Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1976

By Norman F. Sohl *and* Wilna B. Wright

CONTRIBUTIONS TO STRATIGRAPHY

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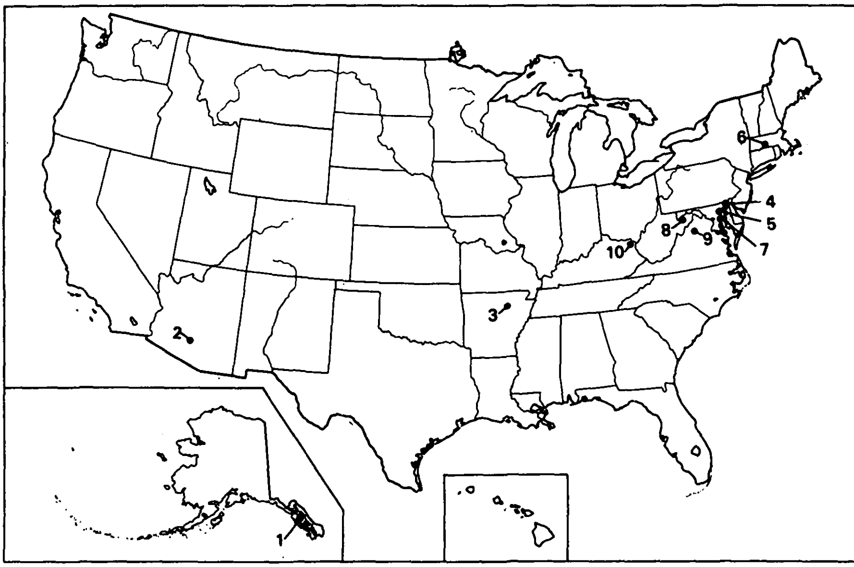

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CHANGES IN STRATIGRAPHIC NOMENCLATURE BY THE U.S. GEOLOGICAL SURVEY, 1976

By NORMAN F. SOHL and WILNA B. WRIGHT

LISTING OF NOMENCLATURAL CHANGES

Of special note in 1976 was the publication of the "International Stratigraphic Guide" edited by H. D. Hedberg (Internat. Union Geol. Sci., Internat. Subcomm. Strat. Classification, 1976) which represents the culmination of a 20-year-study on problems of stratigraphic nomenclature by the International Subcommission on Stratigraphic Classification of the IUGS Commission on Stratigraphy. At the annual meeting of the American Commission on Stratigraphic Nomenclature, November 10, 1976, the Committee to compare the American Code and the International Stratigraphic Guide commended the Guide as an exemplary document. The Committee, however, recommended continued use and modification by amendment or revision of the Code. In this fashion, the Code can continue to express the opinions of North American stratigraphers. Thus, at least for the immediate future, publications of the U.S. Geological Survey will continue to conform to the articles of the Stratigraphic Code.

ALBEMARLE GROUP
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to Cambrian.

ALLOWAY CLAY MEMBER (of Kirkwood Formation)
middle Miocene
southwestern and south-central New Jersey

Nemickas, Bronius, and Carswell, L.D., 1976, Stratigraphic and hydrologic relationship of the Piney Point aquifer and the Alloway Clay Member of the Kirkwood Formation in New Jersey: U.S. Geol. Survey Jour. Research, v. 4, no. 1, p. 1-7.

Alloway Clay of Kummel and Knapp (1904) adopted as Alloway Clay Member of Kirkwood Formation as used by Isphording (1970). Basal member of Kirkwood; probably underlies Shiloh Marl Member.

AMMONIA TANKS MEMBER
(of Timber Mountain Tuff)
(of Piapi Canyon Group)
early Pliocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Stratigraphically extended to include two informal units at base--tuffs of Cat Canyon and Transvaal.

AMSDEN FORMATION
Late Mississippian to Middle Pennsylvanian
Wyoming, Montana, and Idaho

Sando, W.J., Gordon, Mackenzie, Jr., and Dutro, J.T., Jr., 1975, Stratigraphy and geologic history of the Amsden Formation (Mississippian and Pennsylvanian) of Wyoming, Part A: The Amsden Formation (Mississippian and Pennsylvanian) of Wyoming: U.S. Geol. Survey Prof. Paper 848-A, 83 p.

In west-central Wyoming, Moffat Trail Limestone Member adopted, assigned to Amsden Formation, and restricted to mountain ranges of western Wyoming. Conformably overlies or is equivalent to part of Horseshoe Shale Member of Amsden; conformably underlies Ranchester Limestone Member of Amsden.

ANTIMONY TUFF MEMBER (of Mount Dutton Formation)
early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Antimony Tuff Member adopted as member of Mount Dutton Formation (new name) and geographically restricted to southern Sevier Plateau. Intercalated with unnamed volcanic breccia member of Mount Dutton.

ATTEAN QUARTZ MONZONITE
New age: Early Ordovician
Former age: Ordovician(?)
Maine

Boudette, E.L., and Boone, G.M., 1976, Pre-Silurian stratigraphic succession in central western Maine, _in_

Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 79-96.

Age changed from Ordovician(?) to: Early Ordovician.

BALDHILLS TUFF MEMBER (of Isom Formation)
Oligocene and (or) Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Baldhills Member of Mackin (1960) adopted as Baldhills Tuff Member, middle of three members of Isom Formation. Overlies Blue Meadows Tuff Member (new name) of Isom or Needles Range Formation; underlies Hole-In-The-Wall Tuff Member of Isom or Mount Dutton Formation (new name), Bear Valley Formation, or Buckskin Breccia (new name).

BALTIMORE COMPLEX
early Paleozoic
central and northeastern Maryland and
southeastern Pennsylvania

Higgins, M.W., The Baltimore Complex: this report.

Baltimore Complex adopted, but not to be confused with Baltimore Gneiss (formal name in same area).

BANBURY BASALT or FORMATION
New age: Miocene
Former age: middle Pliocene
northeastern Nevada and southwestern Idaho

Covington, H.R., 1976, Geology of the Snake River Canyon near Twin Falls, Idaho: U.S. Geol. Survey Misc. Field Studies Map MF-809, 2 sheets.

Age changed from middle Pliocene to: Miocene.

BASELINE SANDSTONE
New age: Early and Late Createceous
Former age: Late Cretaceous
Arizona and Nevada

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Age changed from Late Cretaceous to: Early and Late Cretaceous.

BAUERS TUFF MEMBER
(of Condor Canyon Formation)
(of Quichapa Group)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Bauers Tuff Member of Quichapa Formation reassigned as upper of two members of Condor Canyon Formation of Quichapa Group (now raised in rank). Overlies Swett Tuff Member of Condor Canyon; intercalated with Mount Dutton Formation (new name).

BEAR CANYON MEMBER (of Oquirrh Formation)
Middle Pennsylvanian (Atokan and Des Moinesian)
north-central Utah

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Bear Canyon Member adopted as one of five named members of Oquirrh Formation. Overlies Bridal Veil Limestone Member of Oquirrh; underlies Shingle Mill Limestone Member of Oquirrh.

BEAR VALLEY FORMATION
Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Bear Valley Formation of Anderson (1966, 1971) adopted. Intercalated with Leach Canyon Formation (now raised in rank); overlies Buckskin Breccia (new name) or Isom Formation.

BEAVER MEMBER (of Mount Dutton Formation)
late Oligocene and (or) early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Beaver Member adopted as member of Mount Dutton Formation (new name) and geographically restricted to southern Tushar Mountains. Intercalated with unnamed volcanic-flow member of Mount Dutton.

BEAVER BROOK MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Beaver Brook Member adopted and assigned to Nashoba Formation as uppermost of ten members. Overlies Long Pond Gneiss Member (new name) of Nashoba; underlies Tadmuck Brook Schist (new name).

BECKERS BUTTE MEMBER (of Martin Formation)
New age: late Middle or early Late Devonian
Former age: Early or Middle Devonian
Arizona

Elston, D.P., and Bressler, S.L., 1976, Correlations of basal Cambrian and Devonian sedimentary rocks, central and northern Arizona, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 158.

Age changed from Early or Middle Devonian to: late Middle or early Late Devonian.

BELLINGHAM DRIFT
(of Everson Interstade)
(of Fraser Glaciation)
Pleistocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Bellingham Glaciomarine Drift of Easterbrook (1963) adopted as Bellingham Drift and assigned to Everson Interstade of Fraser Glaciation. Overlies Deming Sand of Everson; underlies outwash sand and gravel of Sumas Stade.

BELLOWS HILL MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Bellows Hill Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Boxford Member (now reduced from formation rank) of Nashoba; underlies Billerica Schist Member (new name) of Nashoba.

