls. 1-A, 1-B. Lower member of Cassin formation. Composed of sandy and silty, ribbed or banded limestone with abundant intraformational breccias, beds composed of trilobite fragments, and a few light bluish-gray weathering sublithographic limestones. Thickness 82.7 feet to 105 feet. Underlies Emerson School member (new); contact between the two members gradational.

C. W. Welby, 1964, Geol. Soc. America Bull., v. 75, no. 8, p. 781—784. An earlier correlation of Burchards Member of Chipman Formation with part of Emerson School Member of Cassin Formation is revised. In studying section at Ellsworth Ledge, Cornwall, Vt., author (1961) concluded that the Burchards resembled limestones in upper part of sequence to which he gave name Emerson School Member of Cassin Formation. This led to erroneous correlations of Thorp Point Member of Cassin with beds "5a" and "5b" of Cornwall section described by Wing (*in* Dana, 1877, Am. Jour. Sci., 3d ser., v. 13), the Emerson School Member with "5c" of Wing's section, and the Burchards with upper part of Emerson School Member. These errors led to recommendation that term Chipman Group be dropped (Welby, 1961). Burchards Member as described by Kay and Cady (1947) is unit "5c" as described by Wing. Beds of Wing's "5a" and "5b" can be correlated with Thorp Point and Emerson School Members of Cassin. respectively, whereas the Buchards ("5c" of Wing) is correlated with lower part of Bridport Dolostone.

Type section: Along western shore of Thorp Point. Section begins about 20 yards west of bostonite dike at northwest corner of Thorp Point, about 1 mile S. 42° E. of Cedar Island (in Lake Champlain), and extends south along shore to south side of first cove south of dike and thence southeastward up slope to position 20 yards west of barn. Supplemental section: Same as type section for Emerson School Member. Thorp Point is small point protruding into Town Farm Bay about half way between eastern shore of Thompson Point and mouth of Thorp Brook. Town Farm Bay is name currently used for Balls Bay of earlier reports.

Thousand Pockets Tongue (of Navajo Sandstone)

Middle and Upper(?) Jurassic: Southeastern Utah and Northeastern Arizona.

D. A. Phoenix, 1963, U. S. Geol. Survey Bull. 1137, p. 32—33, 62, 65—66, 67, pl. 2. Name applied to crossbedded sandstone in upper part of Navajo. Horizontally bedded sandstone is herein named Judd Hollow tongue of Carmel formation. At type locality, unit is composed of light-gray to white to pale-reddish-brown fine grained to very fine grained quartzose silty sandstone 228 feet thick. Tangentially crossbedded. In Cedar Mountain area, consists of pale-yellowish-orange medium- to fine-gained tangentially crossbedded sandstone similar to that in Navajo. Underlain conformably by Judd Hollow tongue and is overlain conformably by Carmel formation of Jurassic age.

J. C. Wright and D. D. Dickey, 1963, U. S. Geol. Survey Prof. Paper 450—E, p. E65. Thousand Pockets Tongue of Navajo Sandstone intertongues with the Carmel throughout Paria Plateau and Paria Valley. From area of Glen Canyon Dam, where tongue is about 200 feet thick, it extends north and northwestward more than 50 miles to where it pinches out. Cannot be distinguished easily from rest of the Navajo southeast of pinchout of underlying Judd Hollow Tongue of Carmel Formation.

Type section; On north side of Judd Hollow in NW¼ sec. 31, T. 43 E., Kane County, Utah. Named for Thousand Pockets in Lees Ferry area where it first appears as distinct unit.

Thrasher Peak Conglomerate

Lower Devonian: Northern Maine.

A. M. Hussey, 2d, and others, 1967, Preliminary geologic map of Maine (1:500,000): Maine Geol. Survey. Thrasher Peak Conglomerate mapped in northern Oxford County.

Three C Member (of Abrigo Formation)

Middle and Upper(?) Cambrian: South-central Arizona.

S. C. Creasey, 1967, U. S. Geol. Survey Bull. 1218, p. 27–29, pl. 1. Stoyanow (1936, Geol. Soc. America Bull., v. 47, no. 4) correlated Middle and Upper Cambrian rocks in Peppersauce Canyon in Mammoth quadrangle with type Abrigo (Ransome, 1904) on Mount Martin near Bisbee, 80 miles southeast of present report, but adopted new nomenclature. To replace Abrigo he proposed four new formations (ascending): Peppersauce Sandstone, Abrigo Formation, Southern Belle Quartzite, and Santa Catalina Formation. Abrigo Formation is herein subdivided into three members (ascending): Peppersauce, Southern Belle, and Three C. Peppersauce Member is equivalent to Stoyanow's Peppersauce Sandstone and Abrigo Formation. Southern Belle and Three C Members are equivalent to Stoyanow's Southern Belle Quartzite and Santa Catalina Formation, respectively. The Three C consists of reddish-brown thin-bedded largely fine-grained feldspathic sandstone alternating with thin shale partings. Colors range from slightly iron-streaked white through pale-reddish-brown to dark-reddish-brown beds averaging only 1 or 2 inches thick. Thickness in Nugget Canyon 335 feet.

Named for Three C Ranch, largest ranch in Mammouth quadrangle, Pinal County.

Threelinks Conglomerate

Tertiary: Southeastern Arizona.

J. R. Cooper and L. T. Silver, 1964, U. S. Geol. Survey Prof. Paper 416, p. 84-87, pl. 1. Name applied to the conglomerate and intercalated sands, silts, and lava flows that lie unconformably on Cretaceous strata and below Galiuro volcanics. Estimated thickness 50 to 125 feet in south end of Steele Hills and at least 700 feet at one locality on east side of the hills. Tertiary, on basis of relation to other formations.

Type section; At southeast end of Steele Hills, on Threelinks Ranch, Dragoon quadrangle, Cochise County.

Thunder Mountain Quartzite

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1960, Inst. on Lake Superior Geology, Papers No. 6, p. 30. Stratigraphy and structure of McCaslin quartzite region. Region contains McCaslin Mountain quartzite, Thunder Mountain quartzite, and the complex of border rocks associated with the quartzites. District covers an area of about 375 square miles in parts of Marinette, Langlade, Forest, and Oconto Counties.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 6. Relatively fine gained and somewhat impure quartzite—more properly, a quartz-rich greywacke. Presumably same as McCaslin quartzite.

Thunder Mountain is west of High Falls reservoir, Marinette County.

Thunder Springs Member (of Redwall Limestone)

Mississippian: Northwestern Arizona.

J. W. Parker and J. W. Roberts, June 1963, Four Corners Geol. Soc. 4th Field Conf., p. 45-46. Thin-bedded series of chert and limestone beds cropping out as a banded cliff, each about 1 to 3 and up to 6 inches thick. Limestone in western and dolomite in eastern Grand Canyon. Members probably correlate with Dawn Limestone and Anchor Limestone Members of Monte Cristo Limestone in southern Nevada. Thickness 138 feet at type section Overlies Whitmore Wash Member (new); underlies Mooney Falls Member (new). Name credited to McKee (unpub. ms.)

E. D. McKee, [Nov.] 1963, U. S. Geol. Survey Prof. Paper 475—C, p. C32—C22. Formal proposal of name. Thin beds of chert alternating with thin beds of carbonate rock. Chert beds are most conspicious feature of member. In western part of Grand Canyon there are associated with limestone but to east with dolomite. Thickness 138 feet at type section. Overlies Whitmore Wash Member; underlies Mooney Falls Member.

Type section; In cliff of Redwall Limestone west of springs at head of Thunder River, about 2 miles north of Colorado River in central Grand Canyon.

Tibble Formation

Tertiary: Northern Utah.

A. A. Baker and M. D. Crittenden, Jr., 1961, U. S. Geol. Survey Geol. Quad. Map GQ—132.Youngest consolidated rock in quadrangle. Pebble to boulder conglomerate, sandy to shaly greenish-gray to reddish-brown tuffaceous sediments, and thin lenticular beds of white fresh-water algal(?) limestone. Thickness along American Fork Canyon about 2,500 feet. Occupies large areas in basins of Tibble, Mill, and Deer Creeks, and dips 20^{o} to 40^{o} northeastward until cut off by Deer Creek fault. Basal beds rest on old erosion surface beneath which the rocks are generally stained with iron oxide to depth of several hundred feet.

Type locality: In secs. 7 and 8, T. 4 S., R. 3 E., between Tibble Fork and Mill Canyon, adjacent to American Fork, Timpanogos Cave quadrangle. Forms prominent red-stained outcrops along southeast side of American Fork Canyon for about three-fourths of a mile above Tibble Fork.

Tidal Formation

Upper Silurian: Southeastern Alaska.

D. L. Rossman, 1963, U. S. Geol. Survey Bull, 1121—K, p. K10 (fig. 2), K12—K16, pls. 1, 2. Consists predominantly of well-indurated fine-grained argillite. Outcrops dominantly brown or gray; fresh rock black to nearly white. One member 500 to 2,300 feet thick consists of thin-bedded light-gray limestone. Thickness of exposed part of formation can be estimated from structure and topographic position of various segments of formation. Thickest continuous section, which lies below thin-bedded member, is 5,500 feet thick; thin-bedded limestone exposed on Mount Wright is 2,300 feet thick; incomplete section overlying the thin-bedded limestone is 2,300 feet thick. Total exposed section believed to have minimum thickness of 10,100 feet. Relation to older rocks not known as lower contact not observed in mapped area. On columnar section and map legend the Tidal is listed above Willoughby formation. Contact with overlying Pyramid Peak formation (new) seems to be conforable. Formation largely unfossiliferous. Suggested that Tidal is Late Silurian.

Typical section: On southwest flank of the 3,594-foot peak 2.8 miles southeast of eastern end of Tidal Inlet, Mount Fairweather quadrangle, Glacier Bay.

Tiger Mountain Formation (in Puget Group)

Eocene, upper: Northwestern Washington.

J. D. Vine, 1962, Washington Div. Mines and Geology Rept. Inv. 21, p. 12—13, 19. A sequence of nonmarine arkosic sandstone, claystone, and coal that contains leaf impressions of land plants. Conformably overlies and is transitional with marine rocks of Raging River Formation (new). Upper part of formation, as much as 900 feet thick, is interstratified with Tukwila Formation throughout an interval of as much as 1,725 feet. Exposed rocks in lower 1,100 feet of formation are mostly beds of medium-grained arkosic sandstone. Total thickness 2,000 feet.

Type area: Localities of south side of Tiger Mountain and north side of Taylor Mountain, King County, in SW¼ sec. 9, sec. 16, S½ sec. 17, N½ sec. 20, and N½ sec. 21, T. 23 N., R. 7 E., and sec. 22, T. 23 N., R. 7 E.

Tigerton Anorthosite

Precambrian: Northeastern Wisconsin.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 1 (map), 14, 16, 18. Blue gray, gray, or light gray or almost black on fresh surfaes, light gray to white on weathered surfaces. Rock may be called gabbroic anorthosite, anorthositic gabbro, or hornblende anorthosite. Surrounded by Bowler granite (new).

New Tigerton, southwestern Shawano County.

Tilden Formation

Upper Pennsylvanian: Northern Utah.

L. A. Hansen, 1961, Utah Geol. Soc. Guidebook 16, p. 71 (fig. 14), 76. Consists of 310 feet of light-gray quartzite and sandy quartzite with several thin limestones and sandy limestones, at least some of which are lentils. Fossil limestone is a 10- to 15-foot sandy limestone approximately 115 feet below Petro-Tilden contact. Overlies Parnell limestone.

In Carr Fork Canyon, in southwest fork of Bingham Canyon.

Tillery Formation (in Albermarle Group)

Ordovician(?): Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 126-127, geol. map. Basal formation of Albermarle Group (new). At type locality essentially finely laminated meta-shale exhibiting graded bedding. East and northeast of Troy anticlinorium contains graywacke and greenstone beds which grade upward into laminated slate. West of anticlinorium formation has been metamorphosed into argillite. East and northeast of anticlinorium, formation grades downward into Efland Formation (new). West of anticlinorium the Tillery rests directly on Uwharrie Formation (new). Underlies McManus Formation (new). Early Paleozoic.

The U. S. Geological Survey currently designates the age of the Tillery Formation as Ordovician(?) on the basis of a study now in progress.

Type locality: On North Carolina Highway 109, on southeast side of bridge crossing Uwharrie River. Named for Lake Tillery, along whose shoreline it is typically exposed. Area of report is Carolina Slate belt west of Deep River-Wadesboro Triassic basin.

Tillman Metasedimentary Group

Cambrian: Southwestern Oklahoma (subsurface).

W. E. Ham, R. E. Denison, C. A. Merritt, 1964, Oklahoma Geol. Survey Bull. 95, p. 21, 23, 37, 105-125, pl. 14, table 18. A sedimentary sequence of probable Early Cambrian age, dominated by graywacke but also containing siltstone, shale, sandstone, arkose, and bedded chert. Oldest rock group in Wichita province. Believed to be several thousand feet thick and to represent first stage in filling of southern Oklahoma geosyncline. Information about metasediments derived mainly from study of cuttings from 13 wells in Jackson, Tillman, and Cotton Counties. Injected by Raggedy Mountain Gabbro Group (new). Meers Quartzite included in group but has not been encountered in drilling. No isotopic age determination.

Name taken from Tillman County where rocks have been penetrated in subsurface by numerous wells.

Timberlake Fanglomerate

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 27—31, pl. 1. Consists largely of limestone-cobble conglomerate. East of Cowboy Spring also contains masses of fanglomerate composed of boulders and blocks of limestone conglomerate up to 200 feet in diameter. Thickness 0 to possibly 500 feet. Difficult to distinguish from underlying Cowboy Spring Formation (new) where the two formations are in contact. Where Cowboy Spring Formation is absent the Timberlake overlies sandstone of Mojado Formation. Underlies Basin Creek Tuff (new), Bennett Creek Breccia (new), Oak Creek Tuff, Bluff Creek Formation (new), and probably underlies Horse Hill Breccia (new).

Named for exposures near Timberlake Ranch, Walnut Wells quadrangle, Hildago County.

Timber Mountain Tuff (in Piapi Canyon Group)

Pliocene, lower: Southeastern Nevada.

P. P. Orkild, 1965, U. S. Geol. Survey Bull. 1244—A, p. A44—A51. Includes (ascending) Rainier Mesa Member, tuff of Cat Canyon, tuff of Transvaal, and Ammonia Tanks Member (new). Unconformably overlies Paintbrush Tuff (new). Pliocene.

P. W. Lipman, 1966, U. S. Geol. Survey Geol. Quad. Map GQ-489. Mapped in Thirsty Canyon SE quadrangle, Nye County. Includes (ascending) Rainier Mesa Member, tuff of Cat Canyon, tuff of camp Transvaal, and Ammonia Tanks Member. Underlies tuff of Cutoff Road.

D. C. Noble and others, 1967, U. S. Geol. Survey Geol. Quad. Map GQ-614. Mapped in Dead Horse Flat quadrangle, Nye County, where it includes Rainier Mesa Member and Ammonia Tanks Member and is as much as 1,740 feet thick. Overlies Paintbrush Tuff and underlies Thirsty Canyon Tuff. Pliocene.

The U. S. Geological Survey currently designates the age of the Timber Mountain Tuff as lower Pliocene on the basis of a study now in progress.

Type area: Timber Mountain region, Nye County.

Tims Peak Basalt

Pliocene (Clarendonian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 20. Ophitic clinopyroxene basalt. Thickness 10 to 250 feet as one or several flow units. Overlies Butte Creek Volcanic Sandstone (new); underlies Wildcat Creek Welded Ash-Flow Tuff (new) or Juntura Formation.

Type Locality: Near Tims Peak in SE¼ sec. 34, T. 21 S., R. 40 E., Malheur County. Forms prominent plateau in northern part of Monument Peak district; also in Malheur Gorge district.

Tinemaha Granodiorite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1529—1530. Commonly porphyritic and contains subhedral to anhedral grains of perthite up to 1½ cm across; some specimens equigranular or seriate. Intruded by Lamarck Granodiorite (new), granodiorite of McMurry Meadows, and quartz monzonite similar to Cathedral Peak Granite. Intrusive relations with Inconsolable Granodiorite (new) not determined.

Type locality: In cirques at head of Tinemaha Creek, east-central Sierra Nevada, near Bishop. Named after Mount Tinemaha. Outcrop area in south half of Big Pine quadrangle about 32 square miles.

Tinkers Creek Marl

Pleistocene (Wisconsin): Northeastern Ohio.

V. Sterki, 1920, Ohio Jour. Sci., v. 20, no. 6, p. 173—176. Name applied to marl exposed along Tinkers Creek. Generally the marl is pure, white, or whitish, but locally mixed with muck or peat. Highly fossiliferous.

Aurele La Rocque, 1967, Ohio Geol. Survey Bull. 62, pt. 2, p. 307, 313, 316, 318, 324, 352. Tinkers Creek marl, Pleistocene (late Wisconsin), mentioned in report on Pleistocene mollusca of Ohio.

Exposed along Tinkers Creek, near line of Summit and Portage Counties, south of station Moran of Wheeling and Lake Erie Railroad. Place is about 1,000 feet above sea level and somewhat over 400 feet above level of Lake Erie, within drainage of the latter (Cuyahoga River).

Tip Top beds (in Machias Formation)

Upper Devonian: New York.

Warren Manspeizer, 1963, Pennsylvania Geol. Survey, 4th ser., Bull. G-39, p. 267-268, fig. 2a. A nonfossiliferous wedge-shaped body containing mudstones and red beds. Thickness about 175 feet. Occurs below Cuba Formation.

Named from drainage divide in Alfred Township, Allegany County.

Titusville Till

Pleistocene (Wisconsinan): Northwestern Pennsylvania.

G. W. white and S. M. Totten, 1965, Science, v. 148, no. 3667, p. 234—235. Peat discovered below drift near Titusville, formerly called "inner Illinoian," has carbon-14 age of 31,400±2,100 years. Overlying drift, herein named Titusville Till, is not Illinoian but is late early Wisconsinan or late Altonian of Lake Michigan lobe classification. Titusville Till is surface material between eastern boundary of that till and boundary of Kent Till. It is overlain by Kent Till west of Kent margin. Commonly underlain by sand or gravel ranging from fraction of an inch to 15 feet in thickness, which in turn lies upon bedrock or upon till of an as yet unknown age.

Type section: Exposure in south margin of large gravel pit and in adjacent deep cut along Pennsylvania Highway 8, Cherry Tree Township, Venango County, about 1.6 miles south of post office in Titusville, 1.2 miles southwest of Drake well, and 1.7 miles west of the Strawbridge pit.

Tiva Canyon Member (of Paintbrush Tuff)

Tiva Canyon Member (of Piapi Canyon Formation)

Tiva Canyon Member (of Oak Spring Formation)

Miocene, upper: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—96—D—103. Member of Oak Spring Formation. Lower part, 0 to 250 feet thick, consists of gray and yellow fine lapilli bedded tuff; zeolitic near French Peak; medium to very thick bedded. Upper part, 0 to 550 feet thick, consists of gray, purple, and brown densely welded tuff; local zones of lithophysae and sperulities in middle and upper parts; zone of porous finely crystalline partially welded tuff at top; basal part white and pink nonwelded shards and pumice. Overlies Topopah Springs member (new); underlies Rainier Mesa member (new). Oak Spring formation is Miocene(?) or younger.

F. G. Poole and F. A. McKeown, 1962, U. S. Geol. Survey Prof. Paper 450-C, p. C60-C62. Reallocated to member status in Piapi Canyon Formation (new). Overlies Topopah Spring Member; underlies Rainier Mesa Member. Oak Spring raised to group rank.

J. T. O'Connor, 1963, U. S. Geol. Survey Prof. Paper 475—B, p. B52—B55. Petrographic characteristics of some welded tuffs of Piapi Canyon Formation. Tiva Canyon is compound cooling unit. Some welded tuff, previously thought to belong to cooling unit of Tiva Canyon, is actually part of Rainier Mesa Member.

P. W. Lipman and R. L. Christiansen, 1964, U. S. Geol. Survey Prof. Paper 501—B, p. B74—B78. Underlies Yucca Mountain Member (new) of Piapi Canyon Formation.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224-A, p. A44-A51. Piapi Canyon redefined and raised to group rank. Includes two new formations, Paintbrush Tuff and overlying Timber Mountain Tuff. Tiva Canyon reallocated to member status in Paintbrush Tuff. According to interpretation of potassium-argon dating Paintbrush Tuff is Miocene(?) and Pliocene.

The U. S. Geological Survey currently designates the age of the Tiva Canyon Member of the Paintbrush Tuff as late Miocene on the basis of more recent potassium-argon dating.

Type locality: Tiva Canyon, Nye County.

Toecane amphibolites

Precambrian: Western North Carolina

R. E. Wilcox and Arie Poldervart, 1958, Geol. Soc. America Bull., v. 69, no. 11, p. 1332—1333. Discussion of metadolerite dike swarm in Bakersville-Roan Mountain area. Amphibolite problems reviewed. Exposure at west end of bridge near Toecane contains a coarse-grained spotted amphibolite and a fine-grained black schistose amphibolite in sharp but irregular contact, similar to contacts of coarse- and fine-grained phases of the dike swarm. No contact is exposed between the amphibolite and quartzofeldspathic country rock which crops out 20 yards away. The Toecane amphibolites differ markedly from typical Roan amphibolities most of which are compositionally banded parallel to foliation. Toecane-type amphibolites are also exposed in close proximity to the dike swarm; hence, they may be metamorphosed equivalents of Bakersville-Roan Mountain dike swarm but field evidence at Toecane is inclusive.

R. M. Gates, 1967, Am. Jour. Sci., v. 265, no. 2, p. 118-131. Toecane orthoamphibolites mentioned in general discussion of amphibolites as syntectonic intrusions.

Exposed along Route 197 between Red Hill and Toe River and along Toe River, especially southwest of Deyton Bend. First noted on west side of Toe River across from Toecane village, 3 miles west of Bakersville.

Tolstoi Formation (in Beaver Bay Group)

Paleocene and Eocene: Southwestern Alaska.

C. A. Burk, 1965, Geol. Soc. America Mem. 99, pt. 1, p. 83-85, 98—99, 101—102; pt. 2, maps. Overlying Upper Cretaceous Hoodoo Formation (new) southwest of Wide Bay is sequence of black siltstones with interbedded volcanic sandstones and conglomerates, flows, sills, and volcanic breccias. Rocks have yielded Paleocene plants and middle Eocene marine invertebrates. This sequence is herein named Tolstoi Formation. Thickness about 5,000 feet in Beaver Bay area. Conformably overlain by Stepovak Formation. Gradational contact between these two units often difficult to place, even within 500 to 1,000 feet of strata. Where these units cannot reasonably be separated from each other, or where Tolstoi Formation cannot be recognized with confidence, whole Paleocene sequence is mapped as Beaver Bay Group. Conformably underlies Meshik Formation in Chignik Bay area.

Type locality: Along east shore of Pavlof Bay, north of Cape Tolstoi and Tolstoi Peak northward to entrance to Canoe Bay, Alaska Peninsula. Not definitely known to be present southwest of type locality. Traced northeast of Pavlof Bay for 50 miles to head of Port Moller.

Tomhegan Formation (in Moose River Group)

Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U. S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 161—165, pl. 34. Consists of sandstone, slate, rhyolitic and volcanic rocks. Two subdivisions: Upper unit, the main part of formation; and lower unit, Kineo volcanic member (new). Estimated thickness of main part of unit about 6,000 feet; Kineo volcanic member 0 to 4,000 feet. Overlies Tarratine formation (new). Early Onondaga age.

Louis Pavlides and others, 1964, U. S. Geol. Survey Prof. Paper 501—C, p. C37. Tomhegan Formation now dated as lower Emsian (Schoharie) age. Lower Devonian.

Type sections: Upper unit, on west shore of Moosehead Lake between Blue Ridge on south and Tomhegan Cove; lower unit, northeast side of Mount Kineo in NW¼ of Moosehead Lake quadrangle. Present in Somerset County and adjacent parts of Piscataquis.

Tonasket Gneiss

Age not stated: North-central Washington.

J. R. Snook, 1963, Dissert. Abs., v. 23, no. 8, p. 2878. Consists of variable group of gently dipping banded migmatitic and feldspathic gneisses; basic gneisses; subordinate isochemically metamorphosed amphibolities and lime-silicate rocks and mylonitized derivatives of these rocks. Occurs north of Patterson Lake Gneiss (new). Intruded by hypabyssal dike.

J. R. Snook, 1965, Geol. Soc. America Bull., v. 76, no. 3, p. 759—776, pls. Formal proposal of name. Name applied to gneisses previously described as "Coleville batholith" gneisses by Waters and Krauskopf (1941, Geol. Soc. America Bull., v. 52). Gneisses contain surbordinate isochemical rocks, mainly amphibolities with small amounts of calcsilicate rocks; basic gneisses; highly variable group of migmatitic and feldspathic gneisses; and mylonitized derivitatives of these rocks. Stratigraphic position of gneisses not yet determined because all boundaries are in fault contact with rocks of Triassic to Tertiary age. Tonasket Gneiss known to occupy area of at least 900 square miles and is small part of plutonic complex that extends across northern Washington into Canada.

Area of report includes parts of Tonasket and Omak Lake quadrangles. Mapped area comprises 320 square miles along and east of Okanogan Valley. Gneisses best exposed from Wagonroad Coulee to Tunk Mountain north of Riverside, Wash.

Toney Bay Member (of Wicomico Formation)

Pleistocene, lower: Eastern South Carolina.

D. J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS-12. Upper part of Wicomico divided into five members: Toney Bay, Dean Swamp, Sandridge, Wassamassaw Swamp, and Four Hole. Toney Bay is medium to coarse grained. Thickens adjacent to Surry Scarp and thins seaward. Gradational with underlying channel-fill sediments. Contains broken and entire exogenic and endogenic fauna and lithic fragments where it grades into basal part of Wassamassaw Swamp Member.

Named for Toney Bay in Eutawville quadrangle.

Tonti Member (of St. Peter Sandstone)

Middle Ordovician (Champlainian): Illinois and southwestern Wisconsin.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 13, 36, 45—46, 225. Chiefly fine-grained well-sorted friable sandstone. Medium- to coarse-grained beds occur locally. Thickness 100 to 200 feet. Overlies Kress Member (new); underlies Starved Rock Sandstone Member (new); in some areas underlies Kingdom Sandstone Member of Glenwood Formation or Augusta Member (new) of Joachim Formation.

Most widely distributed member of the St. Peter and present throughout entire area of the formation. Tonti Sandstone Member previously called lower fine-grained unit of St. Peter.

M. E. Ostrom, 1965, Wisconsin Geol. and Nat. History Survey Inf. Circ. 6 (also Guidebook for 29th Ann. Tri-State Field Conf.), p. 4, 55. Geographically extended into southwestern Wisconsin. At stop 13 (3½ miles north of New Glarus), Tonti is 80 feet thick. Underlies Glenwood Member. Base of exposure at road level.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Overlies Readstown Member (new). Name Readstown used in preference to name Kress Member.

Type section: Exposures at Starved Rock, Lovers' Leap, and French Canyon in Starved Rock State Park, LaSalle County, Ill., W½NW¼ and NW¼NW¼SW¼ sec. 22, T. 33 N., R. 2 E., Ottawa quadrangle. Named for Tonti Canyon in Starved Rock State Park.

Tonuco Formation

Upper Cambrian: Southern New Mexico.

R. H. Flower, 1958, Roswell Geol. Soc. Guidebook 11th Field Conf., p. 62 (fig. 1). Named on correlation chart of pre-Pennsylvanian formations of southern New Mexico. Underlies Bliss formation. [Page 66, mentions, but does not name, a unit of very late Franconian at Tunuco Mountain.]

R. H. Flower, 1965, New Mexico Geol. Soc. Guidebook 16th Field Conf., p. 115, 116 (fig. 1). Discussion of Shandon-Bliss Formations. Evidence suggests that the whole of type Bliss is Cambrian. In diagrams Bliss is used for Canadian beds, Tonuco for the Cambrian, and Shandon to include both units.

In area of Tonuco Mountain.

Topaz Mountain Rhyolite

Tertiary: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 30–34, pl. 1. Name applied to uppermost volcanic unit in Thomas Range, Keg Mountains, and Honeycomb Hills. Most conspicuous sections are in escarpment on west side of Thomas Range where flows make cliffs as much as 800 feet high. Thickness 200 feet in Keg Mountains; about 1,000 feet in Honeycomb Hills. In most places overlies Topaz Mountain Tuff (new). In northern Thomas Range, on the west side, Topaz Mountain Rhyolite flows occur both under as well as over the tuff. Flow under the tuff unconformably overlies Keg Mountain Ignimbrites (new).

W. N. McNulty and A. A. Levinson, 1964, Econ. Geology, no. 5, p. 770. Topaz Mountain rhyolite is similar in appearance to Honey Comb rhyolite.

Named for occurrence at Topaz Mountain, Juab County.

Topaz Mountain Tuff

Miocene or Pliocene: West-central Utah.

M. P. Erickson, 1963, Utah Geol. Soc. Guidebook 17, p. 27–30, pl. 1. Light-colored, predominantly vitric tuff which underlies latest rhyolite flows of Honeycomb Hills, Thomas Range, and Keg Mountains. Rhyolite flows of these areas are designated Topaz Mountain Rhyolite. Thickness 450 feet on west side of Thomas Range; 200 to 800 feet in Keg

Mountains; 30 feet in Honey Comb Hills but base not exposed. On west side of northern Thomas Range, overlies Thomas Range Rhyolite (new) with no erosional break. To south on both sides of the range rests with angular unconformity on Keg Mountain Ignimbrite (new). At south end of range rests unconformably on Paleozoic sedimentary rocks. In Keg Mountains rests in part on Keg Mountain ignimbrites and associated flows and in part on units of Keg Spring Andesite (new). Base not exposed in Honeycomb Hills region. Underlies Topaz Mountain Rhyolite with no erosional break.

Named for exposures in vicinity of Topaz Mountain and Amphitheater, in Thomas Range, Juab County.

Topliff Limestone Member (of Great Blue Formation)

Upper Mississippian: Central Utah.

H. T. Morris and T. S. Lovering, 1961, U.S. Geol. Survey Prof. Paper 361, p. 107, 108--109, pl. 5. Entirely limestone in well-defined beds from 6 to 8 inches to 6 feet or more in thickness. Thickness 462 feet at type section. Basal member of formation; underlies Paymaster member (new). Base not well defined but placed at top of uppermost quartzite bed assigned to Humbug formation.

Type section: North side of Edwards Canyon, North Tintic district, on S½SE¼ sec. 31, T. 8 S., R. 3 W., and N½NE¼ sec. 6, T. 9 S., R. 3 W., East Tintic Mountains. Named for Topliff quarries near Topliff Hill, where it was formerly quarried for metallurgical limestone.

Topopah Spring Member (of Paintbrush Tuff)

Topopah Spring Member (of Piapi Canyon Formation)

Topopah Spring Member (of Oak Spring Formation)

Miocene, upper: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U.S. Geol. Survey Prof. Paper 424—D, p. D—96——D—103. Member of Oak Spring formation. Brown and reddish-purple densely welded tuff; persistent black and brown vitrophyre in upper part and local vitrophyre in lower part; local zones of geodes and lithophysae; basal tuff nonwelded to partly welded and locally silicified; pale-red crystal-poor welded tuff in lower part; pumice fragments as much as 18 inches long. Thickness 0 to 900 feet. Overlies Stockade Wash Member (new); underlies Tiva Canyon member (new). Miocene(?) or younger.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C62. Reallocated to member status in Piapi Canyon Formation (new). Overlies Stockade Wash Member; underlies Tiva Canyon Member. Oak Spring raised to group rank.

P. P. Orkild, 1965, U.S. Geol. Survey Bull. 1224—A, p. A44—A51. Piapi Canyon rank raised to group status and Topopah Spring reallocated to member status in Paintbrush Tuff (new). Underlies Pah Canyon Member (new).

F. G. Poole, W. J. Carr, and D. P. Elston, 1965, U.S. Geol. Survey Bull. 1224—A, p. A40. On Skull Mountain, Wahmonie Formation (new) is directly overlain by Topopah Spring Member of Paintbrush Tuff of Piapi Canyon Group. Northwest of Wahmonie Flat a late flow of the Wahmonie occurs between the Topopah Spring and Tiva Canyon Members of the Paintbrush. Miocene(?) and Pliocene.

The U.S. Geological Survey currently designates the age of the Paintbrush Tuff as late Miocene on the basis of a study now in progress.

Type locality: Topopah Spring, Nye County. Thickest at 311 Wash. Extends from 311 Wash northward to pinchout on Rainier Mesa, southward to Shoshone Mountain, eastward to county line, and westward to Calicco Hills and probably to Yucca Mountain.

Topsfield granitic facies

See **Bottle Lake Quartz Monzonite.**

Topsfield Granodiorite

Middle(?) Paleozoic: Eastern Massachusetts.

