

Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1970

By GEORGE V. COHEE, ROBERT G. BATES, *and* WILNA B. WRIGHT

CONTRIBUTIONS TO STRATIGRAPHY

GEOLOGICAL SURVEY BULLETIN 1354-A



CONTENTS

	Page
Listing of nomenclatural changes -----	A1
The Mifflintown Formation of Middle Silurian age, Bedford County, Pennsylvania, by Wallace de Witt, Jr -----	28
New age assignments in the stratigraphy of the Glass Mountains, western Texas, by G. A. Cooper and R. E. Grant -----	30
References -----	31

CONTRIBUTIONS TO STRATIGRAPHY

**CHANGES IN STRATIGRAPHIC NOMENCLATURE BY THE
U.S. GEOLOGICAL SURVEY, 1970**

By **GEORGE V. COHEE, ROBERT G. BATES, and WILNA B. WRIGHT**

LISTING OF NOMENCLATURAL CHANGES

In the following table, stratigraphic names adopted, revised, reinstated, or abandoned are listed alphabetically. The age of the unit, the revision, and the area involved, along with the author's name and date of publication of the report, are given. The publications in which the changes in nomenclature were made are listed in the references at the end of this publication. The capitalization of age terms in the age column follows official usage.

Name	Age	Location
Akalura Glaciation or Drift.	Pleistocene -----	Alaska -----
Albee Formation -----	Middle Ordovician ----	Vermont and New Hampshire.
Albion Range Group ---	Precambrian(?) -----	Utah -----
Allen Ridge Formation (of Mesaverde Group).	Late Cretaceous -----	South-central Wyoming.
Almond Formation (of Mesaverde Group).	Late Cretaceous -----	Southwestern Wyoming.
American Flag Formation.	Late Cretaceous -----	Arizona -----
Andrew Lake Formation Angelo Member (of Green River Formation).	middle or late Eocene-- Eocene -----	Southwestern Alaska - Southwestern Wyoming.
Animikie Series -----	middle Precambrian --	Northern Michigan and northern Wisconsin.
Ashlock Formation ----	Late Ordovician -----	Central Kentucky ----
Bakers Bridge Granite -	Precambrian -----	Southwestern Colorado
Baraga Group -----	middle Precambrian --	Northern Michigan and northern Wisconsin.
Barstow Formation ----	late Miocene -----	Southern California --
Bashi Marl Member (of Hatchetigbee Formation of Wilcox Group).	Eocene -----	Mississippi -----
Baxter Springs Member (of Boone Formation).	Late Mississippian ---	Oklahoma and Kansas--
Beidell Quartz Latite --	Oligocene -----	Southwestern Colorado
Belden Formation -----	Early (Morrow) and Middle (Atoka) Pennsylvanian.	Colorado -----
Belt Supergroup -----	Precambrian -----	Idaho -----
Ben Hur Limestone ----	Middle Ordovician ----	Eastern Tennessee ----
Bethlehem Gneiss -----	Early(?) Devonian ---	New Hampshire -----
Bickford Granite -----	Middle(?) and Late(?) Devonian.	New Hampshire -----
Big Basin Sandstone ---	Permian -----	Southwestern Kansas -
Bingham Mine Formation.	Late Pennsylvanian (Missouri and Virgil).	North-central Utah ---
Bingham Quartzite ----	Pennsylvanian -----	North-central Utah ---
Boehls Butte Formation (of Belt Supergroup).	Precambrian -----	Idaho -----
Bonanza Latite -----	Oligocene -----	Southwestern Colorado
Boone Formation -----	Early and Late Mississippian.	Oklahoma and Kansas--

Revision and reference

- Akalura Glaciation or Drift adopted. (Karlstrom, 1969.)
- Age changed from Ordovician to Middle Ordovician. (Cady, 1969.)
- Albion Range Group extended into Curlew Valley, northwestern Utah. (Bolke and Price, 1969.)
- Allen Ridge Formation of Bergstrom (1959) adopted in Hanna and Carbon basins. Overlies Haystack Mountains Formation (new); unconformably underlies Pine Ridge Sandstone. (Gill and others, 1970.)
- Almond Formation extended into south-central Wyoming. (Gill and others, 1970.)
- Age changed from Cretaceous(?) to Late Cretaceous. (Hayes, 1970a.)
- Andrew Lake Formation adopted. (Scholl and others, 1970.)
- Angelo Member adopted. (Oriel and Tracey, 1970.)
- Animikie Series abandoned in northern Michigan and northern Wisconsin; replaced by Marquette Range Supergroup. Animikie Group remains in good usage in northern Minnesota. (Cannon and Gair, 1970.)
- Tate member of Ashlock Formation in central Kentucky extended into northeastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
- Bakers Bridge Granite adopted. (Barker, 1969.)
- Baraga Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
- Age changed from middle and late Miocene to late Miocene. (Lewis, 1968.)
- Bashi Marl Member of Hatchetigbee Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
- Baxter Springs Member adopted. (McKnight and Fischer, 1970.)
- Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)
- Age changed from Pennsylvanian to Early (Morrow) and Middle (Atoka) Pennsylvanian. (Mutschler, 1970.)
- Includes Boehls Butte Formation in report area. (Hietanen, 1968.)
- Ben Hur Limestone changed to Ben Hur Formation in this quadrangle. (Harris and Nixon, 1970.)
- Age changed from Late Devonian(?) to Early(?) Devonian. (Cady, 1969.)
- Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
- Big Basin Sandstone of Cragin (1896) adopted. (Meyer and others, 1970.)
- Bingham Mine Formation of Welsh and James (1961) adopted as uppermost of three formations in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Includes (in ascending order): Clipper Ridge and Markham Peak Members (both new). Overlies Butterfield Peak Formation (new). (Tooker and Roberts, 1970.)
- Bingham Quartzite abandoned. Rocks at its type locality reassigned to part of Oquirrh Group. (Tooker and Roberts, 1970.)
- Boehls Butte Formation adopted. Includes units formerly considered lowest exposed part of Prichard Formation in Boehls Butte area. (Hietanen, 1968.)
- Age changed from Tertiary to Oligocene. (Lipman and others, 1970.)
- Boone Formation in Picher field area divided into the following members (in ascending order): St. Joe Limestone, Reeds Spring, Grand Falls, Joplin (new), Short Creek, Baxter Springs (new), and Moccasin Bend. (McKnight and Fischer, 1970.)

Name	Age	Location
Borden Formation -----	Early and Late Mississippian.	Kentucky -----
Breeze Phyllite -----	Early Cambrian -----	Vermont -----
Bright Angel Shale ----	Early and Middle Cambrian.	Southeastern California and southern Nevada.
Brimfield Schist -----	Middle(?) Ordovician or older.	Connecticut -----
Browns Canyon Formation.	Miocene -----	Colorado -----
Browns Park Formation	Miocene and Pliocene (?).	Utah, Colorado, and Wyoming.
Buckhorn Conglomerate Member (of Cedar Mountain Formation).	Early Cretaceous ----	Utah and Colorado ---
Buffalo Wallow Formation.	Late Mississippian ---	Kentucky -----
Bug Formation -----	Pliocene or Pleistocene	Wyoming -----
Bulldog Hollow Member (of Fowkes Formation).	Eocene -----	Southwestern Wyoming.
Bull Fork Formation ---	Late Ordovician -----	Northeastern Kentucky
Bullpen Member (of Wasatch Formation).	Eocene -----	Southwestern Wyoming.
Butterfield Limestone Member (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Butterfield Peaks Formation.	Middle Pennsylvanian-	North-central Utah ---
Caballo Blanco Rhyolite Tuff Member (of Datil Formation).	Oligocene -----	Southwestern New Mexico.
Catoctin Formation ----	Precambrian -----	West Virginia, Virginia, Pennsylvania, and Maryland.
Cedar Mountain Formation.	Early Cretaceous ----	Utah and Colorado ---
Chiapuk Rhyolite -----	Late Cretaceous -----	Arizona -----
Choclay Group -----	middle Precambrian---	Northern Minnesota and northern Wisconsin.
Cinnamon Ridge Member (of Flat Ridge Formation).	Precambrian -----	North Carolina, Virginia, and Tennessee.
Circle Volcanics -----	upper Paleozoic -----	East-central Alaska --
Clarno Formation ----	Eocene and early Oligocene.	Oregon -----
Clipper Ridge Member (of Bingham Mine Formation).	Late Pennsylvanian --	North-central Utah ---

Revision and reference

Farmers Siltstone Member of New Providence Formation of Stockdale (1939) redefined and adopted as Farmers Member of Borden Formation. Includes Henley Bed at base. (Peck, 1969.)

Name changed from Brezee Phyllite to Brezee Formation. (Cady, 1969.)

Age changed from Middle Cambrian to Early and Middle Cambrian in southern Nevada and southeastern California; age remains Middle Cambrian in Arizona. (Stewart, 1970.)

Daly Swamp Member (new) of Brimfield Schist adopted. (Snyder, 1970.)

Browns Canyon Formation adopted. (Van Alstine, 1969.)

Age changed from Miocene(?) to Miocene and Pliocene(?). (Izett and others, 1970.)

Buckhorn Conglomerate of Stokes (1944) adopted as Buckhorn Conglomerate Member of Cedar Mountain Formation. (Cullins, 1969.)

In north-central Kentucky, Buffalo Wallow Formation includes following members (in ascending order): Vienna Limestone, Waltersburg, Menard Limestone, unnamed unit (includes equivalents of Degonia Sandstone, Clore Limestone, and Palestine Sandstone), and Kinkaid Limestone. (Goudarzi, 1970.)

Bug Formation adopted. (Love, 1970.)

Bulldog Hollow adopted as middle member. Overlies Sillem Member (new); underlies Gooseberry Member (new). (Oriol and Tracey, 1970.)

Sunset Member of Arnheim Formation of Foerste (1912) adopted as Sunset Member of Bull Fork Formation. (Outerbridge, 1970.)

Bullpen Member adopted. (Oriol and Tracey, 1970.)

Butterfield Limestone Member abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)

Butterfield Peaks Formation adopted as middle formation of three in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Overlies West Canyon Limestone; underlies Bingham Mine Formation. (Tooker and Roberts, 1970.)

Caballo Blanco Rhyolite Tuff of Elston (1957) adopted as member of Datil Formation. (Ericksen and others, 1970.)

Age changed from late Precambrian(?) to Precambrian. (Espenshade, 1970.)

Cedar Mountain Formation divided into Buckhorn Conglomerate Member and overlying unnamed shale member. (Cullins, 1969.)

Age changed from late(?) Mesozoic to Late Cretaceous. (Hayes, 1970a.)

Chocolay Group removed from Animikie Series (abandoned); placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)

Cinnamon Ridge Member abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)

Age changed from Early Mississippian to late Paleozoic. (Brabb and Churkin, 1969.)

Age changed from Eocene to Eocene and early Oligocene. (Swanson, 1969.)

Clipper Ridge Member adopted as basal member. Recognized in Bingham sequence (central and southern Oquirrh Mountains). Underlies Markham Peak Member (new). (Tooker and Roberts, 1970.)