BELUGA FORMATION (of Kenai Group)
New age: late Miocene
Former age: Tertiary
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Age changed from Tertiary to: late Miocene (Homerian Floral Stage).

BENTON SHALE or FORMATION
Early and Late Cretaceous (varies locally)
Montana, Wyoming, Colorado, New Mexico, Nebraska, Minnesota, North and South Dakota, Utah, and Iowa

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

In central Colorado raised in rank to Benton Group and divided into (ascending): Graneros Shale, Greenhorn Limestone, and Carlile Shale. Age of Benton and its Graneros Shale is Late Cretaceous only in this area; age remains Early and Late Cretaceous elsewhere.

BIG ELK SANDSTONE MEMBER (of Colorado Shale)
New age: Early Cretaceous
Former age: Late Cretaceous
Montana

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Age changed from Late Cretaceous to: Early Cretaceous.

BIG ELK CREEK MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland and western Delaware

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Big Elk Creek Member adopted as one of eight members of James Run Formation of Glenarm Group. Overlies Gilpins Falls Member of James Run; probably partly equivalent to Happy Valley Branch and Principio Creek Members (both new names) of James Run.

BIG HORSE LIMESTONE MEMBER (of Orr Formation)
Late Cambrian
western Utah

Hintze, L.F., and Palmer, A.R., 1976, Upper Cambrian Orr Formation--its subdivisions and correlatives in western Utah: U.S. Geol. Survey Bull. 1405-G, 25 p.

Big Horse Limestone Member adopted as lowermost member of Orr Formation. Overlies Weeks Limestone or Wah Wah Summit Formation; underlies Candland or Steamboat Pass Shale Member (both new names) of Orr.

BILLERICA SCHIST MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Billerica Schist Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Bellows Hill Member and underlies Spencer Brook Member (both new names of Nashoba).

BISHOP CONGLOMERATE
New age: Oligocene
Former age: Miocene(?)
Wyoming and Utah

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into northwestern Colorado. Age changed from Miocene(?) to: Oligocene.

BLACK EARTH DOLOMITE MEMBER (of St. Lawrence Formation)
Late Cambrian
Wisconsin and Illinois

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

Reinstated in Wisconsin and Illinois. Geographically extended into east-central Minnesota as Black Earth Member of St. Lawrence Formation. Lower of two named members of St. Lawrence; underlies Lodi Member of St. Lawrence.

BLOOMINGTON FORMATION
Middle Cambrian
northern Utah and southeastern Idaho

Sorensen, M.S., and Crittenden, M.D., Jr., 1976, Preliminary geologic map of the Mantua quadrangle and part of the Willard quadrangle, Box Elder, Weber, and Cache Counties, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-720.

In northwestern Utah, divided into (ascending): Hodges Shale Member, unnamed limestone member, and Calls Fort Shale Member.

BLOOMSBURG RED BEDS or SHALE or FORMATION
(of Cayuga Group)
Late Silurian
Pennsylvania, Maryland, Virginia, and West Virginia

Perry, W.J., Jr., The Williamsport Formation or Sandstone (Upper Silurian) in eastern West Virginia: this report.

Cedar Cliff Limestone Member assigned to Williamsport Formation or Sandstone of Cayuga Group in its western part and to Bloomsburg Formation of Cayuga Group to northeast.

BLUE MEADOWS TUFF MEMBER (of Isom Formation)
late Oligocene and (or) early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Blue Meadows Tuff Member adopted as basal of three members of Isom Formation and geographically restricted to eastern Markagunt Plateau. Overlies Needles Range Formation; underlies Baldhills Tuff Member of Isom; lateral equivalent of unnamed sandstone member of Isom.

BOONE FORMATION
Early and Late Mississippian
Arkansas, Oklahoma, Kansas, and Missouri

Gordon, Mackenzie, Jr., Walls Ferry Limestone Bed of the St. Joe Limestone Member of the Boone Formation: this report.

In Arkansas only, Walls Ferry Limestone redefined as and reduced in rank to Walls Ferry Limestone Bed and assigned to St. Joe Limestone Member of Boone Formation.

BOXFORD FORMATION
New age: pre-Silurian
Former age: Silurian(?) or older
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Reduced from formation rank to Boxford Member and assigned to Nashoba Formation as lowermost of ten members; underlies Bellows Hill Member (new name). Includes part of rocks of Marlboro Formation (now stratigraphically restricted and redefined). Age changed from Silurian(?) or older to: pre-Silurian.

BRIAN HEAD FORMATION
Miocene(?)
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Brian Head Formation abandoned; its rocks now included in parts of Claron, Needles Range, Isom, Leach Canyon, and Mount Dutton (new name) Formations.

BREATHITT FORMATION or GROUP
Early and Middle Pennsylvanian
Kentucky, Tennessee, and Virginia

Rice, C.L., The Vanport Limestone as used by Phalen (1912) in northeastern Kentucky: this report.

Vanport Limestone Member abandoned as member of Breathitt in Kentucky; still remains good usage elsewhere as member or formation of Allegheny Formation or Group. In Kentucky only, informal usage as "Vanport Limestone as used by Phalen (1912)" will be used henceforth.

BUCKSKIN BRECCIA
late Oligocene and (or) early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Buckskin Breccia adopted and geographically restricted to Markagunt and Sevier Plateaus. Overlies Isom Formation; underlies Bear Valley Formation; or intercalated with Mount Dutton Formation (new name).

BUFFALO PEAKS ANDESITE
Oligocene(?)
central Colorado

Sanders, G.F., Jr., Scott, G.R., and Naeser, C.W., 1976, The Buffalo Peaks Andesite of central Colorado: U.S. Geol. Survey Bull. 1405-F, 8 p.

Buffalo Peaks Andesite of Gould (1935) adopted. Overlies unnamed ash-flow tuff; top is eroded.

BULLFROG MEMBER (of Crater Flat Tuff)
Miocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Bullfrog Member adopted as lower of two members of Crater Flat Tuff (new name). Overlies Redrock Valley Tuff (new name); underlies Prow Pass Member (new name) of Crater Flat.

BULLION CANYON VOLCANICS
New age: Oligocene and Miocene(?)
Former age: Oligocene
southwestern Utah

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Oligocene to: Oligocene and Miocene(?).

BURLINGTON FORMATION
pre-Silurian (late Precambrian? to Ordovician?)
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Burlington Formation adopted. Overlies Greenleaf Mountain Formation and Middlesex Fells Volcanic Complex (both new names); underlies Marlboro Formation (now stratigraphically restricted and redefined).

CALIENTE FORMATION
New age: Miocene
Former age: Oligocene(?), Miocene, and Pliocene
California

Bohannon, R.G., 1975, Mid-Tertiary conglomerates and their bearing on Transverse Range tectonics, southern California, _in_ Crowell, J.C., ed., San Andreas fault in southern California; a guide to San Andreas fault from Mexico to Carrizo Plain: California Div. Mines and Geology, Spec. Rept., no. 118, p. 75-82.

Age changed from Oligocene(?), Miocene, and Pliocene to: Miocene.

CALLS FORT SHALE MEMBER (of Bloomington Formation)
Middle Cambrian
northwestern Utah

Sorensen, M.L., and Crittenden, M.D., Jr., 1976, Preliminary geologic map of the Mantua quadrangle and part of the Willard quadrangle, Box Elder, Weber, and Cache Counties, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-720.

Calls Fort Shale Member of Maxey (1958) adopted as upper of three members of Bloomington Formation. Overlies unnamed limestone member of Bloomington.

CALOSO MEMBER (of Kelly Limestone)
Early Mississippian (Keokuk)
west-central New Mexico

Armstrong, A.K., and Mamet, B.L., 1976, Biostratigraphy and regional relations of the Mississippian Leadville Limestone of the San Juan Mountains, southwestern Colorado: U.S. Geol. Survey Prof. Paper 985, 25 p.

Caloso Formation of Kelley and Silver (1952) adopted as Caloso Member, lower of two members of Kelly Limestone (geographically restricted). Unconformably overlies Precambrian rocks; unconformably underlies Ladron Member (new name) of Kelly.

CANDLAND SHALE MEMBER (of Orr Formation)
Late Cambrian
western Utah

Hintze, L.F., and Palmer, A.R., 1976, Upper Cambrian Orr Formation--its subdivisions and correlatives in western Utah: U.S. Geol. Survey Bull. 1405-G, 25 p.

Candland Shale Member of Orr Formation adopted. Conformably overlies Big Horse Limestone Member (new name) of Orr; conformably underlies John Wash Limestone Member of Orr.

CAPE HORN SLATE
Mississippian
California

Clark, L.D., 1976, Stratigraphy of the north half of the western Sierra Nevada metamorphic belt, California: U.S. Geol. Survey Prof. Paper 923, 26 p.