Priestley Toulmin, 3d, 1964, U.S. Geol. Survey Bull. 1163—A, p. A20—A24, pl. 1. Coarse-grained pink to orange massive to vaguely foliated, locally pseudoporphyritic altered granodiorite. Transects structure of Newbury Formation and separates body of Newbury Formation in Salem quadrangle from main area of the formation in Newbury.

Crops out in northeast-trending belt about one-half mile wide and 2 miles long in northwest part of Salem quadrangle. Band widens to northeast in Georgetown quadrangle, where excellent exposures in village of Topsfield are basis for the name.

Topsy Formation

Tertiary: Southern Alaska.

George Plafker, 1967, U.S. Geol. Survey Misc. Geol. Inv. Map I-484. Sparsely fossiliferous marine unit consisting of about 1,200 feet of hard calcareous siltstone and sandstone. Intertongues with and overlies Cenotaph Volcanics (new). Base not exposed. Underlies Yakataga Formation.

Type locality: Along upper Topsy Creek, 7 miles southeast of mouth of Lituya Bay.

Tortola Formation

Upper Cretaceous: Virgin Islands.

T. W. Donnelley, 1966, Geol. Soc. America Mem. 98, p. 129 (footnote). Helsley (1960, unpub. thesis) referred to the formation now termed Hans Lollik as the Hans Lollik augite andesite breccia member of the Tortola Formation.

Tortugas Alluvium

Pleistocene: South-central New Mexico.

A. L. Metcalf, 1967, Texas Univ. at El Paso, Sci. Ser., no. 1, 62 p. An investigation related to late Quaternary fossil mollusks from alluvial deposits associated with stepped, geomorphic surfaces along the Rio Grande valley between Caballo Dam, N. Mex., and El Paso, Tex. Oldest fauna (considered most likely of late Illinoian age) was associated with Tortugas Surface. It comprised 21 species, all terrestrial, six of which still inhabit the area studied. Seven species were taken exclusively in Tortugas alluvium. Some present-day montane species were also common, together with seven aquatic species, in the next youngest alluvium (probably Wisconsinan in age), associated with Picacho Surface. The faunas from the Tortugas and Picacho alluviums are interpreted as indicating more mesic conditions than those presently prevailing in area. Younger sediments (Fillmore Alluvium) associated with Fillmore Surface, from which radiocarbon dates of ca. 2,000—5,000 B.P. have been obtained, yielded only species presently inhabiting the area studied. Bodies of sediments underlying Tortugas and Picacho surfaces seem to have been associated with the geomorphic cycles culminating in the formation of these surfaces. These sediments termed "Tortugas alluvium" and "Picacho alluvium" are essentially morphostratigraphic units in the sense of Frye and Willman (1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 1), identified chiefly by means of land forms with which they are associated. It is stressed that only those parts of the morphostratigraphic units laid down during the Tortugas and Picacho gromorphic cycles are called "Tortugas alluvium" and "Picacho alluvium." It is necessary to make this stipulation because the surfaces may, in some places, truncate rocks (especially Santa Fe Formation) older than those involved in their own cycles of erosion. The Tortugas and Picacho alluviums are wedge shaped, thickening medially but ultimately terminating medially in erosional escarpments. Laterally towards Valley rims, the sediments are gradually reduced to a thin layer of calichified gravels usually overlying cut surface of beds of Santa Fe Formation or of post-Santa Fe fan alluvium associated with Jornando Surface of Ruhe (1964, Annals Assoc. Amer. Geography, v. 54).

Totavi Lentil (in Puye Conglomerate)

Pliocene, upper: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 29—31, pl. 1. Poorly consolidated conglomerate composed of material ranging from fine-grained sand to boulders more than 1 foot in diameter. Thickness about 53 feet at type locality. Nonconformable with underlying undifferentiated unit of Santa Fe Group at some places and disconformable at other places. In northeastern part of area is overlain conformably by fanglomerate member of the Puye. At northwest tip of Sagebrush Flats, is overlain unconformably by arkosic sedimentary rocks of upper tongue of undifferentiated unit of Santa Fe Group. Overlain and interfingers with basaltic rocks of Chino Mesa in White Rock Canyon. To west, interfingers in subsurface with quartz latite flows of Tschicoma Formation.

Type locality: Quarry just north of Totavi in NW¼SE¼SE¼ sec. 15, T. 19 N., R. 7 E., Los Alamos area. Base not exposed in quarry. Named for community of Totavi in eastern part of area.

Totem Pass Migmatites

Tertiary: Northwestern Washington.

A. R. Grant, 1966, Dissert. Abs., v. 27, no. 6, sec. B, p. 1982. Incidental mention in discussion of bedrock geology in Dome Peak area.

Dome Peak area is on western flank of Northern Cascades in Chelan, Skagit, and Snohomish Counties.

Townsend Gulch Schists or Schist

Pre-Triassic(?): Northern California.

W. P. Pratt, 1965, Dissert., v. 25, no. 7, p. 4084. Hornblende schists probably older than Applegate Group.

G. A. Davis, 1966, California Div. Mines and Geology Bull. 190, p. 44. Townsend Gulch Schist mentioned in discussion of metamorphic and granitic history of Klamath Mountains.

Northeastern part of Scott Bar Quadrangle, Marble Mountains area, Siskiyou County.

Toy Limestone Member (of Gozar Gravel)

Quaternary: Western Texas.

J. P. Brand and R. K. DeFord, 1962, Texas Univ. Bur. Econ. Geology Geol. Quad. Map 24. Nonmarine, probably lacustrine. Megascopically appears to be algal limestone formed by colonies of algae which belong to green algae. Maximum thickness 16½ feet. Although the Toy appears to underlie typical Gozar Gravel (new), it can be traced laterally into gravel facies.

Type locality: U.S. Coast and Geodetic Survey's Toy triangulation station 31°17.0′ N., 104°08.8′ W., eastern half Kent quadrangle, Culberson County.

Toyeh soil

See **Turupah Formation** and **Fallon Formation.**

Trace Creek Shale Member (of Bloyd Shale)

Lower Pennsylvanian (Morrow Series): Northwestern Arkansas.

L. G. Henbest, 1962, U.S. Geol. Survey Prof. Paper 450—D. p. D43—D44. Composed of marine dark-gray to black shaly siltstone and claystone with minor local thin calcareous zones and limestone or calcareous sandstone lenses. Thickness commonly 60 to 70 feet; 125 feet near southwest corner of Washington County. Locally intergrades with underlying Kessler Limestone Member; underlies Greenland Sandstone Member of Atoka Formation.

Type locality: Southwest part of Bloyd Mountain from center of E½ sec. 3 to center of north side sec. 4, T. 14 N., R. 30 W., Washington County. Name derived from Trace Creek.

Trail Member (of Ericson Formation)

Upper Cretaceous: Northwestern Colorado (subsurface).

J. H. Smith, 1965, Wyoming Geol. Assoc. Guidebook 19th Ann. Field Conf., p. 18. Name suggested for lower part of Ericson (Iles) Formation. Base of member grades down and intertongues with Mancos Shale. Underlies "Rusty Zone" of Ericson (Iles) Formation. Possible that base of member contains time-stratigraphic equivalents of upper Rock Springs Formation which would include McCourt Sandstone Tongue, Coulson Shale Tongue, and Brooks Sandstone Tongue. Name has been in common use among oil company geologists and others that have interests in Vermilion Basin.

Occurs in Mountain Fuel Supply Co.'s Trail Field, Moffat County, Colorado.

Trail Creek granite facies

Precambrian: Colorado-Wyoming

D. H. Eggler, 1967, Mountain Geologist, v. 4, no. 3, p. 109. Informal term applied to outer granite facies of Sherman batholith.

Near Livermore-Tie siding area, in northern Front Range-southern Laramie Range.

Trailer Limestone

Middle Cambrian: West-central Utah.

M. H. Staatz and W. J. Carr, 1964, U.S. Geol. Survey Prof. Paper 415, p. 9 (table 4), 21—22, pl. 1. Consists of blue-gray limestone and shale. Lower 150 feet is massive to thick-bedded dark-blue-gray limestone with a few *Girvanella* near base, and is locally cut by stringers of white calcite. Upper part is dark-blue-gray very fine grained limestone. Beds are one-fourth to 2 inches thick and are separated by tan or yellow argillaceous partings. Thickness 384 feet at type section; 470 feet, 0.3 mile north of Trailer Wash. Overlies Shadscale formation; underlies Fandangle limestone.

Type section: On east side of Dugway Range on ridge 0.6 mile north of Trailer Wash, Juab County. Also crops out at five other places: (1) knolls along east side of Dugway Range just north of Straight Canyon, (2) knolls about 1 mile east of Dugway Pass, (3) in band on west side of south end of Fandangle Canyon, (4) on ridge at south end of Bullion Canyon, and (5) along two hillsides 1.4 miles southeast of Four Metals mine.

Trail Ridge Member (of Thirsty Canyon Tuff)

Pliocene: Southeastern Nevada.

D. C. Noble and others, 1964, U.S. Geol. Survey Prof. Paper 475—D, p. D24—D27. In most outcrops includes basal bed of air-fall pumice; commonly less than 5 feet thick but locally as much as 30 feet thick. In vicinity of Black Mountain and Thirsty Canyon, bulk of member consists of lithic-rich moderately to densely welded ash-flow tuff, which is capped by thin unit of densely welded shard tuff containing very few pumice fragments or lithic inclusions and few phenocrysts. To north lithic-rich part of member is absent. Thickness about 100 feet at type locality where both lower lithic-rich zone and upper shard zone are well developed. Almost 200 feet thick in general vicinity of Thirsty Canyon. At type locality overlies Spearhead Member and is paraconformably overlain by Gold Flat Member (new).

Type locality: North of Black Mountain (lat 37°21′N., long 116°39′ W.) about 7 miles west of Trail Ridge, Nye Canyon.

Tramway trondhjemite

Lower Cretaceous(?): Southeastern Oregon.

W. H. Taubeneck, 1964, Geol. Soc. America Bull., v. 75, no. 11, p. 1096, 1097 (fig. 2), 1098 (fig. 3), 1102, 1103, 1106. Cornucopia stock contains at least five distinct tonalites and trondhjemites; each is separate injection. Oldest and largest is Cornucopia tonalite. Next oldest is Tramway trondhjemite. Following unit, first in series of three cordierite trondhjemites, is the Big Kettle, and the two subsequent units are Pine Lakes and Crater Lake.

Wallowa Mountains, Baker County.

Trees City Sand (in Tokio Formation)

Upper Cretaceous: Subsurface in Louisiana and Arkansas.

S. H. Ogier, 1963, Shreveport Geol. Soc. Ref., v. 5, p. 102, 104. A rather well developed sand conformably overlies middle Tokio unit in northern part of Caddo Parish. Has commonly been referred to as "Blossom" sand

and may be equivalent to part of Blossom sand of Texas. Upper limit of Blossom, at its type locality at Blossom, Lamar County, Tex., has never been well defined. As result, term Blossom has gradually come to be applied in subsurface to any or all of sands of Austin equivalent, including Brownstown Formation. Relationships between the sand developed in Caddo Parish and type Blossom will have to be established by detailed studies to establish their continuity. Meanwhile, the sand developed in Caddo Parish is herein referred to as Trees City sand. In [type well] consists of 77 feet of medium-grained quartz sand. In this well, separated from overlying Roberson sand (new) by 8 feet of shale. For convenience in correlation this shale is included in the Trees City unit.

Occurs in interval 1892-1977 feet in Glen Rose Gas Co., Stiles No. 1 well, sec. 22, T. 21 N., R. 16 W., in Trees City district of Caddo-Pine Island field of Caddo Parish, La.

Treman Member (of Ithaca Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Uppermost member of Ithaca (redefined) in Ithaca-Owego area. Overlies Renwick Member; underlies Middlesex Formation (the Ithaca of previous usage).

Type section: In Buttermilk Creek (Buttermilk Falls State Park), 1 mile south of Ithaca, Tompkins County.

Trenton Canyon Member (of Havallah Formation)

Lower Permian: North-central Nevada.

R. J. Roberts, 1964, U.S. Geol. Survey Prof. Paper 459—A, p. A46, pl. 1. Middle member of formation. Composed of interbedded chart and shale. Chert layers mostly red, green, or purple, or gray and commonly thin bedded. Individual layers range from 1 to 12 inches in thickness and average about 4 inches. Thickness about 1,000 feet at type section. Overlies Jory Member (new); underlies Mill Canyon Member (new).

Type section: In Trenton Canyon just north of Black Rock mine, Antler Peak quadrangle, Pershing County.

Tres Alamos Member (of Quiburis Formation)

Pliocene: Southeastern Arizona.

L. D. Agenbroad, 1967, Dissert. Abs., v. 28, no. 2, sec. B, p. 737. There is lateral facies change within Quiburis formation. The conglomeratic member interfingers with a central fine-grained member and names Tres Alamos and Redington are proposed for these units.

Redington-San Manuel area, San Pedro Valley.

Trident Member (of Three Forks Formation)

Upper Devonian: Montana, Idaho, and Wyoming.

C. A. Sandberg, 1965, U.S. Geol. Survey Bull. 1194—N, p. N2 (fig. 1), N8 (fig. 3), N12—N14. Overlies Logan Gulch Member (new); underlies Sappington Member. At Logan, Mont., member is largely greenish-gray, light-olive-gray, and yellowish-gray calcareous to slightly calcareous fossiliferous clay shale. Thickness 73 feet at Logan. Farther west it ranges from 100 to 225 feet. Extends short distance into northwestern

Wyoming. A partly equivalent formal member [Horseshoe Hills] that was proposed by Rau (1962) is disregarded because it includes lower half of Sappington as used by many authors. Trident Member comprises beds that Wilson (1955, Billings Geol. Soc. Guidebook 6th Ann. Field Conf.) considered the restricted Three Forks. Previous usage of name Trident as casually applied by Keyes (1926) is herein abandoned.

C. A. Sandberg and Gilbert Klapper, 1967, U.S. Geol. Survey Bull. 1251—B, 70 p. East of limit of the Sappington Member of Three Forks Formation, Cottonwood Canyon Member (new) of Madison Limestone or Lodgepole Limestone rests unconformably on Trident and Logan Gulch Members of Three Forks in descending order.

C. A. Sandberg, W. J. Mapel, and J. W. Huddle, 1967, U.S. Geol. Survey Prof. Paper 575—C, p. C127—C131. Geographically extended into Lost River Range, Idaho. In measured section in Custer County, in Mackay 15-minute quadrangle, Trident Member is 267 feet thick and is in conformable contact with underlying Birdbear Member of Jefferson Formation and is unconformable below Mississippian Milligen Formation.

Type section: Incuded in type section of Three Forks stated by Sandberg (1962) in gulch and on bluffs at north side of Gallatin River, northeast of Logan, in S½S½ sec. 25, T. 2 N., R. 2 E., Gallatin County, Mont. Named from town of Trident on Missouri River about 5 miles northwest of Logan.

Trinity Stage

Cretaceous (Comanchean): Atlantic and Gulf Coastal Province.

G. E. Murrary, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 307—319. Name Trinity was first applied in 1888 to exposures on Trinity River, Tex., consisting of alternating sands, marls, and limestones. Original definition applied only to basal part of Trinity group of current usage which Hill (1888) noted as underlying the Comanche and overlying the Carboniferous. Hill's usage has been emended to include Comanchean strata older than the Fredericksburgian. It has generally been divided into (descending) Paluxy, Glen Rose, and Travis Peak formations. Barrow (1953, unpub. thesis) proposed substitution of Trinity stage for Trinity group since the group had been defined paleontologically, base being generally considered base of *Dufrenoya texana* zone which occurs in Cow Creek limestone member of type Travis Peak, and top being commonly designated as base of *Metengoceras* aff. *M. hilli* zone of basal Fredericksburgian. As normally used in northern Gulf coastal province, term Trinity stage includes all sedimentary rocks below Fredericksburg stage and above the Hosston-Sligo, or their equivalents. Commonly believed to embrace oldest Comanchean rocks in the coastal province and to overlie older Cretaceous strata assigned to Coahuilan series.

Type region: Trinity River exposures in Texas.

Trommald Formation

Precambrian: Central Minnesota.

R. G. Schmidt, 1963, U.S. Geol. Survey Prof. Paper 407, p. 11, 18—26, 31, 39, 54, 57, pls. 1—8. Consists almost entirely of iron-formation of varied mineral composition and texture. Has thin- and thick-bedded facies which have characteristic compositional and textural differences. In parts of [Cuyuna] North Range, entire formation is thin-bedded facies; in others, formation is all thick-bedded facies; and in about one-third, the thin-bedded underlies the thick-bedded and grades upward into it. Thickness 45 to more than 500 feet. Overlies Mahnomen formation and underlies Rabbit Lake formation (both new).

Type area: Drill holes and mines near Trommald, Crow Wing County.

Trout Meadows basalt

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 4, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Trout Meadows basalt gave age of 3.5 ± 0.1 m.y.

Sample comes from series of basalt flows which rest on Little Kern Plateau at confluence of Kern and Little Kern Rivers, Hockett Peak quadrangle near Trout Meadows.

Trout Valley Formation

Lower and Middle Devonian: North-central Maine

Erling Dorf and D. W. Rankin, 1962, Jour. Paleontology, v. 36, no. 5, p. 999—1004. Predominantly clastic rocks. Main body of formation is heterogeneous assemblage of light-blue-gray to black shale, siltstone, sandstone, and conglomerate. Black sideritic ironstone and sandstone comprise small part of formation. Maximum exposed thickness 1,500 feet. Crops out over an area about 1½ by 8 miles. To north and west abuts against high-angle normal fault and is on downthrown side of the fault. To south and east unconformably overlies series of felsite lavas, tuffs, and welded tuffs, locally 9,000 feet thick. These have been called Traveller rhyolite by Toppan (1932). Formation, youngest stratified unit in area, lies in trough of synclinorium involving pre-Silurian, Silurian, and Devonian rocks. Axis of synclinorium strikes east-northeast paralleling Trout Brook Valley and plunges slightly southwest. Plant fossils described. Lower Devonian.

The U.S. Geological Survey currently designates the age of the Trout Valley Formation as Lower and Middle Devonian on the basis of a study now in progress.

Type section: Exposures along Trout Brook between bridge over Trout Brook 2,000 feet downstream from junction with South Branch Ponds Brook, T. 6, R. 9, and quartz andesite sill at sharp bend in Trout Brook, T. 5, R. 10, Traveler Mountain quadrangle. Occupies valley of Trout Brook between west shoulder of Trout Brook Mountain and north shoulder of Burnt Mountain.

Truckee basin flows

See Lousetown flows.

Tschicoma Formation (in Tewa Group)

Pliocene: North-central New Mexico.

Original references (Chicoma Volcanic Formation): H. T. U. Smith, 1937, (abs.) Geol. Soc. America Proc. 1936, p. 103; 1938, Jour. Geology, v. 46, no. 7, p. 939—940.

R. L. Griggs, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 42—45. First mapped by Smith (1938) as Chicoma volcanic formation. No type locality was specified, but it is presumed that formation was named for high peak composed of these rocks about 5 miles north of Los Alamos area that is now designated Tschicoma Mountain on Geological Survey topographic map of Polvadera Peak quadrangle (1953). Revised spelling is used in present report. In Los Alamos area consists of two mappable units. Older composed of latite and quartz latite flows, and the younger of pyroxene andesite flows. Base not exposed in area. Exposed thickness in Pajarito Canyon adjacent to Pajarito Mountain at east side of Valley Caldera more than 2,600 feet. Thins rapidly beneath Bandelier Tuff on Pajarito Plateau and interfingers with upper part of undifferentiated unit and Puye Conglomerate of Santa Fe Group. Cut by rhyolite of dome which belongs to Cerro Toledo Rhyolite (new) of Quaternary age. Also cut by Valles Rhyolite (new).

The U.S. Geological Survey currently classifies the Tschicoma as a formation in the Tewa Group on the basis of a study now in progress.

Probably named for Tschicoma Mountain in Polvadera Peak quadrangle, north of Los Alamos area.

Tshirege Member (of Bandelier Tuff)

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U.S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8). A welded rhyolitic tuff composed of small fragments of crystallized pumice and crystals and crystal fragments of sanidine and quartz in a welded tuff matrix. Thickness 100 to 200 feet near eastern margin of area [Los Alamos]; about 1,000 feet at head of Rito de los Frijoles in southwestern part of area. Rests with erosional unconformity on all older rocks with which it is in contact. On Pajarito Plateau rests on Otowi Member (new) and fills eroded channels in that member. Overlaps Otowi Member to west and rests on Tschicoma Formation in the Sierra de los Valles. Also, in the Sierra de los Valles, the Tshirege Member laps onto some of Cerro Toledo Rhyolite (new) domes.

Type area: Pajarito Plateau and adjacent lower slopes of the Sierra de los Valles, Los Alamos area. Named for exposures in vicinity of Tshirege ruins, NW¼ sec. 5, T. 18 N., R. 7 E., where member forms capping rock over large area of Pajarito Plateau. Small outliers cap mesas as far east as Puye Escarpment.

Tuana Gravel (In Idaho Group)

Pleistocene, lower: Southwestern Idaho.

H. E. Malde and H. A. Powers, 1962, Geol. Soc. America Bull., v. 73, no. 11, p. 1199 (fig. 1), 1209—1210, pl. 1. Name applied to typical sequence of brown and gray beds of pebble gravel, sand, silt, and clay in Indian Butte (a prominence along Tuana Gulch) and to a patch of pediment gravel in upland drained by Bruneau River. At Indian Butte the Tuana is 200 feet thick. Eastward and northward from Indian Butte, the Tuana extends to bluffs of Snake River, where base of gravel is about 600 feet above river level; southward extends to upland plains drained by lower reach of Salmon Falls Creek. In Bruneau River area the Tuana extends northward to an eroded terminus 850 feet above Snake River, 6 miles southeast of Bruneau. In Tuana Gulch area, the Tuana overlies beds of flood-plain facies of Glenns Ferry Formation (new), which are truncated by angular unconformity that dips northward to average gradient 15 to 20 feet per mile. Not in actual contact with Bruneau Formation (new) but relations show that the Bruneau is stratigraphically younger.

Type locality: Tuana Gulch, a tributary that drains upland plain, west of Hagerman, Gooding County.

Tub Spring Member (of Belted Range Tuff)

Tub Spring Member (of Indian Trail Formation)

Tub Spring Member (of Oak Spring Formation)

Miocene: Southern Nevada.

E. N. Hinrichs and P. P. Orkild, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—96—D—103. Member of Oak Spring Formation. Greenish-gray welded tuff, gray vitrophyre and reddish-brown partially welded pumice; inclusions of rhyolite, welded tuff, and Paleozoic rocks; base nonwelded gray vitric and at some places yellow zeolitic tuff. Thickness 0 to 250 feet. Underlies Grouse Canyon member (new); overlies unnamed basal unit of formation. Oak Spring formation is Miocene(?) or younger.

F. G. Poole and F. A. McKeown, 1962, U.S. Geol. Survey Prof. Paper 450—C, p. C60—C61. Reallocated to member status in Indian Trail Formation (new). Underlies Grouse Canyon Member. Tub Spring and Grouse Canyon are multiple-flow simple cooling units of rhyolitic welded and nonwelded ash-flow tuff and associated ash-fall tuff. These units wedge out southward from Oak Spring Butte area, whereas northward they thicken and become more densely welded. Oak Spring Formation raised to group rank to include Indian Trail and Piapi Canyon Formations.

K. A. Sargent, D. C. Noble, and E. B. Ekren, 1965, U.S. Geol. Survey bull. 1224—A, p. A32—A36. Indian Trail Formation restricted to eastern part of Nevada Test Site. North and west of Test Site, the Tub Spring and Grouse Canyon are members of Belted Range Tuff (new). Age of Belted Range Tuff Miocene or Pliocene.

R. B. Colton and D. C. Noble, 1967, U.S. Geol. Survey Geol. Quad. Map GQ-719. Belted Range Tuff with Tub Spring Member mapped in Groom Mine SW quadrangle Nye County. Tub Spring is 150 to 350 feet thick. Miocene.

Type locality: Tub Spring, Nevada Test Site, Nye County. Present on north and east sides of Yucca Flat.

Tucker Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Tucker sand occurs at depth of 8,588 to 8,600 feet in type well. Correlation of Roseberry, Sexton, Tucker, and Taylor sands is difficult downdip from type area because sands merge into massive sandstone bar of the Schuler.

Type well: Hunt Oil Co., No. 1 Owens, sec. 13, T. 23 N., R. 7 W., East Haynesville field. Reference well: Stanolind Oil and Gas Co., No. 1 Beene unit, sec. 5, T. 22 N., R. 9 W., Shongaloo field, Webster Parish.

Tucker Creek Formation (in Clover Creek Group)

Upper Triassic: Northeastern Oregon.

H. J. Prostka, 1962, Geology of the Sparta quadrangle, Oregon (1:62,500): Oregon Dept. Geology and Mineral Industries. Clover Creek Greenstone to be elevated to group rank and subdivided into two new formations, Harsin Ranch and Tucker Creek of Permian and upper Triassic ages respectively. New names and classification credited to Koch and Bowen (1962, written commun.). Inasmuch as all rocks mapped as Clover Creek Greenstone in Sparta quadrangle are believed to be Triassic, they would be equivalent to Tucker Creek Formation and may be referred to by that name.

Tucson Wash Member (of San Manuel Formation)

Tertiary, middle(?): Southeastern Arizona.

L. A. Heindl, 1963, U.S. Geol. Survey Bull. 1141—E, p. E20—E21, pl. 1. Dark gray to purplish gray; characteristically contains boulder-size fragments of volcanic and fanglomerate rocks derived from Cloudburst formation and Precambrian quartz monzonite. Becomes finer grained to south where it merges into undifferentiated part of San Manuel formation. Intensely faulted. Thickness more than 1,000 feet. Lies disconformably on erosional surface cut on Kannally member (new); underlies Quiburis formation (new).

Named for exposures along Tucson Wash. Pinal County. Best exposed along southwest side San Manuel fault near Red Hill. Also well exposed in roadcuts along new highway and railroad connecting town of San Manuel and San Manuel mine near Red Hill.

Tukwila Formation (in Puget Group)

Eocene, upper: Northwestern Washington.

H. H. Waldron, 1962, U.S. Geol. Survey Geol. Quad. Map GQ—159. Consists of lower volcanic sedimentary rock unit that constitutes most of formation, a middle arkosic unit about 250 feet, and an upper volcanic sedimentary unit that is less than 500 feet thick. Estimated thickness about 2,500 feet. Overlies middle Eocene marine sedimentary rocks; may be fault contact. Conformably overlain by Renton formation (new).

J. D. Vine, 1962, Washington Div. Mines and Geology Rept. Inv. 21, p. 14—16, 18. In King County the Tukwila represents a 7,000-foot-thick lens of volcanic material entirely enclosed within coal-bearing sedimentary rocks of Puget Group. Beds of sandstone, siltstone, and coal typical of Puget Group overlie, underlie, and are interstratified with andesitic rocks of the Tukwila. Subdivided locally on basis of gross lithology and texture. Tuff, fine-grained volcanic sandstone, and volcanic tuff-breccia characterize lower members that are interstratified with Tiger Mountain Formation (new). These rocks are overlain on Taylor Mountain by volcanic sandstone and spherulitic volcanic flows in lower part; volcanic sandstone and 2- to 5-foot-thick vesicular basalt sills interstratified with 25- to 100-foot-thick beds of carbonaceous claystone, coal, and micaceous sandstone bed in middle; and tuff-breccia and volcanic conglomerate in beds up to 100 feet thick, interbedded with medium- to coarse-grained volcanic sandstone and tuff, in upper part. Underlies Renton Formation; contact sharp. Reference section designated.

Named for town of Tukwila, King County, where beds in lower part of Puget group crop out nearby in secs. 11 and 14, T. 23 N., R. 4 E., Des Moines quadrangle. Reference section: Secs. 22, 27, and 34, T. 23 N., R. 7 E., Taylor Mountain area, King County.

Tularcitos Formation

See Los Tularcitos Member (of Chamisal Formation).

Tule Canyon Complex

Pre-Middle Cretaceous: Southern California

R. V. Sharp, 1967, Geol. Soc. America Bull., v. 78, no. 6, pl. 1. San Jacinto fault zone is one of major branches of San Andreas fault system in southern California. The straightness, continuity, and high seismicity of the zone, as well as its present right-lateral strain rate, suggest that currently it may be the most active member of the system in this region. Only one scheme of correlation across the San Jacinto fault zone is compatible with the configuration of offset of crystalline bodies, many of which are individually distinctive in their structural and lithologic character. Listed in table 1 are the sequences of correlative bodies, their separations across major fractures in fault zone, and distinguishing features on which correlations are based. Tule Canyon complex [not listed in table but mapped] is one of six complexes used in these correlations. Several plutons and sills are also listed and mapped.

San Jacinto fault zone is in Peninsular Ranges of southern California.

Tuledad Formation

Pliocene: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p 186 (table 15). Named on table of geologic formations in Madeline Plains. Consists of lake deposits.

Crops out only in Tuledad Valley.

Tungsten Hills Quartz Monzonite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1533—1534. Typical quartz monzonite; away from margins is medium grained and medium light gray on fresh exposures. Intrudes Wheeler Crest Quartz Monzonite (new), granodiorite of Deep Canyon, Lamarck Granodiorite (new), and Round Valley Peak Granodiorite (new). Intruded by quartz monzonite and alaskite similar to that in Cathedral Peak Granite.

Type locality: A hill 2 miles No. 20° E. of Grouse Mountain in southwestern part of Tungsten Hills, east-central Sierra Nevada, near Bishop. Crops out discontinuously in northwest-trending belt through central part of mapped area.

Tungsten King Granite

Precambrian: Southeastern Arizona.

J. R. Cooper and L. T. Silver, 1964, U. S. Geol. Survey Prof. Paper 416, p. 32—35, pl. 1. Name applied to granite mass exposed in and near Tungsten King mine. Outcrop near mine is about 1 by 3 miles and forms central and steepest part of west slope of Little Dragoon Mountains. Exposure is upfaulted block or horst between Tungsten King fault of east and South Camp fault on northwest. Overlapping alluvium forms most of western boundary. The alluvium, lamprophyric dikes, Pinal schist, and aplite associated in space with the granite are the only formations in contact with the granite mass.

Named for Tungsten King mine, Dragoon quadrangle, Cochise County.

Tunnel Stade

Tunnel Drift

Holocene: Alaska.

T. N. V. Karlstrom, 1964, U. S. Geol. Survey Misc. Geol. Inv. Map—1357. Tunnel drift listed with named glacial drifts included in moraine units.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1), 361. The Tunnel Stade of the Alaskan Glaciation, well-dated by radiocarbon analyses of logs buried in the older moraines and by ring counts from trees growing on young moraines, consists of several glacial advances during the last 1,500 years. Younger than Tustumena Stade.

Karlstrom, 1964, used term Tunnel advance in his professional paper. Terms advance and readvance are not acceptable terms in formal nomenclature.

Cook Inlet region.

Tunnel City Group

Upper Cambrian (Franconian): Wisconsin.

M. E. Ostrom, 1966, Wisconsin Geol. and Nat. History Survey Inf. Circ. 7 (also Michigan Basin Geol. Soc. Guidebook Ann. Field Conf. May 21—22) p. 7 (fig. 2), 8 (fig. 3), 37, 38. Includes all rock strata above Wonewoc Formation (new) and below St. Lawrence Formation. Includes Lone Rock Formation (new) and Mazomanie herein raised to formation status.

M. E. Ostrom, 1967, Wisconsin Geol. and Nat. History Survey Inf. Circ. 8. Proposed that names Dresbach and Franconia be reserved for use as stage names in biostratigraphy and that names Elk Mound and Tunnel City be used as lithostratigraphic replacements with minor modifications. Tunnel City Group as defined consists of all strata above Elk Mount Group and below St. Lawrence Formation or Jordan Sandstone.

Name is taken from village of Tunnel City in and near which the rocks are exposed in railroad cuts, roadcuts, quarries, and natural outcrops. Tunnel City is in Monroe County.

Tupik Formation (in Lisburne Group)

Upper Mississippian: Northern Alaska.

E. G. Sable and J. T. Dutro, Jr., 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 5, p 592—593. Predominantly dark-gray to black, finely crystalline limestone and black chert. Thickness 135 feet at type section, upper part missing; 700 feet 5 miles west-southwest of type section.

Overlies Kogruk formation (new); underlies chert and shale of probable Permian age 3 miles northwest of type locality.

R. H. Campbell, 1967, U. S. Geol. Survey Prof. Paper 395, p 18—19, 34—35, pls. Described in vicinity of Chariot Test Site where it best exposed in sea cliffs about 1½ miles west of mouth of Nasorak Creek. Elsewhere only locally present at top of group. Thickness 330 + (200?) feet. Overlies Kogruk(?) Formation. Underlies Siksikpuk Formation.

Type section: Southside of Tupik Mountain, adjacent to type section of Kogruk formation, De Long Mountains.