Name	Age	Location
Cloudburst Formation --	Late Cretaceous -----	Arizona -----
Cocoraque Formation --	Early Cretaceous ----	Arizona -----
Cody Shale -----	Late Cretaceous -----	Central Wyoming ----
Commercial Limestone Member (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Concepción Formation -	Eocene -----	Northwestern Puerto Rico.
Concord Granite -----	Middle(?) and Late(?) Devonian.	New Hampshire -----
Conejos Formation -----	Oligocene and older(?)	Southwestern Colorado
Copper Basin Formation	Early Mississippian to Late Pennsylvanian.	South-central Idaho --
Corkscrew Quartzite ---	Early Cambrian -----	Nevada and California
Cornett Basalt Member (of Flat Ridge Forma- tion).	Precambrian -----	North Carolina, Virginia, and Tennessee.
Coronados Volcanics ---	Middle Devonian -----	Southeastern Alaska --
Crooks Gap Conglomer- ate.	Eocene -----	Wyoming -----
Dad Sandstone Member (of Lewis Shale).	Late Cretaceous ----	Wyoming -----
Daly Swamp Member (of Brimfield Schist).	Middle(?) Ordovician or older.	Connecticut -----
Datil Formation -----	Oligocene -----	New Mexico -----
Daylight Formation ---	Precambrian and Early Cambrian.	Nevada and California
Decie Ranch Member (of Skinner Ranch Forma- tion).	Early Permian (Wolf- camp).	Western Texas -----
Descon Formation -----	Early Ordovician and Early Silurian.	Southeastern Alaska --
Deseret Limestone -----	Late Mississippian ---	Utah -----
Dry Union Formation --	Miocene and Pliocene -	Colorado -----
Dugout Mountain Mem- ber (of Skinner Ranch Formation).	Early Permian (Wolf- camp).	Western Texas -----
Dutton Creek Formation	Paleocene -----	Wyoming -----
Echooka Member (of Sadlerochit Forma- tion).	Late Permian -----	Northern Alaska ----
Echooka River Glacia- tion).	Pleistocene -----	Northern Alaska ----
El Capitan Granite ----	Late Jurassic -----	Eastern California ---
Electra Lake Gabbro ---	Precambrian -----	Southwestern Colorado
Elk River Beds -----	Pliocene or Pleistocene	Southwestern Oregon -

Revision and reference

- Age changed from Late(?) Cretaceous or early Tertiary to Late Cretaceous. (Hayes, 1970a.)
- Age changed from Mesozoic to Early Cretaceous. (Hayes, 1970a.)
- Wallace Creek Tongue adopted as upper member of Cody Shale. Separated from main body of Cody by Fales Sandstone Member of Mesaverde Formation. (Gill and others, 1970.)
- Commercial Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)
- Concepción Formation adopted. Underlies Mal Paso Formation (new). (McIntyre and others, 1970.)
- Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
- Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
- Age changed from Early Mississippian to Early Permian to Early Mississippian to Late Pennsylvanian. (Nelson and Ross, 1969.)
- Corkscrew Quartzite abandoned. Its rocks reassigned to Zabriskie Quartzite. (Stewart, 1970.)
- Cornett Basalt Member abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)
- Coronados Volcanics adopted. (Eberlein and Churkin, 1970.)
- Crooks Gap Conglomerate adopted. (Love, 1970.)
- Dad Sandstone Member of Hale (1961) adopted. (Gill and others, 1970.)
- Daly Swamp Member adopted. (Snyder, 1970.)
- Caballo Blanco Rhyolite Tuff and Kneeling Nun Tuff made members of Datil Formation in Black Range area. Age changed from Tertiary to Oligocene. (Ericksen and others, 1970.)
- Daylight Formation abandoned. Its rocks reassigned to Wood Canyon Formation. (Stewart, 1970.)
- Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
- Descon Formation adopted. Underlies Heceta Limestone (new). (Eberlein and Churkin, 1970.)
- Deseret Limestone extended into northeastern Utah. (Hansen, 1969.)
- Age changed from Pliocene to Miocene and Pliocene. (Van Alstine, 1969.)
- Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
- Dutton Creek Formation is coarse-grained conglomerate facies of Hanna Formation; Dutton Creek Formation therefore abandoned. (Gill and others, 1970.)
- Age changed from Permian to Late Permian. (Detterman, 1970b.)
- Echooka River Glaciation abandoned; considered equivalent to Itkillik Glaciation which name will now be used. (Detterman, 1970a.)
- Age changed from Cretaceous to Late Jurassic. (Evernden and Kistler, 1970.)
- Electra Lake Gabbro adopted. (Barker, 1969.)
- Type Elk River Beds restricted to those beds in the type section below a wave-cut platform. Age changed from late Pleistocene to Pliocene or Pleistocene. (Clifton and Boggs, 1970.)

Name	Age	Location
Erda Formation -----	Middle Pennsylvanian (Atoka and Des Moines).	North-central Utah ---
Escabrosa Limestone ---	Early and Late Mississippian.	Arizona and New Mexico,
Evanston Formation ---	Late Cretaceous and Paleocene.	Southwestern Wyoming
Fales Sandstone Member (of Mesaverde Formation).	Late Cretaceous -----	Central Wyoming ----
Farmers Member (of Borden Formation).	Mississippian -----	Eastern Kentucky ----
Fearn Springs Member (of Nanafalia Formation of Wilcox Group).	Eocene -----	Mississippi -----
Finger Bay Volcanics --	early Tertiary -----	Southwestern Alaska -
Fish Creek Mountains Tuff.	early Miocene -----	Central Nevada -----
Flat Ridge Formation (of Mount Rogers Volcanic Group).	Precambrian -----	North Carolina, Virginia, and Tennessee.
Foote Creek Formation -	Late Cretaceous and Paleocene.	Wyoming -----
Fossil Butte Member (of Green River Formation).	Eocene -----	Southwestern Wyoming
Fowkes Formation ----	Eocene to Pliocene(?) -	Southwestern Wyoming
Frederika Formation --	Miocene -----	Alaska -----
Freeman Silt -----	early Miocene (early Saucasian).	California -----
French Pond Granite --	Middle(?) and Late(?) Devonian.	New Hampshire -----
Gaptank Formation ----	Middle and Late Pennsylvanian and Early Permian (Wolfcamp).	Western Texas -----
Gem Park Complex ----	Cambrian -----	Colorado -----
Gile Mountain Formation.	Early Devonian -----	Vermont and New Hampshire.
Glastonbury Gneiss ----	Devonian or Mississippian.	Connecticut -----
Glorieta Sandstone -----	Early Permian (late Leonard).	New Mexico -----
Golden Horn Limestone Lentil (of Hasen Creek Formation) (of Skolai Group).	Early Permian -----	Alaska -----
Gooseberry Member (of Fowkes Formation).	Pliocene -----	Southwestern Wyoming
Grainger Formation ---	Early Mississippian --	Southeastern Kentucky

Revision and reference

- Erda Formation adopted as middle formation of three in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Lake Point Limestone (new); underlies Kessler Canyon Formation (new). (Tooker and Roberts, 1970.)
- Escabrosa Limestone raised to group rank in southeastern Arizona and southwestern New Mexico; includes (in ascending order): Keating and Hachita Formations. Remains of formation rank elsewhere. (Armstrong, 1970.)
- Evanston Formation divided into lower member and Hams Fork Conglomerate Member (new) (Upper Cretaceous) and upper unit (Upper Cretaceous and Paleocene). (Oriol and Tracey, 1970.)
- Fales Sandstone Member of Barwin (1961) adopted as basal member of Mesaverde Formation in southeastern Wind River basin. (Gill and others, 1970.)
- Henley Bed adopted as basal unit of Farmers Member of Borden Formation. (Peck, 1969.)
- Fearn Springs Member of Nanafalia Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
- Age changed from Tertiary(?) to early Tertiary. (Scholl and others, 1970.)
- Fish Creek Mountains Tuff adopted. (McKee, 1970.)
- Flat Ridge Formation abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)
- Foote Creek Formation abandoned. Its rocks are lower or coal-bearing parts of Medicine Bow and Hanna Formations. (Gill and others, 1970.)
- Fossil Butte Member adopted. (Oriol and Tracey, 1970.)
- Fowkes Formation divided into three members (in ascending order): Sillem and Bulldog Hollow (both Eocene) and Gooseberry (Eocene(?) to Pliocene(?)) (all three new). Age changed from late Eocene to Eocene to Pliocene(?). (Oriol and Tracey, 1970.)
- Frederika Formation adopted. (MacKevett, 1970.)
- Freeman Silt of Kleinpell (1938) adopted. Overlies Jewett Sand; underlies Olcese Sand. (Addicott, 1970.)
- Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
- Upper part of Gaptank Formation placed in Wolfcamp Series. (Cooper and Grant, this report, p. A30.)
- Gem Park Complex adopted. (Parker and Sharp, 1970.)
- Age changed from Devonian to Early Devonian. (Cady, 1969.)
- Glastonbury Gneiss of Gregory (1906) adopted. (Snyder, 1970.)
- Age changed from Permian to Early Permian (late Leonard) in Fort Wingate area. (Ash, 1969.)
- Golden Horn Limestone Lentil adopted. (Smith and MacKevett, 1970.)
- Gooseberry adopted (provisionally assigned) as upper member. Overlies Bulldog Hollow Member (new). (Oriol and Tracey, 1970.)
- Outcrop of Grainger Formation extended into southeastern Kentucky; previously known in southeastern Kentucky in subsurface only. (Csejtey, 1970).

Name	Age	Location
Grand Falls Chert Member (of Boone Formation).	Early Mississippian --	Oklahoma and Kansas
Granite Creek Granodiorite.	Cretaceous -----	Idaho -----
Grant Lake Limestone --	Late Ordovician -----	Northeastern Kentucky
Green Ravine Formation	Late Mississippian ---	North-central Utah ---
Green River Formation	Eocene -----	Southwestern Wyoming
Guacio Member (of Río Culebrinas Formation).	middle Eocene -----	Northwestern Puerto Rico.
Hachita Formation (of Escabrosa Group).	Early and Late Mississippian.	Southwestern New Mexico and southeastern Arizona.
Half Dome Quartz Monzonite.	Late Cretaceous -----	Eastern California ---
Halfway Draw Tuff Member (of Wind River Formation).	early Eocene -----	Wyoming -----
Hams Fork Conglomerate Member (of Evanson Formation).	Late Cretaceous -----	Southwestern Wyoming
Hanna Formation -----	Paleocene -----	Wyoming -----
Hartford Hill Rhyolite Tuff.	early Miocene -----	Western Nevada ----
Hartselle Sandstone ----	Late Mississippian ---	Southeastern Kentucky
Hasen Creek Formation (of Skolai Group).	Early Permian -----	Alaska -----
Hatchetigbee Formation	Eocene -----	Mississippi -----
Hatfield Sandstone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous -----	Wyoming -----
Hawi Volcanic Series --	late Pleistocene -----	Hawaii -----
Hayden Creek Drift (of Salmon Springs Glaciation).	Pleistocene -----	Washington -----
Haystack Mountains Formation (of Mesaverde Group).	Late Cretaceous -----	South-central Wyoming
Hebron Formation ----	Ordovician or older ---	Connecticut -----
Heceta Limestone -----	Middle and Late Silurian.	Southeastern Alaska --

Revision and reference

- Age changed from Mississippian to Early Mississippian. (McKnight and Fischer, 1970.)
- Age changed from Jurassic or Cretaceous to Cretaceous. (King and others, 1970.)
- Tate Member of Ashlock Formation in central Kentucky extended into north-eastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
- Green Ravine Formation adopted. Recognized in Rogers Canyon sequence (northern Oquirrh Mountains). Underlies Oquirrh Group. (Tooker and Roberts, 1970.)
- Green River Formation in Fossil Basin divided into two members (in ascending order): Fossil Butte and Angelo Members (both new). (Oriol and Tracey, 1970.)
- Guacio Member adopted. Underlies Maricao Basalt. (McIntyre and others, 1970.)
- Hachita Formation of Armstrong (1962) adopted as upper formation of Escabrosa Group. (Armstrong, 1970.)
- Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
- Halfway Draw Tuff Member adopted. (Love, 1970.)
- Hams Fork Conglomerate Member adopted. (Oriol and Tracey, 1970.)
- Age changed from Eocene to Paleocene; restricted to Hanna and Carbon basins. (Gill and others, 1970.)
- Age changed from Oligocene(?) to early Miocene. (Moore, 1969.)
- Hartselle Sandstone changed to Hartselle Formation in southeastern Kentucky. (Lewis and Luft, 1970.)
- Hasen Creek adopted as upper of two formations in Skolai Group (new). Overlies Station Creek Formation (new). Includes Golden Horn Limestone Lentil (new). (Smith and MacKevett, 1970.)
- Hatchetigbee Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. Includes Bashi Marl Member. (Cushing and others, 1970.)
- Hatfield Sandstone Member of Hale (1961) adopted as uppermost named member of Haystack Mountains Formation in Hanna and Carbon basins. (Gill and others, 1970.)
- Age changed from Pliocene and early and middle Pleistocene to late Pleistocene. (McDougall, 1969.)
- Hayden Creek Drift adopted. (Crandell, 1969.)
- Haystack Mountains Formation adopted as basal formation of Mesaverde Group in Hanna and Carbon basins. Includes (in ascending order): Tapers Ranch Sandstone Member, lower unnamed member, O'Brien Spring Sandstone Member, middle unnamed member, Hatfield Sandstone Member, and upper unnamed member. (Gill and others, 1970.)
- Age changed from Early Devonian or older to Ordovician or older. (Snyder, 1970.)
- Heceta Limestone adopted. Overlies Descon Formation (new); underlies Karheen Formation (new). (Eberlein and Churkin, 1970.)