Cape Horn Slate abandoned; part of its rocks now included in epiclastic rocks of Late Jurassic age and part in Cosumnes-type rocks.

CARDENAS LAVAS
(of Unkar Group)
(of Grand Canyon Supergroup)
Precambrian
north-central Arizona

Elston, D.P., and Scott, G.R., 1976, Unconformity at the Cardenas-Nankoweap contact (Precambrian), Grand Canyon Supergroup, northern Arizona: Geol. Soc. America Bull., v. 87, no. 12, p. 1765-1772.

Cardenas Lava Series of Keyes (1938) adopted as Cardenas Lavas, uppermost of six formations of Unkar Group of Grand Canyon Supergroup. Conformably overlies Dox Sandstone of Unkar; unconformably underlies Nankoweap Formation (formerly Nankoweap Group of Van Gundy, 1934, 1951).

CARLILE SHALE (of Colorado Group)
CARLILE SHALE MEMBER (of Mancos or Cody or Colorado Shale)
Late Cretaceous
Colorado, Nebraska, North and South Dakota, Wyoming, Montana, Kansas, Iowa, and New Mexico

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

In central Colorado assigned as uppermost of three formations of Benton Group (raised in rank); overlies Greenhorn Limestone of Benton.

CARMAN SANDSTONE MEMBER (of Etchegoin Formation)
New age: late Pliocene
Former age: late Miocene
southern California

Lanphere, M.A., and Dalrymple, G.B., 1976, Correlative late Cenozoic tephra, California and western Nevada, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 79-80.

Age of Etchegoin and its members changed from late Miocene to: late Pliocene.

CASPER FORMATION
New age: Middle and Late Pennsylvanian and Early Permian (varies)
Former age: Early, Middle, and Late Pennsylvanian and Early Permian (varies)
Wyoming and Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Early, Middle, and Late Pennsylvanian and Early Permian (varies) to: Middle and Late Pennsylvanian and Early Permian (varies).

CAVE MOUNTAIN FORMATION
Triassic
northern Washington

Rinehart, C.D., and Fox, K.F., Jr., 1976, Bedrock geology of the Conconully quadrangle, Okanogan County, Washington: U.S. Geol. Survey Bull. 1402, 58 p.

Cave Mountain Formation adopted. Overlies, with probable unconformity, Anarchist Group; conformably underlies Triassic metamorphic complex of Conconully; includes five unnamed members.

CAYUGA GROUP or SERIES or DOLOMITE
Late Silurian and Early Devonian
New York, Pennsylvania, Ohio, Maryland, Virginia, and West Virginia

Perry, W.J., Jr., The Williamsport Formation or Sandstone (Upper Silurian) in eastern West Virginia: this report.

Williamsport Formation or Sandstone and its member, Cedar Cliff Limestone Member, included in Cayuga Group.

CEDAR CLIFF LIMESTONE MEMBER
(of Williamsport Formation or Sandstone) or
(of Bloomsburg Formation)
(of Cayuga Group)
Late Silurian
northeastern West Virginia, northwestern Virginia, south-central Pennsylvania, and western Maryland

Perry, W.J., Jr., The Williamsport Formation or Sandstone (Upper Silurian) in eastern West Virginia: this report.

Cedar Cliff Limestone Lens of Swartz (1923) adopted as Cedar Cliff Limestone Member of Williamsport Sandstone as used by Woodward (1941). Assigned to Williamsport Formation or Sandstone of Cayuga Group in western part and to Bloomsburg Formation of Cayuga to northeast.

CHESTERFIELD RANGE GROUP
New age: Early and Late Mississippian (Osagean and Meramecian)
Former age: Late Mississippian
southeastern Idaho and northeastern Utah

Sando, W.J., Dutro, J.T., Jr., Sandberg, C.A., and Mamet, B.L., 1976, Revision of Mississippian stratigraphy, eastern Idaho and northeastern Utah: U.S. Geol. Survey Jour. Research, v. 4, no. 4.
Age changed from Late Mississippian to: Early and Late Mississippian (Osagean and Meramecian) based on age of Little Flat Formation.

CHILSON MEMBER (of Lakota Formation)
Early Cretaceous
South Dakota and Wyoming

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into Black Hills uplift area of Montana.

CHINO VALLEY FORMATION
New age: Devonian
Former age: Cambrian(?)
northwestern Arizona

Hereford, Richard, 1977, Deposition of the Tapeats Sandstone (Cambrian) in central Arizona: Geol. Soc. America Bull., v. 88, no. 2, p. 199-211.

Age of Chino Valley Formation changed from Cambrian(?) to: Devonian.

CHINQUAPIN METABASALT MEMBER
(of South Fork Mountain Schist)
New age: Early Cretaceous
Former age: Late(?) Cretaceous
northwestern California

Lanphere, M.A., Blake, M.C., Jr., and Irwin, W.P., 1976, Early Cretaceous metamorphic age, South Fork Mountain Schist, northern Coast Ranges [California], in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 77-78.

Age changed from Late(?) Cretaceous to: Early Cretaceous.

CHOPAWAMSIC FORMATION (of Glenarm Group)
New age: early Paleozoic
Former age: Early Cambrian
northern Virginia

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Age changed from Early Cambrian to: early Paleozoic based on correlation with James Run Formation.

CHUCKANUT FORMATION
New age: Late Cretaceous(?) and Paleocene
Former age: Late Cretaceous and Paleocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Age changed from Late Cretaceous and Paleocene to: Late Cretaceous(?) and Paleocene.

CID FORMATION (of Albemarle Group)
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to Cambrian.

CLARON FORMATION

New age: Eocene and Oligocene
Former age: Eocene(?)
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Eocene(?) to: Eocene and Oligocene.

CLAY CITY BED

(of Farmers Member)
(of Borden Formation)
Early Mississippian
east-central Kentucky

Weir, G.W., 1976, Geologic map of the Means quadrangle, east-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1324.

Clay City Siltstone Member of Stockdale (1939) adopted as Clay City Bed of Farmers Member of Borden Formation.

CLEAR LAKE VOLCANICS

late Pliocene(?) to Holocene
northern California

Hearn,B.C., Jr., Donnelly, J.M., and Goff, F.E., 1976, Geology and geochronology of the Clear Lake Volcanics, California, in United Nations Symposium on the Development and Use of Geothermal Resources, 2d, San Francisco, California, USA, May 20-29, 1975: Proc., v. 1, p. 423-428.

Clear Lake Volcanic series of Brice (1953) adopted as Clear Lake Volcanics as used by California Department of Water Resources (1962).

CLINTON FORMATION or SHALE or GROUP
Middle Silurian
New York, Pennsylvania, Michigan,
West Virginia, Ohio, and Kentucky

Miller. R.L., 1976, Silurian nomenclature and correlations in southwest Virginia and northeast Tennessee: U.S. Geol. Survey Bull. 1405-H, 25 p.

Geographically restricted from Virginia and Tennessee; replaced by Rose Hill Formation (now geographically extended into southwestern Virginia and northeastern Tennessee). Clinton Formation or Shale or Group still in good usage elsewhere.

COAL VALLEY FORMATION
late Miocene to middle Pliocene
western Nevada

Whitebread, D.H., 1976, Alteration and geochemistry of Tertiary volcanic rocks in parts of the Virginia City quadrangle, Nevada: U.S. Geol. Survey Prof. Paper 936, 43 p.

Coal Valley Formation of Axelrod (1956) adopted; replaces Truckee Formation (now geographically restricted from Virginia Range, Storey County, western Nevada).

COCHETOPA PARK MEMBER (of Nelson Mountain Tuff)
late Oligocene
southwestern Colorado

Steven, T.A., and Lipman, P.W., 1976, Calderas of the San Juan volcanic field, southwestern Colorado: U.S. Geol. Survey Prof. Paper 958, 35 p.

Removed from Nelson Mountain Tuff and raised to

COLLIER SHALE
New age: Early Ordovician
Former age: Cambrian
Arkansas and Oklahoma

Haley, B.R., 1976, Geologic map of Arkansas: U.S. Geol. Survey Spec. Map.

Age changed from Cambrian to: Early Ordovician.

COLTON FORMATION
New age: late Paleocene and early Eocene
Former age: Eocene
central Utah

Fouch, T.D., 1976, Revision of the lower part of the Tertiary System in the central and western Uinta Basin, Utah: U.S. Geol. Survey Bull. 1405-C, 7 p.

Age changed from Eocene to: Paleocene and Eocene.

COLUMBIA RIVER GROUP or COLUMBIA RIVER BASALT
middle Miocene to early Pliocene
Washington, Oregon, and Idaho

Griggs, A.B., 1976, The Columbia River Basalt Group in the Spokane quadrangle, Washington, Idaho, and Montana: U.S. Geol. Survey Bull. 1413, 39 p.