Turkey Tank Flow

Pleistocene: Central Arizona.

H. S. Colton, 1937, Mus. Northern Arizona Bull. 10, p 34. Discussion of basaltic cinder and lava flows of San Francisco Mountain volcanic field. First period of volcanic activity was near close of Tertiary and basaltic lava flow occurred in many parts of San Francisco region. A second period of activity extruded acid or intermediate lavas over the layers of basalt of first period. Basaltic activity occurred during the Pleistocene and continued almost to present time. As many as 388 vents have been listed. Basaltic lava flows are divided into five groups (stages) based on stage of erosion which they exhibit. Turkey Tank flow listed with flows that are thick with steep fronts. Stage III and Stage IV flows show considerable variation in thickness. Some are 10 to 20 feet thick and others 75 to 100 feet thick.

H. S. Colton, 1967, The basaltic cinder cones and lava flows of the San Francisco Mountain volcanic field: Flagstaff, Ariz., Northland Press, p. 37, 53. According to Damon (1966, Geochronology Labs., Washington) the paleomagnetic data together with K-Ar dating can be interpreted as indicating that Colton's late stage II and all of stage III, IV, and V basalts were extruded during the last 0.85 m.y.

Issued from Turkey Tank Crater.

Turkey Track Andesite

Turkey Track Porphyry

Oligocene-Miocene: Southeastern Arizona.

T. C. Denton, 1947, U. S. Bur. Mines Rept. Inv. 4007, p. 14. "Turkey Track" (andesite and basaltic) porphyry listed in study of project at Aravaipa.

J. R. Cooper, 1961, Arizona Geol. Soc. Digest, v. 6, p. 17—33. Tertiary igneous rocks of southeastern Arizona include a distinctive porphyry characterized by abundant tabular phenocrysts of plagioclase as much as 1 inch or locally as much as 2 inches in diameter in gray to reddish-brown fine-grained to glassy groundmass. Many years ago Eldred D. Wilson referred to the rock as turkey-track porphyry—an apt descriptive name which has come into fairly wide popular usage and has appeared in at least one published report (Denton, 1947). Most geologic reports refer to the rock as basalt or andesite. These names imply more about the composition of the rocks than it is possible to determine by petrographic means, and the purely descriptive term turkey-track porphyry is preferable unless chemical analyses are available. Turkey-track porphyry flows, dikes, and sills are present in many places within radius of 75 miles of Tuscon. Individual flows and groups of flows probably nowhere exceed 1,000 feet in thickness. May be valid marker for regional correlations. Information in present report comes mostly from Twin Buttes quadrangle about 20 miles southwest of Tuscon, Dragoon quadrangle about 50 miles east of Tuscon, and Klondyke quadrangle about 50 miles northeast of Tuscon. Younger than 20-called Mineta formation, which is between late Oligocene and middle Miocene. Best estimate of age is probably Miocene.

P. E. Damon and Michael Bikerman, 1964, Arizona Geol. Soc. Digest, v. 7, p. 66, 69 (table 2). Turkey Track Andesite listed from Sentinel Peak ("A" Mountain), Pima County, in report on potassium-argon dating of post-Laramide plutonic and volcanic rocks in Basin and Range province of southeastern Arizona and adjacent areas. Age 28.0±2.6 m.y.

J. E. Mielke, 1964, Arizona Geol. Soc. Digest, v. 7, p. 87-96. Trace element investigation of "Turkey Track" porphyry. Although "Turkey Track" localities appear to be from same parent, they probably do not represent one eruption from one vent. They may represent a series of eruptions from several vents or intrusions into several areas, all within span of a few million years. Damon and Bikerman show that a great number of volcanic and plutonic rocks in southern Arizona formed around Paleogene-Neogene boundary, 25 to 30 million years ago. If most middle Tertiary "basalts" in this area formed within this time interval, "Turkey Track" is even more restricted in time, as it is found near base of sequence.

Reported by Denton (1947) at Aravaipa, Graham County.

Turner Formation (in Buckfield Group)

Silurian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., Trip K, p. 104 (table 1), 105, figs. 1, 2, road log. Basal unit in Buckfield Group (new). Underlies Patch Mountain Formation. Composed of sillimanite-biotite-muscovite-garnet schist with many zones and beds of biotite quartzite and biotite meta-graywacke. Thin zone of graphite schist present in some areas. Noted as an unpublished and unofficial stratigraphic name.

Area of report is Buckfield and Dixfield quadrangles.

Turner Creek Formation

Miocene: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 52, v. 2, pls. Principally mudflows and tuffs with lesser amounts of basalt flows and interbedded sandstone, conglomerate, and diatomite. Thickness about 4,000 feet. Maybe correlative with upper part of Cedarville series and in part with Big Valley Mountains volcanic series (new).

Present in mountainous areas between Warm Springs Valley and Big Valley.

Turney Ranch Formation

See **Apache Canyon Formation** (in Bisbee Group).

Turtle Lake Sand

Pleistocene: Southeastern Minnesota.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM-2 (with text), p. 6 (table 2), 20-21. Largely a very pale brown fine to medium-laminated to thin-bedded sand with occasional laminae of silt. Directly overlies Twin Cities Formation. A lake deposit.

Type area: NW¼NW¼ sec. 14, T. 30, N., R. 23 W., New Brighton quadrangle. Named for Turtle Lake in Arden Hills.

Turton Member (of De Forest Formation)

Quaternary: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, and G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 5, p. 473—487. Varies texturally from silt loam to loam. May be calcareous to the surface, or upper 5 to 6 feet may be noncalcareous. Colors range from dark grayish brown to grayish brown. Maximum thickness 12 feet. Disconformably overlies Mullenix and Hatcher members (both new); disconformity marked by sands and gravels and locally has relief of 12 feet or more. In all cases is inset below top of the Mullenix and top may be as much as 16 feet below top of Mullenix. May range in age from greater than 250 years B.P. to greater than 76 years B.P.

Type section: On east bank of Thompson Creek, 200 feet west from confluence of Watkins Branch and Thompson Creek, in NE¼ sec. 18, T. 80 N., R. 42 W., Harrison County. Named for Turton Branch.

Turupah Formation (in Lahontan Valley Group)

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—113. Consists of as much as 30 feet of eolian sand and local alluvium overlying Sehoo and Indian Lakes formations (both new) with local disconformity and conformably underlying post-Lahontan soil and Fallon formation (new).

R. B. Morrison, 1964, U. S. Geol. Survey Prof. Paper 401, p. 75—78, pls. Youngest formation in group. Consists of eolian sand and alluvium overlying Sehoo formation and underlying the Toyeh soil and Fallon formation. Note on type locality.

Type locality: Exposure of eolian sand northwest of Turupah Flat that extends about one-half mile on each side of side road south on U. S. Highway 50, from NW¼ sec. 33 to SE¼ sec. 29, T. 18 N., R. 30 E., Churchill County, Carson Desert (Fallon) area.

Tuscarawas Shale

Pennsylvanian: Eastern Ohio.

M. T. Sturgeon and R. M. DeLong, 1964, Ohio Jour. Sci., v. 64, no. 1, p. 41—43. Revisions of some stratigraphic names in between the Lower and Middle Kittanning coals in eastern Ohio. Name Tuscarawas applied to a shale unit about 1½ feet thick that overlies Strasburg coal and underlies Red Kidney ironstone. The fauna, including *Dunbarella* and chonetid brachiopods, is definitely marine.

Type exposure: In abandoned strip mine of Strasburg Coal and Clay Co., NW¼NW¼ sec. 30, Pike Township, and NE¼NE¼ sec. 25, Bethlehem Township County. Named for exposures in Tuscarawas River valley.

Tustumena Stade

Tustumena Drift

Holocene: Alaska.

T. N. V. Karlstrom, 1964, U. S. Geol. Survey Misc. Geol. Inv. Map I—357. Tustumena drift listed with named glacial drifts included in moraine units.

T. L. Péwé, D. M. Hopkins, and J. L. Giddings, 1965, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 360 (table 1), 361.Logs buried in drift indicate that some glacial advances during the Tustumena Stade of the Alaskan Glaciation took place more than 2,500 years ago. Indirect evidence led Karlstrom to conclude that the Tustumena Stade extended from about 5,000 to 2,000 years ago. Older than Tunnel Stade.

Karlstrom, 1964, used term Tustumena advance in his professional paper. Terms advance and readvance are not acceptable terms in formal stratigraphic nomenclature.

Cook Inlet region.

Twelve Foot Falls Quartz Diorite

Precambrian: Northeastern Wisconsin.

J. A. Cain, 1962, (abs.) Lake Superior Geology Inst. 8th Ann. Mtg., May 10—12 (Michigan Coll. Mining and Technology), p. 5. Discussion of a Precambrian pluton near Pembine, Wis. Nine rock units mapped within some 350 square miles of the Precambrian granitic and metamorphic complex. Relative age relationships are suggested primarily from study of xenoliths, as follows (ascending): Quinnesec Formation, biotite gneiss, Marinette Quartz Diorite (new), Twelve Foot Falls Quartz Diorite, metagabbro sills, Hoskin Lake Granite (new), Newingham Granite, Amberg Granite (new), and diabase dikes.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology of northeastern Wisconsin. In Pembine—Amberg area, eight rock units younger than Quinnesec Formation are recognized and mapped. Five of these units are named. Twelve Foot Falls Quartz Diorite is third in sequence (ascending). Younger than Marinette Quartz Diorite (new); older than unnamed metagabbro sills. Name credited to Wadsworth (1962, unpub. thesis).

J. A. Cain, 1964, Michigan Acad. Sci., Arts, and Letters Papers, v. 49, p. 81—103. Described in Pembine area. Intrudes Quinnesec Formation. Crops out between, and is older than, Newingham Granite and Amberg Granite.

Type locality and derivation of name not stated.

Twin Canyon Member (of Osgood Mountain Formation)

Lower Cambrian(?): North-central Nevada.

P. E. Hotz and Ronald Willden, 1964, U. S. Geol. Survey Prof. Paper 431, p. 7, 8—9. A discontinuous member characterized by interbedded shale and impure quartzite. Represents beds apparently transitional between Osgood Mountain quartzite and overlying Preble formation. Maximum thickness 2,500 feet. Lower contact of member commonly abrupt and conformable, but in some places is gradational over a distance of a few feet. This contact is drawn at base of first prominent shale bed, above which there is an alternating succession of shale and impure quartzite.

Named from typical exposures in Twin Canyon, SW¼ sec. 25, T. 38 N., R. 41 E., Osgood Mountains quadrangle, Humboldt County. Crops out in two narrow elongated belts on east side of Osgood Mountains.

Twin Cities Formation

Pleistocene (Wisconsin): Southeastern Minnesota.

H. E. Wright and others, 1965, Internat. Assoc. Quaternary Research 7th Cong., Boulder Colo., Guidebook Field Conf. C, Upper Mississippi Valley, p. 47 (fig. 6-3), 50 (fig. 6-6), 51, 52. Complex till consisting of (a) till, silt loam, light-olive-brown (gray where unoxidized), highly calcareous; (b) till, loam, reddish-brown, noncalcareous to calcareous; (c) sorted drift, silt to pebble gravel. Sequence, which can be traced in subsurface as well as mapped at surface, is (descending): New Brighton Formation (new), Twin Cities Formation, and Hillside Sand (new). In some areas overlies Decorah Shale. Name Twin Cities credited to J. E. Stone [Minnesota Geol. Survey Geol. Map Ser., GM-2, in press].

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM-2 (with text). p. 6 (table 2), 9-12. Formal proposal of name. Underlies Turtle Lake Sand (new). Type section and alternate type section designated.

Type section: Roadcut on north side of the 3d street, one-fourth mile east of Silver Lake Road in New Brighton, SE¼NW¼SE¼ sec. 30, T. 30 N., R. 23 W., New Brighton quadrangle. Alternate type section: Borrow pit immediately east of Hart Lake and north of 37th Street N.E. in St. Anthony Village, SE¼SE¼SE¼ sec. 36, T. 30 N., R. 24 W. Named for Minneapolis and St. Paul.

Twin Mountains Formation

Upper Cretaceous: North-central Texas.

W. L. Fisher and P. U. Rodda, 1966, Texas Univ. Bur. Econ. Geology Rept. Inv. 58, p. 5-8, pl. 1. Consists of buff sand, crossbedded to laminated or massive conglomeratic in lower part; red, gray, and green, silty, laminated to massive clay; and siliceous conglomerate with chert, quartz, and quartzite pebbles and granules. Thickness 125 to 250 feet. Underlies Glen Rose Formation. Overlies pre-Cretaceous rocks. Basal Cretaceous sequence of north-central Texas commonly is referred to as lower Trinity sands, an informal designation easily confused with other uses of term Trinity. Name Travis Peak from central Texas has been applied to basal Cretaceous sequence of north-central Texas. Because facies of north-central Texas is distinct from that of central Texas, it is suggested that Travis Peak Formation of central Texas area (Llano facies) be restricted to the area in which it was originally proposed. Name Twin Mountains is proposed for the outcrop and subcrop sequence in north-central Texas.

Type locality: Northwestern Erath County. Name is from Twin Mountains in Erath County.

Twin Vent Flow

See Lava Cast Forest Flow.

Twisp River Schist

Probably lapsus for Twisp Valley Schist.

Twisp Valley Schist

Pre-Cretaceous(?): Northwestern Washington.

J. B. Adams, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Black Peak quartz diorite grades into Skagit gneiss on west and south and on northeast is intrusive into low-grade Twisp Valley schist of probable pre-Cretaceous age.

J. B. Adams, 1964, Am. Jour. Sci., v. 262, no. 3, p. 290—306. Contact between Skagit Gneiss-Black Peak Quartz Diorite complex and Twisp Valley Schist is sharp and discordant. Contact marks eastern boundary of gneissic and granitic core of main Northern Cascades.

Present in Stehekin-Twisp Pass area, Northern Cascades.

Twist Creek Siltstone (in Tuxedni Group)

Middle Jurassic: Southern Alaska.

R. L. Detterman, 1963, U. S. Geol. Survey Prof. Paper 475—C, p. C30—C34. Name applied to sequence of rocks included by Imlay (1962, U. S. Geol. Survey Prof. Paper 418—A) as lower part of Bowser Member of Tuxedni Formation. Consists of uniformly soft, poorly consolidated siltstone and shale with a few thin graywacke-type sandstone interbeds. Thin-bedded to massive, arenaceous, dark gray, and weathers rusty dark brown. Some intercalated beds of volcanic ash. Thickness 240 feet at type locality; maximum thickness about 410 feet near Red Glacier. Overlies Cynthia Falls sandstone (rank raised); underlies Bowser Formation (restricted and rank raised), major unconformity; as result of this unconformity, the Twist Creek is missing in southwestern part of Iniskin Peninsula.

R. L. Detterman and J. K. Hartsock, 1966, U. S. Geol. Survey Prof. Paper 512, p. 34-35, pl. Outcrops of the Twist Creek Siltstone on Iniskin Peninsula are confined to three narrow northeast-trending belts. Best exposures are in hills along flanks of Tonnie syncline, where the nonresistant siltstone is preserved between the resistant sandstone of the underlying and overlying formations. Maximum outcrop width is about 1,000 feet near northeast end of syncline where the beds cross axis of structure. Southwest of this point the belts become narrower as the unconformity between the Twist Creek Siltstone and Bowser Formation cuts out part of section. Belt of the Twist Creek along east flank of Havenstrite Ridge is somewhat wider than the ones along the hills northwest of Fitz Creek because the beds are exposed in the dip slope. In vicinity of Hickerson Lake the siltstone emerges from beneath a lava flow on southside of Boulder Creek. From here the formation continues northeast to Bear Creek near Tuxedni Bay. Angular unconformity exists between the Twist Creek and Bowser Formation. Overlies Cynthia Falls Sandstone. Thicknesses: 420 feet on Gaikema Creek; 400 feet on Cliff Creek; 240 feet on Tonnie Creek; and 100 feet in headwaters of Fitz Creek.

Type section: On Tonnie Creek, starting 5,000 feet S. 47° E. of Tonnie Peak and continuing upstream for 500 feet, Cook Inlet region. Named after Twist Creek, a tributary of Fitz Creek.

Two Teats quartz latite

Pleistocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 5 (table 1), 37. Discussion of Cenozoic chronology of the Sierra Nevada. As listed on table, potassium-argon age of Two Teats quartz latite is 3.0±.1 m.y. Mammoth Mine basalt and San Joaquin Mountain basalt, both in same area, are dated as 3.1±0.1 m.y.

R. R. Curry, 1966, Science, v. 154, no. 3750, p. 770—771. Discussion of Deadman Pass Glaciation (new) in Sierra Nevada. The till overlies an andesite flow that has been dated by potassium-argon method at 3.1×10^6 years. The Two Teats quartz latite, which directly overlies the till, and in places actually incorporates it, has been dated by the same method at 3.0×10^6 years. The Two Teats quartz latite collected by Dalrymple was from area of summit of Two Teats. Present author collected samples of the quartz latite from the ridge crest 1 km northwest of Deadman Pass for further dating. These two age determinations indicate ages of 2.70×10^6 and 2.74×10^6 years for this sample of Two Teats quartz latite. Two Teats quartz latite was first described by Erwin (1934, California Jour. Mines Geology, v. 30, no. 1), who thought it consisted of two distinct flow units. He differentiated a light-colored unit and a darker glassy unit, which he thought was contemporaneous with Mammoth Mountain quartz latite, cropping out 4 km south of southernmost exposures of Two Teats rock. Since then the Mammoth Mountain rocks have been dated at 370,000 years and thus differentiated from the Two Teats unit. [Erwin described the rock which composes the Two Teats but did not use formal term Two Teats quartz latite.] Probably the Two Teats quartz latite is actually a composite of flows and domes that erupted intermittently from two or more vents along and east of the present drainage divide between 3.1 and at least 2.7×10^6 years ago. The darker unit dated about 2.7×10^6 years, appears to have originated from a fissure in the lighter quartz latite on the south side of Two Teats Mountain, and flowed southeastward over a till sheet deposited on the gently dipping surface of the Tertiary andesite flow. Since the quartz latite is now restricted to ridge crests, it is possible that the region has undergone topographic reversal in the last 2.7×10^6 years.

Two Teats Mountain is on the border of Madera and Mono Counties in northeastern part of Devils Postpile quadrangle.

Tygett Sandstone Member (of Clore Formation)

Mississippian (Chesterian): Southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 6 (fig. 2), 20. Middle member of Clore. Consists of sandstone and shale. Thickness 30 feet. Overlies Cora Member (new); underlies Ford Station Member (new). Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 40, 42, 84, pl. 1. Name formally proposed in this report for middle clastic member of Clore Formation of Elviran age. Overlain by Cora Member and underlain by Fort Station Member. Thickness 26 feet at type section.

Type section: On south bank of Bradshaw Creek, 0.4 mile southeast of Water Valley School and 1.5 miles north of Tygett School, near center of NE¼NW¼ sec. 24, T. 11 S., R. 1 W., Carbondale quadrangle, Union County.

Tyler Lake Granite

Middle Paleozoic: Northwestern Connecticut.

R. M. Gates, 1961, Connecticut Geol. and Nat. History Survey Quad. Rept. 11, p. 4—5, 26—28, pl. 1. Three major rock units underlie bulk of Cornwall quadrangle. They are gneiss complex of Housatonic Highlands, Stockbridge marble, and Waramaug formation. In addition are the omnipresent, but not separately mappable, amphibolites, and large amoeboid mass of Tyler Lake granite. Use of name Thomaston for all "late" granites regardless of lithological, structural, and textural dissimilarities has caused confusion. Therefore, name Tyler Lake is proposed for the related granite masses in Cornwall and West Torrington quadrangles near Tyler Lake. These granite masses have been included with Thomaston granite and granite gneiss in maps and publications prior to 1950. Tyler Lake is structureless massive white fine- to medium-grained granite. Intrudes and forms irregularly shaped mass within Waramaug formation.

R. M. Gates and N. I. Christensen, 1965, Connecticut Geol. and Nat. History Survey Quad. Rept. 17, p. 30-31, pl. 1. Described and mapped in West Torrington quadrangle. Middle Paleozoic.

Names for exposures east of Tyler Lake, Cornwall quadrangle. A large poorly exposed mass of granite occurs south of Mohawk Mountain.

Tyrone Gap Conglomerate

Permian: Northeastern Nevada.

H. J. Bissell, 1962, *in* Pennsylvanian system in the United States—a symposium: Tulsa, Am. Assoc. Petroleum Geologists, p. 231. Name applied to coarse-clastic Permian section south of Elko and Carlin Canyons. This is probably valid name in Sulphur Spring Range and contiguous areas. Sections aggregating about 3,000 feet of medium to coarse clastic sediments were measured by De Joia (1952, unpub. thesis) who assigned lower 500 feet at least to lower and middle Wolfcampian. Present writer [Bissell] collected Leonardian schwagerinids and parafusulinids near top of Tyrone Gap formation where Tyrone Creek flows through Garden Pass (Tyrone Gap). This area is 15 miles north of Eureka. About 5 miles south of Eureka another conglomerate section which, until recently, has been provisionally lumped in the Permian, by comparison with Sulphur Spring Range sections of Tyrone Gap. Nolan, Merriam, and Williams (1956) applied name Newark Canyon formation to this sequence, which aggregates 1,400 to 1,800 feet, and suggested Early Cretaceous age for it. Steele (1959, unpub. thesis) reported "well preserved fusulinids from basal 150 feet of the 'Cretaceous' formation which correlate with the Second Member of Garden Valley formation." Present writer verified Steele's report and found that interbedded sandy limestones within reported "Cretaceous" contain specimens of *Parafusulina* spp., suggestive of late Leonardian to early Guadalupean age. Name Newark Canyon formation cannot apply to this particular locality. Nolan and others (1956) collected Wolfcampian and Leonardian fusulinids from Garden Valley formation. This latter formation is equivalent to Tyrone Gap formation, and because of its better definition, may eventually replace name Tyrone Gap.

Named from exposures south of Nevada State Highway 20, where Tyrone Creek flows through Garden Pass (Tyrone Gap), Elko County.

Tyson Member (of Kings Lake Formation)

Middle Ordovician (Champlainian): Eastern Missouri.

J. S. Templeton and H. B. Willman, 1963, Illinois Geol. Survey Bull. 89, p. 111, 235. Consists largely of dolomitic, very silty, and argillaceous limestone. Commonly medium to thick bedded. Thickness 7½ feet at type section; thins northward to 4¼ feet at Kings Lake, Mo., and 3 feet 11 inches at New London, Mo. Overlies Mincke Member (new). Underlies Dunleith Formation: in some areas the Guttenberg truncates the Dunleith and rests directly on the Tyson.

Type section: South bluff of Meramec River along St. Louis-San Francisco Railroad, one-fourth mile northeast of Mincke Siding, St. Louis County, Mo., near center E½ SE SE 21, 44N-4E, Manchester quadrangle. Named for Tyson Hollow, a small branch of Meramec Valley, St. Louis County.

Ulaneak Creek Glaciation

Holocene: Northwestern Alaska.

A. T. Fernald, 1964, U. S. Geol. Survey Bull. 1181—K, p. K26—K27, pl. 1. A series of very fresh moraines, confined to higher parts of Schwatka Mountains, represent Ulaneak Creek Glaciation of Recent age. Followed Walker Lake Glaciation (new).

The U. S. Geological Survey uses the term Holocene in preference to term Recent. Named for Ulaneak Creek valley, central Kobuk River Valley.

Ullin Limestone

Mississippian: Southern Illinois and Indiana.

J. A. Lineback, 1966, Illinois Geol. Survey Circ. 401, p. 29—36, 37, 38—40. Name proposed for the light-colored fine- to coarse-grained bryozoan- and crinoid-rich limestone strata that overlie Fort Payne Formation (or the Borden, Springville, Warsaw, or Chouteau Formations where Fort Payne is absent) and underlie Salem Limestone. The Ullin filled elongate depressions between the tongue of the Fort Payne Formation and the Borden delta. Reaches maximum thickness in excess of 800 feet in Hamilton County, Ill., and is less than 500 feet thick in southwestern Indiana. Pinches out between Warsaw and Salem Formations in western Illinois. Includes Ramp Creek Member below and Harrodsburg Member above.

Type section: Compiled from exposures in secs. 14, 21, and 22, T. 14 S., R. 1 W., Alexander and Pulaski Counties, Ill. Named for town of Ullin, Ill., in sec. 23., T. 14 S., R. 1 W., Pulaski County.

Umatilla Basalt Flow (in Yakima Basalt)

Umatilla Flow (in Priest Rapids Basalt Member of Yakima Basalt)

Miocene: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 25. Flow about 285 feet thick in Priest Rapids Basalt Member. Name credited to Laval (1956, unpub. thesis).

H. U. Schmincke, 1965, Dissert Abs., v. 25 no. 11, p. 6541. Umatilla Basalt, Pomona Basalt, Elephant Mountain Basalt, and Ward Gap Basalt, the four youngest Yakima Basalt flows in area, intertongue with volcaniclastic and arkosic sediments of Ellensburg Formation. Selah Member of the Ellensburg separates the Umatilla and Pomona flows.

W. N. Laval, 1966, in Fourth Ann. Engineering Geology and Soils Engineering Symposium: Moscow, Idaho, p. 95. In eastern part of Toppenish Ridge and Horse Heaven Hills the Priest Rapids Member includes: Basal flows, Mabton interbed, and the Upper (Umatilla and Sillusi) flows. Both the Umatilla and Sillusi flows are well exposed upstream from McNary Dam in walls of Wallula Gap. The Umatilla is especially noted for massive columnar structure that is commonly intersected by slabs and plates at random angles near base of flow. Maximum thickness 100 to well over 200 feet.

Umatilla flow forms Umatilla Rapids of Columbia River.

Umbagog Granodiorite

Ordovician(?): New Hamsphire and Maine.

J. C. Green, 1964, Geol. Soc. America Spec. Paper 77, p. 33, 39, pl. 1. Foliated to massive, medium-grained, peraluminous, microcline granite. Lead-alpha age determinations suggest that Umbagog Granodiorite crystallized during Ordovician and belongs to Highlandcroft magma series.

Underlies broad lowland around Umbagog Lake, Errol quadrangle, New Hampshire and Maine.

Umiat Bentonite (in Seabee Formation)

Cretaceous: Northern Alaska.

D. M. Anderson and R. C. Reynolds, 1966, Am. Mineralogist, 51, nos. 9-10, p. 1443—1456. Field specimens of Umiat bentonite are dark green on fresh fractures but cream to buff on weathered surfaces. Biotite flakes abundant and more or less randomly distributed. In basal part of Seabee formation.

From Umiat Mountain, about 4 miles northeast of town of Umiat.

Unalaska Formation

Miocene, lower, and older: Alaska.

Harald Drewes and others, 1961, U. S. Geol. Survey Bull. 1028—S, p. 590—610, pl. 75. A thick sequence of coarse and fine sedimentary and pyroclastic rocks intercalated with dacitic, andesitic, and basaltic flows and sills; cut by numerous dikes and small plutons. Topographic relief indicates minimum thickness of 3,000 feet; maximum thickness of 55,000 feet calculated from regional dip of rocks of 15° to north-northwest on eastern part of island but duplication by faults and flexures likely. Oldest rocks on island. Unconformably covered by basalt and andesite of Makuskin volcanics (new). In vicinity of Unalaska village the formation is of probable early Miocene age; elsewhere the nonfossiliferous rocks are possibly middle or early Tertiary; the older age is included because the fossiliferous rocks are possibly high in the formation. On geologic map of Alaska, Dutro and Payne (1957) show rocks herein called Unalaska as part of generalized unit which is of questionable Mesozoic age in this area. This age was based on information available before discovery of desmostylid teeth. The Mesozoic and Tertiary volcanic rocks shown north of Beaver Inlet on this map are now known to be unaltered representatives of Unalaska formation.

Named for exposures on Unalaska Island, Aleutian Islands. Exposed over two-thirds of island.

Unaluk Glaciation

Unaluk Drift

Pleistocene, upper: Southwestern Alaska.

S. C. Porter, 1967, Arctic, v. 20, no. 4, p. 227—246. Present investigation disclosed that glacier ice had invaded Chagvan Bay area from east and had pushed north into lower part of Salmon River valley. Four drift sheets recognized, from oldest to youngest, Kemuk, Clara Creek, Chagvan, and Unaluk. Moraines built during the Chagvan and Unaluk Glaciations exhibit less modified constructional topography characterized by low arcuate ridges and numerous kettle lakes. Radiocarbon dates provide a minimum age for the Unaluk Drift of 8910±110 years.

Named for Unaluk River, which follows northern margin of this drift sheet before joining Kinegnak River and entering northeast corner of Chagvan Bay. At latitude of Chagvan Bay, western margin of drift lies about 4 miles east of bay.

Uncle Joe Member (of Deseret Limestone)

Upper Mississippian: Central Utah.

H. P. Morris and T. S. Lovering, 1961, U. S. Geol. Survey Prof. Paper 361, p. 95—96, pl. 5. Principally coarse-grained massive coquinoid limestone containing much nodular chert. Coquinoid limestone units are from 20 feet to more than 165 feet thick and are composed of fragmented brachiopod shells and crinoid plates and columnals in crude laminae and crossbeds. These beds are light pinkish gray to very pale grayish orange. Interlayered with the coquinoid limestones are fine- to medium-grained medium to dark blue-gray limestones and dolomite units that contain much chert; these beds are locally streaked with medium- and coarse-grained brown-weathering sand. Within 100 to 150 feet of top, the member contains thick unit of thin-bedded, platy weathering dolomite or limestone thiat is useful marker in locating upper boundary of the Deseret. Thickness 544 feet on east slope of Sioux Peak. Overlies Tetro member; underlies Humbug formation. Includes the so-called "Humbug" limestones of mining geologists of Tintic district; name "Humbug" when used in this sense refers to limestones that enclose the ore bodies of Humbug mine and are not the limestone beds of Humbug formation.

Named from Uncle Joe claim on crest of Godiva Mountain in East Tintic Mountains.

Underhill Formation (in Camels Hump Group)

Underhill facies (of Pinnacle Formation)

Lower Cambrian(?): Northwestern Vermont.

R. A. Christman and D. T. Secor, Jr., 1961, Vermont Geol. Survey Bull. 15, p. 18—36, 41—42, pl. 1. Name proposed for rocks which lie above Pinnacle formation and below Hazens Notch formation in Camels Hump group. Consists principally of moderately fine-grained quartzo-feldspathic and pelitic sedimentary rocks and some basic volcanic rocks which have been metamorphosed to greenschist facies. Comprises most of Camels Hump group in Mount Mansfield quadrangle. In southwest part of area where Pinnacle formation is missing, overlies Tibbet Hill volcanics. In part equivalent in time to upper parts of Pinnacle formation because of changes in facies. To north partly equivalent to West Sutton formation. To south in Mount Lincoln quadrangle, underlies Mount Abraham schist. Cambrian.

C. G. Doll and others, 1961, Centennial geologic map of Vermont (1:250,000): Vermont Geol. Survey. As mapped includes following named units: Fairfield Pond, White Brook, Forestdale, Jay Peak, Foot Brook, Mount Abraham schist, Battell, and Mountain Peak members. Lower Cambrian.

W. M. Cady, A. L. Albee, and J. F. Murphy, 1962, U. S. Geol. Survey Geol. Quad. Map GQ-164. Described in Lincoln Mountain quadrangle. Composed chiefly of quartz sericite-albite-chlorite-biotite schist. In rocks of higher metamorphic grade on summit of Green Mountains, the schist is garnetiferous, contains albite porphyroblasts, and grades into beds of gneiss. Formation also includes carbonaceous schist and quartzite, feldspathic and sericitic quartzite, calcite marble, greenstone, and amphibolite. Locally rests on Mount Holly complex, but elsewhere on Pinnacle formation. Grades stratigraphically upward into as well as laterally eastward into Mount Abraham schist. This relationship is clearest northeast of Mount Ellen where southward-plunging Underhill formation interfingers with Mount Abraham schist. Lower Cambrian(?).

J. G. Dennis, 1964, Vermont Geol. Survey Bull. 23, p. 19—26, pl. 1. Described in Enosburg area where it consists mainly of greenish quartz-chlorite-sericite phyllites lying stratigraphically between Pinnacle and Cheshire Formations, where present author [Dennis] would place rocks of type locality within Underhill facies of Pinnacle Formation, for they are clearly statigraphically equivalent to rocks of Pinnacle Formation in Enosburg area, being below an excellent horizon marker, the Whitebrook dolomite and slate. However Underhill facies of the Pinnacle and phyllites of Underhill Formation are practically indistinguishable in the field, and it is unavoidable, wherever dividing White Brook dolomite and slate are absent, to map all rocks of Underhill facies as one unit. In western part of outcrop belt Underhill rocks are well defined between White Brook Dolomite or coarse Pinnacle Graywacke below and Chesire Formation above. Rocks in this clearly defined area are here recognized as Fairfield Pond Member. As mapped the Underhill includes Fairfield Pond Member, Bakersfield Greenstone, Peaked Mountain Greenstone, White Brook Member, Jay Peak Member, and West Sutton Slate Member. Eastern facies of Underhill is named Bonsecours facies.