Name	Age	Location
Heceta Limestone -----	Early through Late Silurian.	Southeastern Alaska --
Hempfield Shale -----	Mississippian -----	Pennsylvania and Ohio
Henley Bed (of Farmers Member).	Mississippian -----	Eastern Kentucky ----
Hidalgo Volcanics -----	Late Cretaceous -----	New Mexico -----
Highland Boy Limestone Member (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Highlandcroft Plutonic Series.	Middle or Late Ordovician.	New Hampshire -----
Hines Tongue (of Reed Dolomite).	Precambrian -----	Southern Nevada ----
Hinsdale Formation ----	Miocene and Pliocene -	New Mexico and Colorado.
Hite Bed of Church Rock Member (of Chinle Formation).	Late Triassic -----	Northeastern Arizona -
Hoosac Formation -----	Early Cambrian or older.	Massachusetts, Connecticut, and Vermont.
Horquilla Limestone ---	Early, Middle, and Late Pennsylvanian.	Southwestern New Mexico and south-eastern Arizona.
Horseshoe Mesa Member (of Redwall Limestone).	Late Mississippian (Meramec and Chester).	Arizona -----
House Limestone (of Pogonip Group).	Late Cambrian and Early Ordovician.	Western Utah and eastern Nevada.
Huachuca Quartz Monzonite.	Jurassic -----	Arizona -----
Humbug Formation ----	Late Mississippian ---	Utah -----
Hurrah Slate -----	Precambrian -----	Northwestern Alaska -
Ice Point Conglomerate.	Eocene -----	Wyoming -----
Irving Greenstone -----	Precambrian -----	Southwestern Colorado
Jewett Sand -----	lower Miocene -----	California -----
John Day Formation ---	middle Oligocene to early Miocene.	Oregon -----
Jones Ridge Limestone -	Early Cambrian to Middle or Late Ordovician.	East-central Alaska --
Joplin Member (of Boone Formation).	Early Mississippian --	Oklahoma and Kansas
Jordan Limestone Member (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---

Revision and reference

- Age changed from Middle and Late Silurian to Early through Late Silurian. (Ovenshine and Webster, 1970.)
- Hempfield Shale abandoned; now upper unnamed member of Shenango Formation. (Kimmel and Schiner, 1970.)
- Henley Shale Member of New Providence Formation as used by Stockdale (1939) adopted as Henley Bed, basal unit of Farmers Member of Borden Formation. (Peck, 1969.)
- Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
- Highland Boy Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)
- Age changed from Late Ordovician to Middle or Late Ordovician. (Cady, 1969.)
- Hines Tongue extended into southern Nevada. (Stewart, 1970.)
- Age changed from late Tertiary to Miocene and Pliocene. (Lipman and others, 1970.)
- Hite Bed extended into northeastern Arizona. (O'Sullivan, 1970.)
- Age changed from Early(?) Cambrian to Early Cambrian or older. (Hatch, 1969.)
- Horquilla Limestone extended into southwestern New Mexico. Age in report area is Early Pennsylvanian. (Armstrong, 1970.)
- Age changed from Mississippian to Late Mississippian (Meramec and Chester). (McKee and Gutschick, 1969.)
- House Limestone of Hintze (1951) adopted as lowermost formation of Pogonip Group and extended from its type area, western Utah, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
- Age changed from Jurassic(?) to Jurassic. (Hayes, 1970b.)
- Humbug Formation extended into northeastern Utah. (Hansen, 1969.)
- Age changed from post-Ordovician(?) to Precambrian. (Sainsbury and others, 1970.)
- Ice Point Conglomerate adopted. (Love, 1970.)
- Irving Greenstone changed to Irving Formation. Also includes Archean schist and gneiss of Cross, Howe, Irving, and Emmons (1905), in southwestern and northern Needle Mountains. (Barker, 1969.)
- Jewett zone designated by Godde (1928) adopted as Jewett Sand. Includes Pyramid Hill Sand Member at its base. Overlies Vedder Sand (when present) or Walker Formation; underlies Freeman Silt. (Addicott, 1970.)
- Age changed from late Oligocene and early Miocene to middle Oligocene to early Miocene. (Swanson, 1969.)
- Age changed from Cambrian to Middle or Late Ordovician to Early Cambrian to Middle or Late Ordovician. (Brabb and Churkin, 1969.)
- Joplin Member adopted. (McKnight and Fischer, 1970.)
- Jordan Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)

Name	Age	Location
Kanosh Shale (of Pogonip Group).	Middle Ordovician ----	Eastern Nevada and western Utah.
Karheen Formation ----	Late Silurian and Early Devonian.	Southeastern Alaska --
Karluk Glaciation or Drift.	Pleistocene -----	Alaska -----
Katakturuk Dolomite --	Middle Devonian or older.	Northeastern Alaska --
Keating Formation (of Escabrosa Group).	Early Mississippian --	Southeastern Arizona and southwestern New Mexico.
Keechelus Andesitic Series.	Eocene to Miocene ----	Washington -----
Kekiktuk Conglomerate (of Endicott Group).	Mississippian -----	Northeastern Alaska --
Kessler Canyon Formation (of Oquirrh Group).	Late Pennsylvanian (Virgil) and Early Permian (?) (Wolfcamp?).	North-central Utah ---
Kigluaik Group -----	Precambrian -----	Northwestern Alaska --
Kinsman Quartz Monzonite.	Early (?) Devonian ----	New Hampshire -----
Klawak Formation ----	Early and Middle Pennsylvanian.	Southeastern Alaska --
Kneeling Nun Tuff ----	Oligocene -----	New Mexico -----
Kneeling Nun Tuff ----	Oligocene -----	Southwestern New Mexico.
Ladrones Limestone ---	Early and Middle Pennsylvanian.	Southeastern Alaska --
La Jara Canyon Member (of Treasure Mountain Tuff).	Oligocene -----	Colorado -----
Lake Fork Formation --	Oligocene and older(?)	Southwestern Colorado
Lake Point Limestone (of Oquirrh Group).	Late Mississippian and Early Pennsylvanian.	North-central Utah ---
Lamarck Granodiorite -	Late Cretaceous -----	Eastern California ---
Lead Camp Limestone --	Middle Pennsylvanian (Des Moines).	New Mexico -----
Lehman Formation (of Pogonip Group).	Middle Ordovician ----	Western Utah and eastern Nevada.
Lenox Limestone Member (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Lewis Shale -----	Late Cretaceous -----	Central Wyoming ----
Lisburne Group -----	Early and Late Mississippian.	Northern Alaska ----

Revision and reference

- Kanosh Shale of Hintze (1951) adopted and included in Pogonip Group. Underlies Lehman Formation. Extended from its type area, western Nevada, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
- Karheen Formation adopted. Overlies Heceta Limestone (new): (Eberlein and Churkin, 1970.)
- Karluk Glaciation or Drift adopted. (Karlstrom, 1969.)
- Katakaturuk Dolomite adopted. Underlies Nanook Limestone (new). (Dutro, 1970.)
- Keating Formation of Armstrong (1962) adopted as lower formation of Escabrosa Group. (Armstrong, 1970.)
- Keechelus Andesitic Series abandoned. Its rocks designated by informally-named stratigraphic unit. (Vine, 1969.)
- Age changed from Late(?) Devonian or Mississippian to Mississippian. (Reiser, 1970.)
- Kessler Canyon Formation adopted as uppermost of three formations in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Erda Formation (new); underlies Park City Formation. (Tooker and Roberts, 1970.)
- Age changed from Devonian(?) to Precambrian. (Sainsbury and others, 1970.)
- Age changed from Late Devonian(?) to Early(?) Devonian. (Cady, 1969.)
- Klawak Formation adopted. (Eberlein and Churkin, 1970.)
- Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
- Kneeling Nun Tuff made a member of Datil Formation in Black Range area, southwestern New Mexico. Remains of formation rank elsewhere. (Ericksen and others, 1970.)
- Ladrones Limestone adopted. (Eberlein and Churkin, 1970.)
- La Jara Canyon Member adopted. (Lipman and Steven, 1970.)
- Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
- Lake Point Limestone adopted as lowermost of three formations in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Green Ravine Formation (new); underlies Erda Formation (new). (Tooker and Roberts, 1970.)
- Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
- Age changed from Pennsylvanian to Middle Pennsylvanian (Des Moines). (Bachman and Harbour, 1970.)
- Lehman Formation of Hintze (1951) adopted as uppermost formation, locally, of Pogonip Group. Overlies Kanosh Shale. Extended from its type area, western Utah, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
- Lenox Limestone Member abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
- Lewis Shale divided into lower part, Dad Sandstone Member, and upper part in Hanna and Carbon basins. (Gill and others, 1970.)
- In central and eastern Brooks Range age changed from Early and Late Mississippian, Pennsylvanian(?) and Permian to Early Mississippian (Osage) to Middle Pennsylvanian (Atoka). Elsewhere it is Early and Late Mississippian. (Armstrong and others, 1970.)

Name	Age	Location
Littleton Formation ----	Late Silurian(?) and Early Devonian.	Connecticut, Massa- chusetts, and New Hampshire.
Livingston Hills Forma- tion.	Cretaceous or Tertiary	Southwestern Arizona -
Los Pinos Gravel -----	Oligocene to Pliocene -	New Mexico and Colorado.
Lykins Formation -----	Permian and Triassic(?).	Colorado -----
Mal Paso Formation ---	Eocene -----	Northwestern Puerto Rico.
Maricao Basalt -----	Late Cretaceous -----	Northwestern Puerto Rico.
Markham Peak Member (of Bingham Mine Formation).	Late Pennsylvanian --	North-central Utah ---
Marquette Range Super- group.	middle Precambrian --	Northern Michigan and northern Wisconsin.
Matilde Formation -----	middle Eocene -----	Puerto Rico -----
McClure Mountain Com- plex.	Cambrian -----	Colorado -----
McNeeley Drift (of Fraser Glaciation).	Pleistocene -----	Washington -----
Medicine Bow Forma- tion.	Late Cretaceous -----	Wyoming -----
Menard Limestone ----	Late Mississippian ---	Kentucky -----
Menominee Group -----	middle Precambrian --	Northern Michigan and northern Wisconsin.
Mesaverde Group -----	Late Cretaceous -----	Wyoming -----
Mifflintown Formation -	Middle Silurian -----	South-central Pennsylvania .
Milagros Formation ----	middle Eocene -----	Puerto Rico -----
Moat Volcanics -----	Permian(?) -----	New Hampshire -----
Moccasin Bend Member (of Boone Formation).	Late Mississippian ---	Oklahoma and Kansas
Molas Formation -----	Mississippian and Early Pennsylvanian (Morrow).	Colorado, New Mexico, and Arizona .
Monmouth Group -----	Late Cretaceous -----	New York, Pennsylvania, and New Jersey.