Renamed Columbia River Basalt Group and stratigraphically restricted to exclude Mascall Formation. Now includes (ascending): Picture Gorge Basalt and Yakima Basalt. Columbia River Basalt remains good usage where it can not be subdivided.

CONDOR CANYON FORMATION (of Quichapa Group)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Condor Canyon Formation of Cook (1965) adopted and assigned to Quichapa Group (now raised in rank). Divided into (ascending): Swett and Bauers Tuff Members. Overlies Bear Valley or Mount Dutton (new name) Formation; underlies Bear Valley Formation or is intercalated with Mount Dutton.

COONEY QUARTZ LATITE

New age: Oligocene
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Oligocene.

COWBOY SPRING FORMATION

late Early or early Late Cretaceous
southwestern New Mexico

Ash, S.R., and Read, C.B., 1976, North American species of _Tempskya_ and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Cowboy Spring Formation of Zeller and Alper (1965) adopted. Conformably overlies Mojado Formation; unconformably underlies Timberlake Fanglomerate of Zeller and Alper (1965).

CRANKTOWN SANDSTONE

New age: Oligocene
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Oligocene.

CRATER FLAT TUFF
Miocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Crater Flat Tuff adopted. Divided into (ascending): Bullfrog and Prow Pass Members. Overlies Redrock Valley Tuff (new name); underlies tuffs of Sleeping Butte.

CRYSTAL MOUNTAIN SANDSTONE
New age: Early Ordovician
Former age: Ordovician(?)
Arkansas and Oklahoma

Haley, B.R., 1976, Geologic map of Arkansas: U.S. Geol. Survey Spec. Map.

Age changed from Ordovician(?) to: Early Ordovician.

DALE CITY QUARTZ MONZONITE
Early Cambrian
northeastern Virginia

Seiders, V.N., Mixon, R.B., Stern, T.W., Newell, M.F., and Thomas, C.B., Jr., 1975, Age of plutonism and tectonism and a new minimum age limit on the Glenarm Series in the northeast Virginia Piedmont near Occoquan: Am. Jour. Sci., v. 275, no. 5, p. 481-511.

Dale City Quartz Monzonite adopted. Intrudes Quantico Slate; underlies Cretaceous and younger Coastal Plain sediments.

DARWIN SANDSTONE MEMBER (of Amsden Formation)
New age: Late Mississippian
(early Meramecian to late Chesterian)
Former age: Mississippian
central and northwestern Wyoming

Sando, W.J., Gordon, Mackenzie, Jr., and Dutro, J.T., Jr., 1975, Stratigraphy and geologic history of the Amsden Formation (Mississippian and Pennsylvanian) of Wyoming, Part A: The Amsden Formation (Mississippian and Pennsylvanian) of Wyoming: U.S. Geol. Survey Prof. Paper 848-A, 83 p.

Age changed from Mississippian to: Late Mississippian (early Meramecian to late Chesterian).

DAVIDSON GRANODIORITE
New age: Miocene
Former age: Miocene(?)
Nevada

Whitebread, D.H., 1976, Alteration and geochemistry of Tertiary volcanic rocks in parts of the Virginia City quadrangle, Nevada: U.S. Geol. Survey Prof. Paper 936, 43 p.

Age changed from Miocene(?) to: Miocene.

DEEP CREEK FORMATION
New age: Early and Late Mississippian
(Osagean and Meramecian)
Former age: Mississippian
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

Age changed from Mississippian to: Late Mississippian.

Sando, W.J., Dutro, J.T., Jr., Sandberg, C.A., and Mamet, B.L., 1976, Revision of Mississippian stratigraphy, eastern Idaho and northeastern Utah:

U.S. Geol. Survey Jour. Research, v. 4, no. 4, p. 467-479.

Age changed from Late Mississippian to: Early and Late Mississippian (Oseagean and Meramecian).

DEGONIA SANDSTONE
Late Mississippian (Chesterian)
Kentucky and Illinois

Trace, R.D., 1976, Geologic map of the Lola quadrangle, Livingston and Crittenden Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1288.

Name changed to Degonia Formation for use in Lola quadrangle; remains Degonia Sandstone elsewhere.

DELHI FORMATION
Mississippian
California

Clark, L.D., 1976, Stratigraphy of the north half of the western Sierra Nevada metamorphic belt, California: U.S. Geol. Survey Prof. Paper 923, 26 p.

Delhi Formation abandoned; its rocks now included in undifferentiated chert and argillaceous members of Calaveras Formation.

DEMING SAND
(of Everson Interstade)
(of Fraser Glaciation)
Pleistocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Deming Sand of Easterbrook (1963) adopted and assigned to Everson Interstade of Fraser Glaciation. Overlies Kulshan Drift of Everson; underlies Bellingham Drift of Everson.

DRY CREEK SHALE
DRY CREEK SHALE MEMBER (of Snowy Range Formation)
Late Cambrian
northwestern Wyoming and south-central Montana

Tysdal, R.G., 1976, Paleozoic and Mesozoic stratigraphy of the northern part of the Ruby Range, southwestern Montana: U.S. Geol. Survey Bull. 1405-I, 26 p.

Geographically extended into southwestern Montana, reduced in rank to member, and reassigned to Red Lion Formation as lower of two members. Usage remains unchanged elsewhere.

DRY HOLLOW FORMATION
Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, *in* Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Stratigrahically restricted to rocks as originally adopted by Callaghan (1939); former parts (later redefined and added) now included in Osiris Tuff (new name), Needles Range Formation, and older basalts.

EAGLE ROCK TUFF
early(?) Pliocene(?)
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

Eagle Rock Tuff abandoned; its rocks now replaced by Walcott Tuff following usage of Stearns and Isotoff (1956).

EAGLE VALLEY EVAPORITE or FORMATION
New age: Middle and Late Pennsylvanian
Former age: Middle Pennsylvanian
Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Middle Pennsylvanian to: Middle and Late Pennsylvanian.

EDINBURG FORMATION
Middle Ordovician
north-central Virginia

Rader, E.K., and Perry, W.J., Jr., 1976, Reinterpretation of the geology of Brocks Gap, Rockingham County, Virginia: Virginia Minerals, v. 22, no. 4, p. 37-45.

Edinburg Formation of Cooper and Cooper (1946) adopted. Overlies Lincolnshire Limestone; underlies Martinsburg Shale.

ELK BUTTE MEMBER (of Pierre Shale)
Late Cretaceous
South Dakota and Nebraska

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

ELKHEAD LIMESTONE
Middle Cambrian
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho:

U.S. Geol. Survey Bull. 1399, 115 p.

Elkhead Limestone adopted. Overlies Gibson Jack Formation; underlies Bloomington Formation.

ELKO FORMATION
Oligocene or Eocene
central Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Elko Shale of Emmons (1877) adopted as Elko Formation. Unconformably overlies Paleozoic rocks; unconformably underlies Indian Well Formation (new name).

ELK RIVER BEDS
Pliocene or Pleistocene
southwestern Oregon

Repenning, C.A., 1976, Enhydra and Enhydrioden from the Pacific Coast of North America: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 305-315.

Name changed from Elk River Beds to Elk River Formation.

ELLEMEHAM FORMATION
New age: Late Triassic or Jurassic
Former age: Jurassic or Cretaceous
northern Washington

Fox, K.F., Jr., Rinehart, C.D., and Engels, J.C., 1977, Plutonism and orogeny in north-central Washington--timing and regional context: U.S. Geol. Survey Prof. Paper 989, 27 p.

Age changed from Jurassic or Cretaceous to: Late Triassic or Jurassic.

ELLSWORTH SCHIST
New age: Late Cambrian or Ordovician(?)
Former age: Cambrian(?) and Ordovician(?)
Maine

Stewart, D.B., and Brookins, D.G., 1976, Stratigraphy of the Ellsworth structural block, eastern coastal Maine, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 53-54.

Age changed from Cambrian(?) and Ordovician(?) to: Late Cambrian or Ordovician(?).

ELY GREENSTONE
New age: Precambrian W
Former age: early Precambrian
northeastern Minnesota

Sims, P.K., 1976, Early Precambrian tectonic-igneous evolution in the Vermilion district, northeastern Minnesota: Geol. Soc. America Bull., v. 87, no. 3, p. 379-389.

Divided into (ascending): unnamed lower member, Soudan Iron-formation Member (reduced from formational rank), and unnamed upper member. Age changed from early Precambrian to: Precambrian W.