Type locality: Underhill Township in northern part of Camels Hump quadrangle and in southern part of Mount Mansfield quadrangle.

Union Marble Member (of St. George Formation)

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Medium- to coarse-grained marble. True thickness of marble unknown because units of this marble have been tectonically thinned.

Type locality: Quarry within the bend of St. George River west of Union Center, northwestern Knox County marble belt.

Upper Kinney Lake tuff

Miocene: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 20, 21, 22, 36. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Rhyolite tuff. Potassium-argon age 20.7 ± 0.4 m.y. Upper Lake Kinney tuff was collected near Ebbetts Pass and is on Wilshire's (1956, unpub. thesis) geologic map of that area. This tuff rests on granitic basement rock and is overlain by andesite mudflow breccia.

One-fourth mile west of Upper Kinney Lake, Markleeville quadrangle.

Urbeno Formation

Urbeno Member (of Mount Selman Formation)

Eocene: Southwestern Texas.

J. M. Patterson, 1942, Am. Assoc. Petroleum Geologists Bull., v. 26, no. 2, p. 259 (fig. 2). Red and green shales 300 feet thick at top of formation. Underlies Garceno sandstone member of Cook Mountain formation.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper & Brothers, p. 380 (fig. 6.41), 385. In Rio Grande embayment proper, Urbeno and Garceno formations apparently are equivalent to the Weches and Sparta, respectively.

Occurs near Urbeno, Zapata County.

Utukok Formation (in Lisburne Group)

Lower Mississippian: Northern Alaska.

E. G. Sable and J. T. Dutro, Jr., 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 5, p. 591—592. Predominantly ferruginous sandy limestone, calcareous and quartzitic sandstone, and calcareous shale. Thickness at least 2,500 feet at type section; nearly 3,000 feet of beds measured in section but fault may cut sequence about 500 feet above base. Basal formation of group in area; underlies Kogruk formation (new), contact believed to be gradational. Fossil assemblage indicates Early Mississippian age.

Type section: Exposures on north face and along top of Tupik Mountain, about 2½ miles northwest of junction of Tupik and Kogruk Creeks, De Long Mountains. Named for Utukok River.

Uwharrie Formation

Ordovician(?): Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 121—122, geol. map. Felsic tuffs consisting of interbedded lithic, lithic-crystal, and devitrified vitric-crystal tuffs, welded flow tuffs, and rhyolite. Base not known to be exposed. Total thickness conjectural. If formation has not been repeated by faulting and folding, exposed part is at least 20,000 feet thick. East of Troy anticlinorium conformably underlies Efland Formation (new); west of anticlinorium underlies Tillery Formation (new).

The U. S. Geological Survey currently designates the age of the Uwharrie Formation as Ordovician(?) on the basis of a study now in progress.

Named for Uwharrie Mountains where it is best exposed and least metamorphosed. Crops out in belt 41 miles long and as much as 18 miles wide along axis of Troy anticlinorium in Carolina slate belt west of Deep River-Wadesboro Triassic basin. Also appears in areas of anticlinal folds along western border of slate belt in Union County, central Orange

County, in Durham County northwest of Triassic basin, and in southeastern Person County.

Valder Formation

Ordovician: Northeastern Nevada.

Marshall Kay, 1966, Canadian Petroleum Geology Bull., v. 14, no. 4, p. 585 (fig. 3), 587 (fig. 4). Comparison of Lower Paleozoic volcanic and nonvolcanic geosynclinal belts in Nevada and Newfoundland. Valder Formation listed in table showing distribution of the sequences with argillites, cherts, and volcanic rocks in Nevada and Idaho. Thickness 100 feet. Overlies Cambrian. Below Agort Chert (new). Name credited to Riva (1966, in press).

Type locality and derivation of name not stated.

Valentinian Age

Pliocene, lower: Western North America.

R. W. Wilson, 1960, Kansas Univ. Paleont. Contr., Vertebrata, art. 7, p. 14 (fig. 5). Listed on chart showing some proposed correlations of the North American provincial ages with European standards. Placed above the Sheepcreekian (new) and below the Clarendonian. Chart credited to Schultz and Stout, Stout, from various sources.

C. B. Schultz and T. M. Stout, 1961, Nebraska Univ. State Mus. Spec. Pub. 2, p. 9 (fig. 3). Valentinian shown on correlation chart of the Miocene and Pliocene of the central Great Plains. Above the Hemingfordian and below the Clarendonian. Includes Valentine Formation which contains Crookston Bridge, Railroad Quarry, Fort Niobrara, Devils Gulch, and Burge local faunas. Correlated with the Messinian of the European Standard.

The Valentine Formation is named for town of Valentine in Cherry County, Nebr.

Valles Rhyolite

Pleistocene: North-central New Mexico.

R. L. Griggs and J. D. Hem, 1964, U. S. Geol. Survey Water-Supply Paper 1753, p. 18 (fig. 8), 58—59, pl. 1. Domes of Valles Rhyolite exhibit zoning more or less parallel to outer surface. Where domes are only slightly eroded, the outer rind is jumble of blocky pumice and pumiceous glass that grades from white to light gray to pale pink. Toward interior of this zone are local areas of obsidian. Glassy rind changes farther inward to slightly porous light-gray rhyolite. Rocks in deeply eroded parts of domes are light-gray and fine-grained rhyolite. Northernmost dome of Valles Rhyolite in Cerros de Trasquilar cuts Tschicoma Formation. Valles Rhyolite of western dome of the Cerros de los Posos cuts Cerro Toledo Rhyolite (new). Valles Rhyolite not in contact with Cerro Rubio Quartz Latite (new) or Bandelier Tuff at any place in east half of Valles Caldera. West of Los Alamos area, Valles Rhyolite was extruded through Tshirege Member (new) of Bandelier Tuff.

Type locality: Rhyolite domes in Valles Caldera in west-central part of Los Alamos area.

Valley basalt

Pleistocene(?): East-central Oregon.

L. W. Vigrass, 1961, Dissert. Abs., v. 22, no. 5, p. 1588. Overlies Rattlesnake welded tuff.

Suplee area, Crook, Grant, and Harney Counties.

Van Duzer Limestone

Devonian(?): Northeastern Nevada.

R. W. Decker, 1962, Nevada Bur. Mines Bull. 60, p. 20—21, 36 (table 1), pl. 1. Massive- to thin-bedded limestone; shaly material increases in more thinly bedded strata; color blue-gray to nearly white. Thickness 5,000 to 7,000 feet. Overlies Storff Formation (new). Contact with upper plate of overthrust Western Assemblage is subparallel to strike of both the upper and lower plate rocks and trace of thrust fault in this area could be interpreted in places as an unconformable contact between Van Duzer Limestone and overthrust cherts and siliceous shales. Devonian(?).

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 12 (table 2). Table 2 is a stratigraphic section of Mountain City quadrangle by E. C. Stephens (1946, unpub. rept.). The Van Duzer which consists mostly of well-bedded bluish-gray limestone with argillite members and narrow quartz lenses underlies Crosby Formation (new). Paleozoic.

Name derived from Van Duzer Creek, a prominent stream flowing eastward from Bull Mountains in southern part of Owyhee quadrangle. Limestone forms a wide east-west band across the range and is present in northeast part of Bull Run quadrangle, Elko County.

Van East Group

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 8 (strat. column), 81, 82, 83. Felsites of St. Francois Mountain divided into two groups, Middlebrook, older, and Van East, younger. Rocks of Van East dominantly rhyolite. Tuff present above many flows that have been assigned to Middlebrook and separates it from younger flows of Van East group. Includes French Mills felsite, Annapolis rhyolite, Stouts Creek rhyolite, and Hogan Mountain rhyolite (all new). Name credited to Tolman and Robertson (in preparation).

Occurs in St. Francois Mountain area. Van East Mountain is in T. 33 N., R. 5 E., Madison County.

Van Horn Formation

Pleistocene, upper: Southeastern Alaska.

G. M. Haselton, 1966, Ohio State Univ. Inst. Polar Studies Rept. 18, p. 12—16. Consists of three members: lower gravel member 0 to 57 m thick; lacustrine member a few centimeters to 12 m thick; and upper gravel member 0 to 75 m thick. Total thickness of formation 3 to 90 m. Overlies Muir Till (new) and in turn is overlain by Glacier Bay Till (new). Overlies bedrock in some exposures. Was deposited during interval from Late Wisconsin ice retreat to the beginning of Neoglacial advance. Interstadial time lasted about 5,000 years as determined by dates of trees in place in this formation.

Named for exposures on south side of Van Horn Ridge on east side of upper Muir Inlet in northeast part of Glacier Bay National Monument, about 135 km northeast of Juneau.

Vantage Sandstone Member (of Yakima Basalt)

Miocene, upper: South-central Washington.

J. H. Mackin, 1961, Washington Div. Mines and Geology Rept. Inv. 19, p. 5, 7—8, 12. In Vantage-Priest Rapids area is 30±10 feet thick and consists chiefly of quartz-feldspar-mica sand and (or) tuffaceous sand of hornblende andesite composition. Overlies Museum Basalt Member (new); underlies Frenchman Springs Basalt Member (new).

J. W. Bingham and M. J. Grolier, 1966, U. S. Geol. Survey Bull. 1224—G, p. G6, G7 (fig. 4). Member consists of a distinctive medium friable quartz-feldspar-mica sand, or of a weakly cemented tuffaceous sand, silt, or clay containing hornblende. About 35 feet thick in Vantage-Priest Rapids area and thins northeastward to about 2 feet near Bacon siding, about 10 miles northeast of Soap Lake. Overlies lower basalt flows and underlies Frenchman Springs Member. Note type locality.

Type locality: In roadcuts along old U. S. Highway 10, at mouth of Schnebly Coulee in SW¼NW¼ sec. 19, T. 17 N., R. 23 E., 1 mile west of old Vantage bridge, Kittitas County.

Varian Ranch Beds (in Paso Robles Formation)

Pliocene-Pleistocene: West-central California.

W. R. Dickinson, 1966, Geol. Soc. America Bull., v. 77, no. 5, p. 466 (table 4), 468 (fig. 8), pl. 1. "Varian Ranch Beds" —an informal name applied to part of "Paso Robles Formation" in English (1918, U. S. Geol. Survey Bull. 691). Consists of weakly consolidated granitic sand and gravel. Thickness 1,500 feet. No fossils.

In Table Mountain area, near Parkfield, in southern Diablo Range.

Vaughan Neck sillimanite gneiss facies (of Appleton formation)

Pre-Silurian: South-central Maine.

E. S. Cheney, [1967], Main Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. A rusty weathering sillimanite-bearing fine-grained gneiss. Sillimanite occurs as transparent to tan needles up to 2 cm long or as brown fan-shaped grains up to 0.5 by 3 cm. Probably stratigraphic equivalent of Ghent phyllite (new) and chiastolite-bearing phyllites and schists of Appleton formation.

Well exposed on median ridge of Vaughan Neck and extends southwestward to North Pond, northwestern Knox marble belt.

Vanughn Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana. Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. Vaughn sand occurs at depth of 8,444 to 8,464 feet in type well.

C. J. Mann and W. A. Mann, 1964, Gulf Coast Assoc. Geol. Soc. Trans., v. 14, p. 150 (table 1). Included in Vaughn Tongue of Terryville Sandstone (new).

Type well: Lisbon Exploration Co., No. 1 Vaughn, sec. 36, T. 21 N., R. 5 W., Lisbon field. Reference well: Drilling and Exploration Inc., No. 2 Burgess-Simmons, sec. 2, T. 20 N., R. 5 W., Claiborne Parish.

Vaughn Tongue (of Terryville Sandstone)

Upper Jurassic: Northern Louisiana (subsurface).

C. J. Mann and W. A. Thomas, 1964, Gulf Coast Assoc. Geol. Soc., v. 14, p. 148, 150. Third tongue in sequence (descending) in the Terryville (new). Underlies Bodcaw Tongue (new); overlies McFearin Tongue (new). Occurs at depth of 10,410 to 10,502 feet in type well. Includes blanket sandstones Purdy, Vaughn and Redwine.

Type well: Southwest Gas Producing Co., Redwine No. 1, NE¼NW¼ sec. 11, T. 17 N., R. 3. W., Lincoln Parish.

Vaughn Gulch Limestone

Silurian: Eastern California.

D. C. Ross, 1963, U. S. Geol. Survey Prof. Paper 475—B, p. B74, B81—B83. Dominantly thin-bedded argillaceous and silty limestone. Seven units distinguished at type section on basis of gross color differences and varying ratios of bioclastic limestone to argillaceous limestone. Thickness 1,518 feet at type section. Contact with underlying Ely Springs Dolomite conformable. Contact with overlying Mississippian Perdido Formation is erosional unconformity.

Type section: Along ridge northwest of Vaughn Gulch in NE¼ sec. 8, T. 13 S., R. 36 E., Inyo County. Vaughn Gulch is small canyon tributary to Owens Valley near mouth of Mazourka Canyon. Formation exposed as discontinuous faulted and folded belt extending from point about 2 miles southeast of Vaughn Gulch north for about 7 miles to Water Canyon. Outcrop terminated at south end by granitic intrusive body and a fault.

Vega Bay Formation

Tertiary, middle: Southern Alaska.

R. R. Coats and others, 1961, U. S. Geol. Survey Bull. 1028—R, p. 569—570, pl. 71. Predominantly pyroclastic rocks, interbedded with substantial amounts of flow rocks and minor amounts of sandstone and conglomerate, which consist of reworked volcanic material. No complete section exposed. Thickness about 2,000 feet at type locality. Underlies Kiska Harbor formation (new).

Type locality: Along coast of Vega Bay, west of Gertrude Cove, Kiska Island, Aleutian Islands.

Vekol Formation

Mesozoic: Southwestern Arizona.

L. A. Heindl, 1965, U. S. Geol. Survey Bull. 1194—G, p. G1—G9. A series of green-gray sedimentary rocks. Includes thick lenses of conglomerate, green-gray pebbly arkose and graywacke, green and maroon mudstone, and beds of quartzite, arkosic quartzite, or aphanitic claystone. Includes a local basal member, 50 to 200 feet thick, of purplish-green volcanic conglomerate. At type locality lowest part of formation consists of alternating beds of conglomerate and mudstone. This sequence is about 300 feet thick and grades upward through a transition zone into main part of formation. At Copperosity mine (reference section), formation is conglomerate made up almost entirely of deeply weathered, intensely sheared pebbles and cobbles. The Vekol in this area is about 1,000 feet thick. At second reference section, formation is predominantly limestone conglomerate. At third reference section, Vekol is a series of pebble conglomerate beds that overlie Phonodoree Formation (new) or older rocks. Thickness commonly between 2,000 and 3,000 feet. Overlaps Phonodoree Formation and lies unconformably on older rocks. West of Reward mine, is overlain unconformably by Chiapuk Rhyolite (new). Elsewhere is exposed below cover of Tertiary volcanic rocks and Tertiary and Quaternary alluvium.

Type locality: West of Reward mine, Vekol Mountains, Papago Indian Reservation. First reference locality: Southeast of Copperosity mine. Second reference locality: Between Copperosity and Vekol mines. Third reference locality: Vicinity of village of Sif Vaya. Named for exposures in Vekol Mountains.

Vester Formation

Upper Triassic: Northeastern Oregon.

T. P. Thayer and C. E. Brown, 1966, U. S. Geol. Survey Geol. Quad. Map GQ—438. Mapped in Aldrich Mountain quadrangle, Grant County. Consists of graywacke with some conglomerate and shale. Separated from Fields Creek Formation of Aldrich Mountains Group (both new) by angular unconformity.

C. E. Brown and T. P. Thayer, 1966, U. S. Geol. Survey Misc. Geol. Inv. Map I—447. Formal proposal of name. At type locality, comprises (ascending) about 6,000 feet of pebbly conglomerate and interbedded shale, about 1,000 feet of water-laid andesitic tuff, and 1,000 feet or more of black shale. About 2 miles north of type locality and 1 mile west of Buck Creek, interlayered ophitic basalt flows, flow breccia, and chert are included in basal part of formation. Lies unconformably on Paleozoic schist and greenstone and Mesozoic serpentine, diorite, and gabbroic rocks. North of Murderers Creek, major angular unconformity separates the Vester from overlying Fields Creek Formation; elsewhere, the Vester is in fault contact with younger rocks.

Type locality: Along lower part of Vester Creek, the second north-flowing creek west of South Fork of Deer Creek, in north-central part of Izee quadrangle, Grant County.

Veta Grande Formation

Middle and (or) Upper Jurassic: Western Nevada.

D. C. Noble, 1963, Dissert. Abs., v. 23, no. 11, p. 4319. Composed of 200 to 1,100 feet of felsic lapilli tuff and volcanic sandstone, 450 to 1,500 feet of andesite, and 3,000+ feet of coarse volcanic conglomerate and breccia, all of continental origin. Conformably overlies Preachers Formation (new); underlies Double Spring Formation (new).

Exposed in southern Pine Nut Range 25 miles south-southeast of Carson City.

Victorio Formation (in El Paso Group)

Canadian: New Mexico.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 148. Name given to first piloceroid zone. Younger than Cooks formation (new); older than Jose formation (new). Canadian treated as system in this report.

Named for exposures in Victorio Mountains.

Vinson Chalk Member (of Atco Formation)

Vinson Formation (in Austin division)

Cretaceous (Gulf Series): Central Texas.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Bros., p. 353. According to Durham (1957, unpub. thesis) the type Austin sequence (in vicinity of Austin) includes (ascending) Atco chalk, Bruceville chalk-marl, Vinson chalk, Jonah limestone, Dessau chalk, Burditt chalk marl, and Big House chalk.

Louis de A. Gimbrede, 1962, Jour. Paleontology, v. 36, no. 5, p. 1121-1123. Vinson chalk member, south of Austin, is equivalent to Bruceville marl member north of Austin. Name credited to Durham (1957).

Keith Young, 1962, Geol. Soc. America Guidebook Houston Mtg., p. 99 (table 2), 103 (table 3). Shown on tables as formation. Listed above Atco formation and below Jonah formation. Gulf series.

Occurs in type section of Austin Group at Austin.

Viopuli Ignimbrite Member (of Roskruge Volcanics)

Upper Cretaceous-Tertiary, lower: Southern Arizona.

Michael Bikerman, 1967, Geol. Soc. America Bull., v. 78, no. 8, p. 1029—1036. Isotopic studies in Roskruge Mountains, Pima County. Overlying the mid-Cretaceous sequence is a thick series of brightly colored ash flows and volcanic breccias called Roskruge rhyolite by Heindl (1965) and here termed the (Laramide) Roskruge volcanics in deference to their varied rock type. This formation, primarily quartz latitic to rhyodacitic composition, forms main part of Roskruge Mountains. The volcanics are made up of two ash-flow sheets intercalated with air-fall tuffs and breccias and capped by a thick series of volcanic breccias and flows. The lower ash-flow sheet, the bright red Viopuli ignimbrite, is here considered to be lowest member of Roskruge volcanics.

Named for exposures around Indian village of Viopuli, Roskruge Mountains, Pima County.

Virginia Supergroup

Virginian Series

Pennsylvanian: Central Appalachians.

C. C. Branson, 1962, *in* Pennsylvanian System of the United States—a symposium: Tulsa, Am. Assoc. Petroleum Geologists, p. 100. Name Pottsville should be replaced and a name and type section be selected in an area more likely to provide exposures that can be more successfully studied and related regionally. Name Virginia supergroup (Virginian series) is available for unit.

Type section: In McDowell County, W. Va., northward into New River and Kanawah River exposures. Name derived from names of States of Virginia and West Virginia.

Vista Alegre Formation

Lower(?) and Upper Cretaceous: Puerto Rico.

A. E. Nelson and W. H. Monroe, 1966, U. S. Geol. Survey Bull. 1221—C, p. C3—C5, pl. 1. Most of formation consists of volcanic sandstone and subordinate amounts of siltstone, some of which is calcareous. Included in the siltstone and sandstone are bedded crystal tuff, lithic tuff, and reworked tuff. Lenses of volcanic breccia, lapilli tuff, and basaltic tuff distributed sporadically through formation. Formation complexly faulted; thickness not exactly known, but at least 500 m. Conformably underlies Mameyes Formation (new). Contact placed at base of lowest lava of the Mameyes. Base not exposed in Florida quadrangle [this report] but conformably overlies Robles Formation in adjacent Jayuya quadrangle.

R. P. Briggs, 1967, U. S. Geol. Survey Bull, 1254—A, p. A25, A26. Malo Breccia is lateral equivalent of middle and upper parts of Robles Formation and on the west, and perhaps to north and south, it interfingers with or grades into tuff and volcanic sandstone of Tetuan and Vista Alegre Formations.

Type exposures: Along road northwest of Cerro Vista Alegre in southeast corner of Florida quadrangle between coordinates 48,000-142,740 and 48,380-142,500 P. R. meter grid.

Vly Summit Member (of Great Meadows Formation)

Lower Canadian; Eastern New York.

R. H. Flower, 1964, New Mexico Bur. Mines Mineral Resources Mem. 12, p. 156, 158. Upper member of formation. Consists of 2 feet of even-bedded, slightly dolomitic siltstone, followed by 40 feet of dolomite, free from vermicular markings but containing irregular chert masses. Overlies Skene member. Underlies Smith Basin limestone. Term Canadian used as system in this report.

Type section: Along road leading east from Smith Basin, Fort Ann quadrangle, New York. Named for Vly Summit (misnamed Fly Summit).

Volcanic Knob basalt

Pliocene: Northern California.

G. B. Dalrymple, 1963, Geol. Soc. America Bull., v. 74, no. 3, p. 380. Report on potassium-argon dates of some Cenozoic volcanic rocks of Sierra Nevada. Sample of Volcanic Knob basalt gave age of 3.6±0.1 m.y.

Sample collected from Mount Abbot quadrangle from top of Volcanic Knob. Volcanic Knob is part of gently sloping upland between Lake Thomas A. Edison and Bear Creek.

Volentine Sand (in Schuler Formation)

Jurassic: Northern Louisiana (subsurface).

W. A. Thomas and C. J. Mann, 1963, Shreveport Geol. Soc. Ref. [Rept.], v. 5, p. 9—17. Report discusses and gives type wells for 22 sands in the Schuler Formation in upper Cotton Valley Group in northern Louisiana.

Formal nomenclature is not proposed for these sandstones although the authors [Thomas and Mann] believe that recognition of the sandstones as formal stratigraphic units should not be withheld simply because they are oil sands. The Volentine occurs at depth of 7,216 to 7,224 feet in type well. The name Volentine is new in this report.

Type well: California Co., no. 1, Volentine, sec. 33, T. 20 N., R. 14 W., Dixie field, Caddo Parish.

Voltage Lavas

Pleistocene: Southeastern Oregon.

A. M. Piper, T. W. Robinson, and C. F. Park, Jr., 1939, U. S. Geol. Survey Water-Supply Paper 841, p. 16, 17, pl. 4B. Name applied to lava in Voltage lava field. Malheur Cave, in sec. 18, T. 27 S., R. 36 E., is on tongue of Voltage lava that extends into Indian Creek valley.

N. V. Peterson and E. A. Groh, 1962, Ore Bin, v. 26, no. 2, p. 19. Voltage lava flowed out on erosional surface and surrounded isolated remnants of Harney Formation.

Named for occurrence near Voltage townsite, in eastern part of T. 27 S., R. 32 E., Harney County.

Vondergreen Hill Peridotite

Upper Jurassic: Southwestern Oregon.

J. G. Koch, 1963, Dissert. Abs., v. 24, no. 4, p. 1572. "Diablan" diastrophism apparently involved emplacement of Vondergreen Hill Peridotite as well as small dioritic and gabbroic bodies.

J. G. Koch, 1966 Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 55—58. Formal proposal of name. Vondergreen Hill Peridotite is most westerly large ultramafic body in Klamath Mountains province. Grossly concordant with Otter Point Formation. Maximum thickness about 2,000 feet. Extends southeast from its typical exposures. Unit is dark brownish green to blue-black, massive, coarsely crystalline and laced by veinlets of chrysolite serpentine and, rarely, by carbonate and quartz. Emplaced in Otter Point Formation at end of Jurassic.

Typical exposures are at Vondergreen Hill in sec. 32, T. 35 S., R. 14 W., Port Orford quadrangle.

Wabash Formation

Silurian (Niagaran) :Northern Indiana.

A. P. Pinsak and R. H. Shaver, 1964, Indiana Geol. Survey Bull. 32, p. 34—47. Formation herein named for the body of rock in northern Indiana that extends southward from northern part of Fort Wayne Bank and that lies above Louisville Limestone and below Salina Formation. Where the Salina is absent and where the Wabash Formation is not at bedrock surface, it underlies rocks of Devonian System. In earlier reports, rocks referred here to Wabash Formation have been described as Wabash flaggings, reef rock, Huntington stone, shell rock, reefs, bioherms, quaquaversal structures, part of Niagara Group (line), Mississinewa Shale, Liston Creek Limestone, part of Huntington Dolomite, and part of New Croydon Limestone. Formations formerly called Mississinewa Shale and Liston Creek Limestone are herein accorded member status and assigned to Wabash Formation. Reefs, bioherms, banks, and upper Niagaran thick-bedded reef-detrital limestones and dolomites of northern Indiana that collectively have been called part of Huntington Dolomite are for most part facies of Mississinewa and Liston Creek Members of the

Wabash. Term Huntington abandoned as stratigraphic term and Huntington Lithofacies proposed to replace it. Type area, five principal reference sections, and two reference sections designated. Term Wabash Formation proposed by Fuller and Clapp (1904, U. S. Geol. Atlas, Folio 105) for rocks of Pennsylvanian age has had little usage and is herein considered abandoned.

Type area: Upper Wabash Valley in Carroll, Cass, Miami, Wabash, and Huntington Counties. Principal reference sections: (1) Northern Indiana Public Service Co. Gale M. and Glada Skinner No. 1 well, NW¼NW¼ sec. 10, T. 28 N., R. 1 W., near Royal Denter, Cass Countrry; (2) Indiana Highway 13 roadcut south of Wabash and Wabash River, sec. N½ J.B. Richardville Reserve No. 8, T. 27 N., R. 6 E., Wabash County; (3) Big Four Railroad cut in Wabash, Wabash County; (4) Erie Stone Co., quarry just east of Huntington, SE¼ sec. 12, T. 28 N., R. 9 E., Huntington County; (5) May Stone and Sand, Inc., quarry southwest edge of Fort Wayne, NW¼ sec. 29, T., 30 N., R. 12 E., Allen County.

Wabassus Quartz Monzonite

Devonian: Eastern Maine.

D. M. Larrabee, 1964, U. S. Geol. Survey Geol. Map GQ—358. Herein named. Consists of pick or gray medium-grained quartz monzonite; gray and leucocratic on Amazon Mountain. Distinctly different from the coarsely porphyritic quartz monzonite in a separate pluton to northwest in Scraggly Lake quadrangle and from the fine-grained quartz monzonite at Love Ridge. Believed to be of Devonian age, because it has not been regionally metamorphosed, intrudes rocks of Silurian(?) age, and has relationships similar to other intrusive granites considered Devonian in general area.

D. M. Larrabee, 1964, U. S. Geol. Survey Mineral Inv. Field Studies Map MF—282. Gray and pink medium-grained quartz monzonite. Wabassus Lake quadrangle.

Type area: Eastern shore of Grand Lake between Grand Lake Stream and Dyer Cove Point. Also well exposed in the road from Grand Lake Stream Village westward to Wabassus Lake, and forms prominent Wabassus Mountain, all in Wabassus Lake quadrangle.

Wadena Till, Drift

Pleistocene: Central Minnesota.

A. R. Schneider, 1961, Minnesota Geol. Survey Bull. 40, p. 33—38, 43—53, 66, 100. Keewatin drift, as discussed in this report, was deposited by Wadena lobe and its glacio-fluvial derivatives. Lithologic name "gray sandy till" suggests general characteristics of the ice-deposited material. Because of loose sandy texture and good internal drainage of Wadena-lobe till, its unoxidized dark-gray to blue-gray color is seldom observed. Commonly overlies Superior till and underlies Pierz till.

Wadena drumlin field covers most of Wadena County and parts of Todd, Cass, Hubbard, and Otter Tail Counties.

Wagon Bed Formation

Eocene, middle and upper: Central Wyoming.

F. B. Van Houten, 1964, U. S. Geol. Survey Bull. 1164, p. 13 (table 2), 34—53, pls. Bentonitic greenish-yellow to yellowish-gray, locally tuffaceous zeolitic mudstone and sandstone in persistent beds; also volcanic sandstone and conglomerate. Thickness 130 to 700 feet. Conformably overlies Wind River Formation. Overlain unconformably by White River Formation. Wedges out against Sweetwater uplift, Conant Creek anticline, and Sweetwater anticline.

P. E. Soister, 1966, U. S. Geol. Survey Bull. 1244—A, p. A45. Stratigraphically above Puddle Springs Arkose Member (new) of Wind River Formation.

Type section: In SE¼ sec. 33, SW¼ sec. 34, T. 32 N., R. 95 W., Fremont County. Name taken from Wagon Bed Spring.

Wagonbed Springs Formation

Probably lapsus for **Wagon Bed Formation.**

Wahmonie Formation

Miocene, upper, and Pliocene, lower(?): Southwestern Nevada.

F. G. Poole, W. J. Carr, and D. P. Elston, 1965, U. S. Geol. Survey Bull. 1224—A, p. A36—A44. A sequence of lava flows, tuff, tuff-breccia, conglomerate, and lithic tuff-breccia. Divided into 5 informal units. Maximum exposed thickness about 3,500 feet. Overlies Salyer Formation (new). On Skull Mountain underlies Topopah Spring Member of Paintbrush Tuff. Northwest of Wahmonie Flat a late flow of the Wahmonie occurs between Topopah Spring and Tiva Canyon Members of the Paintbrush. Locally intertongues with part of the Salyer. Late Miocene and early Pliocene(?).

Type section: Composite of partial sections on east and south sides of Wahmonie Flat, at Mount Salyer, and in area between Cane Spring and Hampel Hill, Nevada Test Site, Nye County. Unit 1, a small exposure on low ridge about 1¼ miles northwest of Cane Spring; unit 2, on northeast-trending ridge about half a mile southeast of Cane Spring and around Hampel Hill; unit 3, at Mount Salyer; unit 4, on northwest side of Hampel Hill; unit 5, incomplete sections at east end of Wahmonie Flat and on north side of Skull Mountain. Covers area of little more than 500 square miles.

Wahoo Limestone (in Lisburne Group)

Pennsylvania(?) and Permian: Northeastern Alaska.

W. P. Brosgé and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 12, p. 2190—2192, 2196—2198. Uppermost formation in Lisburne Group in eastern Brooks Range. A limestone that commonly is light colored and includes 25 per cent or more of either coarse-grained limestone or sublithographic to lithographic limestone. Divided informally into a lower member and an upper member. Lower member present in all sections of formation; upper member distinguished only in the thickest sections (Wahoo Lake, Echooka River, and Kongakut River). Thickness ranges from zero to as much as 1,367 feet at type section. Overlies Alapah limestone; unconformably underlies Siksikpuk Formation at Galbraith Lake; east of Galbraith Lake underlies Sadlerochit Formation which rests unconformably on both the lower and upper members but which also may be locally conformable with upper member.

Type section: Along west fork of Echooka River, beginning at contact with Sadlerochit Formation about 3½ miles south of Wahoo Lake (69° 01′ N. 146° 57′ W.) and extending about one-half mile downstream along west bluff; lower 68 feet of section is in east bluff, eastern Brooks Range.

Walche Member (of Menard Limestone)

Mississippian (Chesterian): Northwestern Kentucky and southeastern Illinois.

J. W. Baxter, P. E. Potter, and F. L. Doyle, 1963, Illinois Geol. Survey Circ. 342, p. 4 (table 1), 6 (fig. 2), 19, pl. 1. Basal member of Menard. Consists of dark-gray argillaceous fossiliferous limestone. Thickness commonly 3 to 8 feet. Separated from overlying Scottsburg Member (new) by 5 to 7 feet of shale. Underlies Waltersburg formation. Name credited to Swann (in preparation).

D. H. Swann, 1963, Illinois Geol. Survey Rept. Inv. 216, p. 8, 10, 38—40, 85, pl. 1. Name formally proposed in this report for lowest and thinnest of three main limestone members of Menard Formation of Elviran age, commonly called "little Menard." Overlies Waltersburg Formation. Separated from middle or Scottsburg Limestone Member of Menard by 3 to 30 feet of shale. Thins northward from outcrop along southern margin of [Illinois] basin and is absent north of irregular boundary near base line in Illinois that swings southeastward across Indiana to central part of Meade County, Ky. Thickness at type exposure 14½ feet.