Revision and reference

- Age changed from Early Devonian to Late Silurian(?) and Early Devonian. (Cady, 1969.)
- Livingston Hills Formation adopted. (Miller, 1970.)
- Los Pinos Gravel changed to Los Pinos Formation; age changed from Miocene and Pliocene(?) to Oligocene to Pliocene. (Lipman and others, 1970.)
- Age changed from Permian(?) and Triassic(?) to Permian and Triassic(?). (Scott, 1970.)
- Mal Paso Formation adopted. Overlies Concepción Formation (new); underlies Rio Culebrinas Formation. (McIntyre and others, 1970.)
- Maricao Basalt of Mattson (1960) adopted. Overlies Yauco Mudstone. (McIntyre and others, 1970.)
- Markham Peak Member adopted as upper member. Recognized in Bingham sequence (central and southern Oquirrh Mountains). Overlies Clipper Ridge Member (new). (Tooker and Roberts, 1970.)
- Marquette Range Supergroup adopted. Includes (in ascending order): Chocolay, Menominee, Baraga, and Paint River Groups. Replaces Animikie Series (abandoned). Animikie Group remains in good usage in northern Minnesota. (Cannon and Gair, 1970.)
- Age changed from late Paleocene and Eocene to middle Eocene. (McIntyre and others, 1970.)
- Age changed from Precambrian or Cambrian to Cambrian. (Parker and Sharp, 1970.)
- McNeeley Drift adopted. (Crandell, 1969.)
- Medicine Bow Formation restricted to Hanna, Laramie, and Carbon basins. (Gill and others, 1970.)
- Menard Limestone made member of Buffalo Wallow Formation in north-central Kentucky. Menard Limestone remains in good usage in Illinois and western Kentucky. (Goudarzi, 1970.)
- Menominee Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
- Mesaverde Formation raised to Mesaverde Group in south-central Wyoming where it is composed of the Haystack Mountains Formation, Allen Ridge Formation, Pine Ridge Sandstone, and Almond Formation. In Laramie basin, group composed only of Rock River Formation and Pine Ridge Sandstone. Mesaverde Formation still recognized in southeastern Wind River basin where divided into Fales Sandstone Member, Parkman Sandstone Member, unnamed middle member, and Teapot Sandstone Member, and in Powder River basin where divided into Parkman Sandstone Member, unnamed marine shale member, and Teapot Sandstone Member. (Gill and others, 1970.)
- Mifflintown Formation as used and redefined by Miller and Conlin (in Miller, 1961) adopted. (de Witt, this report, p. A28.)
- Age changed from Eocene(?) to middle Eocene. (McIntyre and others, 1970.)
- Age changed from Late Permian to Permian(?). (Cady, 1969.)
- Moccasin Bend Member adopted. (McKnight and Fischer, 1970.)
- Age changed from Pennsylvanian to Mississippian and Early Pennsylvanian (Morrow). (Mutschler, 1970.)
- Monmouth Group abandoned in Maryland and Delaware; remains in good usage in New Jersey, Pennsylvania, and New York. Monmouth Formation remains in good usage in Maryland near District of Columbia. (Owens and others, 1970.)

Name	Age	Location
Monterey Formation ---	Miocene -----	California -----
Mooney Falls Member (of Redwall Lime- stone).	Early and Late Mississippian (Meramec and Osage).	Arizona -----
Morales Member (of Santa Margarita For- mation).	late Miocene -----	California -----
Mount Rogers Formation	Precambrian -----	North Carolina, Virginia, and Tennessee.
Nanafalia Formation (of Wilcox Group).	Eocene -----	Mississippi -----
Nanook Limestone ----	Middle Devonian ----	Northeastern Alaska --
Nathrop Volcanics ----	Late Oligocene -----	Colorado -----
Needles Range Forma- tion.	Oligocene -----	Southwestern Utah and eastern Nevada.
Nelson Mountain Quartz Latite.	Oligocene -----	Colorado -----
New Hampshire Plutonic Series.	Devonian -----	New Hampshire and Vermont.
Nome Group -----	Precambrian -----	Northwestern Alaska -
Nonesuch Shale -----	Precambrian -----	Michigan and Wisconsin .
Northfield Formation --	Middle(?) Silurian --	Vermont -----
Obispo Tuff Member (of Monterey Formation).	Miocene -----	California -----
O'Brien Spring Sand- stone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous -----	Wyoming -----
Ojito Creek Member (of Treasure Mountain Tuff).	Oligocene -----	Colorado -----
Olcese Sand -----	middle Miocene -----	California -----
Oquirrh Formation ----	Late Mississippian to Early Permian(?).	North-central Utah ---
Oquirrh Formation ----	Pennsylvanian and Permian.	Northwestern Utah ---

Revision and reference

- Obispo Tuff Member, basal member of Monterey Formation, removed from Monterey Formation and raised in rank to Obispo Formation following usage of Hall and others (1966). (Turner and others, 1970.)
- Age changed from Mississippian to Early and Late Mississippian (Meramec and Osage). (McKee and Gutschick, 1969.)
- Morales Member of Santa Margarita Formation raised in rank to Morales Formation. Age changed from late Miocene to Pliocene. (Vedder, 1970.)
- Mount Rogers Volcanic Group reduced from group to formation rank and name changed to Mount Rogers Formation. Its former subdivisions, Flat Ridge Formation containing Cinnamon Ridge and Cornett Basalt Members, abandoned and their rocks included in Mount Rogers Formation. (Rankin, 1970.)
- Nanafalia Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. Includes Fearn Springs Member. (Cushing and others, 1970.)
- Nanook Limestone adopted. Overlies Katakturuk Dolomite (new). Dutro, 1970.)
- Nathrop Volcanics adopted. (Van Alstine, 1969.)
- Needles Range Formation extended into eastern Nevada. Age changed from Eocene or early Oligocene to Oligocene. (Whitebread, 1969.)
- Age changed from middle or late Tertiary to Oligocene. (Lipman and others, 1970.)
- Age changed from Late Devonian(?) to Devonian. (Cady, 1969.)
- Age changed from Silurian and Ordovician to Precambrian. (Sainsbury and others, 1970.)
- Nonesuch Shale extended into Wisconsin (northwestern part). (Vine and Tourtelet, 1969.)
- Name changed from Northfield Slate to Northfield Formation; age changed from Middle Silurian to Middle(?) Silurian. (Cady, 1969.)
- Obispo Tuff Member removed from Monterey Formation and raised in rank to Obispo Formation following usage of Hall and others (1966). (Turner and others, 1970.)
- O'Brien Spring Sandstone Member adopted as middle named member of Haystack Mountains Formation. (Gill and others, 1970.)
- Ojito Creek Member adopted. (Lipman and Steven, 1970.)
- Olcese Sand of Diepenbrock (1933) adopted. Overlies Freeman Silt; underlies Round Mountain Silt. (Addicott, 1970.)
- In Oquirrh Mountains, its type area, Oquirrh Formation raised in rank to Oquirrh Goup. Age ranges from Late Mississippian to Early Permian(?). South of Midas thrust, in Bingham sequence, contains (in ascending order): West Canyon Limestone, Butterfield Peaks Formation, and Bingham Mine Formation. Age there is Early, Middle, and Late Pennsylvanian. North of the North Oquirrh thrust, in the Rogers Canyon sequence, includes (in ascending order): Lake Point Limestone and Erda and Kessler Formations. Age is Late Mississippian to Early Permian(?). Overlies Green Ravine Formation; underlies Park City Formation. (Tooker and Roberts, 1970.)
- In Curlew Valley, northwestern Utah, the Oquirrh is of formational rank and of Pennsylvanian and Permian age. (Bolke and Price, 1969.)

Name	Age	Location
Oreville Formation ----	Precambrian -----	South Dakota -----
Packsaddle Mountain Grandiorite.	Cretaceous -----	Idaho -----
Pahrump Series -----	late Precambrian ----	Southeastern California
Paint River Group ----	middle Precambrian --	Northern Michigan and northern Wisconsin.
Panther Seep Formation	Late Pennsylvanian and Early Permian.	New Mexico -----
Paradise Formation ---	Late Mississippian ---	Southeastern Arizona and southwestern New Mexico.
Paskenta Formation ---	Early Cretaceous ----	California and Oregon
Peratrovich Formation -	Early and Late Mississippian.	Southeastern Alaska --
Perryville Member (of Lexington Limestone).	Middle Ordovician ----	Kentucky -----
Phoenix Limestone Lentil (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah --
Pine Ridge Sandstone Member (of Mesaverde Formation).	Late Cretaceous ----	Wyoming -----
Pinnacle Formation ----	Early Cambrian(?) --	Vermont -----
Pioche Shale -----	Cambrian -----	Northeastern Nevada -
Pogonip Group -----	Late Cambrian, Early and Middle Ordovician.	Eastern Nevada and western Utah.
Point Pleasant Forma- tion.	Middle and Late Ordovician.	North-central Kentucky
Polulu Volcanic Series -	late Pleistocene -----	Hawaii -----
Poplar Tank Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas -----
Port Refugio Formation	Late Devonian -----	Southeastern Alaska --
Potosi Volcanic Group --	Oligocene -----	Southwestern Colorado
Prospect Mountain Quartzite.	Precambrian and Early Cambrian.	Southeastern California and southern Nevada.
Puckmummie Schist ----	Precambrian -----	Northwestern Alaska -
Pyramid Hill Sand Mem- ber (of Jewett Sand).	early Miocene -----	California -----
Quapaw Limestone ----	Late Mississippian ---	Oklahoma -----
Rainstorm Member (of Johnnie Formation).	late Precambrian ----	Southeastern California
Ra Jadero Member (of Treasure Mountain Tuff).	Oligocene -----	Southwestern Colorado
Rampart Group -----	Permian(?) -----	Central Alaska -----
Rat Creek Quartz Latite	Oligocene -----	Colorado -----

Revision and reference

- Oreville Formation adopted. (Ratte and Wayland, 1969.)
Age changed from probably Jurassic or Cretaceous to Cretaceous. (King and others, 1970.)
Name changed from Pahrump Series to Pahrump Group; definition remains unchanged. (Stewart, 1970.)
Paint River Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
Age changed from Late Pennsylvanian to Late Pennsylvanian and Early Permian. (Bachman and Harbour, 1970.)
Paradise Formation of Stoyanow (1926) adopted. (Armstrong, 1970.)
- Paskenta Formation abandoned as it was defined as biostratigraphic unit. (Jones and others, 1969.)
Peratrovich Formation adopted; overlies Wadleigh Limestone (new). (Eberlein and Churkin, 1970.)
Name changed from Perryville Member to Perryville Limestone Member. (Cressman and Hrabar, 1970.)
Phoenix Limestone Lentil abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
- In Hanna, Carbon, and Laramie basins, Pine Ridge Sandstone Member raised to formation rank in Mesaverde Group. (Gill and others, 1970.)
- Age changed from Cambrian(?) to Early Cambrian(?). (Cady, 1969.)
Name changed to Pioche Formation in the Ruby Mountains where the shale is metamorphosed. (Willden and Kistler, 1969.)
Pogonip Group in southern Snake Range includes (in ascending order): House Limestone, an unnamed limestone unit, Lehman Formation, and Kanosh Shale. Age locally is Late Cambrian and Early and Middle Ordovician. (Whitebread, 1969.)
Age changed from Middle Ordovician to Middle and Late Ordovician. (Luft, 1970.)
Age changed from Pliocene to late Pleistocene. (McDougall, 1969.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
- Port Refugio Formation adopted. (Eberlein and Churkin, 1970.)
Age changed from middle and late Tertiary to Oligocene. (Lipman and others, 1970.)
Prospect Mountain Quartzite restricted from Kingston Range and Clark Mountain area; replaced by (in ascending order): Johnnie, Stirling, Wood Canyon, and Zabriskie Formations. (Stewart, 1970.)
Age changed from post-Ordovician(?) to Precambrian. (Sainsbury and others, 1970.)
Pyramid Hill Sand of Wilson (1935) adopted as basal member of Jewett Sand. (Addicott, 1970.)
Quapaw Limestone adopted. (McKnight and Fischer, 1970.)
Rainstorm Member extended into southeastern California. (Stewart, 1970.)
Ra Jadero Member adopted. (Lipman and Steven, 1970.)
- Age changed from Mississippian to Permian(?). (Brosgé and others, 1969.)
Age changed from middle or late Tertiary to Oligocene. (Lipman and others, 1970.)