EQUITY MEMBER (of Rat Creek Tuff)
late Oligocene
southwestern Colorado

Steven, T.A., and Lipman, P.W., 1976, Calderas of the San Juan volcanic field, southwestern Colorado: U.S. Geol. Survey Prof. Paper 958, 35 p.

Removed from Rat Creek Tuff and reassigned to Nelson Mountain Tuff.

ETCHEGOIN FORMATION
New age: late Pliocene
Former age: late Miocene
California

Lanphere, M.A., and Dalrymple, G.B., 1976, Correlative late Cenozoic tephra, California and western Nevada, _in_ Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 79-80.

Age changed from late Miocene to: late Pliocene.

EUREKA QUARTZITE
Middle and Late(?) Ordovician
Nevada, Utah, and California

Compton, R.R., 1975, Geologic map of the Park Valley quadrangle, Box Elder County, Utah, and Cassia County, Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I-873, 6 p. text.

Geographically extended into southeastern Idaho.

EVERSON INTERSTADE (of Fraser Glaciation)
Pleistocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Divided into (ascending): Kulshan Drift, Deming Sand, and Bellingham Drift.

EVINGTON GROUP
early Paleozoic(?)
south-central Virginia

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Slippery Greenstone adopted and assigned to Evington Group as its uppermost unit.

FALL RIVER SANDSTONE/FORMATION
(of Inyan Kara Group)
Early Cretaceous
South Dakota, Wyoming, and Montana

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

FANNEY RHYOLITE
New age: Miocene(?)
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Miocene(?).

FARMERS MEMBER (of Borden Formation)
Early Mississippian
Kentucky

Weir, G.W., 1976, Geologic map of the Means quadrangle, east-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1324.

Clay City Siltstone Member of Stockdale (1939) adopted as Clay City Bed of Farmers Member of Borden Formation.

FERNOW QUARTZ LATITE
New age: Oligocene
Former age: middle Eocene
north-central Utah

Morris, H.T., 1975, Geologic map and sections of the Tintic Mountain quadrangle and an adjacent part of the McIntyre quadrangle, Juab and Utah Counties, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-883.

Age changed from middle Eocene to Oligocene.

FLAGSTAFF LIMESTONE
New age: late Paleocene and early Eocene
Former age: late Paleocene and early Eocene(?)
Utah

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Age changed from late Paleocene and early Eocene(?) to late Paleocene and early Eocene.

Fouch, T.D., 1976, Revision of nomenclature of the lower part of the Tertiary System in the central and western Uinta Basin, Utah: U.S. Geol. Survey Bull. 1405-C, 7 p.

Reduced in rank to Flagstaff Member and assigned as basal member of Green River Formation.

FLANNER BEACH FORMATION
Pleistocene (pre-Sangamon?)
eastern North Carolina

Mixon, R.B., and Pilkey, O.H., 1976, Reconnaissance geology of the submerged and emerged Coastal Plain province, Cape Lookout area, North Carolina: U.S. Geol. Survey Prof. Paper 859, 45 p.

Flanner Beach Formation of DuBar and Solliday (1963) adopted and stratigraphically restricted to exclude their Minnesott Ridge sand and other younger Pleistocene beds. Includes three informally named members; unconformably overlies Yorktown Formation.

FLAT SWAMP MEMBER
(of Cid Formation)
(of Albermarle Group)
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to Cambrian.

FLOYD CHURCH MEMBER
(of Cid Formation)
(of Albemarle Group)
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to Cambrian.

FORT POND MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Fort Pond Member adopted and assigned to Nashoba Formation as one of 10 members. Overlies Nagog Pond Gneiss Member and underlies Long Pond Gneiss Member (both new names of Nashoba).

FOUNTAIN FORMATION
New age: Middle and Late Pennsylvanian and Early Permian
Former age: Early, Middle, and Late Pennsylvanian and Early Permian
Colorado and Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Early, Middle, and Late Pennsylvanian and Early Permian to: Middle and Late Pennsylvanian and Early Permian.

FRANCONIA SANDSTONE OR FORMATION
late Cambrian
Minnesota, Michigan, Wisconsin, Iowa, and Illinois

Mcleod, R.S., 1976, A digital-computer model for estimating hydrologic changes in the aquifer system in Dane County, Wisconsin: Univ. Wisconsin Extension--Geol. and Nat. History Survey Inf. Circ. 30, 40 p.

In south-central Wisconsin, divided into (ascending): Ironton Sandstone Member, Mazomanie Sandstone Member (reduced in rank), and Reno Member (newly adopted).

FRASER GLACIATION
Pleistocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Everson Interstade of Fraser divided into (ascending): Kulshan Drift, Deming Sand, and Bellingham Drift.

Miller, R.D., 1975, Surficial geologic map of the Juneau urban area and vicinity, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-885.

Geographically extended into southeastern Alaska.

FRENCHIE CREEK RHYOLITE (of Pony Trail Group)
New age: Late Jurassic
Former age: Late(?) Jurassic
north-central Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Stratigraphically extended to include formerly unnamed rhyolite plug in Pony Trail Group.
Age changed from Late(?) Jurassic to: Late Jurassic.

FRENCHTOWN MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Frenchtown diorite of Grimsley (1894) adopted as Frenchtown Member as redefined in this report. Overlies Principio Furnace Member (new name) of James Run; probably partly equivalent to Little Northeast Creek Member (new name) of James Run; underlies Gilpins Falls Member of James Run.

FRONTIER FORMATION/SANDSTONE/SANDSTONE MEMBER
(of Mancos Shale)
New age: Early and Late Cretaceous
Former age: Late Cretaceous
Wyoming, Colorado, Utah, Idaho, and Montana

Ryer, T.A., 1977, Age of the Frontier Formation, in north-central Utah: Am. Assoc. Petroleum Geologists Bull., v. 61, no. 1, p. 112-116.

Oyster Ridge Sandstone Member of Frontier Formation geographically extended from Wyoming into north-central Utah. Age of Frontier changed from Late Cretaceous to: Early and Late Cretaceous.

FUSON FORMATION/SHALE (of Inyan Kara Group)
Early Cretaceous
South Dakota, Wyoming, Montana, and Nebraska

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

GAMMON FERRUGINOUS MEMBER (of Pierre Shale)
Late Cretaceous
northeastern Wyoming and southeastern Montana

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

GEERTSEN CANYON QUARTZITE
New age: Early Cambrian
Former age: Precambrian Z and Early(?) Cambrian
northern Utah

Sorensen, M.L., and Crittenden, M.D., Jr., 1976, Preliminary geologic map of the Mantua quadrangle and part of the Willard quadrangle, Box Elder, Weber, and Cache Counties, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-720.

Age changed from Precambrian Z and Early(?) Cambrian to: Early Cambrian.

GILPINS FALLS MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland and western Delaware

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Age changed from Late Cambrian to: early Paleozoic. Overlies Frenchtown Member of James Run; underlies Big Elk Creek Member (new name) of James Run.

GLASTONBURY GNEISS

New age: Devonian

Former age: Middle Ordovician to Middle Devonian

Connecticut and Massachusetts

Leo, G.W., Geologic character and revision of the age of the Glastonbury Gneiss: this report.

Age changed from Middle Ordovician to Middle Devonian to: Devonian.

GLENARM GROUP

latest Precambrian to early Paleozoic

Maryland, Pennsylvania, Virginia, New Jersey, and Delaware

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Name changed from Glenarm Series to: Glenarm Group.

GRAND CANYON SERIES

Precambrian

northern Arizona

Elston, D.P., and Scott, G.R., 1976, Unconformity at the Cardenas-Nankoweap contact (Precambrian), Grand Canyon Supergroup, northern Arizona: Geol. Soc. America Bull., v. 87, no. 12, p. 1765-1772.

Name changed to Grand Canyon Supergroup. Includes (ascending): Unkar Group, Nankoweap Formation, and Chuar Group.

GRANEROS SHALE (of Colorado Group)

GRANEROS SHALE MEMBER (of Mancos Shale)

Early and Late Cretaceous

(varies locally)

Colorado, North and South Dakota, Oklahoma, New Mexico, Kansas, Nebraska, and Wyoming

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

In central Colorado assigned as lowermost of three formations of Benton Group (raised in rank); underlies Greenhorn Limestone of Benton. Age is Late Cretaceous only in this area.

GRANGER MOUNTAIN MEMBER (of Oquirrh Formation)
Early Permian (Wolfcampian)
north-central Utah

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Granger Mountain Member adopted as uppermost of five named members of Oquirrh Formation. Overlies Wallsburg Ridge Member (new name) of Oquirrh; underlies Kirkman Limestone.