Type section: Exposed in Walche's cut on Illinois Central Railroad 3 miles northeast of Scottsburg and 3,500 feet west of Claxton in southwest corner of 18-H-21, 6,400 feet from south line and 8,600 feet from east line of H-21, Princeton East quadrangle, Caldwell County, Ky.

Walcksville Sandstone Member (of Catskill Formation)

Upper Devonian: East-central Pennsylvania.

Harry Klemic, J. C. Warman, and A. R. Taylor, 1963, U. S. Geol. Survey Bull, 1138, p. 26—27, pl. 1. Consists of red and gray very fine to medium-grained sandstone and siltstone with some thin shaly partings. Red beds make up about 50 to 55 percent of section at Walcksville. At type section beds are overturned and trend about N. 67° E. and dip 83° SE. Thickness of section, corrected for dip and strike and almost 50 feet of thickening by drag folding, is about 600 feet. Basal member of Catskill. Underlies Beaverdam Run member (new).

Type section: Exposed in roadcut between highway survey location marks 402 and 410 near Walcksville, Carbon County, where northeastern extension of Pennsylvania Turnpike cuts through ridge called Indian Hills.

Waldoboro Granite

Devonian(?): South-central Maine.

H. W. Sundelius, 1963, Econ. Geology, v. 58, no. 1, p. 86 (fig. 2), 88, 89. Named in report on spodumene pegmatites. Consists of light-gray to buff medium- to coarse-grained muscovite granite. The pegmatites occur within the Penobscot formation. Clark Island and Waldoboro granites crop out east and west of pegmatite occurrences. Age not stated.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. Report on northwestern Knox County marble belt. The Waldoboro granitic pluton underlies the southwest corner of North Pond in Warren. West of map area in quarry on north side of U. S. Route 1 just east of Waldoboro is a medium-grained buff-colored biotite granite, but near the contact on southwest shore of North Pond it contains muscovite. Devonian(?) on map bracket. Has been suggested that the granite may be of Acadian age.

Probably named for occurrences in Waldoboro quadrangle.

Walker Lake Glaciation

Pleistocene (Wisconsin): Northwestern Alaska.

A. T. Fernald, 1964, U. S. Geol. Survey Bull, 1181—K, p. K14—K16, pl. 1. A series of lobate moraines were deposited by glaciers that originated in Schwatka Mountains and flowed down valleys of Ambler, Shungank, and Kogoluktuk Rivers within mapped area [central Kobuk River valley], and valleys of Maunlik River, Beaver Creek, and Reed River, east of area. Glacial episode during which these moraines were deposited is here named Walker Lake Glaciation. Followed Ambler Glaciation (new). Preceded Ulaneak Creek Glaciation (new).

Moraines exposed near Walker Lake at headwarters of Kobuk River.

Wallace Slate

Cambrian: Vermont.

George Theokritoff, 1964, Geol. Soc. America Bull. 75, no. 3, p. 175, table 1. Name used by Swinnerton (1922, unpub. thesis). Wallace Slate and Hubbardton Slate are both apparently equivalent to part of Zen's (1961, Geol. Soc. America Bull. 72, no. 2) Mettawee Slate facies of Bull Formation and also part of Biddie Knob Formation.

Wallace Creek Tongue (of Cody Shale)

Upper Cretaceous: Central Wyoming.

J. R. Barwin, 1959, Am. Assoc. Petroleum Geologists, Rocky Mountain Sec., Geol. Record, p. 141 (fig. 6), 142. Named on diagrammatic cross section showing correlation of Mesaverde formation. Overlies Phayles Reef member (new) of Mesaverde; underlies unnamed middle member of Mesaverde.

J. R. Barwin, 1961, Wyoming Geol. Assoc. Guidebook 16th Ann. Field Conf., p. 172—174, 177 (fig. 4). In Rattlesnake Hills, composed of predominantly gray sandy to silty shale interbedded with buff to tan poorly consolidated sandstone. Thin blocky-weathering calcareous siltstone beds and gray to brown highly calcareous ledge-forming sandstone beds also present. Tongue becomes less sandy and silty to east where dark-gray clay shale is predominant lithology. Thickness about 180 feet at type locality. Pinches out westward at northwestern end of Rattlesnake Hills. Thickens eastward and merges with upper part of Cody shale in vicinity of Casper arch. Overlies Phayles member of Mesaverde; underlies unnamed middle member of Mesaverde in southeastern Wind River Basin.

Type section: On northwestern flank of Rattlesnake Hills in SW sec. 4, T. 33 N., R. 87, Natrona County, where tongue is exposed northeast of prominent sandstone ridge known locally as "Phayles Reef."

Wallkill Valley drift

Pleistocene: Southeastern New York.

G. G. Connally and L. A. Sirkin, 1967, New York State Geol. Assoc. Guidebook 39th Ann. Mtg., p. A14. Discussion of Pleistocene geology of Wallkill Valley. Pollen stratigraphy, confirmed by radiocarbon dating, indicates that recession from Wallkill Valley began prior to 15,000 years B. P. This suggests that Wallkill Valley drift, and probably Lake Albany, predates Kent Substage of Muller (1965) and is correlative with classical Tazewell Substage of midwest.

Wallkill Valley is a northeast-southwest trending basin about 65 miles long and 20 miles wide, narrowing to the south. Western boundary is scarp of Shawangunk Mountain cuesta. Eastern boundary is dip slope of Marlboro Mountain hogback on north, and fault scarp of Hudson Highlands on south. Valley heads in northern New Jersey in glacial drift north of Ogdensburg-Culvers Gap moraine and opens into Rondout Creek Valley between Rosendale and Kingston, N. Y.

Wallpack Center Member (of Decker Formation)

Upper Silurian: Western New Jersey and northeastern Pennsylvania.

A. G. Epstein and others, 1967, U. S. Geol. Survey Bull. 1243, p. 10—11, 53—54. Herein proposed that (1) name Decker Formation (=Decker Ferry Formation of Weller, 1900, New Jersey Geol. Survey Ann. Rept. of the State Geologist for 1899) be applied to strata lying between Bossardville Limestone and Rondout Formation in northeastern Pennsylvania and New Jersey, (2) the calcareous facies northeast of Hainesville area, New Jersey, be designated Clove Brook Member, and (3) the arenaceous facies southwest of Hainesville area be designated Wallpack Center Member. The Wallpack Center consists of medium-dark- to medium-light-gray generally fine-grained calcareous sandstone that weathers yellowish gray to grayish orange, lenses of calcareous quartz-pebble conglomerate, fine- to coarse-grained calcareous sandstone, calcareous siltstone, fine- to coarse-grained arenaceous limestone, medium-dark-gray calcareous shale, and dark-gray to medium-dark-gray very fine grained dolomite. Boundary with overlying Duttonville Member (new) of Rondout Formation is abrupt and is placed at top of first arenaceous limestone or calcareous sandstone found downward in the section. Contact with underlying Bossardville Limestone is gradational through an interval as much as 18 feet thick. Thickness 81.8 feet at type section; 80 feet near Haney's Mill, N. J.; 54 feet near Tocks Island, N. J.; 85 feet south of Croasdale quarry, about 0.8 mile southwest of Minisink Hills, Pa. Northeast of type section grades into and is replaced by Clove Brook Member.

Type section: One mile northeast of Wallpack Center, N. J., on the southeast slope of Wallpack Ridge, in Culvers Gap quadrangle.

Walls Ferry Limestone

Lower Mississippian: Northeastern Arkansas.

Mackenzie Gordon, Jr., 1964, U. S. Geol. Survey Prof. Paper 460, p. 8—12. Name applied to thin pre-Boone limestone of very local distribution. It is one of several thin units that at various localities in Batesville district occupy interval between Penters chert below and Boone formation above. Consists of impure yellowish- to buff-gray fine- to medium-grained limestone. Contains sparsely scattered crinoid columnals, trilobites, and very few mollusks and brachiopods. Flat fish scales at base. Thickness one foot or less. Overlies Gaylor sandstone (new) or Gaylor sandstone equivalent(?).

Type locality: On east side of the White River, Independence County, five-eighths mile south of Walls Ferry and about 12 miles west-northwest of Batesville.

Walnut Creek Formation

Pleistocene, middle: Nebraska.

E. C. Reed and V. H. Dreeszen, 1965, Nebraska Geol. Survey Bull. 23, p. 4 (fig. 3), 32—33, 55. Consists of alluvial sequence grading upward from coarse to fine clastics that is believed to have been deposited during retreat of Cedar Bluffs ice in Medial Kansan time. Thickness about 24 feet at type locality. Overlies Red Cloud Formation; underlies Sappa Formation. Is fluviatile equivalent of Cedar Bluffs Till (new).

Type locality: On west side of Walnut Creek valley in E½SW¼NW¼ sec. 7, T. N., R. 2 E., Seward County. Also well exposed on southwest side of West Fork Big Blue River valley, near center sec. 26, T. 9 N., R. 2 E.

Walnut Gap Volcanics

Triassic or Jurassic: Southeastern Arizona.

J. R. Cooper and L. T. Silver, 1964, U. S. Geol. Survey Prof. Paper 416, p. 70—73, pl. 1. Andesite and rhyolite conglomerates, pyroclastics, and subordinate flows. At type locality, formation is about 350 feet thick and lies unconformably on Concha limestone and Scherrer formation of Naco group. Here lowest bed is pebble conglomerate consisting of subangular fragments of chert and sandstone in sandy matrix. Top of volcanics is clear-cut unconformity at base of Glance conglomerate of Bisbee group. Base of volcanics exposed near southeast end of Walnut Gap in Gunnison Hills, where the volcanic rocks crop out between Naco group on southeast and Glance conglomerate on northeast.

Type section: On Scherrer Ridge near southeast end of Walnut Gap, Dragoon quadrangle, Cochise County.

Walnut Grove Beds

Pliocene, lower: Arizona.

J. F. Lance, 1960, Arizona Geol. Soc. Digest, v. 3, p. 156. Beds that contain Walnut Grove fauna.

Locality is south of Prescott.

Walrod sandstone (in Chaffee Formation)

Upper Devonian: West-central Colorado.

A. C. McFarlan, 1961, Rocky Mountain Assoc. Geologist Guidebook 12th Ann. Field Conf., p. 128 (fig. 4), 130. Informal term applied to a lenticular but rather persistent sandstone 2 to 11 feet thick in middle part of Chaffee.

Cement Creek area, Gunnison County.

Walters Hill Formation

Pliocene and (or) Pleistocene, lower(?): Northwestern Oregon.

D. E. Trimble, 1963, U. S. Geol. Survey Bull. 1119, p. 10 (fig. 4), 43—46, pl. 1. Conglomerate and sandstone with minor local mudflow deposits; conglomerate generally corase-grained, cobble size predominating; poorly stratified, poorly indurated; severely weathered. Maximum thickness probably about 400 feet. Underlain by Boring lava. That the Walters Hill may not be distinct unit, but may represent erosional remnants of Springwater formation (new) is suggested by similar altitudes of widely separated exposures of the two formations. Projection of slope of upper limits of Walters Hill, however, suggests that surface of Walters Hill would be several hundred feet higher than present surface of Springwater formation where altitude of Springwater is equivalent to that of highest Walters Hill. Considered older than Springwater formation. Treasher (1942, Oregon Dept. Geology and Mineral Industries Geol. Map Ser. 7) mapped these rocks as part of Troutdale formation and in some places as Boring lava.

Name taken from Walters Hill immediately south of Gresham, Multomah County.

Waltham Canyon Formation

Upper Cretaceous: West-central California.

R. L. Ross and L. P. Colburn, 1963, Soc. Econ. Paleontologists and Mineralogists, Pacific Sec., Guidebook Ann. Spring Field Trip, May 24—25, p. 40 (strat. column), 42—43, geol. map. A sequence of clastic sediments that is divisible into three lithologic units: lower mudstone with thin beds of sandstone, middle member of conglomerate and sandstone, and an upper sequence of mudstone. J. Q. Anderson (unpub. report) referred to these units as lower Waltham shale member, Juniper Ridge conglomerate member, and upper Waltham shale member. In this report, the three members are collectively referred to as Waltham Canyon formation. Thickness 5,600 feet. Overlies Curry Mountain sandstone; underlies Santa Margarita formation.

Exposed in east-central part of Priest Valley quadrangle. Waltham [Warthan] Creek is in area. Text refers to Waltham Canyon fault and Warthan Canyon fault.

Waltman Shale Member (of Fort Union Formation)

Paleocene: Central Wyoming.

W. R. Keefer, 1961, Am. Assoc. Petroleum Geologists Bull., v. 45, no. 8, p. 1310—1323. Term proposed for a thick homogeneous sequence consisting predominantly of silty micaceous shale and claystone in upper part of Fort Union Formation in central and northeastern parts of Wind River Basin. At type section unit is 645 feet and characterized by chocolate-brown and gray silty and shaly claystone interbedded with a few thin beds of ledge-forming sandstone. Where thickest, the Shotgun and Waltman are essentially contemporaneous units, and there is nearly complete lateral gradation between the two lithologic types. At many places both members are present and thin transitional zones of interbedded sandstone, black micaceous shale, carbonaceous shale, and coal directly underlie and overlie the Waltman. Lower zone is transgressive and is included in lower part of Fort Union; upper zone is regressive and is included in overlying Shotgun. The Waltman is developed only in narrow outcrop belt which lies north and east of town of Waltman. These exposures are in sequence of vertical to overturned beds that form west flank of Casper arch.

Type section: In S½ sec. 8 and NE¼ sec. 17, T. 36 N., R. 86 W., Natrona County. Named for town of Waltman.

Walton Formation

Upper Devonian: Southeastern New York.

F. W. Fletcher, 1964, Pennsylvania Geol. Survey, 4th ser., Bull. G—39, p. 25, 38—39. Chadwick (1933) defined as Onteora 1,150 feet of red and gray beds which lie between Twilight Park and Stony Clove Sandstone in vicinity of High Peak. The Stony Clove, which Chadwick (1944, New York State Mus. Bull. 336) described as "gray sandstones coarsely flaggy and without a noticeable trace of red color throughout a thickness of 800 or 900 feet" actually contains three thick zones of red shale and claystone within type section. Since it is impossible to distinguish series of rocks formerly included in Stony Clove Sandstone from zone of red beds

Chadwick reported to be in basal part of his Katsberg Formation, these two groups of strata are combined with Chadwick's Onteora to form mappable unit herein named Walton Formation. Entire formation not exposed at any one locality. Maximum thickness estimated to be 1,800 feet. Strata of upper 900 feet crop out in Delaware River valley from Deposit to Handsome Eddy along New York Route 17 from Neversink to Deposit. Northeast of type locality red beds of unit are exposed above 2,500 feet elevation on Mount Utsayantha, 1 mile southeast of Stamford. Underlies Wittenberg Formation; overlies Oneonta Formation. Interfingers with Sonyea and Rhinestreet Formations west of Deposit.

L. V. Rickard, 1964, New York Stat Mus. Sci. Service Geol. Survey, Map and Chart Ser.: No. 4. As shown on correlation chart, overlies Oneonta shale and sandstone and underlies Slide Mountain sandstone and conglomerate. Upper Devonian.

Type locality: Bear Spring Mountain about 1 mile southwest of Walton, Walton quardrangle.

Wapi Lava Flow

Recent: Southern Idaho.

R. B. Butler and others, 1965, Tebiwa, v. 8, no. 2, p. 24. During Recent time basaltic eruptions from Pillar Butte, located about 10 miles northwest of Lake Channel, produced Wapi Lava Flow. Southern extremity of lava flow does not approach boundaries of the Lake Channel region but the flow appears to overlie loessial deposits adjacent to it on north. At some future date this relationship may be significant in the age of either the loess or the basalt flow.

Lake Channel region is part of Snake River Plain section of High Lava Plains subprovince of Columbia Plateau.

War Creek Gneiss

Tertiary: Northwestern Washington.

J. B. Adams, 1962, Dissert. Abs., v. 22, no. 11, p. 3981. Skagit gneiss in area has been subdivided in three mappable units, McGregor gneiss, Rainbow Lake schist, and War Creek gneiss, which strike approximately N. 30° W. and dip vertically or steeply to northeast.

Area of report is Stehekin-Twisp Pass, Northern Cascades.

Ward Gap Basalt Flow or Member (of Yakima Basalt)

[Miocene or Pliocene]: South-central Washington.

H. U. Schmincke, 1965, Dissert. Abs., v. 25, no. 11, p. 6541. Youngest flow in the Yakima in area. Younger than Elephant Mountain Basalt. Intertongues with sediments of Ellensburg Formation. Does not extend west of Yakima. Age not stated.

H. U. Schmincke, 1967, Geol. Soc. America Bull., 78, no. 3, p. 321 (fig. 2). Discussion of fused tuff and peperites in south-central Washington. Shown on figure 2 as Ward Gap Basalt Member of Yakima Basalt. Overlies Elephant Mountain Basalt Member.

Type locality and derivation of name not given.

Warm Lake Quartz Monzonite

Age not stated: Central Idaho.

C. N. Savage, 1961, Idaho Bur. Mines and Geology Bull. 17, p. 81. Quartz monzonite which megascopically resembles Gold Fork granodiorite (new). Underlies "core" of Idaho batholith. Name credited to D. L. Schmidt (1958, U. S. Geol. Survey open-file rept.)

Widespread occurrences on east side of Long Valley, Boise Basin.

Warm Springs Tuff Member (of Alturas Formation)

Plio-Pleistocene: Northeastern California.

California Department Water Resources, 1963, California Dept. Water Resources Bull. 98, v. 1, p. 56, 97 (table 10), v. 2, pls. A sequence of 100 to 400 feet of gray to brown massive pumice lapilli tuff, light-colored ashy sandstone, and resistant rimrock areas formed by basaltlike welded tuff. Overlies a lower unnamed member and underlies unnamed basalt member.

Area of Alturas, Modoc County.

Washakie Point Glaciation, Till

Pleistocene: Western Wyoming.

G. M. Richmond, 1964, U. S. Geol. Survey Prof. Paper 501—D, p. D104—D109. Washakie Point Glaciation is older than Cedar Ridge Glaciation. Till lies disconformably below varved lake sediments subjacent to Cedar Ridge Till and overlies lake beds that rest disconformably on conglomerate of Tertiary age. Till has thick pedocal soil developed on it and is characterized by abundant material from the conglomerate.

Type locality of till: In bluff of Cedar Ridge below small promontory 2,000 feet east of Washakie Point (SE¼SE¼ sec. 29, T. 3 N., R. 3 W.). Washakie Point is abrupt promontory along Cedar Ridge on north side of Bull Lake, Wind River Mountains.

Washington Quartzite

Silurian: South-central Maine.

E. S. Cheney, [1967], Maine Geol. Survey Bull. 19 (Spec. Econ. Studies Ser. 7), 32 p. A gray weathering grayish to greenish fine grained calc-silicate rich metaquartzite with biotite commonly along bedding planes. Characteristically even bedded (3 to 5 inches thick) and slabby weathering. Approximately 1,200 feet thick. Unconformably overlies Appleton and St. George formations (both new). Has been suggested that Washington quartzite possibly may be part of Vassalboro formation which is basal unit of Siluro-Devonian sequence in west-central Maine; also thought to be part of Bucksport formation which has been mapped as far south as Belfast. Vassalboro and Bucksport are thicker than the Washington but the Washington may be a basal member of one or both of them.

Forms small ridges in eastern Washington and in Appleton northwest of Appleton Ridge, northwestern Knox County marble belt.

Washington Volcanic Ash

Washington Ash

Post-glacial: Washington and Oregon.

H. P. Hansen, 1947, Am. Philosoph. Soc. Trans., new ser., v. 37, p. 114 (table 9). Washington volcanic ash shown in table of postglacial forest succession. Deposited about 6,000 years ago. Older than Willamette Valley pumice and younger than Mount Mazama pumice.

H. P. Hansen, 1967, Rev. Paleobotany and Palynology, v. 4, p. 104 (table 1). Washington Ash listed in table of postglacial pollen profiles in the

Pacific Northwest. Radiocarbon date gives 6,750 years. Older than Mount Mazama Pumice. Some authors believe Washington ash and Mazama pumice are one and the same, with the source from Crater Lake, Oreg.

Washita Stage

Cretaceous (Comanchean): Atlantic and Gulf Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 324—331. Washita is used in this book as a provincial stage for the uppermost time-rock unit of the Comanchean series to include all beds in Gulf and Atlantic coastal province and adjacent area which can be reasonably demonstrated to be equivalent to the type Washita and its typical subdivisions. The stage includes beds which have been generally judged to be correlative with the upper Albian and lower Cenomanian of Europe.

Type locality of Washita Group is at Fort Washita, Bryan County, Okla.

Washtucna Gravel

Quaternary: Southeastern Washington.

M. T. Huntting and others, 1961, Geologic map of Washington (1:500,000): Washington Div. Mines and Geology. Name applied to gravel in Washtucna Coulee.

Washtucna Coulee is in Adams and Franklin Counties.

Wason Park Rhyolite

Oligocene: Southwestern Colorado.

J. C. Ratté and T. A. Stevens, 1964, U. S. Geol. Survey Prof. Paper 475—D, p. D49, D50. Mentioned in discussion of magmatic differentiation in a volcanic sequence related to Creede caldera.

T. A. Stevens and J. C. Ratté, 1964, U. S. Geol Survey Prof. Paper 457—D, p. D54—D59. Formal proposal of name. A distinctive sheet of rhyolitic welded tuff that forms prominent cliffs throughout central San Juan area near Creede. Thickness 600 to 700 feet over wide areas in central San Juan Mountains; wedges out northward toward Continental Divide. Largely coextensive with underlying Mammoth Mountain Rhyolite, except it extends somewhat farther laterally over rough underlying topography. Separated from Mammoth Mountain Rhyolite by tongue of Huerto Formation south of Bristol Head. Several quartz latite lava flows intervene between the formations east of Wagon Wheel Gap. The Wason Park is equivalent to tridymite latite unit of Emmons and Larsen (1923, U. S. Geol. Survey Bull. 718), and in its type area and in most other places was included by Larsen and Cross (1956, U. S. Geol. Survey Prof. Paper 258) in tridymite rhyolitic latite member of their Piedra Rhyolite. Middle or upper Tertiary.

The U. S. Geological Survey currently designates the age of the Wason Park Rhyolite as Oligocene on the basis of a study now in progress.

Type area: Floor of Wason Park, a high flat bench on southern flank of La Garita Mountains northeast of Creede.

Wasp Spring Flow Breccia Member (of South Rim Formation)

Oligocene or younger: Southwestern Texas.

R. A. Maxwell and J. W. Dietrich, 1965, West Texas Geol. Soc. Pub. 65—51, p. 24, road logs. Basal member of formation. Underlies Lost Mine

Rhyolite Member (new); overlies unnamed brown rhyolite. Thickness about 150 feet at Casa Grande Peak. On Burro Mesa underlies Burro Mesa Riebeckite Rhyolite Member.

R. A. Maxwell and others, 1967, Texas Univ. Bur. Econ. Geology Pub. 6711, p. 139—140, pls. Formal proposal of name. Member is predominantly flow breccia unit. At most places it is the base of the South Rim Formation. About 100 to 350 feet thick in high Chisos Mountains area. Normally thins rapidly away from highest Chisos Mountains peaks and is commonly less than 30 feet thick in peripheral areas of present outcrop. In addition to flow breccia units, member also contains rhyolitic lava, coarse massive conglomerate, coarse sandstone, and tuff. Source of member was probably central Chisos Mountains although location of vent not known. Underlies Lost Mine Rhyolite Member. In some areas overlies unit referred to informally as Brown rhyolite member.

Wasp Spring is south of Burro Mesa in southwestern part of Big Bend National Park, Brewster County.

Wassamassaw Swamp Member (of Wicomico Formation)

Pleistocene, lower: Eastern South Carolina.

D. J. Colquhoun and D. A. Duncan, 1966, South Carolina Div. Geology Map MS-12. Upper Wicomico divided into five members: Toney Bay, Dean Swamp, Sandridge, Wassamassaw Swamp, and Four Hole. The Wassamassaw Swamp contains large amounts of fine sand and kaolinitic montmorillonite similar to that occurring in Sandridge Member. Underlies in part and grades southeastward from the Sandridge. Represents a shallow shelf marine environment. Deposited with and gradational from Toney Bay Member.

Named for Wassamassaw Swamp Summerville NW quadrangle.

Wassataquoik Chert

Middle Ordovician: East-central Maine.

R. B. Neuman, 1967, U. S. Geol. Survey Prof. Paper 524—I, p. I11—I13, pl. 1. Thin-bedded chert, including medium- to dark-gray, greenish-gray, and red varieties; volcanic rocks interbedded in some places. Estimated thickness based on Wassataquoik Stream 300 to 1,500 feet; on Sandbank Stream may be as much as 3,000 feet.

Type locality: At bridge over Wassataquoik Stream about 1 mile northwest of its mouth, Stacyville quadrangle.

Waterfall Greenstone

Triassic(?): Southeastern Alaska.

R. A. Loney and others, 1963, U. S. Geol. Survey Misc. Geol. Inv. Map I—388 (with separate text). Sequence consisting predominantly of greenstone, but containing lesser amounts of graywacke, greenschist, radiolarian chert, and marble. Overlies Pinnacle Peak Phyllite (new); nature of contact unknown because of intense folding of phyllite. Probably transitional both upward and laterally with Kelp Bay Group. Appears to wedge out to southeast near Cobol in Slocum Arm by intertonguing with strata of Kelp Bay Group. In present report the "schist" unit of Reed and Coats (1941, U. S. Geol. Survey Bull. 929) and Rossman (1959, U. S. Geol. Survey Bull. 1058—E) is assigned a Triassic(?) and Jurassic(?) age. It is here divided in western part of Chichagof Island into (ascending) Pinnacle Peak Phyllite (new), Waterfall Greenstone, and Kelp Bay Group.

Typically exposed in ridge lying immediately east and north of Waterfall Lake in western Chichagof Island.

Waterpipe Canyon Formation

Post-Silurian and pre-Tertiary: Northeastern Nevada.

J. W. Kerr, 1962, Geol. Soc. America Bull., v. 73, no. 4, p. 443 (fig. 2), 448—449, pl. 1. Name given to late Paleozoic or Mesozoic siltstones that lie unconformably upon lower Paleozoic rocks of Smith Creek sequence and are exposed in upper part of Smith Creek and in Waterpipe Canyon area. Base of formation marked by medium-gained graywacke which contains occasional black shale and chert pebbles; remainder of section is monotonous sequence of platy, black argillaceous quartz siltite interbedded with occasional fine- to medium-grained graywacke similar to the basal beds. Minimum thickness 700 feet. For most part rests upon Taylor Canyon Formation (new) except in upper Waterpipe Canyon where it lies upon Happy Camp (new) and Hanson Creek formations. Higher beds of formation cut out by overriding thrusts; they may have been partly removed by pre-thrusting erosion. Post-Silurian and pre-Tertiary but may be Mississippian and equivalent to Diamond Peak and Chairman formations.

Named for occurrence in Waterpipe Canyon, Seetoya Mountains, Elko County.

Water Tank Conglomerate

Tertiary-Quaternary: Southeastern Arizona.

J. E. Kinnison, 1959, Arizona Geol. Soc. Guidebook 2, p. 149 (fig. 28). Named on map legend where it is placed above Shorts Ranch andesite.

Saginaw area, Tucson Mountains, Pima County.

Wathena Shale

Pennsylvanian: Northeastern Kansas.

A. R. Troell, 1965, (abs.) Houston Geol. Soc. Bull. 8, no. 3, p. 21. In lower part of Oread megacyclothem. Underlies Toronto Limestone.

Wathena is in Doniphan County.

Watkins Member (of De Forest Formation)

Quaternary: Southwestern Iowa.

R. B. Daniels, Meyer Rubin, G. H. Simonson, 1963, Am. Jour. Sci., v. 261, no. 5, p. 473—487. Dominantly a massive calcareous silt loam with little indication of bedding. Thickness 8 to 13 beet. Always disconformably overlies Soetmelk member (new). Disconformably underlies Hatcher member (new). Major period of deposition may considerably pre-date 2020 years B. P.

Type section: Thompson Creek, 100 yards east of country road between secs. 13 and 14, in SW¼sec. 13, T. 80 N., R. 43 W., Harrison County. Named after major tributary of Thompson Creek.

Watonga Dolomite Bed (in Dog Creek Shale)

Permian (Guadalupean): West-central Oklahoma

R. O. Fay, 1962, Oklahoma Geol. Survey Bull. 89, p. 48 (fig. 17), 52, 53, 55 (fig. 19), 56—58, pl. 1. Name given to the 3- to 7-foot-thick unit of dolomite and interbedded dolomitic shales and siltstone in lower part of

Dog Creek Shale; about 25 to 40 feet above top of Shimer Gypsum. Separated from overlying Southard Dolomite Bed (new) by unnamed shale interval as much as 45 to 50 feet thick. Cragin (1897, Am. Geologist, v. 19) used name Amphitheatre Dolomite for this unit but name Amphitheatre fell into disuse.

Type section: On State Highway 33, about 7 miles east of Watonga, in SW¼SW¼ sec. 19, T. 16 N., R. 10 W., and SE¼SE¼ sec. 24, T. 16 N., R. 11 W., Blaine County.

Watsons Creek Basalt

[Pleistocene]: Eastern California.

G. B. Dalrymple, 1964, California Univ. Pubs. Geol. Sci., v. 47, p. 4 (table 1), 35. Report on potassium-argon dating research pertinent to some problems of Cenozoic history of the Sierra Nevada. Potassium-argon age 2.2 ± 0.1 m.y.

Sample collected one-eighth mile north of Watsons Creek on west side of Highway 28, north end of Lake Tahoe, Tahoe quadrangle.

Watton Canyon Member (of Twin Creek Limestone)

Upper Jurassic: Northeastern Utah, southeastern Idaho, and southwestern Wyoming.

R. W. Imlay, 1967, U. S. Geol. Survey Prof. Paper 540, p. 41–45, pls. Mostly medium- to brownish-gray compact brittle medium- to thin-bedded limestone; ranges in thickness from about 60 to 400 feet (399 feet at type section). Grades into overlying Leeds Creek Member (new). Overlines Boundary Ridge Member (new). Was called member E by Imlay (1950, Wyoming Geol. Assoc. Guidebook 5th Ann. Field Conf.).

Type section: Continuous exposures on the north side of Birch Creek about 8 miles west of Woodruff, Utah. Base of member exposed just below upper dam across Birch Creek. Top exposed in small southward-draining gully at extreme northwest corner of sec. 19. Named after Watton Canyon, just south of Birch Creek, where sequence of beds appears to be the same as on Birch Creek.

Waupee Series or Volcanics

Precambrian: Northeastern Wisconsin.

J. J. Mancuso, 1961, Dissert. Abs., v. 21, no. 11, p. 3420–3421. Oldest rocks in McCaslin district are Waupee series which is distributed about outer borders of trough of McCaslin syncline. Series is a complex of metamorphosed volcanic flows, agglomerates, and tuffs with large included bodies of granite and diorite. Overlain unconformably by McCaslin formation (new). Considered lower Precambrian and a possible correlative of Quinnesec formation of Iron and Dickinson Counties, Mich.

W. F. Read and L. W. Weis, 1962, Tri-State 26th Ann. Geol. Field Conf. Guidebook, p. 2, 3 (geol. map), road log. Baldwin conglomerate (new) is flanked on southeast by Waupee volcanics. The volcanics are cut by Macauley granite (new). Mancuso (unpub. thesis) believed the volcanics to be the floor on which McCaslin quartzite and Baldwin conglomerate were deposited. On southwest [Hager], rhyolite and Waupee volcanics are cut off by a younger granite, which Mancuso (unpub. thesis) named Belongia. Patches of volcanics occur east of Thunder Mountain and north of McCaslin Mountain.

J. A. Cain, 1963, Ohio Jour. Sci., v. 63, no. 1, p. 7—14. A review of some problems of Precambrian geology or northeastern Wisconsin. Mancuso (1957, 1960, unpub. thesis) mapped and established following succession: Waupee Volcanics (oldest), Macauley Granite, Baldwin Conglomerate and McCaslin Quartzite, Hager Rhyolite Porphyry, Belongia Granite and High Falls Granite.

Probably named from Waupee Creek.

Weber Canyon facies

Upper Mississippian-Lower Permian: North-central Utah.

M. D. Crittenden, Jr., 1964, Utah Geol. and Mineralog. Survey Bull. 69, p. 21. An informal term applied to rocks of Late Mississippian through Early Permian in Wasatch Range north of its junction with Traverse Mountains. Includes Doughnut Formation, Round Valley Limestone, and Weber Quartzite.