Name	Age	Location
Rawley Andesite -----	Oligocene -----	Southwestern Colorado
Reeds Spring Member (of Boone Formation).	Early Mississippian --	Oklahoma -----
Ringbone Shale -----	Late Cretaceous -----	New Mexico -----
Río Blanco Formation --	Late Cretaceous -----	Northwestern Puerto Rico.
Río Culebrinas Forma- tion.	Eocene -----	Northwestern Puerto Rico.
Roadside Formation ---	Late Cretaceous -----	Arizona -----
Rock River Formation (of Mesaverde Group).	Late Cretaceous -----	Wyoming -----
Roskruge Rhyolite -----	Late Cretaceous -----	Arizona -----
Round Mountain Silt ---	middle Miocene -----	California -----
Round Valley Peak Granodiorite.	Late Cretaceous -----	Eastern California ---
Rubio Peak Formation -	Oligocene -----	New Mexico -----
Ruby Star Granodiorite-	Paleocene -----	Southern Arizona ---
Russell Mountain For- mation.	Middle Silurian -----	Western Massachusetts
Sadlerochit Formation -	Late Permian and Early Triassic.	Northern Alaska ----
Sag River Sandstone ---	Late Triassic -----	Northern Alaska ----
St. Joe Limestone Mem- ber (of Boone For- mation).	Early Mississippian --	Oklahoma -----
St. Joseph Island Volcanics.	Devonian(?) -----	Southeastern Alaska --
Salem Limestone -----	Late Mississippian ---	Eastern Kentucky ---
San Andres Limestone -	Early Permian (Leonard).	Northwestern New Mexico.
Sangre de Cristo Forma- tion.	Late Pennsylvanian and Early Permian.	New Mexico and Colorado.
San Juan Formation ---	Oligocene and older (?)	Southwestern Colorado
San Ramon Sandstone -	early Miocene(?) ----	California -----
Satanka Shale -----	Permian -----	Colorado and Wyoming
Savanna Shale (of Krebs Group).	Pennsylvanian -----	Oklahoma and Kansas
Schieffelin Granodiorite -	Late Cretaceous -----	Arizona -----
Servilleta Formation ---	Pliocene -----	Colorado and New Mexico.
Shawangunk Conglomerate.	Early and Middle Silurian.	Eastern Pennsylvania and northeastern New Jersey.

Revision and reference

- Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)
Name changed from Reeds Spring Chert Member to Reeds Spring Member.
(McKnight and Fischer, 1970.)
- Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
- Río Blanco Series of Hubbard (1923) adopted as Río Blanco Formation.
(McIntyre and others, 1970.)
- Río Culebrinas Series of Hubbard (1923) adopted and redefined as Río
Culebrinas Formation. Overlies Mal Paso Formation (new). (McIntyre
and others, 1970.)
- Age changed from Mesozoic to Late Cretaceous. (Hayes, 1970a.)
- Rock River Formation adopted as basal formation in Mesaverde Group along
west flank of Laramie Basin. Does not occur east of Laramie Range and
to west grades into Allen Ridge Formation of Mesaverde Group. (Gill and
others, 1970.)
- Age changed from Mesozoic to Late Cretaceous. (Hayes, 1970a.)
- Round Mountain Silt of Diepenbrock (1933) adopted. Overlies Olcese Sand
(new). (Addicott, 1970.)
- Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler,
1970.)
- Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
- Ruby Star Granodiorite of Livingston, Mauger, and Damon (1968) adopted.
(Lovering and others, 1970.)
- Russell Mountain Formation adopted. (Hatch and others, 1970.)
- Age changed from Permian and Early Triassic to Late Permian and Early
Triassic. (Detterman, 1970b.)
- Sag River Sandstone of Fackler and others (1970) adopted. (Reiser, 1970.)
- Age changed from Mississippian to Early Mississippian. (McKnight and
Fischer, 1970.)
- St. Joseph Island Volcanics adopted. (Eberlein and Churkin, 1970.)
- Name changed from Salem Limestone to Salem Formation in eastern Ken-
tucky. (Lewis and Luft, 1970.)
- In Fort Wingate area, New Mexico, age changed from Early and Late
Permian to Early Permian (Leonard). (Ash, 1969.)
- Age changed from Pennsylvanian and Permian to Late Pennsylvanian and
Early Permian. (Johnson, 1970.)
- Age changed from Oligocene or older to Oligocene and older(?) (Lipman and
others, 1970.)
- Age changed from late Oligocene or early Miocene to early Miocene(?).
(Addicott, 1970.)
- Name changed from Satanka Shale to Satanka Formation in report area.
(Braddock and others, 1970.)
- Name changed from Savanna Formation to Savanna Shale in report area.
Savanna Formation or Sandstone is good usage elsewhere. (McKnight and
Fischer, 1970.)
- Age changed from Late Cretaceous or Tertiary to Late Cretaceous. (Hayes,
1970a.)
- Servilleta Formation of Montgomery (1953) adopted. (Lipman and others,
1970.)
- In report area name changed to Formation and age changed from Silurian
to Early and Middle Silurian. (Drake and others, 1969.)

Name	Age	Location
Shenango Formation ---	Mississippian -----	Pennsylvania and Ohio
Shingle Creek Quartzite	late Precambrian ----	Eastern Nevada and western Utah.
Short Creek Oolite Member (of Boone Formation).	Late Mississippian ---	Oklahoma and Kansas
Sillem Member (of Fowkes Formation).	Eocene -----	Southwestern Wyoming
Silver Point Quartz Monzonite.	Mesozoic(?) -----	Northeastern Washington.
Skinner Ranch Formation.	Early Permian (Wolfcamp).	Western Texas -----
Skokomish Gravel ----	Pleistocene (Olympia Interglaciation).	West-central Washington.
Skolai Group -----	Permian(?) and Permian.	Alaska -----
Skunk Ranch Conglomerate.	Late Cretaceous ----	New Mexico -----
Snow Creek Porphyry --	early Tertiary -----	Montana -----
Station Creek Formation	Permian(?) -----	Alaska -----
Sturgeon River Glaciation or Drift.	Pleistocene -----	Alaska -----
Sugarlump Tuff -----	Oligocene -----	New Mexico -----
Sullivan Peak Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas -----
Sunset Member (of Bull Fork Formation).	Late Ordovician ----	Northeastern Kentucky.
Sunshine Peak Rhyolite--	Oligocene -----	Southwestern Colorado
Taft Granite -----	Late Jurassic -----	Eastern California ---
Talisay Member (of Alifan Limestone).	Miocene -----	Guam -----
Tapeats Sandstone ----	Early Cambrian ----	Southeastern California.
Tapers Ranch Sandstone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous ----	Wyoming -----
Tate Member (of Ashlock Formation).	Late Ordovician ----	Northeastern Kentucky
Theresa Formation ----	Late Cambrian and Early Ordovician.	Vermont and New York
Thunder Springs Member (of Redwall Limestone).	Early Mississippian (Osage).	Arizona -----
Tilden Limestone Lentil (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Tracy Creek Quartz Latite.	Oligocene -----	Southwestern Colorado

Revision and reference

- Shenango Formation revised to include Shenango Formation, as previously used, as unnamed lower member and the Hempfield Shale (abandoned) as unnamed upper member. (Kimmel and Schiner, 1970.)
- Shingle Creek Quartzite of Misch and Hazzard (1962) adopted. (Whitebread, 1969.)
- Age changed from Mississippian to Late Mississippian. (McKnight and Fischer, 1970.)
- Sillem adopted as basal member. Underlies Bulldog Hollow Member (new). (Oriol and Tracey, 1970.)
- Silver Point Quartz Monzonite adopted. (Miller, 1969.)
- Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
- Skokomish Gravel adopted. (Molenaar and Noble, 1970.)
- Skolai Group adopted. Includes (in ascending order): Station Creek and Hasen Creek Formations (both new). (Smith and MacKevett, 1970.)
- Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
- Age changed from post-Cretaceous(?) to early Tertiary. (Witkind and others, 1970.)
- Station Creek adopted as lower of two formations in Skolai Group (new). Underlies Hasen Creek Formation (new). (Smith and MacKevett, 1970.)
- Sturgeon River Glaciation or Drift adopted. (Karlstrom, 1969.)
- Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
- Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
- Sunset Member of Arnheim Formation of Foerste (1912) adopted as Sunset Member of Bull Fork Formation. (Outerbridge, 1970.)
- Age changed from middle and late Tertiary to Oligocene. (Lipman and others, 1970.)
- Age changed from Cretaceous to Late Jurassic. (Evernden and Kistler, 1970.)
- Age changed from Miocene and Pliocene to Miocene. (Leopold, 1969.)
- Strata of Tapeats Sandstone in Providence Mountains reassigned to Johnnie, Stirling, Wood Canyon, and Zabriskie Formations. (Stewart, 1970.)
- Tapers Ranch Sandstone Member adopted as basal member of Haystack Mountains Formation in Hanna and Carbon basins. (Gill and others, 1970.)
- Tate Member of Ashlock Formation in central Kentucky extended into north-eastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
- Name changed from Theresa Dolomite to Theresa Formation; age changed from Late Cambrian to Late Cambrian and Early Ordovician. (Cady, 1969.)
- Age changed from Mississippian to Early Mississippian (Osage). (McKee and Gutschick, 1969.)
- Tilden Limestone Lentil abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
- Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)

Name	Age	Location
Treasure Mountain Rhyolite.	Oligocene -----	Southwestern Colorado
Tunp Member (of Wasatch Formation).	Eocene -----	Southwestern Wyoming
Tuolumne Intrusive Series.	Late Cretaceous -----	California -----
Tusahoma Formation (of Wilcox Group).	Eocene -----	Mississippi -----
Twilight Granite -----	Precambrian -----	Southwestern Colorado
Utica Shale -----	Middle Ordovician ----	Eastern New York ---
Vedder Sand -----	early Miocene -----	California -----
Vekol Formation -----	Late Cretaceous -----	Arizona -----
Vicksburg Group -----	early Oligocene -----	Louisiana, Alabama, and Mississippi.
Wachsmuth Limestone (of Lisburne Group).	Early and Late Mississippian.	Northern Alaska ----
Wadleigh Limestone ---	Middle and Late Devonian.	Southeastern Alaska -
Wahoo Limestone (of Lisburne Group).	Early and Middle Pennsylvanian.	Northern Alaska ----
Walker Formation ----	middle or late Eocene to early Miocene.	California -----
Wallace Creek Tongue (of Cody Shale).	Late Cretaceous -----	Wyoming -----
Waltersburg Formation/ Sandstone.	Late Mississippian ---	Kentucky -----
Wasatch Formation ----	Paleocene and Eocene -	Southwestern Wyoming
West Canyon Limestone	Early Pennsylvanian -	North-central Utah ---
West Elk Breccia -----	Oligocene and older(?)	Southwestern Colorado
Whitehead Granite ----	Precambrian -----	Southwestern Colorado
White Knob Limestone -	Late Mississippian ---	Idaho -----
White Mountain Plutonic Series.	Late Triassic or Early Jurassic.	New Hampshire -----
Whiteside Granite -----	Precambrian(?) -----	South Carolina and North Carolina.
Whitmore Wash Member (of Redwall Lime- stone).	Early Mississippian (Kinderhook and Osage).	Arizona -----
Wilcox Group -----	Eocene -----	Mississippi -----