GREENHORN LIMESTONE or FORMATION or SHALE etc. (of Colorado Group)
Late Cretaceous
Colorado, Kansas, Montana, Nebraska, North and South Dakota, New Mexico, Wyoming, and Oklahoma

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

In central Colorado assigned as middle of three formations of Benton Group (raised in rank). Overlies Graneros Shale of Benton; underlies Carlile Shale of Benton.

GREENLEAF MOUNTAIN FORMATION
pre-Silurian (late Precambrian? to Ordovician?)
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, _in_ Page, L.R., ed., Contributions to the stratigraphy of New

England: Geol. Soc. America Mem. 148, p. 179-216.

Greenleaf Mountain Formation adopted. Unconformably overlies Middlesex Fells Volcanic Complex and underlies Burlington Formation (both new names).

GREEN RIVER FORMATION

New age: late Paleocene and early and middle Eocene (in Utah only)
Former age: early and middle Eocene
Wyoming, Colorado, and Utah

Fouch, T.D., 1976, Revision of nomenclature of the lower part of the Tertiary System in the central and western Uinta Basin, Utah: U.S. Geol. Survey Bull. 1405-C, 7 p.

In Uinta Basin of Utah only, Flagstaff Limestone reduced in rank to Flagstaff Member and assigned as basal member of Green River Formation. Based on age of Flagstaff, Green River age changed from early and middle Eocene to: late Paleocene and early and middle Eocene in Uinta Basin of Utah only; age remains Eocene elsewhere.

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Laney and Wilkins Peak Members and Luman Tongue of Green River Formation geographically extended into Sand Wash basin of northwestern Colorado.

GROUSE MOUNTAIN BASALT

New age: Miocene
Former age: Pliocene(?)
Colorado

Izett, G.A., 1975, Late Cenozoic sedimentation and deformation in northern Colorado and adjoining areas, _in_ Cenozoic history of the southern Rocky Mountains: Geol. Soc. America Mem. 144, p. 179-209.

Age changed from Pliocene(?) to: Miocene.

HAPPY VALLEY BRANCH MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Happy Valley Branch Member adopted as one of eight members of James Run Formation of Glenarm Group. Overlies Gilpins Falls Member of James Run; probably partly equivalent to Big Elk Creek and Principio Creek Members (both new names) of James Run.

HARMONY HILLS TUFF MEMBER (of Quichapa Formation)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Raised in rank to Harmony Hills Tuff and assigned to Quichapa Group (now raised in rank).

HELL-TO-FINISH FORMATION
Early Cretaceous (pre-Aptian? pre-Trinity?)
southwestern New Mexico

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Hell-to-Finish Formation of Zeller (1958) adopted as described in detail by Zeller (1965). Unconformably overlies Concha Limestone; conformably underlies U-Bar Formation.

HEMLOCK CONGLOMERATE (of Kenai Group)
New age: late Oligocene
Former age: Tertiary
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Age changed from Tertiary to: late Oligocene (Angoonian Floral Stage).

HITZ LIMESTONE MEMBER (of Saluda Limestone)
Late Ordovician
Kentucky and Indiana

Kepferle, R.C., 1976, Geologic map of the Fisherville quadrangle, north-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1321.

In Kentucky only, Hitz Limestone Member reduced in rank to Hitz Limestone Bed of Saluda Dolomite Member of Drakes Formation. In Indiana, Hitz remains Hitz Limestone Member of Saluda Formation (name changed from Saluda Limestone to agree with Indiana State usage).

HOOD BAY FORMATION
New age: Middle Ordovician
Former age: Devonian(?)
southeastern Alaska

Carter, Claire, Age of the Hood Bay Formation, Alaska: this report.

Age changed from Devonian(?) to: Middle Ordovician.

HORSE VALLEY FORMATION
Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Horse Valley Formation adopted and geographically restricted to northern Black Mountains. Overlies Mount Dutton Formation (new name); underlies Mount Belknap Rhyolite.

HOT SPRINGS SANDSTONE
Mississippian
Arkansas

Haley, B.R., 1976, Geologic map of Arkansas: U.S. Geol. Survey Spec. Map.

Reduced in rank to Hot Springs Sandstone Member and assigned to Stanley Shale. Overlies and underlies unnamed members of Stanley.

HUICHICA FORMATION
New age: late Pliocene
Former age: Pleistocene
California

Lanphere, M.A., and Dalrymple, G.B., 1976, Correlative late Cenozoic tephra, California and western Nevada, _in_ Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 79-80.

Age changed from Pleistocene to: late Pliocene.

HUMBOLDT FORMATION
New age: late Miocene
Former age: Miocene and Pliocene(?)
Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Stratigraphically restricted to upper Miocene beds that contain much vitric ash and tuffaceous rocks. Age changed from Miocene and Pliocene(?) to: late Miocene.

HURWAL FORMATION
Late Triassic and Early Jurassic
northeastern Oregon

Weis, P.L., Gualtieri, J.L., Cannon, W.F., Tuchek, E.T., McMahan, A.B., and Federspiel, F.E., 1976, Mineral resources of the Eagle Cap Wilderness and adjacent areas, Oregon: U.S. Geol. Survey Bull. 1385-E, 100 p.

Hurwal Formation of Smith and Allen (1941) adopted. Conformably overlies Martin Bridge Formation; upper contact not exposed.

HYRUM DOLOMITE MEMBER (of Jefferson Formation)
New age: Middle and Late Devonian
Former age: Late Devonian
northern Utah and southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

In Power County of southeastern Idaho, raised in rank to Hyrum Dolomite; former usage remains unchanged elsewhere. Age changed from Late Devonian to: Middle and Late Devonian.

IDAVADA VOLCANICS
New age: Miocene
Former age: Miocene and Pliocene
southern Idaho and northern Nevada

Covington, H.R., 1976, Geologic map of the Snake River Canyon near Twin Falls, Idaho: U.S. Geol. Survey Misc. Field Studies Map MF-809, 2 sheets.

Age changed from Miocene and Pliocene to: Miocene.

INDIAN WELL FORMATION
Oligocene
central Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Indian Well Formation adopted. Unconformably overlies Elko Formation and other older Tertiary, Jurassic, and Paleozoic rocks; unconformably underlies Quaternary rocks.

INGLESIDE FORMATION
New age: Early Permian
Former age: Permian
Colorado and Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Permian to: Early Permian.

INSKIP FORMATION
New age: Early Devonian to Mississippian
Former age: Mississippian(?)
Nevada

Whitebread, D.H., and Epstein, A.G., 1976, Age of Inskip Formation, Nevada, _in_ Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 73.

Age changed from Mississippian(?) to: Early Devonian to Mississippian.

ISOM FORMATION
Oligocene and (or) Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Divided into (ascending): Blue Meadows (new name), Baldhills, and Hole-In-The-Wall Tuff Members.

JACOBSVILLE SANDSTONE
New age: Precambrian Y
Former age: Cambrian and (or) Precambrian
northern Michigan

Sims, P.K., and Peterman, Z.E., 1976, Geology and Rb-Sr ages of reactivated Precambrian gneisses and granite in the Marenisco-Watersmeet area, northern Michigan: U.S. Geol. Survey Jour. Research, v. 4, no. 4, p. 405-414.

Age changed from Cambrian and (or) Precambrian to: Precambrian Y.

JAMES RUN FORMATION (of Glenarm Group)
New age: early Paleozoic
Former age: Early Cambrian
northeastern Maryland and western Delaware

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Divided into (ascending): Principio Furnace Member (new), Little Northeast Creek Member (new) = Frenchtown Member, Gilpins Falls Member, Big Elk Creek Member (new) = Principio Creek Member (new), Happy Valley Branch Member (new), and unnamed felsite member. Age changed from Early Cambrian to: early Paleozoic.

JOE LOTT TUFF

New age: Miocene
Former age: Pliocene(?)
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Pliocene(?) to: Miocene.

JORDAN SANDSTONE
JORDAN SANDSTONE MEMBER (of Trempealeau Formation)

Late Cambrian
Minnesota, Wisconsin, Missouri, Illinois, Iowa, and Michigan

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

In southeastern Minnesota and southwestern Wisconsin, Jordan Sandstone includes (ascending): Norwalk Member and Van Oser Member.

KATALLA FORMATION

New age: middle and late(?) Oligocene
Former age: Oligocene and Miocene

Alaska

Miller, D.J., 1975, Geologic map and sections of the central part of the Katalla district, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-722, 2 sheets.

Stratigraphically restricted to exclude rocks below its Split Creek Sandstone Member, rocks included in Tokun Formation, and rocks above its Burls Creek Shale Member (now assigned to unnamed sandstone member of newly adopted Redwood Formation). Point Hey Member of Katalla abandoned; its rocks now included in upper unit of Burls Creek Shale Member of Katalla and unnamed lower sandstone member of overlying Redwood Formation. Puffy Member of Katalla reassigned as upper of two members of Redwood Formation. As so redefined, Katalla now includes (ascending): Split Creek Sandstone Member, Basin Creek Member, and Burls Creek Shale Member. Age changed from Oligocene and Miocene to: middle and late(?) Oligocene.