Wedin Member (of Cathedral Mountain Formation)

Lower Permian (Leonard Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U. S. Geol. Survey Bull. 1244—E, p. E5—E6, pls. 1, 2. Base of Cathedral Mountain Formation is marked in the Lenox Hills and on Dugout Mountain by a limestone member that contains distinctive productid brachiopod *Institella,* which is important in correlation in the Glass Mountains. This member, herein named Wedin, is the former "Second Limestone" member of the Leonard Formation of King (1931, Texas Univ. Bull. 3038). At type section member consists of 20 feet of biohermal limestone containing abundant representatives of brachiopod *Institella.* It pinches out about a mile east of type section but on west it forms prominent ledge on north edge of Lenox Hills. Somewhat thinner on northwest side of Dugout Mountain, where it was mapped for about a mile by King as the "Fifth Limestone" member of the Leonard. Total extent about 6.5 miles. Overlies Dugout Mountain Member (new) Skinner Ranch Formation.

Type section: Under west knob of hill 5300 in south-central quadrant of Altuda quadrangle, in the Lenox Hills, Brewster County. Name derived from Ava Scribner Wedin No. 1 well on Decie Ranch (King's map), a name doubly appropriate because the ranch formerly was Wedin Ranch.

Weepah Member (of Esmeralda Formation)

Pliocene, upper or Pleistocene: Western Nevada.

R. L. Hay, 1966, Geol. Soc. America Spec. Paper 85, p. 23 (table 5). Name listed on table in report on zeolites and zeolitic reactions on sedimentary rocks. Name credited to Moiola. [Compiler unable to locate report where name is defined.]

Wegee Limestone Member (of Dunkard Group)

Pennsylvanian: East-central Ohio.

H. L. Berryhill, Jr., 1963, U. S. Geol. Survey Prof. Paper 380, p. 51. A thin limestone unit that in places consists of two beds of limestone separated by shale or shaly siltstone. Lies from 6 to 18 feet above Elm Grove limestone member and is separated from it by a siltstone tongue of Waynesburg sandstone member. Thickness about 11½ feet. At type section lies about 12 feet above Elm Grove limestone. In this report Washington and Greene formations of Dunkard group are undifferentiated.

Type locality: In roadcut in SW¼ sec. 32 E., Mead Township, Belmont County. Named for Wegee Creek.

Weller Glaciation

Pleistocene: Alaska.

G. W. Holmes and C. R. Lewis, 1959, (abs.) Canadian Oil and Gas Industries, v. 12, no. 12, p. 55, 1961, *in* Geology of the Arctic, First Internat. Symposium Proc., v. 2: Toronto, Canada, Univ. Toronto Press, p. 851—852. Oldest glaciation recognized in Mount Chamberlin area. Deposits include scattered erratics, a few gravel benches, and several short, low, till ridges at elevations of 1,750 to 2,150 feet along southern slopes of Sadlerochit Mountains. Followed by Chamberlin glaciation.

G. W. Holmes and C. R. Lewis, 1965, U. S. Geol. Survey Bull. 1201—B, p. B9—B10, pl. l. Formal proposal of name. Oldest glaciation recognized in Mount Chamberlin area. Deposits include several short low till ridges, a few gravel benches, and scattered erratics. These deposits lie at altitudes of 1,750 to 2,150 feet along southern slopes of Sadlerochit Mountains. Followed by Chamberlin Glaciation.

Named for Mount Weller, prominent peak in Sadlerochit Mountains, Brooks Range.

Wells Creek Volcanics

Middle Jurassic: Northwestern Washington.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the western Cordillera in British Columbia and neighboring part of the United States—a symposium: Canadian Inst. Mining and Metallurgy, Spec. vol. 8, p. 103, 118, pl. 7—1. Thickness about 3,500 feet. Chiefly andesites grading into keratophyres and fair amounts of dacites. Probably separated from Cultus Formation by unconformity or disconformity. Separated from Nooksack Group by disconformity.

In Skagit region of Northern Cascades.

Wenatchee Ridge Gneiss

Late Paleozoic to early Mesozoic: Northern Washington.

B. B. Van Diver, 1965, Dissert. Abs., v. 25, no. 9, p. 5217. Metamorphic rocks in area consist of two major groups: The first, the Chiwaukum Schist and its granitized equivalent, the Wenatchee Ridge Gneiss and the second, the White River Orthogneiss (new). Derived largely from Poe Mountain mica schists.

B. B. Van Diver, 1967, Am. Jour. Sci., v. 265, no. 2, p. 1312—150. Discussion of contemporaneous faulting-metamorphism in Wenatchee Ridge area. Wenatchee Ridge Gneiss is heterogeneous, leucocratic gneiss chiefly of trondhjemitic composition. Contact between Wenatchee Ridge Gneiss and Chiwaukum Schist is S-shaped, partly parallel, and partly transverse to northwesterly structural trend of area as whole. Derivation of Wenatchee Ridge Gneiss from the Chiwaukum Schist by granitization is indicated by relict layers, lenses, and patches of Chiwaukum Schist material within the Gneiss, by structural continuity between the two units irrespective of the trend of their contact, by a gradational migmatitic contact zone, and by a number of petrographic features. Chiwaukum Schist-Wenatchee Ridge Gneiss Complex also discussed.

Wenatchee Ridge area lies in vicinity of Lake Wenatchee, Wash., on the eastern side of and bounded by the crest of the Northern Cascade Mountains.

Wenban Limestone

Lower, Middle, and Upper Devonian: North-central Nevada.

James Gilluly and Harold Masursky, 1965, U. S. Geol. Survey Bull. 1174, p. 12, 29—38, pl. 1. Name applied to Devonian limestone exposed on western flank of Wenban Peak, south of Cortez. Has gradational contact with underlying Roberts Mountains Limestone. Base taken at first bioclastic limestone bed above thin-bedded gray pyrite-bearing limestone with monograptids of the Roberts Mountain Limestone. Above this is 2,000 feet of interbedded dark-gray thick-bedded bioclastic limestone interbedded with thin-bedded argillaceous gray to yellow-gray weathering slabby limestones. Underlies Pilot Shale. Approximate equivalent of Nevada and Devils Gate Limestones.

Named for exposures on western flank of Wenban Peak, south of Cortez, Cortez quadrangle.

Wenham Monzonite

Upper(?) Paleozoic: Eastern Massachusetts.

Priestley Toulmin, 3d, 1964, U. S. Geol. Survey Bull. 1163—A, p. A42—A45, pl. 1. Medium-grained massive pinkish-cream-colored monzonite composed essentially of microperthite, oligoclase, and ferrohornblende, with smaller amounts of quartz, biotite, and a colorless clinoamphibole. Intrudes Cherry Hill Granite (new).

Exposed in scattered outcrops south of Wenham Swamp in towns of Wenham and Beverly, Salem quadrangle northeast of Boston.

Wepawaug Schist

Silurian and Devonian: South-central Connecticut.

C. E. Fritts, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D32-D36. Name applied to rocks formerly assigned to "main body" of Orange Phyllite. Consists mainly of interlayered fine- to medium-grained argillaceous, siliceous, and minor calcareous rocks of chlorite to kyanite grade. Rocks formerly mapped as Milford Chlorite Schist underlie rather than overlie the Wepawaug. In southeastern corner of Ansonia quadrangle, bedding in both formations strikes northeast and dips 30° to 70° NW. Beds are right side up. Along western side of area of exposure of Wepawaug, beds are nearly vertical and tops face east. Overlies Derby Hill Schist (new) on west, and metavolcanic and metasedimentary rocks, undivided, on east. Map pattern suggests unconformity beneath Wepawaug. Center of Wepawaug characterized by numerous small north-plunging folds, because formation occupies trough of tight north-plunging syncline. Intruded by Woodbridge Granite (new).

Type locality: Along Wepawaug River, south of Wepawaug Reservoir, Ansonia quadrangle. Named for Wepawaug River.

Werner Peak Formation

Precambrian (Belt Series): Northwestern Montana.

A. G. Smith, 1964, Dissert. Abs., v. 24, no. 10, p. 4146. Thickness 1,200 feet. Overlies Grinnell formation; underlies Siyeh formation.

Northwest Whitefish Range, Lincoln County.

Wesselman Tongue (of Kope Formation)

Upper Ordovician: Southwestern Ohio.

J. P. Ford, Jan. 1966, Dissert. Abs., v. 26, no. 7, p. 3861. Tongue in upper part of Kope. Overlies North Bend Tongue (new) of Fairview Formation.

J. P. Ford, 1967, Am. Assoc. Petroleum Geologists Bull., v. 51, no. 6, p. 918—936. Formal proposal of name. Name proposed for unit of Kope lithologic character which has lateral equivalents of Fairview lithologic character. In an area about 9 miles wide, trending ENE.—WSW., and located between western districts of Cincinnati and Miamitown, Ohio, the lower 30 to 40 feet of type Fairview as here redefined grades progressively northwestward into rocks of Kope lithologic type. Wesselman Tongue thickens from about 10 feet in SSE. to about 30 feet in the NNW. In vicinity of Miamitown and northward, the Wesselman merges into and cannot be distinguished from main body of the Kope.

Type section: Exposures in an east-facing embankment on an unnamed creek that is followed by Wesselman Road in Miami Township. Embankment is 400 feet south of Zion Hill bridge.

West Campus Sand

Pleistocene (Wisconsin): Southeastern Minnesota.

H. E. Wright and others, 1965, Internat. Assoc. Quaternary Research 7th Cong., Boulder Colo., Guidebook Field Conf. C, Upper Mississippi Valley, p. 47 (fig. 6-3). Named on geologic cross section through Minneapolis—St. Paul area.

J. E. Stone, 1966, Minnesota Geol. Survey Geol. Map Ser., GM—2 (with text), p. 6 (table 2), 24. Formal proposal of name. A varicolored generally crossbedded gravelly fine to coarse sand that contains lenses of silt, gravel, and moderately well-sorted sand. Interpreted as valley train deposit laid down in late glacial time by melt water from retreating Grantsburg sublobe. Younger than Fridley Formation (new). Type section and type area stated.

Type section: Roadcut on north side of U. S. Highway 12 where it passes through the West Campus, University of Minnesota, NE¼SW¼NW¼ sec. 25, T. 29 N., R. 24 W., New Brighton quadrangle. Type area: Terraces at 830 to 840 foot level on both sides of Mississippi River from St. Anthony Falls south to Lake Street Bridge, Minneapolis.

West Danby Member (of Sonyea Formation)

Upper Devonian: South-central New York.

R. G. Sutton and others, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 392, 393. Represents Sonyea Formation in vicinity of Ithaca and eastward.

Type section: In northward flowing stream one-half mile west of West Danby, Tompkins County.

West Fork Granodiorite

Mesozoic: Alaska.

A. W. Rose, 1967, Alaska Div. Mines and Minerals Geol. Rept. 28, p. 11 (table 4), 13, fig. 1. Leucocratic pink granodiorite and quartz monzonite. Intrudes Chisna formation at several localities between the West Fork and the Main Fork of Chistochina River.

Present in upper Chistochina River area, Mount Hayes quadrangle. Best-exposed body is a north-trending dike or sill with offshoots.

Westgate Formation

Middle Jurassic: West-central Nevada.

J. I. Corvalan, 1962, Dissert. Abs., v. 23, no. 6, p. 2092. Lower plate of Wind Mill thrust represents uninterrupted marine sequence in which three cartographic units are distinguished: Gabbs (Upper Triassic), Sunrise (Lower Jurassic), and Westgate (Middle Jurassic) formations. Westgate consists of calcareous sandstones and limestones containing typical Bajocian ammonites and represents youngest marine deposits so far reported from Nevada.

Westgate area, in southeastern part of Churchill County.

West Nueces Formation

Lower Cretaceous: Southwestern Texas.

F. E. Lozo and G. I. Smith, 1964, Gulf Coast Assoc. Geol. Sco. Trans., v. 14, p. 285—307. Proposed as replacement for so-called "Edwards" and "Comanche Peak" plus "Walnut" formations as applied in Maverick basin area of Rio Grande embayment. Type section about 145 feet thick. Lower 60 feet is regional transgressive unit generally called Comanche Peak. Overlying 80 to 85 feet of massive bedded miliolid-, pellet-, shell-fragment graywackes to mudstones with some grainstones is the so-called Edwards where the overly flaggy unit is referred to the Kiamichi. Overlies Glen Rose with sharp concordant contact. Underlies McKnight Formation (revised).

Type section and locality: Type section exposed in bluffs on left bank of West Nueces River, about 3½ miles northwest of Laguna-Brackettville road crossing (State Highway 334), immediately upstream from confluence with Chalk Creek, Chapman Ranch, northeastern Kinney County. Locality is about 8 miles north of Turkey Mountain and is 2 miles W. 22° N. of Salmon Peak, Turkey Mountain 15-minute quadrangle.

West Rock Diabase (in Newark Group)

Upper Triassic: South-central Connecticut.

C. E. Fritts, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D32—D36. Intruded New Haven Arkose at about time that Talcott Basalt of Newark Group as extruded above the arkose. Intruded by Buttress Diabase (new).

C. E. Fritts, 1963, U. S. Geol. Survey Geol. Quad. Map GQ—199. Consists of coarse- to fine-grained medium-dark-gray to dark-greenish-gray diabase composed of sodic labradorite, augite, pigeonite, magnetite, quartz, alkalic feldspar, and micropegmatite, with minor biotite, chlorite, hornblende, serpentine(?), apatite, sphene, and zircon. Mapped in Mount Carmel quadrangle.

C. E. Fritts, 1963, U. S. Geol. Survey Geol. Quad. Map 200. Mapped in Southington quadrangle. Largest body is sheetlike, approximately 18 miles long, and reaches thickness of nearly 700 feet near Lake Watrous in Mount Carmel quadrangle.

Named for West Rock in New Haven quadrangle.

Westwood Granite

Pre-Carboniferous: Southeastern Massachusetts.

N. E. Chute, 1965, U. S. Geol. Survey Geol. Quad. Map GQ—466. Pinkish-gray, generally massive, fine- to medium-grained granite, composed of 25 to 35 percent quartz, 15 to 30 percent albite, and 35 to 50 percent microperthite. Younger than Dedham Granodiorite.

Type locality and derivation of name not stated. Area of report is Duxbury quadrangle.

Westwood Granite

Precambrian(?): Eastern Massachusetts.

N. E. Chute, 1966, U. S. Geol. Survey Bull. 1163—B, p. B14—B20, pl. 1. A distinctive granite of widespread occurrence that has been considered as part of Dedham Granodiorite. Most of Westwood is a light-pinkish-gray even-grained massive rock rich in quartz and low in dark minerals. Usually distinguished from the Dedham by its finer grain size. In some places the Westwood resembles phases of the Mattapan Volcanic Complex (Emerson, 1917, U. S. Geol. Survey Bull. 597). Contains four phases. The common variety has white phenocrysts of sericitized albite and sodic oligoclase and pink phenocrysts of perthite in a fine-grained pink to lavender groundmass of quartz and feldspar. A hybrid variety and a pink variety are present but were not mapped. The Westwood and Dedham, having been grouped together in the past, were considered to be of same age. But the Westwood is now known to intrude the Dedham. Preliminary Rb-Sr age determinations give ages of 548 and 562 m.y. Additional analytical work on these samples is in progress. On basis of present results Ramo and Fairbairn (1963, U. S. Atomic Energy Comm., NYO-10517) are of the opinion that Dedham Granodiorite and Westwood Granite are of late Precambrian age. In present report the Westwood is mapped as pre-Carboniferous.

The U. S. Geol. Survey presently designates the age of the Westwood Granite as Precambrian(?) on the basis of a study now in progress.

Named for exposures near Westwood-Norwood town line, Norwood quadrangle.

Whalehead Formation

Jurassic: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4321. Graywacke and mudstone interstratified with coarse conglomerate in fault contact to west and north of Chetco Formation (new). Middle Portlandian on basis of lithologic similarity and apparent regional similarity continuity with rocks to north containing Portlandian clam *Buchia piochii.*

Report discusses west-central Klamath province in southwestern Oregon and northwestern California. Whalehead Creek is in Curry County, Oreg.

Wheeler Crest Quartz Monzonite

Cretaceous: East-central California.

P. C. Bateman, 1961, Geol. Soc. America Bull., v. 72, no. 10, p. 1530—1532. Contains conspicuous phenocrysts of K feldspar, set in medium-grained hypidiomorphic-granular groundmass. Intruded by Round Valley Peak Granodiorite, Tungsten Hills Quartz Monzonite (both new), and alaskite similar to Cathedral Peak Granite. Intrudes only diorite, quartz diorite, and hornblende gabbro.

Type locality: North side of Pine Creek Canyon. Named after Wheeler Crest, east-central Sierra Nevada near Bishop. Well exposed in steep eastern face of Wheeler Crest, where it underlies a little more than 17 square miles.

Whetstone Granite

Precambrian: Southern Arizona.

W. W. Tyrrell, Jr., 1964, Dissert. Abs., v. 25, no. 6, p. 3516. Precambrian rocks consist of an older, foliated, metasedimentary series, Pinal schist, and a younger, nonfoliated, granite intrusive, Whetstone granite.

Whetstone Mountain area, Cochise and Pima Counties.

Whidbey Formation

Pleistocene: Northwestern Washington.

D. J. Easterbrook, 1965, *in* Internat. Assoc. Quaternary Research, 7th Cong., Boulder Colo., Guidebook Field Conf. J, Pacific Northwest, p. 68-75. Consists of interglacial floodplain deposits—silt, sand, clay, peat, and scattered lenses of gravel. Thickness about 200 feet at type locality. Overlies Double Bluff Drift (new); underlies Possession Drift (new). In some areas underlies Vashon advance sand and Vashon Drift. Radiocarbon date more than 35,000 years B.P.

D. J. Easterbrook, D. R. Crandell, and E. B. Leopold, 1967, Geol. Soc. America Bull. v. 78, no. 1, p. 13—20. Formal proposal of name. Consists of sand interbedded with silt, clay, peat, and scattered lenses and beds of gravel. Near type locality unit is at least 200 feet thick, but an unknown thickness may have been eroded from top section. More than 300 feet of stratified sediments are exposed in a sea cliff 1 mile east of Double Bluff, and also at Scatchet Head, but upper 100 feet in both places apparently consist of younger sediments deposited unconformably on the Whidbey. At Possession Point the formation is only about 120 feet thick. The Whidbey is nonglacial deposit between the Double Bluff Drift and Possession Drift. The Whidbey could correlate with either the nonglacial peat-bearing sediments between the two Salmon drifts or the Puyallup Formation. It is not considered likely that the Whidbey is older than the Puyallup Formation.

Type locality: Bluffs at West Useless Bay, Whidbey Island, Puget Sound. Type section: Sea cliffs 0.3 to 0.7 mile east of Double Bluff. Composite section of Double Bluff Drift and Whidbey Formation measured in sea cliffs between SE¼NE¼ sec. 28, and SE¼NW¼ sec. 26, T. 29 N., R. 2 E., at southwestern end of Whidbey Island.

Whigville Member (of Taine Mountain Formation)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 17, 21—22, pl. l. Consists of medium-grained plagioclase-mica-quartz schist containing garnet and less commonly kyanite. Schist is non-rusty weathering and normally layered. Overlies Scranton Mountain Member (new). Underlies Bristol Member of Collinsville Formation.

Type locality: Near Whigville in Bristol quadrangle.

Whipple Cave Formation

Upper Cambrian: East-central Nevada.

H. E. Kellogg, 1963, Geol. Soc. American Bull., v. 74, no. 6, p. 691—692, pl. 1. Name given to interval of cherty limestone and dolomite which overlies Dunderberg Formation in Egan Range area. Divided into a lower cherty limestone member and an upper limestone-dolomite member; contact drawn at base of a thick white coarsely crystalline dolomite. Thickness 1,624 feet at type section; 1,883 feet at Dry Canyon; 1,373 feet at Patterson Pass. Upper boundary placed at top of uppermost dolomite beneath cherty Ordovician limestone; this contact agrees with base of Pogonip Group as used by Hintze (1952, Utah Geol. and Mineralog. Survey Bull. 48). Considered late, medial, and possibly early Franconian in lower part and Trempealeauan and possibly earliest Ordovician in its upper part.

Type section: At west entrance to Shingle Pass, in secs. 35, T. 8 N., R. 62 E., Lincoln County. Named for Whipple Cave.

Whipstock Conglomerate

Whipstock Member (of Walloomsac Slate)

Whipstock Hill Conglomerate

Middle Ordovician: Southwestern Vermont and eastern New York.

E-an Zen, 1963, Geol. Soc. American Guidebook Field Trip 3, New York City Mtg., p. 3, 45, 46, pl. 3. Mention of conglomerate called by Potter [unpub. rept.] Whipstock Hill Conglomerate equivalent to Forbes Hill Conglomerate. Page 45 mentions Whipstock Conglomerate unit of Walloomsac Slate. Page 46 mentions Whipstock Conglomerate.

J. M. Bird, 1963, Geol. Soc. America Guidebook Field Trip 3, New York City Mtg., p. 18. Whipstock Member of Walloomsac Slate. Name credited to Potter.

Occurs in vicinity of Whipstock Hill.

Whiskey Creek interbeds (in Columbia River Basalt)

Miocene, middle: West-central Idaho.

J. G. Bond, Idaho Bur. Mines and Geology Pamph. 128, p. 23, fig. 18. Sedimentary units in "Upper" Basalt of Columbia River Basalt [Group]. Composed of two marginal interbeds and an intervening flow similar to Orofino Creek Interbeds (new). Lies about 400 feet, or two thick basalt flows, above Orofino Creek Interbeds. Composed mainly of interstratified sandy and silty layers of basement detritus which suggest lacustrine deposition in part. Lower sedimentary unit about 15 feet thick; overlying flow about 75 feet; upper interbed about 60 feet. Middle Cenozoic.

Jane Gray and L. R. Kittleman, 1967, Am. Jour. Sci., v. 265, no. 4, p. 257—291. Geochronometry of Columbia River Basalt and associated floras of eastern Washington and western Idaho. At least 19 flows and associated interbed in Clearwater Embayment, with maximum thickness of 28,000 feet, are assigned to Upper Basalt Member of Columbia River Basalt by Bond (1963). Nine stratigraphic units are named as members; one of these, the Whiskey Creek Member, which consists of paired interbeds and an intervening flow, provided radiometric date of 19.5 m.y. Clearwater Embayment is capped over much of area by Lolo Creek Flow which gave date of 19 m.y. (Date of 23.1 + 2.0 m.y. obtained by Rice University considered too great for reasons stated herein). Thus floras form sedimentary units above Whiskey Creek Member and below Lolo Creek Flow are, practically speaking, contemporaneous. Middle Miocene.

Named for exposures in roadcuts along Orfino-Grangemont Highway on northwestern slope of Whiskey Canyon, Clearwater Embayment.

Whisky Quartzite

Silurian or Lower Devonian: West-central Maine.

A. J. Boucot, 1961, U. S. Geol. Survey Bull. 1111—E, p. 156 (fig. 16), 176—177, pl. 34. Coarse-grained and conglomeratic quartzite; light brown where fresh; weathers white. Thickness about 200 feet. Lies below Seboomook formation of Devonian age and above unfossiliferous Capens formation (new) and undifferentiated strata of Silurian or Devonian age.

Type section: On east side of Deer Island near Lambert Island, on south limb of eastward-plunging anticline on Deer and Sugar Islands in Moosehead Lake (Moosehead Lake quadrangle). Named for Whisky Island in an eastern embayment of Deer Island.

White Bird Lake Beds

Micoene, upper: West-central Idaho.

J. G. Bond, 1963, Idaho Bur. Mines and Geology Pamph. 128, p. 26—27. Fossiliferous and sandy siltstones of basement dertritus. Deposited on top of highest basalt flow to east of Doumecq Plateau where Lolo Creek Flow (new) is missing. Younger than basalt detritus or marginal deposits of Lawyer Creek Interbed (new) on Doumecq Plateau and Camas Prairie, respectively. Middle Cenozoic.

Jane Gray and L. R. Kittleman, 1967, Am. Jour. Sci., v. 265, no. 4, p. 257—291. Geochronometry of the Columbia River Basalt and associated floras of eastern Washington and western Idaho. Potassium-argon determinations of 12.1 m.y. obtained from basalt overlying the Whitebird tuffs (Evernden and James, 1964, Am. Jour. Sci., v. 262, no. 8) is said to indicate a Clarendonian age for the Whitebird assemblage. Present authors obtained two dates, 13.5 m.y. and 23.6 m.y., from glass-shard and crystal concentrates, respectively, of tuffs interbedded with the fossile beds. Both of these dates are outside the limits of error of the date obtained from overlying basalts. Evidence would seem to favor younger date of 13.5 m.y. as most nearly correct age estimate for Whitebird flora. By accepting 19.5 m.y. as correct determination for Lolo Creek Flow, the date of 13.5 m.y. for Whitebird fossile beds also appears to confirm the suggestion by Bond (1963) that the lake beds were deposited on the plateau surface after cessation of main extursion of Columbia River basalt in Clearwater Embayment. If this is true, the provenance of the overlying basalt at Whitebird dated 12.1 m.y. remains in question. Upper Miocene.

Named for occurrence in vicinity of White Bird, Idaho County.

White House Member (of De Chelly Sandstone)

Permian: Northeastern Arizona.

H. W. Peirce, 1964, Mus. Northern Arizona Bull. 40, p. 15—32. Consists of the large scale cross-stratified sandstones that form the widely photographed sheer walls of Canyon De Chelly. Thickness 570 feet in type area; thins to south and east across Defiance Plateau. Absent south of Oak Springs Cliffs, but easily recognized at Buell Park, Bonito Canyon, and Oak Springs Cliffs on east flank of Defiance Plateau. This unit, though thinned, overlies Oak Springs Cliffs Member (new) at the Oak Springs Cliffs section. Baars (1962, Am. Assoc. Petroleum Geologists

Bull., v. 46, no. 2) did not find a unit above the Oak Springs Cliffs Member (his Yeso Formation) that would correlate with any of the De Chelly Sandstone at Canyon De Chelly. Relationship exposed at Oak Springs Cliffs section demonstrates that White House Member is younger than Baars' Yeso Formation, not older. Underlies Black Creek Member (new).

H. W. Peirce, 1967, New Mexico Geol. Soc. Guidebook 18th Field Conf., p. 57—58. Discussion of Permian stratigraphy of Defiance Plateau, Ariz. The White House Member is the principal component of Gregory's (1917, U. S. Geol. Survey Prof. Paper 93) original De Chelly Sandstone, it constitutes the Upper Member of McKee (1934, Am. Jour. Sci., 5th ser., v. 28, no. 165) and of Read and Wanek (1961, U. S. Geol. Survey Prof. Paper 374—H) at Canyon De Chelly, and it forms the De Chelly Sandstone of Monument Valley. Although Read and Wanek extend their Upper Member throughout Defiance Plateau, present author has subdivided the interval into White House, Black Creek, and Fort Defiance Members. It would appear to be stratigraphically unwise to conclude that the Meseta Blanca Sandstone, which underlies the Yeso Formation (restricted) in Zuni region, is direct correlative of any part of the De Chelly Sandstone, let alone the upper sandstones that constitute the White House Member, as demanded by Baars' correlation. Nomenclatural problem is complex. Concepts about the De Chelly of the Defiance Plateau have evolved to point where it is recognized that it has parts and that some of these parts probably correlate with parts of Supai-Abo-Cutler, Yeso, Glorieta, San Andres, and Kaibab Formations. When These rough correlations are made it is the White House Member that remains unattached, the principal part of Gregory's original De Chelly Sandstone, which Darton (1925, Arizona Bur. Mines Bull. 119) subsequently called Coconino Standstone. Major question continues to be relationship between these two prominent units, De Chelly Sandstone and Coconino Sandstone. Problem is perhaps not difficult for those who subscribe to concept that there isn't any tangible time distinction to be made between Coconino Sandstone of Arizona and Glorieta Sandstone of New Mexico. Using the vehicle of the probable Glorieta-Black Creek Member-White House Member relationships, it can be stated that if the Glorieta transgresses the White House Member, the Coconino Sandstone must do so similarly. Baars suggested that the Glorieta is a marine equivalent of eolian Coconino Sandstone. Although not previously emphasized in Arizona, the sandstone allotted to the "Coconino" along eastern part of Mogollon Rim is not eolian in origin, therefore, not type Coconino Sandstone. Typical eolian Coconino Sandstone transgresses the noneolian phase with at least an easterly component. The noneolian sandstones are believed to grade laterally into the sandstones that constitute Black Creek Member of De Chelly. It appears then that contrasting depositional environments of approximately correlative sandstones complicate the resolution of applicable regional nomenclature. However, all available data (including subsurface) indicate that the Coconino Sandstone immediately overlies White House Member of the De Chelly, but with an unclear relationship. It is certain, however, that the two are not separated by a Yeso Formation (restricted) as suggested by Baars. There still remains possibility that they are one and the same sandstone body and that their differences might be largely attributable to unequally applied post-depositional changes. Present author believes that eolian White House

Member was deposited by northeasterly winds immediately prior to accumulation of Coconino Sandstone by northerly to northwesterly winds. Whereas the Black Creek Member transgresses the White House Member, the Coconino Sandstone transgresses suspected Black Creek Member equivalents. Seems likely then that the Coconino Sandstone must transgress the White House Member as well. Following this line of reasoning it is possible to conclude that the White House Member might well be more closely related to the Supai Formation than it is to the Coconino Sandstone.

Type area: Canyon De Chelly, Apache County. White House Trail in Canyon De Chelly provides only convenient access to complete section of unit. White House is a ruin situated in natural alcove formed in this sandstone.

White Knob Limestone

White Knob Group

Upper Mississippian: Central Idaho.

C. P. Ross, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 384—387, 1962, Idaho Bur. Mines and Geology Pamph. 125, p. 48—53. Name proposed for rocks formerly called Brazer in south-central Idaho. Formation consists mainly of pure limestone, commonly containing chert in nodules and laminae, but containing locally minor, nonpersistent silty, sandy, and conglomeratic beds. Thickness more than 7,300 feet at type locality; may be more than 10,000 feet at other localities. Intertongues westward with Copper Basin Formation (new); overlies Milligen Formation. Lower Mississippian to Lower Permian.

O. K. Huh, 1967, Montana Geol. Soc. Guidebook 18th Ann. Field Conf., p. 31—62. Term White Knob Limestone saised to group status to include four newly named formations (ascending): Middle Canyon, Scott Peak, South Creek, and Surrett Canyon. Overlies Milligen Formation. Underlies unnamed Pennsylvanian quartzites and limestones. In type area the White Knob contains Mississippian strata only.

Type locality: Exposures on ridge above Cabin Creek, in White Knob Mountains, Blaine County. Crops out at many localities in White Knob Mountains and throughout much of southeastern part of central Idaho north and northwest of Snake River Plain and mostly east of long 114°.

White Mountain Complex

Mississippian: Southern California.

R. S. MacColl, 1964, Geol. Soc. America Bull., v. 75, no. 9 p. 809—910, pl. 1. Includes rocks within two metamorphic areas adjacent to Rattlesnake pluton. Larger area, about 5 square miles, lies west of the pluton. Smaller area, about 4 square miles, is centered on White Mountain, east of the pluton. Rocks, in order of decreasing abundance, are marble, calcsilicate hornsfels, schist (including gneisses and migmatites associated with schist), and quartzite. Complex is Mississippian at least in part.

White Mountain is in San Bernadino Mountains, San Bernardino County.

White Owl Creek Member (of Fox Hills Formation)

Upper Cretaceous: Western South Dakota.

W. A. Pettyjohn, 1967, Am. Assoc. Petroleum Geologists Bull. v. 51, no. 7, p. 1361—1367. Upper member of Fox Hills, Meade County area. Composed of as much as 195 feet of silt, sand, sandstone, and purple clay-shale. Divided into two major lithologic units: a lower massively crossbedded sand and sandstone; and an upper, dominantly purpose clay-shale. Includes Enning facies (new) in upper part overlies Fairpoint Member. Underlies White River Group.

Type section: Measured along Bull Creek valley from NW¼SW¼NE¼ sec. 18, T. 7 N., R. 13 E., Meade County. Type locality: Exposures along Bull Creek, 2 miles west of Enning. Named for exposures along upper reaches of White Owl Creek 2½ miles north of Enning.

White Pine Formation (in Oquirrh Group)

Pennsylvanian (early and middle Desmoinesian): Northern Utah.

J. E. Welsh and A. H. James, 1961, Utah Geol. Soc. Guidebook 16, p. 2 (table 1), 10—11, pls. 2, 5. Thickness about 2,350 feet. Top of formation is at base of Ribbon member of Butterfield formation (both new). Overlies Maple formation (new). Includes Butterfield Peaks limestone members and White Pine limestone members. Units and names described herein are those used by Kennecott Copper Corp. geologists within Bingham mining district. They are not intended as formal names unless they are applicable.

H. J. Bissell, 1962, Brigham Young Univ. Geology Studies, v. 9, pt. 1, p. 33. Name preoccupied.

Type section: In sec. 22, T. 4 S., R. 3 W. Corps out on slopes of Butterfield Peaks and is well exposed around Long Ridge anticline in southern Oquirrh Mountains and in North Oquirrh thrust block in northern Oquirrh Mountains.