Revision and reference

- Name changed to Treasure Mountain Tuff; includes (in ascending order): lower tuff, La Jara Canyon Member (new), middle tuff, Ojito Creek Member (new), Ra Jadero Member (new), and upper tuff. (Lipman and Steven, 1970.)
- Tunp Member adopted. (Oriol and Tracey, 1970.)
- Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
- Tuscahoma Formation of Wilcox Group used in central Mississippi. Previously the Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
- Name changed from Twilight Granite to Twilight Gneiss. (Barker, 1969.)
- Age changed from Late Ordovician to Middle Ordovician in report area. Remains Late Ordovician elsewhere. (Cady, 1969.)
- Vedder Sand as redefined by Diepenbrock (1933) adopted. When present: overlies Walker Formation; underlies Jewett Sand. (Addicott, 1970.)
- Age changed from Late(?) Mesozoic to Late Cretaceous. (Hayes, 1970a.)
- Age changed from middle Oligocene to early Oligocene. (Bukry, 1970.)
- Age changed from Early Mississippian to Early and Late Mississippian. (Armstrong and others, 1970.)
- Underlies the Peratrovich Formation of Early and Late Mississippian age. (Eberlein and Churkin, 1970.)
- Age changed from Pennsylvanian(?) and Permian to Early and Middle Pennsylvanian. (Armstrong and others, 1970.)
- Walker Formation of Wilhelm and Saunders (1927) adopted. Underlies Vedder Sand, when present, or Jewett Sand. (Addicott, 1970.)
- Wallace Creek Tongue of Barwin (1961) adopted as upper member of Cody Shale in southeastern Wind River basin. Separated from main body of Cody by Fales Sandstone Member of Mesaverde Formation. (Gill and others, 1970.)
- Waltersburg Formation/Sandstone reduced in rank to member of Buffalo Wallow Formation in north-central Kentucky. Remains of formation rank in Illinois and western Kentucky. (Goudarzi, 1970.)
- In Fossil basin, Wasatch Formation is divided into seven units: basal conglomerate member, lower member, main body, sandstone tongue, mudstone tongue, Bullpen Member (new), and peripheral Tunp Member (new), which is equivalent to parts of upper five units. (Oriol and Tracey, 1970.)
- West Canyon Limestone Member of Nygreen (1958) adopted and redefined as lowermost of three formations in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Underlies Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
- Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
- Whitehead Granite abandoned. Its rocks included in Irving, Twilight, or Ten-mile Formation, depending on location. (Barker, 1969.)
- Age changed from Early Mississippian to Early Permian to Late Mississippian. (Skiyp and Mamet, 1970.)
- Name changed from White Mountain Plutonic-Volcanic Series to White Mountain Plutonic Series. (Cady, 1969.)
- Age changed from Ordovician to Devonian to Precambrian(?). (Bryant and Reed, 1970.)
- Age changed from Mississippian to Early Mississippian. (Kinderhook and Osage). (McKee and Gutschick, 1969.)
- Wilcox Group in central Mississippi divided into Hatchetigbee, Tuscahoma, and Nanafalia Formations. (Cushing and others, 1970.)

Name	Age	Location
Wood Canyon Formation	Precambrian and Early Cambrian.	Southeastern California and southern Nevada.
Yampa Limestone Lentil (of Bingham Quartzite).	Pennsylvanian -----	North-central Utah ---
Zabriskie Quartzite ----	Early Cambrian -----	Southeastern California and southern Nevada.
Zimmer Ridge Member (of Oreville Formation).	Precambrian -----	South Dakota -----

**THE MIFFLINTOWN FORMATION OF MIDDLE SILURIAN AGE,
BEDFORD COUNTY, PENNSYLVANIA**

By WALLACE DE WITT, JR.

Miller and Conlin (in Miller, 1961, p. 11) redefined the Mifflintown Limestone of Lesley (in Dewees, 1878, p. xxv-xxvi) to include the strata between the top of the Rose Hill Formation and the base of the Bloomsburg Red Beds in the Loysville quadrangle, Juniata and Perry Counties, Pa. They designated the Mifflintown a formation and recognized two mappable units: the Keefer Member overlain by the undivided Rochester and McKenzie Members.

Recent geologic mapping in the vicinity of Hyndman and Beans Cove in southwest Bedford County, Pa., demonstrated that the Mifflintown can be mapped in this area, and the formation as redefined by Miller and Conlin is herein adopted for use by the U.S. Geological Survey. The Mifflintown consists of 300-425 feet of soft calcareous shale, intercalated with thin-bedded lenticular fossiliferous limestone, and a small amount of sandstone, siltstone, and sandy hematite in the basal part. The formation is one of the least well exposed units in southwest Bedford County, and generally only the more resistant sandy beds of the basal Keefer Member as used by Miller and Conlin are exposed.

The twofold subdivision of the Mifflintown can be recognized; however, the basal Keefer is commonly too thin to be mapped at a scale of 1:24,000. Locally, in the northwest part of Beans Cove, the Keefer is as much as 25 feet thick, but generally it is about 10 feet thick. Because the Keefer is composed of resistant sandstone, siltstone, and silty mud rock, the unit commonly holds up a line of

Revision and reference

Wood Canyon Formation extended to all rocks previously designated Daylight Formation. Also extended to Kingston Range and Clark Mountain area, California, at expense of Prospect Mountain Quartzite. As thus defined, generally overlies Stirling Quartzite and everywhere underlies Zabriskie Quartzite. (Stewart, 1970.)

Yampa Limestone Lentil abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)

Zabriskie Quartzite extended into Kingston Range, Clark Mountain area, and Providence Mountains. Everywhere overlies Wood Canyon Formation and underlies Carrara Formation. Includes all rocks previously designated Corkscrew Quartzite. (Stewart, 1970.)

Zimmer Ridge Member adopted. (Ratte and Wayland, 1969.)

small knobs that rise as much as 40–80 feet topographically above the less resistant and more calcareous part of the steeply dipping Mifflintown.

In southern Bedford County, as in adjacent Allegany County, Md., the intercalated shale and thin-bedded limestone of the Rochester are lithologically indistinguishable from much of the overlying McKenzie (de Witt and Colton, 1964, p. 17). The two units can only be differentiated by their contained faunas. Meager paleontologic data suggest that the Rochester Member as used by Miller and Conlin may be as much as 35 feet thick in southwest Bedford County but is generally too thin to be mapped as a separate unit at a scale of 1:24,000. In contrast, the McKenzie Member as used by Miller and Conlin is more than 300 feet thick.

The base of the Mifflintown Formation, the lower boundary of the Keefer unit, is marked in southwest Bedford County by an abrupt change from medium-olive-gray silty shale of the underlying Rose Hill Formation to olive-gray calcareous siltstone, lenticular sandy hematite, and light-gray quartzitic sandstone. The top of the Keefer unit is generally covered by float and is rarely observed except in artificial exposures. The McKenzie unit of the Mifflintown is gradational into the overlying Bloomsburg Red Beds in a 10- to 15-foot zone of intercalated thin-bedded dark-gray lenticular limestone, olive-gray calcareous shale, light-greenish-gray silty shale, and grayish-red to purple silty mud rock. The boundary between the two formations is commonly placed at the base of a massive purple silty mud rock in the upper part of the transitional sequence. The boundary is generally marked by an abrupt change in soil color in cultivated fields and by an abundance of chips of reddish-brown and purple silty mud rock in wooded areas.

NEW AGE ASSIGNMENTS IN THE STRATIGRAPHY OF THE GLASS MOUNTAINS, WESTERN TEXAS

By G. A. COOPER¹ and R. E. GRANT

Based on the preponderance of brachiopod evidence, the following new assignments are made in the stratigraphy of the Glass Mountains, western Texas: The upper part of the Gaptank Formation is placed in the Wolfcamp Series as is the Skinner Ranch Formation. These assignments are based on early spasmodic presence of such Permian elements as *Limbella* (an aulostegid brachiopod), *Scacchinella* (a well-known Permian type), and *Waagenoconcha* in rocks formerly considered Late Pennsylvanian. These three and other Permian types became increasingly abundant in the famous Uddenites-bearing shale member of the Gaptank Formation, here placed at the bottom of the Permian. Many Pennsylvanian and Wolfcamp genera and the great biohermal assemblages of the Wolfcamp rocks culminated in the Skinner Ranch Formation, which represents the end of the Wolfcamp Series.

Faunas of the Road Canyon Formation have already been assigned to the Leonard Series by Cooper and Grant (1966), who regarded the preponderance of the fauna to be Leonard in generic content and general expression. Higher Word Formation assemblages are correlated with the Guadalupe type area as follows: Fossils of the China Tank Member (formerly Second Limestone Member) appear in the Cherry Canyon Formation; lower Getaway Limestone Member of the Cherry Canyon has the fauna of the Willis Ranch Member (Third Limestone Member of the Word of P. B. King); and upper Gateway contains fossils of the Appel Ranch Member (Fourth Limestone Member of the Word). The South Wells Member of the Cherry Canyon, a black shale and carbonate facies, seems not to be represented in the Glass Mountains. Bell Canyon Formation (Hegler Limestone Member) fossils have been found in undolomitized limestone at the base of the Capitan Limestone in the Glass Mountains.

Although these changes are based largely on brachiopods, they are in accordance with age indications of some other groups but not all.

¹ U.S. National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.

REFERENCES

- Addicott, W. O., 1970, Miocene gastropods and biostratigraphy of the Kern River area, California: U.S. Geol. Survey Prof. Paper 642, 174 p.
- Armstrong, A. K., 1962, Stratigraphy and paleontology of the Mississippian system in southwestern New Mexico and adjacent southeastern Arizona: New Mexico Bur. Mines and Mineral Resources Mem. 8, 99 p.
- 1970, Mississippian stratigraphy and geology of the northwestern part of the Klondike Hills, southwestern New Mexico, in New Mexico Geol. Soc. Guidebook, 21st Field Conf.: p. 59–64.
- Armstrong, A. K., Mamet, B. L., and Dutro, J. T., Jr., 1970, Foraminiferal zonation and carbonate facies of the Mississippian and Pennsylvanian Lisburne Group, central and eastern Brooks Range, Arctic Alaska: Am. Assoc. Petroleum Geologists Bull., v. 54, no. 5, p. 687–698.
- Ash, S. R., 1969, Ferns from the Chinle Formation (Upper Triassic) in the Fort Wingate area, New Mexico: U.S. Geol. Survey Prof. Paper 613–D, p. D1–D52.
- Bachman, G. O., and Harbour, R. L., 1970, Geologic map of northern part of San Andres Mountains, central New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I–600.
- Barker, Fred, 1969, Precambrian geology of the Needle Mountains, southwestern Colorado: U.S. Geol. Survey Prof. Paper 644–A, p. A1–A35.
- Barwin, J. R., 1961, Stratigraphy of the Mesaverde Formation in the southern part of the Wind River Basin, Wyoming, in Symposium on Late Cretaceous rocks, Wyoming and adjacent areas, Wyoming Geol. Assoc., 16th Ann. Field Conf., 1961: Casper, Wyo., Petroleum Inf., p. 171–179.
- Bergstrom, J. R., 1959, Generalized composite section of “Mesaverde” rocks of southeastern Wyoming, in Haun, J. D., and Weimer, R. J., eds., Symposium on Cretaceous rocks of Colorado and adjacent areas, Rocky Mtn. Assoc. Geologists, 11th Field Conf., Washakie, Sand Wash, and Piceance basins: p. 114.
- Bolke, E. L., and Price, Don, 1969, Hydrologic reconnaissance of Curlew Valley, Utah and Idaho: Utah Dept. Nat. Resources Tech. Pub. 25, 40 p.
- Brabb, E. E., and Churkin, Michael, Jr., 1969, Geologic map of the Charley River quadrangle, east-central Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I–573.
- Braddock, W. A., Calvert, R. H., Gawarecki, S. J., and Nutalaya, Prinya, 1970, Geologic map of the Masonville quadrangle, Larimer County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ–832.
- Brosgé, W. P., Lanphere, M. A., Reiser, H. N., and Chapman, R. M., 1969, Probable Permian age of the Rampart Group, central Alaska: U.S. Geol. Survey Bull. 1294–B, p. B1–B18.
- Bryant, Bruce, and Reed, J. C., Jr., 1970, Structural and metamorphic history of the southern Blue Ridge, in Fisher, G. W., Pettijohn, F. J., Reed, J. C., Jr., and Weaver, Kenneth, eds., Studies of Appalachian geology—central and southern: New York, Intersci. Publishers, p. 213–225.
- Bukry, David, 1970, Cocolith age determinations, Leg 2, Deep Sea Drilling Project, in Initial reports of the Deep Sea Drilling Project—Volume 2, Covering Leg 2 of the cruises of the Drilling Vessel “*Glomar Challenger*,” Hoboken, N.J., to Dakar, Senegal, October–November 1968: Washington, U.S. Gov. Printing Office, p. 349–355.
- Cady, W. M., 1969, Regional tectonic synthesis of northwestern New England and adjacent Quebec: Geol. Soc. America Mem. 120, 181 p.