KATE PEAK FORMATION

New age: middle Miocene
Former age: Miocene and Pliocene(?)
northwestern Nevada

Whitebread, D.H., 1976, Alteration and geochemistry of Tertiary volcanic rocks in parts of the Virginia City quadrangle, Nevada: U.S. Geol. Survey Prof. Paper 936, 43 p.

Age changed from Miocene and Pliocene(?) to: middle Miocene.

KELLY LIMESTONE

Early Mississippian (Osagean)
west-central New Mexico

Armstrong, A.K., and Mamet, B.L., 1976, Biostratigraphy and regional relations of the Mississippian Leadville Limestone of the San Juan Mountains, southwestern Colorado: U.S. Geol. Survey Prof. Paper 985, 25 p.

Geographically restricted to Lemitar, Ladron, and Magdalena Mountains, and Coyote Hills of west-central New Mexico. Divided into (ascending): Caloso Member and unconformably overlying Ladron Member (new name).

KENAI GROUP
Oligocene, Miocene, and Pliocene
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Kenai Group stratigraphically restricted by removal of its lowermost formation, West Foreland Formation. Age remains unchanged.

KINGSTON CANYON TUFF MEMBER (of Mount Dutton Formation)
late Oligocene and (or) early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Kingston Canyon Tuff Member adopted as basal member of Mount Dutton Formation (new name) and geographically restricted to southern Sevier Plateau area. Intercalated with unnamed volcanic breccia member of Mount Dutton.

KIRKWOOD FORMATION
middle Miocene
New Jersey and Pennsylvania

Nemickas, Bronius, and Carswell, L.D., 1976, Stratigraphic and hydrologic relationship of the Piney Point aquifer and the Alloway Clay Member of the Kirkwood Formation in New Jersey: U.S. Geol. Survey Jour. Research, v. 4, no. 1, p. 1-7.

In southwestern and south-central New Jersey, Alloway Clay of Kummel and Knapp (1904) adopted as Alloway Clay Member of Kirkwood Formation as used by Isphording (1970).

KOLOA VOLCANIC SERIES
New age: Pleistocene
Former age: Pleistocene and Holocene
Island of Kauai, The Hawaiian Islands

Burt, R.J., 1976, Availability of ground water for irrigation on the Kekaha-Mana coastal plain, island of Kauai, Hawaii: Hawaii Div. Water and Land Development R-53, 79 p.

Age changed from Pleistocene and Holocene to: Pleistocene.

KRUGER ALKALIC COMPLEX
Jurassic
northern Washington

Fox, K.F., Jr., Rinehart, C.D., and Engels, J.C., 1975, K-Ar age of the Similkameen batholith and Kruger Alkalic Complex, Washington and British Columbia: U.S. Geol. Survey Jour. Research, v. 3, no. 1, p. 39-43.

Kruger alkaline body of Daly (1906, 1912) adopted, renamed Kruger Alkalic Complex, and geographically extended into northern Washington from British Columbia Canada. Intruded by Similkameen batholith.

KULSHAN DRIFT (of Everson Interstade)
(of Fraser Glaciation)
Pleistocene
northwestern Washington

Easterbrook, D.J., 1976, Geologic map of western Whatcom County, Washington: U.S. Geol. Survey Misc. Geol. Inv. Map I-854-B.

Kulshan Glaciomarine Drift of Easterbrook (1963) adopted as Kulshan Drift and assigned to Everson Interstade of Fraser Glaciation. Overlies Vashon Till; underlies Deming Sand of Everson.

LA CASA MEMBER (of Wild Cow Formation)
(of Madera Group)
New age: Late Pennsylvanian and Early Permian
Former age: Late Pennsylvanian
central New Mexico

Myers, D.A., and McKay, E.J., 1976, Geologic map of the north end of the Manzano Mountains, Tijeras and Sedillo quadrangles, Bernalillo County, New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I-968.

Age changed from Late Pennsylvanian to: Late Pennsylvanian and Early Permian.

LADRON MEMBER (of Kelly Limestone)
Early Mississippian (Keokuk)
west-central New Mexico

Armstrong, A.K., and Mamet, B.L., 1976, Biostratigraphy and regional relations of the Mississippian Leadville Limestone of the San Juan Mountains, southwestern Colorado: U.S. Geol. Survey Prof. Paper 985, 25 p.

Ladron Member adopted as upper of two members of Kelly Limestone. Unconformably overlies Caloso Member of Kelly; unconformably underlies Sandia Formation.

LAGUNA SPRINGS LATITE
New age: Oligocene
Former age: middle Eocene
north-central Utah

Morris, H.T., 1975, Geologic map and sections of the Tintic Mountain quadrangle and an adjacent part of the McIntyre quadrangle, Juab and Utah Counties, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-883.

Age changed from middle Eocene to: Oligocene.

LAIRD SANDSTONE
New age: early Paleocene (Ynezian)
Former age: Miocene(?)
California

Nilsen, T.H., and Clarke, S.H., Jr., 1975, Sedimentation and tectonics in the early Tertiary continental borderland of central California: U.S. Geol. Survey Prof. Paper 925, 64 p.

Age changed from Miocene(?) to: early Paleocene (Ynezian).

LAKE VERMILION FORMATION
Precambrian W
northeastern Minnesota

Sims, P.K., 1976, Early Precambrian tectonic-igneous evolution in the Vermilion district, northeastern Minnesota: Geol. Soc. America Bull., v. 87, no. 3, p. 379-389.

Lake Vermilion Formation of Morey, Green, Ojakangas and Sims (1970) adopted. Overlies Ely Greenstone; underlies Knife Lake Group or Newton Lake Formation.

LAKOTA FORMATION or SANDSTONE (of Inyan Kara Group)
Early Cretaceous
South Dakota, Wyoming, Montana, and Nebraska

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

LANEY MEMBER (of Green River Formation)
middle Eocene
southwestern Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into northwestern Colorado.

LARIMER SANDSTONE MEMBER (of Pierre Shale)
Late Cretaceous
northeastern Colorado

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

LAST CHANCE ANDESITE
New age: Miocene and Miocene(?)
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Miocene and Miocene(?).

LEACH CANYON TUFF MEMBER (of Quichapa Formation)
Miocene (K-Ar age - 22.3-24.0 m.y.)
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Raised in rank to Leach Canyon Formation of Quichapa Group (now raised in rank). Divided into (ascending): Narrows and Table Butte Tuff Members.

LIBERTYTOWN METARHYOLITE
late Precambrian or early Paleozoic
western Maryland

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Libertytown Metarhyolite of Stose and Stose (1946) adopted. Overlies Wakefield Marble; interfingers with Sams Creek Formation and Ijamsville Phyllite.

LINK SPRING TUFF MEMBER (of South Park Formation)
Paleocene
central Colorado

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

Link Spring Tuff Member adopted as one of four members of South Park Formation. Overlies unnamed conglomeratic member of South Park; underlies uppermost unnamed arkosic member of South Park.

LITTLE CREEK FORMATION
New age: late Pliocene or early Pleistocene
Former age: Pleistocene(?)
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

Stratigraphically restricted by reassignment of its uppermost basalt to Massacre Volcanics. Age changed from Pleistocene(?) to: late Pliocene or early Pleistocene.

LITTLE FLAT FORMATION (of Chesterfield Range Group)
New age: Early and Late Mississippian (Osagean and Meramecian)
Former age: Late Mississippian
southeastern Idaho and northeastern Utah

Sando, W.J., Dutro, J.T., Jr., Sandberg, C.A., and Mamet, B.L., 1976, Revision of Mississippian stratigraphy, eastern Idaho and northeastern Utah: U.S. Geol. Survey Jour. Research, v. 4, no. 4, p. 467-479.

Age changed from Late Mississippian to: Early and Late Mississippian (Osagean and Meramecian).

LITTLE NORTHEAST CREEK MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Little Northeast Creek Member adopted as one of eight members of James Run Formation of Glenarm Group. Overlies (and probably partly equivalent to) Principio Furnace Member of James Run (new name), partly equivalent to Frenchtown Member of James Run, underlies Gilpins Falls Member of James Run.

LODI SHALE MEMBER (of St. Lawrence Formation)
LODI MEMBER (of Trempealeau Formation)
Late Cambrian
Wisconsin, Minnesota, Michigan, and Iowa

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

In southeastern Minnesota, name changed to Lodi Member of St. Lawrence Formation. Overlies Black Earth Member of St. Lawrence (now reinstated).