White River Orthogneiss

Late Paleozoic to early Mesozoic: Northern Washington.

B. B. Van Diver, 1965, Dissert. Abs., v. 25, no. 9, p. 5217. Represents an originally igneous complex of predominantly quartz dioritic to subordinately dioritic to gabbroic composition. Emplaced in present position next to Chiwaukum Schist by high-angle trusting late during regional metamorphism.

B. B. Van Diver, 1965, (abs.) Geol. Soc. America Spec. Paper 82, p. 285. Consists of directionless and gneissose metaquartz diorites that locally grade into dioritic rocks. These are separated from the Chiwaukum Schist by a zone of amphibolitic schists, metagabbros, and remnant layers and lenses of the main orthogneiss. [Term White River unit and White River mass also used in text.]

B. B. Van Diver, 1967, Am. Jour. Sci., v.265, no. 2, p. 132—150. Discussion of contemporaneous faulting-metamorphism in Wenatchee Ridge area, northern Cascades. It is not known whether the igneous parent rock of the White River Orthogneiss represents a pre-metamorphic intrusive later than the deposition of the supracrustal sequence or whether it is part of the basement on which the sequence was laid down. If the latter applies, the White River Orthogneiss would correlate with Yellow Aster Complex established by Misch farther north in the range and specifically with Marblemount Meta Quartz Diorite and Eldorado Orthogneiss. Certain features seem to favor such a correlation. Among these are petrographic and petrogenitic similarity to the Eldorado and Marblemount units, the association of metamorphic mafic rocks with those units, and of mafic and ultra mafic rocks, partly in tectonic slices, with the Yellow Aster Complex.

Wenatchee Ridge area, northern Cascades. In southern part of Glacier Peak area.

White Rocks Sandstone Member (of Lee Formation)

Pennsylvanian: Southeastern Kentucky.

K. J. Englund and others, 1961, U. S. Geol. Survey Geol. Quad. Map GQ—172. A fine- to coarse-grained light-gray quartzose massive cross-bedded sandstone. Thickness 125 to 340 feet. Overlies sandstone member A; underlies sandstone and shale member B.

K. J. Englund and others, 1963, U. S. Geol. Survey Bull. 1142-B, p. B13, pl. 1. Formal proposal of name. In Ewing quardrangle, is most conglomeratic member of formation. Thickness 300 feet at type exposure; 125 feet on west edge of Ewing quardrangle; 340 feet on east edge. Overlies sandstone member A; underlies sandstone member B.

K. J. Englund, 1964, U. S. Geol. Survey Prof. Paper 501—B, p. B30—B38. Lee Formation divided into seven mapped members as follows: Pinnacle Overlook (new), Chadwell (new), White Rocks Sandstone, Dark Ridge (new), Middlesboro (new), Hensley (new), and Bee Rock Sandstone. Southward from the type locality, the White Rocks Sandstone Member thins and wedges out about 2 miles southwest of Hensley Flats. Where the White Rocks wedges out, the Dark Ridge Member is in gradational contact with Chadwell Member.

Named for exposures at White Rocks, a prominent south-facing cliff at crest of Cumberland Mountain. Caps Cumberland Mountain and forms sheer-sided hogbacks on north slope west of White Rocks.

Whitestone Member (of Walnut Formation)

Cretaceous: South-central Texas.

C. H. Moore, 1962, (abs.) *in* Contributions to geology of South Texas: San Antonio, South Texas Geol. Soc., p. 116. Walnut formation divided into (ascending) Bull Creek, Bee Cave, Cedar Park, Whitestone, and Keys Valley marl (new) members and upper unnamed marl.

C. H. Moore, Jr., 1964, Texas Univ. Bur. Econ. Geology Rpt. Inv. 52, p. 4 (fig. 2), 5, 8, 9 (fig. 4), 10, 26, 30, pls. Cedar Park Limestone Member restricted to lower nodular unit and upper pelsparite and oosparite lentil named Whitestone Limestone Member. Underlies Keys Valley Marl Member. Thickness about 40 feet at type locality.

W. L. Fisher and P. U. Rodda, 1967, Kansas Geol. Survey Spec. Distrib. Pub. 34, p. 56. Incidental mention of Whitestone lentil [Edwards Formation?] in discussion of stratigraphy and genesis of dolomite, Edwards Formation.

Type locality: At locality where Adkins (1933, Texas Univ. Bull. 3232) described original Cedar Park Limestone—quarries about 2 miles north-northwest of Cedar Park, Williamson County.

Whitestripe Marble

Triassic(?): Southeastern Alaska.

R. A. Loney and others, 1963, U. S. Geol. Survey Misc. Geol. Inv. Map I—388 (with separate text). Name given to prominent light-gray marble averaging several hundred feet in thickness, that crops out discontinuously for more than 25 miles near west coast of Chichagof Island. Near Pinnacle Peak the marble is terminated by fault and is represented to southeast by a few scattered thin lenses. Overlies Goon Dip Greenstone (new), apparent conformity; greenstone and marble are interlayered above and below contact. Underlies Pinnacle Peak Phyllite (new).

Type locality: Whitestripe Mountain about 4½ miles east of Portlock Harbor, Chichagof Island.

Whitewater Stade, Drift, Till

Pleistocene (Wisconsin): Southeastern Indiana.

A. M. Gooding, 1963, Jour. Geology, v. 71, no. 6. Whitewater stade followed Sangamon interglacial stage and was followed by New Paris Interstade (new). Whitewater till underlies New Paris silt. Radiocarbon dates from Whitewater till do not prove conclusively that the till was deposited more than 41,000 radiocarbon years ago, dates reported later on overlying organic-rich interstadial deposit give them credibility.

Type section: American Aggregates pit section, in east side of railroad cut at gravel quarry in north-central part of sec. 36, T. 14 N., R. 1 W., at northeast edge of Richmond, Wayne County. In Whitewater Valley and basin.

Whitewater Arroyo Shale Member (of Dakota Sandstone)

Cretaceous: Northwestern New Mexico.

D. E. Owen, 1966, Am. Assoc. Petroleum Geologists Bull., v. 50, no. 5, p. 1023—1028. An olive-gray silty oyster-bearing shale. Thickness at type section 80 feet. Elsewhere about 60 feet. From Gallup area northward, thickness decreases to its wedgeout point near Toadlena. Underlies Twowells Sandstone Member. Overlies unnamed sandstone member of Dakota.

Type section: Located on a small strike valley just below the Twowells Sandstone cuesta northwest of point where the Whitewater Arroyo crosses the Dakota outcrop in NW¼ sec. 17, T. 12 N., R. 19 W., about 1.2 miles west of Two Wells Indian School, McKinley County.

Whitmore Point Member (of Moenave Formation)

Upper Triassic(?): Northwestern Arizona and southern Utah.

R. F. Wilson, 1967, Plateau, v. 40, no. 1, p. 29—40. Name proposed for unit of grayish to reddish siltstone and claystone, commonly 50 to 80 feet thick, that conformably overlies Dinosaur Canyon Member and underlies Springdale Sandstone Member. At type section, member is composed of alternating thin to thick sets of horizontally stratified gray, greenish-gray, graish-red, pale-brown siltstone and claystone. Thickness about 70 feet at type section. Contact with underlying Dinosaur Canyon Member sharp and conformable. Eastward from type section member becomes increasingly sandy due to addition and thickening of several cross-stratified pale-red sandstone sets, including a prominent one at the base of the member. These sets represent tongues of Springdale Sandstone Member.

Type section: At Whitmore Point, a promontory of the Vermilion Cliffs about 5 miles norwest of Pipe Spring National Monument, Ariz., in sec. 15, T. 40 N., R. 5 W.

Whitmore Wash Member (of Redwall Limestone)

Mississippian: Northwestern Arizona.

J. W. Parker and J. W. Roberts, June 1963, Four Corners Geol. Soc. 4th Field Conf., p. 45. A thick-bedded limestone in northern and western Grand Canyon and a dolomite in southeastern Grand Canyon. Thickness 70 to a little more than 100 feet; 101 feet at type section. Underlies Thunder Springs Member (new). Name credited to McKee (unpub. ms.).

E. D. McKee, [Nov.] 1963, U. S. Geol. Survey Prof. Paper 475—C, p. C21—C22. Formal proposal of name. Basal member of formation. At type section member is 101 feet thick and consists of very thick bedded (4 to 15 feet) dolmite that is fine and even grained. Along south side of Grand Canyon, member is 72 to 85 feet thick and is largely dolomite; farther west it is limestone composed mostly of well-rounded bioclasts and locally of ooids. Underlies Thunder Springs Member; overlies Temple Butte Limestone.

Type section: On upthrown side of Hurricane fault, about one-fourth mile north of Colorado River. Exposed along east side of Whitmore Wash valley, northwestern Arizona.

Wichita Granite Group

Middle Cambrian(?): Southwestern Oklahoma.

W. E. Ham, R. E. Denison, and C. A. Merritt, 1964, Oklahoma Geol. Survey Bull. 95, p. 60—79, pls. Dominant outcropping rock in Wichita Mountains is pink medium-grained granite. The grainte rocks consists of several types. They differ in texture, mineral composition, and to some extend in age. Intrusive relations indicate at least four separate granitic injections and possibly six. Term Wichita Granite Group proposed for this assemblage of closely allied rocks. Included in group are granites previously mapped on outcrop as Lugert, Headquarters, Reformatory, Quanah, and Cold Springs, as well as their subsurface equivalents. Intrudes lower part of Carlton Rhyolite Group (new). Dated by four isotropic age determinations. Isotopic age 525 ± 25 m.y.

C. A. Merritt, 1965, Oklahoma Geology Notes, v. 25, no. 10. Includes Mount Scott Granite (new). Mount Scott is oldest granite in group.

Name derived from mountain system in which they are exposed.

Widener Limestone Member (of Elbrook Formation)

Ordovician: Western Virginia.

J. R. Derby, 1963, (abs.) Virginia Jour. Sci., v. 14, new ser., no. 4, p. 239. Uppermost member of formation. Thickness 100 to 600 feet. Contains *Crepicephalus* zone fauna. Overlies unnamed dolomite member. Name credited to Tyler (unpub. thesis).

Damascus quadrangle, Washington County.

Wikieup granodiorite

Precambrian: Northwestern Arizona.

G. W. Putman and C. W. Burnham, 1963, Geochim. et Cosmochim. Acta, v. 27, no. 1, p. 60, 73—74. Name used to distinguish a rock unit in trace elements study. Makes up Wikieup pluton. Part of Cerbat complex. Name as used herein has no claim to priority.

Composes most of southeastern part of Haulpai Range in area west of Wikieup.

Wilbur Mountain Member (of Littleton Formation)

Lower Devonian: Western Maine.

C. V. Guidotti, 1965, Maine Geol. Survey Quadrangle Mapping Ser. 3, p. 43—45, pls. 1, 2. Middle member of formation in Bryant Pond quadrangle. Consists largely of rusty-weathered coarse-grained migmatitic gneiss and quartz-feldspar-biotite granulite. Thickness probably on order of 300 to 500(?) feet. Underlies Howard Pond member (new) and overlies Concord Pond member (new). Unit could be interpreted as lens of rusty gneiss within Concord Pond member.

Well exposed on northwest and northern slopes of Wilbur Mountain area and on two hills to south-southwest of Rumford Corner. Excellent outcrops in brook 1 mile south of East Bethel.

Wildcat Member (of Taine Mountain Formation)

Pre-Triassic: Northwestern Connecticut.

R. S. Stanley, 1964, Connecticut Geol. Nat. History Survey Quad. Rept. 16, p. 17, 19—20, pl. 1. Fairly homogeneous unit composed of biotite-plagioclase-quartz gneiss, with subordinate biotite-plagioclase-muscovite-quartz schist, kyanite-plagioclase-biotite-quartz schist, and a few lenses of amphibolite. All rocks nonrusty-weathering. Underlies Scranton Mountain Member (new). Contact placed above highest nonrusty-weathering biotite-plagioclase-quartz gneiss of Wildcat Member and below rusty-weathering schist and gneiss of Scranton Mountain Member. Contact apparently not gradational and can be located within a zone 10 to 20 feet thick.

Well exposed south of Tunxis Trail in type locaility of Taine Mountain Formation in outcrops east of Case Cemetery, and on Wildcat Mountain in Collinsville and Bristol quadrangles.

Wildcat Creek Welded Ash-Flow Tuff

Pliocene (Clarendonian): Southeastern Oregon.

L. R. Kittleman and others, 1965, Oregon Univ. Mus. Nat. History Bull. 1, p. 5 (fig. 4), 16—17, 40—41. Thickness, including upper and lower zone of no welding, about 200 feet. Commonly overlies Butte Creek Volcanic Sandstone (new). Overlies Tims Peak Basalt (new) in Monument Peak District. Separated from overlying Shumuray Ranch Basalt (new) by thin unnamed volcaniclastic strata.

Type locality: Near head of Wildcat Creek, in SW¼NW¼ sec. 29, T. 24 S., R. 40 E., Malheur County. Occurs as discontinuous ledge-and mesa-forming exposures in Cowley and Monument Peak districts.

Wildcat Valley Sandstone

Lower and Middle(?) Devonian: Southwestern Virginia.

R. L. Miller, L. D. Harris, and J. B. Roen, 1964, U. S. Geol. Survey Prof. Paper 501-B, p. B49—B52. Devonian System, in Wise, Scott, and Lee Counties is represented by a calcareous sandstone about 45 feet thick; overlain by a black shale sequence hundreds of feet thick. The black shale is the Chattanooga, largely of late Devonian age. The underlying calcareous sandstone has in past been called Helderberg Limestone (Stose, 1963, Virginia Geol. Survey Bull. 24). Because Helderberg has been used as time stratigraphic term in this area, that is, for stage in Devonian time

(Cooper and others, 1942, Geol. Soc. America Bull., v. 53, no. 12, pt. 1), and because in most places topmost beds of sandstone contain post-Helderberg fossils, name Wildcat Valley Sandstone is proposed. At type section overlies Hancock Limestone and underlies Chattanooga Shale.

Type section: Two miles south-southeast of Big Stone Gap, Wise County, on spur overlooking Wildcat Creek, 0.15 mile south of Irondale Church on U. S. Highway 23. Name derived from Wildcat Valley, Wise County, about 2 miles south of town of Big Stone Gap between Wallen Ridge on northwest and Powell Mountain on southeast.

Willamette Valley Pumice

Willamette Pumice

Postglacial: Oregon.

H. P. Hansen, 1947, Am. Philosoph. Soc. Trans., new ser., v. 37, p. 114 (table 9). Willamette Valley pumice listed on table showing postglacial forest succession. Younger than Washington volcanic ash. Older than Devils Hill pumice.

H. P. Hansen, 1967, Rev. Paleobotany and Palynology, v. 4, p. 104 (table 1). Willamette Pumice listed in table showing postglacial pollen profiles in Pacific Northwest. Between 4000 and 5000 B.P. Younger than Mount Mazama Pumice and older than Newberry Pumice.

Willard clays

Quaternary: Norwestern Utah.

Necip Güven and P. F. Kerr, 1965, Selected Great Basic playa clays: U. S. Air Force Cambridge Research Lab. Sci. Rept. 4, p. 32. Willard clays mentioned report on mineralogical studies of samples from Deep Springs, Mud Lake, Humboldt, Sevier, and Animas clays.

Necip Güven and P. F. Kerr, 1966, Am. Mineralogist, v. 51, nos. 5—6, p. 858—874. Willard clays discussed in detail in report on weathering effects on the structures of mica-type clay minerals.

Occurs at Willard Reservoir, along northeast shore of Great Salt Lake, north or Ogden.

Willard Creek Quartzite (in McCoy Creek Group)

Precambrian: Centeral northeastern Nevada.

Peter Misch and J. C. Hazzard, 1962, Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 296, 297, 298—299 (pl. 1). Massive cliff-forming unit about 500 feet thick. Underlies Strawberry Creek Formation (new). Overlies unnamed quartzite formation.

Exposed in area of upper Willard and upper Strawberry Creeks, northern part of Southern Snake Range.

Williams Sand Member (of Antelope Formation)

Miocene, upper: Central California (subsurface and surface).

C. D. Callaway, 1962, San Joaquin Geol. Soc. Selected Papers, v. 1, p. 47—55. In lower part of Antelope. In outcrop area is quartzose, fine grained to pebbly conglomeratic, but mainly fine to coarse with local occasional beds of subrounded quartz and shale pebbles. As distance from outcrop increases, the grain size decreases. Well cores in area of

Midway syncline show sand to be silty to fine grained with occasional medium grains. Silt streaks rare. Further from outcrop sand silts out completely. Older than Republic Sand. Stable with relation to time.

Crops out in secs. 28, 33, 34, and 35, T. 32 S., R. 23 E., Midway Sunset field, as a locally confined body of lensing sand beds.

Williamson Canyon Volcanics

Upper(?) Cretaceous or younger: Southeastern Arizona.

F. S. Simons, 1964, U. S. Geol. Survey Prof. Paper 461, p. 9 (table), 44—47, pl. 1. A sequence of rather nondescript andesitic or dacitic volcanic rocks, in general massive and practically devoid of flow layering or bedding. Mainly green, gray, or grayish-purple agglomerates, tuffs, tuff breccias, and so forth—containing subordinate lava flows and flow breccia. Thickness about 2,500 feet. Wherever base is exposed or its depositional character can be surmised, Williamson Canyon Volcanics overlie Pinkard Formation. Contact appears to be disconformity. Overlain unconformably by Horse Mountain Volcanics (new) from north edge of quadrangle southeastward for about 2 miles; farthe; east the contact is a fault. No fossils found; no absolute age determinations made. Formation may be Late Cretaceous or younger.

Crops out northeast of Horse Ridge and along divide between Williamson Canyon and Old Deer Creek, Klondyke quadrangle. Occupy area less than 2 square miles, or less than 1 percent of quadrangle.

Willis Ranch Member (of Word Formation)

Lower Permian (Guadalupe Series): Western Texas.

G. A. Cooper and R. E. Grant, 1966, U. S. Geol. Survey Bull. 1244—E, p. E7—E8, pls. 1, 2. Word Formation restricted by removal of Road Canyon Member and establishing it as Road Canyon Formation. The three limestone members of the Word are herein named (ascending) China Tank, Willis Ranch, and Apple [Appel] Ranch. The Willis Ranch is the "Third Limestone" member of King (1931, Texas Univ. Bull. 3038). At type section consists of (ascending) light gray oolitic limestone, 218 feet; brown calcareous sandstone, 10 feet; gray limestone containing fossils and several seams of small quartz pebbles, 11 feet; and oolitic gray limestone in thin ledges, 69 feet. Member extends along south side of Road Canyon, where it makes large patches on dip slope. Curves northward and arcs under Gilliland Canyon, emerging on west side of that canyon where it has been mistakenly mapped as basal limestone member in the Word. Willis Ranch Member was not assigned a number on King's map, although it was identified as the "First Limestone" on plate 7 (P. B. King, 1931). However, the limestone on the west side of Gilliland Canyon now proves to be a continuation of the Willis Ranch Member, identified by its close lithic and faunal similarity to that member on the east side of the canyon where it is the "Third Limestone" member of King and King (*in* P. B. King, 1931). Member terminates in southwest corner of mouth of southward extension of Gilliland Canyon. In vicinity of Old Word Ranch, member becomes dolomitic and merges with the undifferentiated mass of Word Formation.

Type section: Near eastern entrance to Road Canyon, 1 mile southwest of Old Willis Ranch site in west-central quadrant of Hess Canyon quadrangle, Brewster County. This is locality 243 of R. E. King (1931, Texas Univ. Bull. 3042, p. 136).

Willow Canyon Formation

See **Apache Canyon Formation** (in Bisbee Group).

Willow Canyon Formation

Ordovician: Central Nevada.

Marshall Kay and J. P. Crawford, 1964, Geol. Soc. America Bull., v. 75, no. 5, p. 436—437, pls. 1, 6. Dominantly greenish chert with conspicuous and frequent lavas. Full thickness about 1,000 feet or more. Faulted and has recumbent folds. Associated with and seems to succeed Pinecone Formation.

Typically exposed in Willow Canyon and nearby canyons, Toquima Range.

Willow Creek Leucosyenite

Eocene: Eastern Idaho and southwestern Montana.

L. D. Ramspott, 1963, Dissert. Abs., v. 23, no. 7, p. 2492. Two mappable units occur in Beaverhead pluton: Willow Creek leucosyenite and Beaverhead granitic complex. The Willow Creek is pink medium- to coarse-grained one-feldspar rock.

Crops out over about 2 square miles in Eighteenmile Peak area, Lemhi County, Idaho, and Beaverhead County, Mont.

Willow Gap Member (of Chainman Formation)

Carboniferous: Eastern Nevada and western Utah.

Walter Sadlick, 1966, Dissert. Abs., v. 26, no. 10, p. 5978. Chainman, about 2,000 feet thick along Nevada-Utah boundary, is herein subdivided into six lithostratigraphic members which intertongue with each other. They are (ascending): Needle Siltstone; Skunk Spring Limestone; Camp Canyon; Donner; Willow Gap about 300 feet thick, which formed as carbonate banks; and Jensen.

Type locaility and derivation of name not given.

Willow Spring Member (of Chainman Formation)

Mississippian: Northern and eastern Utah.

C. A. Arnold and Walter Sadlick, 1962, Michigan Univ. Mus. Paleontology Contr., v. 17, no. 11, p. 249 (fig. 4), 250 (fig. 5), 251. Underlies Jensen member (new) and overlies Diamond Peak member. New member names will be introduced later.

Type locality and derivation of name not stated.

Willow Spring Mudstone

Upper Cretaceous (Maastrichtian): West-central California.

E. V. Tamesis, 1967, Dissert. Abs., v. 28, no. 1, sec. B, p. 237. Eight stratigraphic units ranging from Early to Late Cretaceous are recognized in area. In descending [ascending?] order these are: Badger Shale, Risco Formation, Johnson Peak Formation, Catskin Formation (new), Lovel Shale (new), Redman Sandstone, Willow Spring Mudstone (new), and Moreno Formation. Unconformities exist between Campanian Redsman and Maastrichtian Willow Spring Mudstone, Redman and Santonian Lovel Shale, and the Lovel and Cenomanian-Coniacian Catskin Formation.

Area of report is Avenal Ridge-Reef Ridge area of Southern Diablo Range, 200 miles southeast of San Francisco, Fresno and King Counties.

Willow Springs Volcanic Series

Cenozoic: Central eastern California.

C. W. Chesterman and C. H. Gray, 1966, Sacremento Geol. Soc. Guidebook Ann. Field Trip June 18—19, p. 12, 13, pl. 1. Six volcanic series delineated in Bodie quadrangle. They are: Rancheria, Hunewill, Willow Springs, Potato Mountain, Mount Biedeman, and Silver Hill. The Willow Springs consists, principally, of flows of dacite and andesite. Dacite forms canyon walls along Virginia Creek near Willow Springs, and along road to Bodie that follows Clear Creek where it forms massive lava flows as much as several tens of feet in thickness. Andesite is less common than dacite and occurs as flows which crop out along Cinnabar Creek and at Big Alkali Flat, and as small domes, of which several occur along Clearwater Creek not far from its confluence with Cinnabar Creek.

North of Mono Lake, Mono Basin, Mono County.

Wills Granite

Precambrian: Southeastern Missouri.

W. C. Hayes, 1961, Missouri Geol. Survey and Water Resources Rept. Inv. 26, p. 22. Mentioned in road log from Roselle to Mine LaMotte. In contact with Stouts Creek rhyolite.

Occurs in St. Francois Mountain area. Wills Branch flows from St. Francois County into Madison County.

Wilmington Gneiss

Precambrian: Southern Vermont.

J. W. Skehan, 1961, Vermont Geol. Survey Bull. 17, p. 37—45, pls. 1, 3, 24 (fig. 5). Consists essentially of medium to very coarse grained microcline gneiss. About 90 percent is well banded, somewhat foliated, microcline-augen gneiss. About 5 percent consists of schistose gneiss containing some randomly distributed gray and pink microcline grains. Remaining 5 percent is massive medium-grained microcline gneiss. Relationship to other formations uncertain. May be same age as Stamford gneiss. Included in Mount Holly complex.

Well exposed in vicinity of Wilmington Village, in Deerfield River valley, in Wilmington-Woodford area.

Wilson Creek Gneiss

Precambrian: Northwestern North Carolina.

Bruce Bryant, 1962, U. S. Geol. Survey Bull. 1121-D, p. D-5—D-6, pl. 1. Coarse-grained cataclastic quartz monzonite gneiss ranging from quartz diorite to granite; rarely layered. Contains phyllonite zones as much as 4,000 feet thick that are discontinuous both laterally and vertically and contain lenses and layers of less-sheared gneiss and pods of relatively unsheared pegmatite. Underlies Grandfather Mountain formation (new), apparent unconformable contact. Intruded by Linville metadiabase. Mapped as Cranberry granite by Keith (1903).

Type locality: Along banks of Wilson Creek in southeastern part of Linville quadrangle and northeastern part of adjacent Table Rock quadrangle (renamed Linville Falls quadrangle).

Winchuck Member (of Chetco Formation)

Jurassic: Southwestern Oregon.

J. M. Widmier, 1963, Dissert. Abs., v. 23, no. 11, p. 4321. Member of Chetco Formation (new). Gradational with Macklyn Member (new). Macklyn considered older but evidence not convincing. Older than Middle Portlandian.

Report discusses west-central Klamath province in southwestern Oregon and northwestern California. Winchuck River is in Curry County, Oreg.

Windmill Limestone

Lower Devonian: Northeastern Nevada.

J. G. Johnson, 1965, Canadian Petroleum Geology Bull., v. 13, no. 3, p. 369—372. Defined to include heterogeneous sequence of limestone, limestone breccia, dolomitic calcarenite, and calcareous shale conformably overlying Roberts Mountains Formation. Regarded as upper part of Roberts Mountains Formation by Winterer and Murphy (1960, Jour. Geology, v. 68, no. 2). Contact with overlying Rabbit Hill Limestone (restricted) differs slightly from their boundary but lower contact is an easily recognized limestone breccia. Basal breccia beds are composed of nonargillaceous limestone that is cherty at some places and is interbedded with thin-bedded calcarenite. Breccia unit is succeeded by tan- and pink-weathering dolomitic calcarenite. On east side of Coal Canyon unit [thin-bedded calcarenite] is succeeded by limestone with graded bedding together with limestone breccia that crops out as nearly horizontal ledge. This upper breccia is succeeded by tan and black calcareous shale with bedding surfaces at some horizons bearing small brachiopod shells, fine fossil debris, and *Tentaculites.* Tentaculite beds were included in Rabbit Hill Limestone by Winterer and Murphy. Thickness calculated to be 700 feet across beds that strike north and dip 20° to 35°E. on the two flanks of Coal Canyon at type section.

Type section: In SE¼ sec. 17, T. 25 N., R. 49 E., Eureka County, Nev. Windmill Window is along northern front of Simpson Park Range.

Windy Gap Volcanic Member (of Middle Park Formation)

Upper Cretaceous: Northwestern Colorado.

G. A. Izett, R. B. Taylor, and D. L. Hoover, 1962, U. S. Geol. Survey Prof. Paper 450-E, p. E36—E39. Name applied to sequence of andesitic and trachyandesitic volcaniclastic rocks at or near base of Middle Park Formation. Thickness 1,143 feet at type section. In most areas unconformably overlies Pierre Shale of Late Cretaceous age, but locally the unconformity cuts across the Pierre, and Windy Gap rests on Niobrara Formation of Late Cretaceous age. Contact between Windy Gap and older rocks is sharp and marked by a few feet of reworked shale overlain by poorly sorted volcaniclastic rocks. In areas where Windy Gap Member pinches out into lower part of Middle Park, volcanic conglomerates interfinger with arkosic conglomerates. Upper contact of member gradational. Pollen from bed of carbonaceous debris that overlies member is of Late Cretaceous age.

Type locality: On north side of U. S. Highway 40 at Windy Gap, 4 miles west of Granby. Section measured in NE¼ sec. 27, T. 1 N., R. 77 W., Grand County.

Windy Ridge Formation

Permian(?): Northeastern Oregon and western Idaho.

T. L. Vallier, 1967, Dissert. Abs., v. 28, no. 4, sec. B, p. 1585. Consist of 2,000 to 3,000 feet of keratophyre, quartz keratophyre, and keratophric phyroclastic rocks. Unconformably overlain by Hunsaker Creek Formation (new). Oldest rocks in section studied.

Mapped area lies between Wallowa Mountains of northeastern Oregon and Seven Devils Mountains of western Idaho. Part of Snake River Canyon included.

Wingate Hill Drift, Glaciation

Pleistocene, upper(?): Western Washington.

D. R. Crandell, 1963, U. S. Geol. Survey Prof. Paper 388—A, p. A9 (table 4), A29—A32, pl. 1. Defined as drift sheet that mantles Cascade foothills in western Washington, and that is characterized by lack of constructional topography and the presence of weathered rims, as much as one-fourth inch thick, on constituent stones in uppermost few feet. Most of drift is brown and stony and very compact except where modified by weathering or front heaving. Thickness as much as 30 feet. Till probably represents ice cap glaciation. Youngest unit recognized beneath Wingate Hill drift is Lily Creek formation (new); oldest dated overlying deposit is Evans Creek drift (new). Table and text also refer to Wingate Hill glaciation.

Name taken from Wingate Hill south of Carbonado, on west side of which till in drift is typically exposed (measured section 1, along logging road in NE¼ sec. 8, T. 18 N., R 6 E.), Lake Tapps quadrangle, Pierce and King Counties.

Winthrop Creek Glaciation

Holocene: Central Washington.

D. R. Crandell and R. D. Miller, 1964, U. S. Geol. Survey Prof. Paper 501-D, p. D110—D114. Two episodes of glacier advance within last 3,500 years are included in Winthrop Creek Glaciation. The two episodes are separated in time by at least 1,000 years and thus constitute two separate stades wherein named Burroughs Mountain and Garda. Recent.

The U. S. Geological Survey uses the term Holocene in preference to the term Recent.

Type section: Moraines along Winthrop Creek, on northern side of Mount Rainier.

Wintun Formation

Lower Cretaceous (Aptian-Neocomian): Northwestern California.

Stewart Chuber, 1961, Dissert. Abs., v. 22, no. 5, p. 1578. Sandstone 5,000 feet thick. Overlies Sanhedrin formation (new); underlies Aspilche formation (new).

In Elk Creek-Fruto area, Glenn Country.

Witts Springs Formation

Pennsylvanian (Morrow Series): North-central Arkansas.

Mackenzie Gordon, Jr., 1964, U. S. Geol. Survey Prof. Paper 460, p. 45—48. Hale formation and Bloyd shale can be differentiated and most of their subdivisions recognized as far southeast as northwest part of

Newton County, Ark., in vicinity of Compton. Southeast of this area, there is gradual increase in sand content and a thickening of the Morrow section. In this region upper part of Hale formation and various subdivisions recognized in Washington County cannot be differentiated. East of Compton, or for all practical purposes east of Madison County, rocks of Morrow age between Imo formation (new) below and Atoka formation above are called Witts Springs formation. Footnote (p. 6) states that since present report [Prof. Paper 460] was written, the Imo Formation has been mapped into the Cane Hill Member of Hale Formation. Hence name Cane Hill Formation will replace name Imo Formation.

E. E. Glick, S. E. Frezon, and Mackenzie Gordon, Jr., 1965, U. S. Geol. Survey Bull. 1194–D, p. D1–D16. Rocks that overlie Pitkin Limestone of Late Mississippian age in Snowball quadrangle, Newton and Searcy Counties, constitute three mappable units. Middle unit is herein designated Witts Springs Formation. Stratigraphically equivalent to Prairie Grove Member of Hale Formation and to overlying Bloyd Shale of northwest Arkansas. New name is applied in Snowball quadrangle because Prairie Grove and Bloyd are not individually mappable. Predominantly sandstone with some shale. Thickness 300 feet at type section; 193 feet at reference section; 600 feet in southwestern part of quadrangle. Overlies Cane Hill Formation; underlies Atoka Formation. Locally overlies Pitkin Limestone.

Type section: Section in western head-water branch of Calf Creek, which is 2 miles north of Witts Springs, Searcy County. Base of section is in valley bottom in N½NW¼NE¼NE¼ sec. 12, T. 13 N., R. 18 W. Section extends westward 150 feet up main valley and then northwestward up valley of small southward-flowing tributary and crosses into sec. 1, T. 13 N., R. 18 W., near middle of south edge of SE¼ sec. 1. Reference section: In easternmost headwater branch of a tributary to Richland Creek near center of E½ sec. 11, T. 13 N., R. 18 W. Base of section is at mouth of westernmost of two small southward-flowing tributaries to the branch. Top of section is in easternmost tributary, west of church on west side of road from Witts Springs to Magic Springs.

Wonder Lakes Substage, Till

[Recent?]: East-central California.

D. A. Rahm, 1964, (abs.) Geol. Soc. America Spec. Paper 76, p. 221. Listed as oldest of three substages in Neoglacial stage. Older than Basin Mountain substage.