- Cannon, W. F., and Gair, J. E., 1970, A revision of stratigraphic nomenclature for middle Precambrian rocks in northern Michigan: *Geol. Soc. America Bull.*, v. 81, no. 9, p. 2843-2846.
- Clifton, H. E., and Boggs, Sam, Jr., 1970, Concave-up pelecypod (*Psephidia*) shells in shallow marine sands, Elk River Beds, southwestern Oregon: *Jour. Sed. Petrology*, v. 40, no. 3, p. 888-897.
- Cooper, G. A., and Grant, R. E., 1966, Permian rock units in the Glass Mountains, west Texas: *U.S. Geol. Survey Bull.* 1244-E, p. E1-E9.
- Cragin, F. W., 1896, The Permian system in Kansas: *Colorado Coll. Studies*, v. 6, p. 1-48.
- Crandell, D. R., 1969, Surficial geology of Mount Rainer National Park, Washington: *U.S. Geol. Survey Bull.* 1288, 41 p.
- Cressman, E. R., and Hrabar, S. V., 1970, Geologic map of the Wilmore quadrangle, central Kentucky: *U.S. Geol. Survey Geol. Quad. Map GQ-847*.
- Cross, C. W., Howe, Ernest, Irving, J. D., and Emmons, W. H., 1905, Description of the Needle Mountain quadrangle, Colorado: *U.S. Geol. Survey Geol. Atlas Folio 131*, 13 p.
- Csejtey, Béla, Jr., 1970, Geologic map of the Nolansburg quadrangle, southeastern Kentucky: *U.S. Geol. Survey Geol. Quad. Map GQ-868*.
- Cullins, H. C., 1969, Geologic map of the Mellen Hill quadrangle, Rio Blanco and Moffat Counties, Colorado: *U.S. Geol. Survey Geol. Quad. Map GQ-835*.
- Cushing, E. M., Boswell, E. H., Speer, P. R., and Hosman, R. L., 1970, Availability of water in Mississippi embayment: *U.S. Geol. Survey Prof. Paper* 448-A, p. A1-A13.
- Detterman, R. L., 1970a, Early Holocene warm interval in northern Alaska: *Arctic*, v. 23, no. 2, p. 130-132.
- 1970b, Sedimentary history of the Sadlerochit and Shublik Formations in northeastern Alaska, in *Geological Seminar on the North Slope of Alaska*, Palo Alto, Calif., 1970, Proceedings: Los Angeles, Calif., Am. Assoc. Petroleum Geologists, Pacific Sec., p. 0-1 to 0-13.
- Deweese, J. H., 1878, Report of progress in the Juniata district on the fossil iron ore beds of middle Pennsylvania: *Pennsylvania Geol. Survey*, 2d, Rept. F, 139 p.
- de Witt, Wallace, Jr., and Colton, G. W., 1964, Bedrock geology of the Evitts Creek and Pattersons Creek quadrangles, Maryland, Pennsylvania, and West Virginia: *U.S. Geol. Survey Bull.* 1173, 90 p.
- Diepenbrock, Alex, 1933, Mount Poso oil field: *California Oil Fields*, v. 19, no. 2, p. 4-35.
- Drake, A. A., Jr., Epstein, J. B., and Aaron, J. M., 1969, Geologic map and sections of parts of the Portland and Belvidere quadrangles, New Jersey and Pennsylvania: *U.S. Geol. Survey Misc. Geol. Inv. Map I-552*.
- Dutro, T. W., Jr., 1970, Pre-Carboniferous carbonate rocks, northeastern Alaska, in *Geological Seminar on the North Slope of Alaska*, Palo Alto, Calif., 1970, Proceedings: Los Angeles, Calif., Am. Assoc. Petroleum Geologists, Pacific Sec., p. M-1 to M-7.
- Eberlein, G. D., and Churkin, Michael, Jr., 1970, Paleozoic stratigraphy in the northwest coastal area of Prince of Wales Island, southeastern Alaska: *U. S. Geol. Survey Bull.* 1284, 67 p.
- Elston, W. E., 1957, Geology and mineral resources of Dwyer quadrangle,

- Grant, Luna, and Sierra Counties, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 38, 86 p.
- Ericksen, G. E., Wedow, Helmuth, Jr., Eaton, G. P., and Leland, G. R., 1970, Mineral resources of the Black Range Primitive Area, Grant, Sierra, and Catron Counties, New Mexico: U.S. Geol. Survey Bull. 1319-E, p. E1-E162.
- Espenshade, G. H., 1970, Geology of the northern part of the Blue Ridge anticlinorium, in Fisher, G. W., Pettijohn, F. J., Reed, J. C., Jr., and Weaver, Kenneth, eds., Studies of Appalachian geology—central and southern: New York, Intersci. Publishers, p. 199-211.
- Evernden, J. F., and Kistler, R. W., 1970, Chronology of emplacement of Mesozoic batholithic complexes in California and western Nevada: U.S. Geol. Survey Prof. Paper 623, 42 p.
- Fackler, W. C., and others, 1970, The Sag River Sandstone and Kuparuk River sands, two important subsurface units in the Prudhoe Bay Field, in Geological Seminar on the North Slope of Alaska, Palo Alto, Calif., 1970, Proceedings: Los Angeles, Calif., Am. Assoc. Petroleum Geologists, Pacific Sec., p. P-1 to P-3.
- Foerste, A. F., 1912, The Arnheim Formation within the areas traversed by the Cincinnati geanticline: Ohio Naturalist, v. 12, no. 3, p. 429-456.
- Gill, J. R., Merewether, E. A., and Cobban, W. A., 1970, Stratigraphy and nomenclature of some Upper Cretaceous and lower Tertiary rocks in south-central Wyoming: U.S. Geol. Survey Prof. Paper 667, 53 p.
- Godde, H. A., 1928, Miocene formations in the east side fields of Kern County: California Oil Fields, v. 14, no. 1, p. 5-15.
- Goudarzi, G. H., 1970, Geologic map of the Glen Dean quadrangle, Breckinridge and Hancock Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-836.
- Gregory, H. E., 1906, The crystalline rocks [of Connecticut]: Connecticut Geol. and Nat. History Survey Bull. 6, p. 39-156.
- Hale, L. A., 1961, Late Cretaceous (Montanan) stratigraphy, eastern Washaki Basin, Carbon County, Wyoming, in Symposium on Late Cretaceous rocks, Wyoming and adjacent areas, Wyoming Geol. Assoc., 16th Ann. Field Conf., 1961: Casper, Wyo., Petroleum Inf., p. 129-137.
- Hall, C. A., Turner, D. L., and Surdham, R. C., 1966, Potassium-argon age of the Obispo Formation with *Pecten lompocensis* Arnold, southern Coast Range, California: Geol. Soc. America Bull., v. 77, no. 4, p. 443-445.
- Hansen, W. R., 1969, The geologic story of the Uinta Mountains: U.S. Geol. Survey Bull. 1291, 144 p.
- Harris, L. D., and Mixon, R. B., 1970, Geologic map of the Howard Quarter quadrangle, northeastern Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-842.
- Hatch, N. L., Jr., 1969, Geology of the Worthington quadrangle, Hampshire and Berkshire Counties, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-857.
- Hatch, N. L., Jr., Stanley, R. S., and Clark, S. F., Jr., 1970, The Russell Mountain Formation, a new stratigraphic unit in western Massachusetts: U.S. Geol. Survey Bull. 1324-B, p. B1-B10.
- Hayes, P. T., 1970a, Cretaceous paleogeography of southeastern Arizona and adjacent areas: U.S. Geol. Survey Prof. Paper 658-B, p. B1-B42.
- 1970b, Mesozoic stratigraphy of the Mule and Huachuca Mountains, Arizona: U.S. Geol. Survey Prof. Paper 658-A, p. A1-A28.

- Hietanen, Anna, 1968, Metamorphic environment of anorthosite in the Boehls Butte area, Idaho, in Origin of anorthosite and related rocks: New York State Mus. and Sci. Service Mem. 18, p. 371-386.
- Hintze, L. F., 1951, Lower Ordovician detailed stratigraphic sections for western Utah: Utah Geol. and Mineralog. Survey Bull. 39, 100 p.
- Hubbard, Bela, 1923, The geology of the Lares district, Porto Rico: New York Acad. Sci., Sci. Survey of Porto Rico and the Virgin Islands, v. 2, pt. 1, p. 1-115.
- Izett, G. A., Denson, N. M., and Obradovich, J. D., 1970, K-Ar age of the lower part of the Browns Park Formation, northwestern Colorado, in Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-C, p. C150-C152.
- Johnson, R. B., 1970, Geologic map of the Villanueva quadrangle, San Miguel County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-869.
- Jones, D. L., Bailey, E. H., and Imlay, R. W., 1969, Structural and stratigraphic significance of the *Buchia* zones in the Colyear Springs-Paskenta area, California: U.S. Geol. Survey Prof. Paper 647-A, p. A1-A24.
- Jones, W. R., Moore, S. L., and Pratt, W. P., 1970, Geologic map of the Fort Bayard quadrangle, Grant County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-865.
- Karlstrom, T. N. V., 1969, Regional setting and geology, Chapter 2 in Karlstrom, T. N. V., and Ball, G. E., eds., The Kodiak Island refugium, its geology, flora, fauna and history: Toronto, Ontario, Ryerson Press (for Boreal Inst., Univ. Alberta), p. 20-54.
- Kimmel, G. E., and Schiner, G. R., 1970, The Shenango Formation (Mississippian) in northwestern Pennsylvania: U.S. Geol. Survey Bull. 1294-C, p. C1-C13.
- King, E. R., Harrison, J. E., and Griggs, A. B., 1970, Geologic implications of aeromagnetic data in the Pend Orielle area, Idaho and Montana: U.S. Geol. Survey Prof. Paper 646-D, p. D1-D17.
- Kleinpell, R. M., 1938, Miocene stratigraphy of California: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 450 p.
- Leopold, E. B., 1969, Miocene pollen and spore flora of Eniwetok Atoll, Marshall Islands: U.S. Geol. Survey Prof. Paper 260-II, p. 1133-1185 [1970].
- Lewis, G. E., 1968, Stratigraphic paleontology of the Barstow Formation in the Alvord Mountain area, San Bernardino County, California, in Geological Survey research 1968: U.S. Geol. Survey Prof. Paper 600-C, p. C75-C79.
- Lewis, R. Q., Sr., and Luft, S. J., 1970, Geologic map of the Parnell quadrangle, Wayne County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-861.
- Lipman, P. W., and Steven, T. A., 1970, Reconnaissance geology and economic significance of the Platoro caldera, southeastern San Juan Mountains, Colorado, in Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-C, p. C19-C29.
- Lipman, P. W., Steven, T. A., and Mehnert, H. H., 1970, Volcanic history of the San Juan Mountains, Colorado, as indicated by potassium-argon dating: Geol. Soc. America Bull., v. 81, no. 8, p. 2329-2352.
- Livingston, D. E., Mauger, R. L., and Damon, P. E., 1968, Geochronology of the emplacement, enrichment, and preservation of Arizona porphyry copper deposits: Econ. Geology, v. 63, no. 1, p. 30-36.

- Love, J. D., 1970, Cenozoic geology of the Granite Mountains area, central Wyoming: U.S. Geol. Survey Prof. Paper 495-C, p. C1-C154.
- Lovering, T. G., Cooper, J. R., Drewes, Harald, and Cone, G. C., 1970, Copper in biotite from igneous rocks in southern Arizona as an ore indicator, in Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-B, p. B1-B8.
- Luft, S. J., 1970, Geologic map of the De Mossville quadrangle, north-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-862.
- MacKevett, E. M., Jr., 1970, Geologic map of the McCarthy C-4 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-844.
- Mattson, P. H., 1960, Geology of the Mayagües area, Puerto Rico: Geol. Soc. America Bull., v. 71, no. 3, p. 319-361.
- McDougall, Ian, 1969, Potassium-argon ages on lavas of Kohala Volcano, Hawaii: Geol. Soc. America Bull., v. 80, no. 12, p. 2597-2600.
- McIntyre, D. H., Aaron, J. M., and Tobisch, O. T., 1970, Cretaceous and lower Tertiary stratigraphy in northwestern Puerto Rico: U.S. Geol. Survey Bull. 1294-D, p. D1-D16.
- McKee, E. D., and Gutschick, R. C., 1969, Sequence of sediments and unconformities, Chapter 2 of History of the Redwall Limestone of northern Arizona: Geol. Soc. America Mem. 114, p. 13-95.
- McKee, E. H., 1970, Fish Creek Mountains Tuff and volcanic center, Lander County, Nevada: U.S. Geol. Survey Prof. Paper 681, 17 p.
- McKnight, E. T., and Fischer, R. P., 1970, Geology and ore deposits of the Picher field, Oklahoma and Kansas: U.S. Geol. Survey Prof. Paper 588, 165 p.
- Meyer, W. R., Gutentag, E. D., and Lobmeyer, D. H., 1970, Geohydrology of Finney County, southwestern Kansas: U.S. Geol. Survey Water-Supply Paper 1891, 117 p.
- Miller, F. K., 1969, Preliminary geologic map of the Loon Lake quadrangle, Stevens and Spokane Counties, Washington: Washington Div. Mines and Geology Geol. Map GM-6.
- 1970, Geologic map of the Quartzite quadrangle, Yuma County, Arizona: U.S. Geol. Survey Geol. Quad. Map GQ-841.
- Miller, J. T., 1961, Geology and mineral resources of the Loysville quadrangle, Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Topog. and Geol. Atlas A 127, 47 p.
- Misch, Peter, and Hazzard, J. C., 1962, Stratigraphy and metamorphism of Late Precambrian rocks in central northeastern Nevada and adjacent Utah: Am. Assoc. Petroleum Geologists Bull., v. 46, no. 3, p. 289-343.
- Molenaar, Dee, and Noble, J. B., 1970, Geology and related ground-water occurrence, southeastern Mason County, Washington: Washington Dept. Water Resources Water-Supply Bull. 29, 145 p.
- Montgomery, Arthur, 1953, Pre-Cambrian geology of the Picuris Range, north-central New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 30, 89 p.
- Moore, J. G., 1969, Geology and mineral deposits of Lyon, Douglas, and Ormsby Counties, Nevada: Nevada Bur. Mines Bull. 75, 44 p.
- Mutschler, F. E., 1970, Geologic map of the Snowmass Mountain quadrangle, Pitkin and Gunnison Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-853.

- Nelson, W. H., and Ross, C. P., 1969, Geologic map of the Mackay quadrangle, south-central Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I-580.
- Nygreen, P. W., 1958, The Oquirrh formation—stratigraphy of the lower portion in the type area and near Logan, Utah: Utah Geol. and Mineralog. Survey Bull. 61, 67 p.
- Oriel, S. S., and Tracey, J. L., Jr., 1970, Uppermost Cretaceous and Tertiary stratigraphy of Fossil basin, southwestern Wyoming: U.S. Geol. Survey Prof. Paper 635, 53 p.
- O'Sullivan, R. B., 1970, The upper part of the Upper Triassic Chinle Formation and related rocks, southeastern Utah and adjacent areas: U.S. Geol. Survey Prof. Paper 644-E, p. E1-E22.
- Outerbridge, W. F., 1970, Geologic map of the Sherburne quadrangle, north-eastern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-854.
- Ovenshine, A. T., and Webster, G. D., 1970, Age and stratigraphy of the Heceta Limestone in northern Sea Otter Sound, southeastern Alaska, *in* Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-C, p. C170-C174.
- Owens, J. P., Minard, J. P., Sohl, N. F., and Mello, J. F., 1970, Stratigraphy of the outcropping post-Magothy Upper Cretaceous formations in southern New Jersey and northern Delmarva Peninsula, Delaware and Maryland: U.S. Geol. Survey Prof. Paper 674, 60 p.
- Parker, R. L., and Sharp, W. N., 1970, Mafic-ultramafic igneous rocks and associated carbonatites of the Gem Park Complex, Custer and Fremont Counties, Colorado: U.S. Geol. Survey Prof. Paper 649, 24 p.
- Peck, J. H., 1969, Geologic map of the Flemingsburg quadrangle, Fleming and Mason Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-837.
- Rankin, D. W., 1970, Stratigraphy and structure of Precambrian rocks in northwestern North Carolina, *in* Fisher, G. W., Pettijohn, F. J., Reed, J. C., Jr., and Weaver, Kenneth, eds., Studies of Appalachian geology—central and southern: New York, Intersci. Publishers, p. 227-245.
- Ratte, J. C., and Wayland, R. G., 1969, Geology of the Hill City quadrangle, Pennington County, South Dakota—A preliminary report: U.S. Geol. Survey Bull. 1271-B, p. B1-B14.
- Reiser, H. N., 1970, Northeastern Brooks Range—a surface expression of the Prudhoe Bay section, *in* Geological Seminar on the North Slope of Alaska, Palo Alto, Calif., 1970, Proceedings: Am. Assoc. Petroleum Geologists, Pacific Sec., p. K-1 to K-13.
- Sainsbury, C. L., Coleman, R. G., and Kachadoorian, Reuben, 1970, Blueschist and related greenschist facies rocks of the Seward Peninsula, Alaska, *in* Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-B, p. B33-B42.
- Scholl, D. W., Greene, H. G., and Marlow, M. S., 1970, Eocene age of the Adak "Paleozoic(?)" rocks, Aleutian Islands, Alaska: Geol. Soc. America Bull., v. 81, no. 12, p. 3583-3592.
- Scott, G. R., 1970, Quaternary faulting and potential earthquakes in east-central Colorado, *in* Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-C, p. C11-C18.
- Skipp, Betty, and Mamet, B. L., 1970, Stratigraphic micropaleontology of the type locality of the White Knob Limestone (Mississippian), Custer

- County, Idaho, *in* Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-B, p. B118-B123.
- Smith, J. G., and MacKevett, E. M., Jr., 1970, The Skolai Group in the McCarthy B-4, C-4, and C-5 quadrangles, Wrangell Mountains, Alaska: U.S. Geol. Survey Bull. 1274-Q, 26 p.
- Snyder, G. L., 1970, Bedrock geologic and magnetic maps of the Marlborough quadrangle, east-central Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-791, 2 sheets.
- Stewart, J. H., 1970, Upper Precambrian and Lower Cambrian strata in the southern Great Basin, California and Nevada: U.S. Geol. Survey Prof. Paper 620, 206 p.
- Stockdale, P. B., 1939, Lower Mississippian rocks of the east-central interior: Geol. Soc. America Spec. Paper 22, 248 p.
- Stokes, W. L., 1944, Morrison Formation and related deposits in and adjacent to the Colorado Plateau: Geol. Soc. America Bull., v. 55, no. 8, p. 951-992.
- Stoyanow, A. A., 1926, Notes on recent stratigraphic work in Arizona: Am. Jour. Sci., 5th ser., v. 12, p. 311-324.
- Swanson, D. A., 1969, Reconnaissance geologic map of the east half of the Bend quadrangle, Crook, Wheeler, Jefferson, Wasco, and Deschutes Counties, Oregon: U.S. Geol. Survey Misc. Geol. Inv. Map I-568.
- Tooker, E. W., and Roberts, R. J., 1970, Upper Paleozoic rocks in the Oquirrh Mountains and Bingham mining district, Utah: U.S. Geol. Survey Prof. Paper 629-A, 76 p.
- Turner, D. L., Surdham, R. C., and Hall, C. A., 1970, The Obispo Formation and associated volcanic rocks in the central California Coast Ranges—K-Ar ages and biochronologic significance [abs]: Geol. Soc. America Abs. with Programs, v. 2, no. 2, p. 155.
- Van Alstine, R. E., 1969, Geology and mineral deposits of the Poncha Springs NE quadrangle, Chaffee County, Colorado: U.S. Geol. Survey Prof. Paper 626, 52 p.
- Vedder, J. G., 1970, Geologic map of the Wells Ranch and Elkhorn Hills quadrangles, San Luis Obispo and Kern Counties, California, showing juxtaposed Cenozoic rocks along the San Andreas fault: U.S. Geol. Survey Misc. Geol. Inv. Map I-585.
- Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U.S. Geol. Survey Prof. Paper 624, 67 p.
- Vine, J. D., and Tourtelot, E. B., 1969, Geochemical investigations of some black shales and associated rocks: U.S. Geol. Survey Bull. 1314-A, p. A1-A43.
- Welsh, J. E., and James, A. H., 1961, Pennsylvanian and Permian stratigraphy of the central Oquirrh Mountains, Utah, *in* Geology of the Bingham mining district and northern Oquirrh Mountains: Utah Geol. Soc. Guidebook to the Geology of Utah, no. 16, p. 1-16.
- Whitebread, D. H., 1969, Geologic map of the Wheeler Peak and Garrison quadrangles, Nevada and Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-578.
- Wilhelm, V. H., and Saunders, L. W., 1927, Report on the Mt. Poso oil field: California Oil Fields, v. 12, no. 7, p. 5-12.
- Willden, Ronald, and Kistler, R. W., 1969, Geologic map of the Jiggs quadrangle, Elko County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-859.

- Wilson, L. E., 1935, Miocene marine mammals from the Bakersfield region, California: Peabody Mus. Nat. History Bull., v. 4, p. 1-143.
- Witkind, I. J., Kleinkopf, M. D., and Keefer, W. R., 1970, Geologic and gravity evidence for a buried pluton, Little Belt Mountains, central Montana, in Geological Survey research 1970: U.S. Geol. Survey Prof. Paper 700-B, p. B63-B65.