Bishop area, Sierra Nevada.

Wonewoc Formation (in Elk Mound Group)

Upper Cambrian (Dresbachian-Franconian): Wisconsin.

M. E. Ostrom, 1966, Wisconsin Geol. and Nat. History Survey Inf. Circ. 7 (also Michigan Basin Geol. Soc. Guidebook Ann. Field Conf. May 21–22), p. 7 (fig. 2), 8 (fig. 3), 59. Uppermost member of Elk Mound Group (new). Includes Galesville and Ironton Members. Overlies Eau Claire Formation. Underlies Lone Rock Formation (new) of Tunnel City Group (new). Reference exposures noted.

Reference exposures in quarry at north city [Wonewoc] limit and in bluffs at south city limit. Composite section taken from bluffs in and around village of Wonewoc located in secs. 26 and 35, T. 14 N., R. 2 E., Juneau County.

Woodbine Stage

Upper Cretaceous (Gulfian): Atlantic and Gulf Coastal Province.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 333—342. Following Adkins' (1933, Texas Univ. Bull. 3232) definition of Woodbine as a group, the term has gradually been extended to many parts of the coastal province as the basal provincial subdivision of the Gulfian and accordingly has come to be used, intentionally or otherwise, as a time-rock division to include a diverse variety of lithic units judged, for one reason or another, to be of the same age as the type Woodbine and its typical divisions. It is thus used here, except that it is called a stage. Occurs below Eagle Ford stage.

Woodbridge Granite

Devonian: South-central Connecticut.

C. E. Fritts, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D32—D36. Oligoclase granite or sodic quartz diorite. Intruded Wepawaug Schist (new) before climax of progressive regional metamorphism in Devonian time.

C. E. Fritts, 1963, U. S. Geol. Survey Geol. Quad. Map GQ-199. Mapped in Mount Carmel quadrangle which contains type locality.

Type locality: Southwest corner Mount Carmel quadrangle. Named for Woodbridge.

Woodhouse Mesa Flow, Basalt

Pleistocene, lower(?): Northeastern Arizona.

M. E. Cooley, 1962, Arizona Geol. Soc. Digest, V. 5, p. 104 (fig. 8.4). Listed on chart showing correlation and relationships of volcanic flows in San Francisco volcanic field.

Woodhouse Mesa is in Coconino County, northeast of Sunset Crater.

Woods Ranch Member (of Toroweap Formation)

Permian (Leonardian): Northwestern Arizona.

J. E. Sorauf, 1963, Dissert. Abs., v. 24, no. 2, p. 702. Uppermost of three members of Toroweap. Overlies Brady Canyon Member (new). The three members represent transgression, maximum extension, and regression of Toroweap sea, respectively. Underlies Fossil Mountain Member (new) of Kaibab.

Whitmore area, Mohave County.

Woodstock Group

Silurian or Devonian: Northwestern Maine.

Jeffrey Warner and K. A. Pankiwskyj, 1965, New England Intercollegiate Geol. Conf., Guidebook 57th Ann. Mtg., p. 104 (table 1), 105-107, 111 (fig. 1), 112 (fig. 2). Conformable formations composed of rusty- and gray-weathering, well- and poorly-bedded spangled-muscovite schists and gneisses. Includes Anasagunticook (new), Ludden Brook (new), Thompson Mountain, and Newton Hill (new) Formations. Overlies Silurian Buckfield Group (new); underlies Devonian (?) Saddleback Mountain Formation (new). According to map bracket on figure 2, group also includes Shagg Pond and Billings Hill Formations. [May or may not be a new usage of Woodstock Schist of Richardson (1927).]

Group has been traced through Bryant Pond, Rumford, and Bethel quadrangles into the gneisses of Littleton Formation in New Hampshire.

Woodtick Gneiss

Precambrian(?): Southwestern Connecticut.

C. E. Fritts, 1962, U. S. Geol. Survey Prof. Paper 450—D, p. D32—D36. Intruded Waterbury Gneiss but not known to have intruded rocks stratigraphically above this formation.

C. E. Fritts, 1963, U. S. Geol. Survey Geol. Quad. Map GQ-200. Medium-grained light- to medium-gray quartz diorite gneiss. Composed of calcic oligoclase to sodic andesine, quartz, biotite, microcline, muscovite, and garnet, with minor apatite, zircon, epidote, magnetite or ilmenite, rutile, and sphene. Emplaced probably in Precambrian time. No apparent relationship between emplacement of the Woodtick and formation of Waterbury dome. Largest body of Woodtick Gneiss not in center of dome. Type locality stated.

Type locality: About 1 mile southeast of Scovill Reservoir, Southington quadrangle. Named for Woodtick.

Woolen Mill Gabbro

Age not stated: Northern New York.

D. deWaard, 1965, Jour. Petrology, v. 6, pt. 1, p. 175. Mentioned in discussion of occurrence of garnet in granulite-facies terrane of Adirondack highlands.

Occurs near Elizabethtown as a small body in anorthosite.

Worthington Glaciation

Holocene: Alaska.

W. H. Coulter and E. B. Coulter, 1961, U. S. Geol. Survey Geol. Quad. Map GQ-142. Well-developed moraine borders terminous of each of the active glaciers in area. Glacial episode during which these moraines were deposited is here referred to as Worthington glaciation. Younger than Marshall Pass glaciation (new).

Named after deposits at Worthington Glacier immediately north of Thompson Pass, Valdez (A-5) quadrangle, Gulf of Alaska region.

Wyemaha Formation (in Lahonton Valley Group)

Pleistocene, upper: Southern Nevada.

R. B. Morrison, 1961, U. S. Geol. Survey Prof. Paper 424—D, p. D—111—D—112. Comprises eolian sand and alluvium, which reach lowest parts of basin floor and intertongue with shallow-lake deposits of sand to clay. Thickness 100 feet; probably locally more than 150 feet in subsurface of basin interior. Most of unit lies conformably between Eetza formation (new) and middle Lake Lahontan soil, which in turn overlies intertonguing formations Sehoo and Indian Lakes (both new).

R. B. Morrison, 1964, U. S. Geol. Survey Prof. Paper 401, p. 34—41, pls. Detailed description of formation. The sand bears the Churchill soil which is partly eroded. Type locality designated.

Type locality: In saddle between Sehoo and Eetza Mountains at western end of the valley E½ sec. 21, T. 18 N., R. 30 E., Carson Desert, near Fallon, Churchill County. Widely exposed above 3,965 feet.

Wymps Gap Limestone Member (of Mauch Chunk Formation)

Mississippian: Southwestern Pennsylvania.

N. K. Flint, 1965, Pennsylvania Geol. Survey, 4th ser., County Rept. C56A, p. 46—49, pls. Name given to a marine limestone bed in the Maunch Chunk of southwestern Pennsylvania that has long been referred to as "Greenbrier limestone". This bed is just a thin north finger of the much thicker Greenbrier Series of West Virginia and it seems advisable to assign new name to unit. Thickness about 40 feet at type locality, the lower half being massive limestone and upper half interbedded limestone and calcareous shale; commonly 15 to 20 feet in southern Somerset County [this report]. In Negro Mountain area, the Wymps Gap lies about 175 feet above base of formation. This interval thins westward to 30 feet at Youghioheny River Gap in Laurel Hill and to as little as 5 feet in Wymps Gap area. Has been quarried at type locality.

Type locaity: Wymps Gap about 12 miles south of Uniontown, Fayette County and 1 mile north of Pennsylvania-West Virginia boundary.

Yadkin Graywacke Member (of Millingport Formation)

Yadkin Graywacke (in Albermale Group)

Ordovician (?): Central North Carolina.

J. F. Conley and G. L. Bain, 1965, Southeastern Geology, v. 6, no. 3, p. 128—129, geol. map. Dark-green graywacke sandstone containing interbeds of mafic tuffaceous argillite, mafic lithic-crystal tuff, and felsic lithic tuff. Unit is only thick sequence of graywacke in Carolina slate belt. Thickness at least 3,000 feet. Conformably overlies McManus Formation (new); unconformably overlain by mafic pyroclastics of Tater Top Group (new). Early Paleozoic.

The U. S. Geological Survey currently classifies the Yadkin Graywacke as a member of the Millingport Formation (Stromquist and Sundeluis, 1969, U. S. Geol. Survey Bull. 1274—B) and designates the age as Ordovician (?) on the basis of a study now in progress.

Type locality: In roadcut on west side of North Carolina Highway 8 about 100 feet south of where Riles Creek crosses the road, 1 mile north of intersection with U. S. Highway 52, Stanly County. Occurs only west of Troy anticlinorium. Crops out along axis of a southwest plunging fold (New London syncline) which is west of the anticlinorium. Crops out in area about 5 miles wide and has been traced along axis of syncline from New London southward to west of Monroe, a distance of 35 miles.

Yampai Cliffs Member (of Muav Limestone)

Middle Carbrian: Northwestern Arizona.

W. H. Wood, 1966, Geol. Soc. America Bull., v. 77, no. 11, p. 1244. Member of Muav at Yampai Cliffs. Author states that a detailed field study of the lithology and stratigraphic relationships of the Yampai Cliffs Member, including 12 stratigraphic sections, was presented in his Ph.D. dissertion. According to Figure 6 in present report, Yampai Cliff[s] Member is subdivided into three units, A, B, and C. Unit A extends from top of Kanab Canyon Member to top of highest typical bed of mottled limestone facies. Unit B consists of mostly fine clastic materials and dolomite. Unit C consists mostly of dolomite at Music Mountain. Yampai Cliffs are in eastern part of Mohave County.

Yantic Member (of Tatnic Hill Formation)

Middle (?) Ordovician or older: Eastern Connecticut.

H. R. Dixon, 1964, U. S. Geol. Survey Bull. 1194—C, p. C3 (fig. 1), C4-C5. Name Yantic was informally used by Snyder (1961, U. S. Geol. Survey Geol. Quad. Map CQ—144) to distinguish youngest rocks of Putnam Gneiss from rocks of similar composition lower in sequence. This is useful distinction, and Yantic Member is here named as upper unit of Tatnic Hill Formation (new). Name was informally assigned by Snyder for exposures near village of Yantic in Norwich quadrangle, where Yantic Member forms western belt of Snyder's biotite-muscovite schist. At type locality member is 1,250 feet thick, but contains numerous pegmatitic sills and dikes that probably account for about 300 feet of total thickness. Minimum thickness 500 feet about 5 miles north of Tatnic Hill area; maximum thickness about 2,500 feet in Norwich quadrangle, where there is probably some tectontic thickening. Member is predominantly dark-gray medium-grained porphyroblastic muscovite-biotite-oligoclase-quartz schist. Overlies Fly Pond Member; underlies Hebron Formation.

Robert Zartman and others, 1965, U. S. Geol. Survey Prof. Paper 525—D, p. D1—D10. Implications of new radiometric ages in eastern Connecticut and Massachusetts. Tatnic Hill Formation (as well as equivalents and underlying rocks including Quinebaug Formation) is probably Middle Ordovician or older.

Type locality: From boundary between Hampton and Danelson quadrangles, west to Stetson Road. Named for exposures near village of Yantic in Norwich quadrangle.

Yarmony Limestone Member (of State Bridge Formation)

Permian (?): West-central Colorado.

D. S. Sheridan, 1950, Compass, v. 27, no. 3, p. 129, 130—131, 133. Essentially gray to brown sandy limestone. Thickness 2 to 10 feet. Thickest sections are in southwest part of area, and the lime generally thins to the northeast. Occurs about 140 feet above base of formation at type section and separates the formation into a "Lower" State Bridge formation and an "Upper" State Bridge formation. Donner (1949, unpub. thesis) included this sandy limestone in his type section of the State Bridge but attached no particular significance to its presence.

Well exposed on both sides of Yarmony Mountain north and northeast of State Bridge, McCoy area.

Yearian Volcanics (in Challis Group)

Oligocene, upper: East-central Idaho.

A. L. Anderson, 1961, Idaho Bur. Mines and Geology Pamph. 124, p. 48—52, pl. 1. Challis volcanic formation redefined and given group status and subdivided into three units of formational rank (ascending) Cheney, Yearian, and Kadletz Volcanics. Yearian Volcanics characterized by preponderance of pyroclastic materials and, in most places, by only minor intercalations of andesitic and basaltic flows. Individually flows are neither so extensive nor as thick as those in Cheney Volcanics and commonly do not exceed 50 feet. Thickness as much as 3,000 feet. In fault contact with older rocks in many places, against Cheney Volcanics in parts of Lemhi Range and against Precambrian in both Lemhi and Beaverhead Ranges. In places in Beaverhead, volcanics are faulted against Lemhi Quartzite.

Name after Yearian Creek, Lemhi quadrangle.

Yellow Aster Complex or unit

Pre-Middle Devonian: Northwestern Washington.

R. W. Tabor, 1962, Dissert. Abs., v. 22, no. 9, p. 3160. Yellow Aster unit, a pre-Devonian crystalline basement comple. Correlative with Le Conte gneiss (new). Name credited to Misch (1960 and personal commun.). In area south of Cascade Pass.

W. G. Libby, 1965, Dissert. Abs. 25, no. 9, p. 5213. In area between Methow Valley and Agnes Creek, Oval Peak Meta Quartz Diorite (unit) may be equivalent to basement Yellow Aster Complex.

Peter Misch, 1966, *in* Tectonic history and mineral deposits of the Western Cordillera in British Columbia and neighboring parts of the United States—a symposium: Canadian Inst. Mining and Metallurgy Spec. vol. no. 8, p. 102, 104–108. The crystalline basement, Yellow Aster Complex, contains the fragmentary record of an involved and presumably long history of igneous and metamorphic events. It is pre-Middle Devonian and predates metamorphic rocks of Cascade metamorphism. Presumed to be earlier Paleozoic and (or) Precambrian. Top is profound unconformity. Superjacent rocks are Cascade River Schist. Basement rocks occur as tectonic slices on the western flank of the range (Northern Cascades), and as anticlinal belts within its metamorphic core. Rocks of these belts include Marblemount Meta Quartz Diorite and Eldorado Orthogneiss.

Present in northern Cascades.

Yellow Chief sandstone

Tertiary, upper: West-central Utah.

Ben Bowyer, 1963, Utah Geol. Soc. Guidebook 17, p. 16. Local name for host rock of uranium at Yellow Chief mine.

Yellow Chief mine is in sec. 36, T. 12 S., R. 12 W., central Juab County.

Yellow Ridge Rhyolite

Tertiary: Northwestern Wyoming.

W. H. Wilson, 1964, Wyoming Univ. Contr. to Geology, v. 3, no. 2, p. 69, 72, 73, 75. Intrudes Wiggins formation. An ovoid body about 1 mile long and one-half mile wide with exposed thickness of about 800 feet. A yellowish-gray very fine grained felsite that has been locally iron-stained along fracture zones.

Crops out between Yellow Creek and Steer Creek, southern Absaroka Mountains.

Yellow River Formation

Miocene: Florida.

H. S. Puri and R. O. Vernon, 1964, Florida Geol. Survey Spec. Pub. 5, p. 116, 200-202, pls. 2a, 2b, 2c. Unit referred to *Yoldia* faunizone contains clays, sands, shell beds, and silt that are similar to sediments in Shoal River Formation. If data developed in core drilling determines that lithologic separation can be made between Shoal River Formation, *Arca* faunizone, and *Yoldia* faunizone, Yellow River formation is suggested as suitable stratigraphic name for *Yoldia* faunizone. Thickness 10½ to 11½ feet at type locality. Underlies Red Bay formation (new); overlies Tamiami Formation. Choctawhatchee Stage.

Type locality: Albert H. Cosson's Farm, Walton County.

Yellowstone Tuff

Pliocene, middle and upper(?): Northwestern Wyoming and southwestern Montana.

F. R. Boyd, 1961, Geol. Soc. America Bull., v. 72, no. 3, p. 391 (table 1), 393—402, pl. 1. Rhyolite plateau of Yellowstone Park is made up of flows and welded tuff with subsidiary rhyolite domes, basalt, and rhyolite-basalt mix-lava. Two most important units are Yellowstone tuff, exposed over 600 square miles, and group of younger flows, Plateau flows (new) which cover over 1,000 square miles in Madison, Central, and Pitchstone Plateaus. Yellowstone tuff is welded to obsidian at base and grades upward through indurated, lithoidal rhyolite to loose ash at top of an uneroded section. Eroded sections as much as 1,000 feet thick. Tuff surrounds outcrop area of Plateau flows on all sides so probably underlies the flows over an additional area of 1,000 square miles. In some areas overlies Purple Mountain pumice breccia (new). On Mount Everts unconformably overlies Cretaceous shales and sandstones.

C. W. Brown, 1961, Geol. Soc. America Bull., v. 72, no. 8, p. 1183-1184. Suggest age is at least middle Pliocene and possible late Pliocene.

I. J. Witkind, 1964, U. S. Geol. Survey Misc. Geol. Inv. Map I-417. Mapped in Tepee Creek quadrangle, Montana-Wyoming, where it is at least 700 feet thick. Maximum thickness of unit unknown.

Yellowstone National Park.

York Glaciation

York Drift

Pleistocene: Alaska.

C. L. Sainsbury, 1966, Dissert. Abs., v. 26, no. 8, p. 4578. Datable Pleistocene events in New York Mountains begin with Yarmouth Interglaciation when the New York terrace, a marine platform, was cut. In Illinoian time, the New York terrace was uplifted almost 400 feet, and during Sangamon Interglaciation a second marine platform (Lost River terrace) was cut and is not deformed. During Wisconsin time the wide-spread York Glaciation was followed by the more restricted Mint River Glaciation (new).

C. L. Sainsbury, 1967, *in* The Bering Land Bridge: Stanford, Calif., Stanford Univ. Press, p. 121—143. Formal proposal of name. Drift of the glaciation is preserved at widely scattered localities. In some places the York drift completely covers bedrock, as at type locality, as well as in areas east of King River, near mouth of Mint River, and in divide between Elkington and Tozer Creeks. More commonly, the York Glaciation is represented by erosional topography and scattered erratics. End moraines are present at type locality and at south shore of Lopp Lagoon, 40 km north of York Mountains. Followed by Mint River Glaciation. Considered to be early Wisconsin in age.

Type locality: Moraine on York terrace east of Lost River, western Seward Peninsula.

Yosemite Creek Granodiorite

[Cretaceous]: Central California.

R. L. Rose, 1957, Am. Mineralogist, v. 42, nos. 9 and 10, p. 636. Named on geologic sketch map showing part of Yosemite National Park. Younger than Mount Hoffmann quartz monzonite.

R. G. Currie, C. S. Gromme, and J. Verhoogen, 1963, Jour. Geophys. Research, v. 68, no. 8, p. 2265 (fig. 1), 2267. Yosemite Creek Granodiorite mentioned in discussion of remanent magnetization of some Upper Cretaceous granitic plutons in the Sierra Nevada.

Present in Yosemite Valley and vicinity.

Young America Gravel

Miocene: Northern Nevada.

Kent Bushnell, 1967, Nevada Bur. Mines Bull. 67, p. 23—24, pl. 1. Poorly sorted sands, and subrounded to rounded pebbles and cobbles of Prospect Mountain (?) quartite, Jarbidge rhyolite, and granite. Gravels were deposited on an erosion surface that was formed after the extrusion and subsequent deformation of Jarbidge Rhyolite. The gravels lie between Miocene Jarbidge Rhyolite and early Pliocene Idavada Volcanics, so although no direct fossil dating is known, the age of the gravels is fairly well defined.

Erosion surface is best exhibited between Tennessee Mountain and Pine Mountain, where a high flat divide developed on granitic rock, metamorphosed limestone, and quartzite, separates the southern and northern drainage of Rowland quadrangle. Derivation of name not stated.

Young Ranch Tuff

Tertiary: Southwestern New Mexico.

R. A. Zeller, Jr., and A. M. Alper, 1965, New Mexico Bur. Mines Mineral Resources Bull. 84, p. 47—48, pl. 1. Basal beds of formation west of Young Ranch consist of sandstone and limestone deposited in a lake. Remainder of formation is columnar-jointed, flat-lying, deposit at least 100 feet thick. It consists of welded tuff, tuff, and tuff breccia and is of quartz latite composition. Unconformably overlies Cedar Hill Andesite (new) west of the ranch and the U-Bar Formation and Timberlake Fanglomerate (new) south of the ranch. Underlies Gillespie Tuff on northern flank of Horse Hill.

Named for occurrence near Young Ranch, Walnut Wells quadrangle, Hidalgo County.

Yucca Mountain Member (of Paintbrush Tuff)

Yucca Mountain Member (of Piapi Canyon Formation)

Miocene, upper: Southern Nevada.

P. W. Lipman and R. L. Christiansen, 1964, U. S. Geol. Survey Prof. Paper 501—B, p. B74—B78. Member of Piapi Canyon Formation. Immediately underlies Tiva Canyon Member. Conformably overlies thick sequence of bedded tuffs correlative with Survey Butte Member. From maximum thickness of 250 feet near type locality, unit thins to east and south. Underlies entire west-central part of Topopah Spring 15-minute quadrangle. Depositional edge present almost continuously around east and west sides of Yucca Mountain.

P. P. Orkild, 1964, U. S. Geol. Survey Bull. 1224—A, p. A44—A51. Reallocated to member status in Paintbrush Tuff (new). Overlies Pah Canyon Member (new).

The U. S. Geological Survey currently designates the age of the Yucca Mountain Member as upper Miocene on the basis of a study now in progress.

Type locality: Northwest end of mesalike part of Yucca Mountain, Topopah quadrangle, in vicinity of southwestern part of Nevada Test Site.

Yunes Formation

Paleocene to Eocene: Puerto Rico.

J. D. Weaver, ed., 1964, Geol. Soc. America Guidebook for Field Trip Nov. 22—24, p. 25, 27. Thin-bedded tuff underlying Bocas Breccia. In fault contact with hydrothermally altered rocks that include the older Alonso Formation (new). Footnote 2 (p. 6) states that stratigraphic names in quotes are informal; they are either tentative or have been adopted but not yet published. [However, use of quotes with these stratigraphic names is not consistent.]

A. E. Nelson and W. H. Monroe, 1966, U. S. Geol. Survey Bull. 1221—C, p. C14—C15, pl. 1. Formal proposal of name. A thick sequence of well-bedded volcanic rocks consisting mostly of fine-grained bedded tuff, volcanic sandstone, and siltstone. Locally contains volcanic breccia, conglomerate, and lenses of fragmental limestone. Maximum thickness 3,000m in Florida quadrangle [this report]. In fault contact with Tetuán and Mameyes (new) Formations to southwest and Pozas Formation to south; near west edge of map in fault contact with Alonso Formation. To north, unconformably overlain by younger middle Tertiary rocks and associated landslide deposits. Type locality designated. Early Tertiary. Continuous with rocks of late Paleocene to middle Eocene exposed in Utando quadrangle.

A. E. Nelson, 1967, U. S. Geol. Survey Misc. Geol. Inv. Map I—480. Mapped in Utuado quadrangle. Maximum thickness 1,200m. Underlies Jobos Formation (new).

Type locality: Section along Route 140 between coordinates 54,020—136,540 and 53,840—136,540, Florida quadrangle. Named from Río Yunes along which a large part of the formation is exposed.

Zama Member (of Zilpha Formation)

Eocene: Central Mississippi.

W. S. Parks and others, 1963, Mississippi Geol. Survey Bull. 99, p. 20 (fig. 6), 31—35, 38 (fig. 14). Consists chiefly of relatively sand- and silt-free clay, glauconite, glauconitic silt, glauconitic sandy clay, glauconitic clayey sand, and concretionary siderite. Includes all strata in Zilpha formation above top of Winona formation and below top of a prominent glauconite bed that defines top of formation. Thickness 30 feet.

Type section: Exposed in cuts of State Highway 19 at top of hill, SE¼NW¼ sec. 22, T. 13 N., R. 9E., Attala County, about 1 mile southeast of intersection of the road west of Zama.

Zayante Sandstone

Eocene-Miocene: Western California.

J. C. Clark, 1966, Dissert. Abs., v. 27, no. 4, sec. B, p. 1184. A sequence that ranges from early Eocene (Penutian) to early Miocene (Saucesian) consists of following units: Butano Sandstone, informally subdivided into three members; San Lorenzo Formation with Twobar Shale and Rices Mudstone members; Zayante Sandstone, a nonmarine unit; Vaqueros Sandstone; and Lambert Shale.

Felton-Santa Cruz area, west of San Andreas fault in Santa Cruz County.

Zebra Quartz

Age not stated: Southern Arizona.

D. W. Lynch, 1966, *in* Geology of the porphyry copper deposits, southwestern North America: Tucson, Ariz., Univ. Arizona Press, p. 274. A mappable lithologic unit. A tabular-shaped unit 70 feet thick. Takes its name from banded arrangement of breccia fragments.

Occurs almost in exact center of Esperanza pit, Pima mining district, Pima County.

Zeeland Drift

Pleistocene (upper Wisconsin): North Dakota.

Lee Clayton, 1962, North Dakota Geol. Survey Bull, 37, p. 62. Defined as morphostratigraphic unit consisting of till of Zeeland end moraine plus till of associated ground moraine and all other associated drift originating from same glacial ice.

Type area: Secs. 11, 12, 13, 14, 23, and 24, T. 130 N., R. 73 W., 6 miles northeast of Zeeland, McIntosh County.

Zia Sand Formation

Miocene, lower to middle: Northwestern New Mexico.

Ted Galusha, 1966, Am. Mus. Novitates, no. 2271, 12 p. Deposits of Zia Sand Formation are extremely soft sandstones composed predominantly of slightly cemented medium- to coarse-grained quartz sand. A few thin beds of fine-grained sandstone or siltstone occur in the section, and two calcareous ledges crop out. Includes Piedra Parada Member (new) in lower part and Chamisa Mesa Member (new) in upper part. Thickness about 1,000 feet along line of type section. About 400 feet above base of formation is obscure unconformity that may prove significant in future studies of stratigraphy in area. This unconformity lies at top of a 100-foot-thick set of gray sand beds characterized by large concretionary masses and ledges. Sand below the unconformity is darker than that of rest of underlying beds in the set. In type locality, Zia Sand is unconformably overlain by about 500 feet of deposits of Sante Fe Formation. At type locality, unconformably overlies laminated greenish clay deposit about 30 feet thick that in turn conformably overlies Galisteo deposits. Renick (1931, U. S. Geol. Survey Water-Supply Paper 620) described beds here named Zia Sand Formation and cited a locality in northern part of T. 14 N., R. 1 E., as point where contact of Santa Fe Formation with beds of Wasatch Formation are exposed. The Santa Fe beds cited by Renick are those designated here as part of type locality of Piedra Parada Member of the Zia. Beds thought by Renick to be Wasatch are here mapped as part of Galisteo Formation.

Type area: West of Jemez fault in secs. 11, 12, 13, 23, and 24, T. 14 N., R. 1 E., New Mexico principal meridian in Sandoval County. Type section: Begins a few yards north of south line of NW¼ sec. 11, T. 14 N., R. 1. E., and then measured through Standing Rock quarry and continued in southerly to southeasterly direction through sec. 14 and northern part of sec. 23. Named from Zia Indian Pueblo.

Zimmerman Andesite (in Cameron Pass Volcanics Group)

Eocene (?): North-central Colorado.

M. K. Corbett, 1966, Mountain Geologist, v. 3, no. 1, p. 3—20. Group divided into three formations: Skeleton Gulch Andesite, Zimmerman Andesite, and Michigan Basalt (all new). Stratigraphic relationships of units not entirely clear.

Present in Zimmerman Lake area, Mount Richthofen-Iron Mountain region about 40 miles south of Wyoming border. Area straddles Continental Divide where Medicine Bow Mountains and Never Summer Range meet to form eastern boundary of North Park.

Zortman Member (of Emerson Formation)

Upper Cambrian and Lower Ordovician: Central Montana.

Christina Lochman-Balk, 1956, Internat. Geol. Cong., 20th, Mexico, Cambrian Symposium, pt. 2, p. 605, 606—607. In Big Snowy and Little Rocky Mountains and subsurface of east central and northeastern Montana, Park shale is overlain by single indivisible unit of intercalated shales and edgewise pebble conglomerates which accumulated during entire Upper Cambrian and earliest Ordovician (Tremadocian). Unit has been called Pilgrim by Deiss (1936, Geol. Soc. America Bull., v. 47, no. 8) and by Lochman (1950, Jour. Paleontology, v. 24, p. 322—349) but it is neither lithic nor age equivalent of Pilgrim formation of accepted usage in southern and central Montana. Herein proposed to name unit Zortman member of Emerson formation. Consists of interbedded gray-green micaceous shales, large oblong coquina nodules, thin gray limestones, and coarse edgewise pebble conglomerates with small amounts of shale or crystalline limestone matrix. Thickness 300 to 650 feet.

Type locality: Section on Lodgepole Creek at mouth of Emerson Gulch. Name derived from old mining town of Zortman on southeast side of Little Rocky Mountains.

Zullinger Formation (in Conococheague Group)

Upper Cambrian: South-central Pennsylvania.

D. B. MacLachlan and S. I. Root, 1966, Pennsylvania Geologists Guidebook, 31st Ann. Field Conf., p.8 (table 1), 11 (table 3), 57. Consists of cyclically-bedded stromatolitic-mechanical limestone, interbanded limestone and dolomite, interlaminated limestone and dolomite, and thin dolomite. Several thin local quartz sand beds. Thickness 2,500 feet. Underlies Shadygrove Member (new). Overlies Elbrook Formation.

Cumberland Valley, southeastern Franklin County.

Zuloaga Stage

Zuloaga Limestone or Group

Upper Jurassic (Sabinas Series): Gulf Coastal Province.

R. W. Imlay, 1938, Geol. Soc. America Bull., v. 49, no. 11, p. 1657—1659. A thick—bedded limestone about 1,800 feet thick. Underlies La Caja formation.

W. E. Humphrey, 1956, Notes on the geology of northeast Mexico: Corpus Christi Geol. Soc., 41 p. Zuloaga group is basal division of Sabinas series. La Casita group is upper division of series.

G. E. Murray, 1961, Geology of the Atlantic and Gulf Coastal Province of North America: New York, Harper and Brothers, p. 288—292. Term Zuloaga is used in this report as a provincial stage of Sabinas series to include rocks in coastal province which can be demonstrated, by whatever means available, to be time equivalent of type Alvido, Zuloaga-La Gloria, and possibly Minas Viejas-La Joya sequences. If the latter are proved to be appreciably older the lower limit of the stage should then be emended to exclude to the La Joya or the Minas Viejas. Beds included in the Zuloaga stage have generally in the past been considered equivalent to the Oxfordian and lower Kimmeridgian of Europe. Followed by La Casita stage.

Type locality (limestone): Sierra Sombreretillo north of Melchor Ocampo, north-central Mexico on the boundary of Coahuila and Zacatecas.

Zuni sequence

Middle Jurassic to Paleocene, middle: North America.

L. L. Sloss, 1963, Geol. Soc. America Bull., v. 74, no. 2, p. 93—114. Sedimentary record of North American craton from late Precambrian to present is characterized by six major unconformities. These interregional unconformities subdivide cratonic stratigraphic column into six sequences—major rock-stratigraphic units (of higher than group, megagroup, or supergroup rank) which can be identified, where preserved, in all cratonic interior areas. Sequences are Sauk, Tippecanoe, Kaskaskia, Absaroka, Zuni (new), and Tejas (new). Zuni Sequence defined to include North American cratonic strata that lie between interregional unconformities marking top of Absaroka Sequence and base of Tejas Sequence.

Name derived from Zuni uplift on Arizona-New Mexico border, where exposures, supplemented by wells in adjacent San Juan basin, make representative section available.

Zuni Canyon Basalt Flow

Holocene: West-central New Mexico.

E. D. Gordon, 1961, New Mexico State Eng. Tech. Rept. 20, p. 38, 40, pl. 1. A black basalt flow similar to McCartys basalt flow. Thickness probably not more than 40 feet. May be older than McCartys flow. Overlies Laguna basalt flow.

Flow originated at two volcanic vents in Zuni Mountains 4 miles southwest and 4 miles northwest of head of Zuni Canyon. Flowed down Zuni Canyon into Rio San Jose valley where it underlies area of 5 or 6 square miles, extending from south end of Grants Municipal Airport southwestward to 3 south miles of Grants.

Zweig Sandstone Lens (in Santa Anna Branch Shale)

Permian: West-central Texas.

H. E. Rothrock, 1961, Abilene Geol. Soc. Guidebook Sept. 15—16. Name applied to prominent sandstone lens in Santa Anna Branch shale. Sandstone weathers red and is extensively crossbedded. Occurs below Coleman Junction limestone and generally above a persistent limestone which occurs with remarkable persistency 80 feet below the Coleman Junction.

Well exposed on graded road 4 miles west of Burkett in northeast Coleman County. Named for exposures on Wharton Survey 174 owned Mrs. Sophia Zweig.

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