LONG POND GNEISS MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Long Pond Gneiss Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Fort Pond Member and underlies Beaver Brook Member (both new names of Nashoba).

LUMAN TONGUE (of Green River Formation)
early Eocene
southwestern Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into northwestern Colorado.

LUND TUFF MEMBER (of Needles Range Formation)
Oligocene
southwestern Utah

Best, M.G., 1976, Geologic map of the Lopers Spring quadrangle, Beaver County, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-739.

Lund Tuff Member of Best and others (1973) adopted as uppermost member of Needles Range Formation in map area. Conformably overlies Wah Wah Springs Tuff Member of Needles Range; unconformably underlies Isom Formation.

LYKINS FORMATION
New age: Late Permian and Early Triassic
Former age: Permian and Triassic(?)
Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Permian and Triassic(?) to: Late Permian and Early Triassic.

MADERA LIMESTONE or FORMATION or GROUP
Middle and Upper Pennsylvanian and Lower Permian (varies)
New Mexico

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into Colorado as Madera Formation where age range is limited to Middle Pennsylvanian only. Age remains unchanged in New Mexico.

MARLBORO FORMATION
New age: Precambrian Z(?) to early Paleozoic
Former age: Precambrian(?)
Massachusetts and Rhode Island

Nelson, A.E., 1975, Bedrock geologic map of the Framingham quadrangle, Middlesex and Worcester Counties, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-1274.

Age changed from Precambrian(?) to Precambrian Z(?) to early Paleozoic.

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, _in_ Page,

L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Stratigraphically restricted and redefined to exclude parts now replaced by Middlesex Fells Volcanic Complex and Greenleaf Mountain Formation (both new names) and Boxford Member (now reduced in rank) of Nashoba Formation. Divided into (ascending): unnamed lower member and Sandy Pond Amphibolite Member.

MARTINSBURG SHALE or FORMATION
Middle and Late Ordovician
West Virginia, Virginia, Maryland, Pennsylvania, and New Jersey

Perry, W.J., Jr., The Massanutten Sandstone in Rockinham, Page, Shenandoah, and Warren Counties, Virginia: this report.

Stratigraphically extended to include so-called lower member of Massanutten Sandstone (now reinstated and stratigraphically restricted).

MARYSVILLE CLAYSTONE MEMBER (of Meganos Formation)
New age: late Paleocene (Bulitian)
Former age: early Eocene
northern California

Nilsen, T.H., and Clarke, S.H., Jr., 1975, Sedimentation and tectonics in the early Tertiary continental borderland of central California: U.S. Geol. Survey Prof. Paper 925, 64 p.

Age changed from early Eocene to: late Paleocene (Bulitian).

MASCALL FORMATION (of Columbia River Group)
upper Miocene
Oregon

Griggs, A.B., 1976, The Columbia River Basalt Group in the Spokane quadrangle, Washington, Idaho, and Montana: U.S. Geol. Survey Bull. 1413, 39 p.

Removed from Columbia River Group (now renamed and stratigraphically restricted).

MASSACRE VOLCANICS

New age: late Pliocene or early Pleistocene
Former age: Pleistocene(?)
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

Stratigraphically extended by inclusion of uppermost basalt from Little Creek Formation. Age changed from Pleistocene(?) to: late Pliocene or early Pleistocene.

MASSACRE BAY FORMATION

New age: Miocene
Former age: late Tertiary or early Pleistocene
southwestern Alaska

Scholl, D.W., Marlow, M.S., MacLeod, N.S., and Buffington, E.C., 1976, Episodic Aleutian Ridge igneous activity: implications of Miocene and younger submarine volcanism west of Buldir Island: Geol. Soc. America Bull., v. 87, no. 4, p. 547-554.

Age changed from late Tertiary or early Pleistocene to: Miocene.

MASSANUTTEN SANDSTONE

New age: Early and Middle Silurian and younger(?)
Former age: Late Ordovician and Silurian
Virginia

Perry, W.J., Jr., The Massanutten Sandstone in Rockinham, Page, Shenandoah, and Warren Counties, Virginia: this report.

Massanutten Sandstone reinstated to include thick sequence of sandstone and conglomerate occurring between overlying Bloomsburg Formation and underlying Martinsburg Shale (now stratigraphically extended to include former so-called lower member of Massanutten) in this isolated area only. Age now considered to be entirely Silurian (Early and Middle) and correlative of Tuscarora Sandstone, Rose Hill Formation, and Keefer Sandstone and younger(?).

MATTHES GLACIATION
Holocene
eastern California

Sercelj, Alojz, and Adam, D.P., 1975, A late Holocene pollen diagram from near Lake Tahoe, El Dorado County, California: U.S. Geol. Survey Jour. Research, v. 3, no. 6, p. 737-745.

Matthes glacial stage of Wahrhaftig (1962) adopted as Matthes Glaciation as used by Birman (1964). Youngest glaciation in area; preceded by Recess Peak Glaciation.

MAZOMANIE SANDSTONE
Late Cambrian
eastern Wisconsin
eastern Wisconsin

Mcleod, R.S., 1976, A digital-computer model for estimating hydrologic changes in the aquifer system in Dane County, Wisconsin: Univ. Wisconsin Extension--Geol. and Nat. History Survey Inf. Circ. 30, 40 p.

In south-central Wisconsin (by geographical extension), rank reduced to Mazomanie Sandstone Member and assigned as middle of three members of Franconia Sandstone. Overlies Ironton Sandstone Member and underlies Reno Member, both of Franconia.

McGOWAN CREEK FORMATION
New age: Early and Late Mississippian (Kinderhookian, Osagean, and Meramecian)
Former age: Early Mississippian (Kinderhookian and Osagean)
east-central Idaho

Sando, W.J., Dutro, J.T., Jr., Sandberg, C.A., and Mamet, B.L., 1976, Revision of Mississippian stratigraphy, eastern Idaho and northeastern Utah: U.S. Geol. Survey Jour. Research, v. 4, no. 4, p. 467-479.

Age changed from Early Mississippian (Kinderhookian and Osagean) to: Early and Late Mississippian (Kinderhookian, Osagean, and Meramecian).

McGRATH GNEISS
Precambrian W
central Minnesota

Morey, G.B., and Sims, P.K., 1976, Boundary between two Precambrian W terranes in Minnesota and its geologic significance: Geol. Soc. America Bull., v. 87, no. 1, p. 141-152.

McGrath Gneiss of Woyski (1949) adopted; bounded by unnamed metasedimentary rocks of Precambrian X age.

McMONNIGAL LIMESTONE
New age: Early Devonian
Former age: Silurian and Devonian
central Nevada

McKee, E.H., 1976, Geology of the northern part of the Toquima Range, Lander, Eureka, and Nye Counties, Nevada: U.S. Geol. Survey Prof. Paper 931, 49 p.

Age changed from Silurian and Devonian to: Early Devonian.

MEGANOS FORMATION
New age: late Paleocene (Bulitian)
Former age: early Eocene
northern and central California

Nilsen, T.H., and Clarke, S.H., Jr., 1975, Sedimentation and tectonics in the early Tertiary continental borderland of central California: U.S. Geol. Survey Prof. Paper 925, 64 p.

Age changed from early Eocene to: late Paleocene (Bulitian).

MENDOTA DOLOMITE MEMBER (of St. Lawrence Formation)
Late Cambrian
Wisconsin

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

Mendota Dolomite Member abandoned; replaced by Black Earth (Dolomite) Member (now reinstated).

MIDDLESEX FELLS VOLCANIC COMPLEX
pre-Silurian (Precambrian?)
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Middlesex Fells Volcanic Complex adopted. Conformably overlies Westboro Formation; intruded by Dedham Granodiorite; unconformably underlies Greenleaf Mountain Formation and Burlington Formation (both new names).

MIFFLINTOWN FORMATION or LIMESTONE
Middle Silurian
south-central Pennsylvania

Perry, W.J., Jr., 1975, Tectonics of the western Valley and Ridge foldbelt, Pendleton County, West Virginia--a summary report: U.S. Geol. Survey Jour. Research, v. 3, no. 5, p. 583-588.

Geographically extended into West Virginia.

MILFORD GRANITE
New age: Precambrian Z to early Paleozoic(?)
Former age: Devonian(?)
Massachusetts and Rhode Island

Nelson, A.E., 1975, Bedrock geologic map of the

Framingham quadrangle, Middlesex and Worcester Counties, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-1274.

Age changed from Devonian(?) to: Precambrian Z to early Paleozoic(?).

MILLBORO SHALE
Middle and Late Devonian
north-central Virginia

Rader, E.K., and Perry, W.J., Jr., 1976, Reinterpretation of the geology of Brocks Gap, Rockingham County, Virginia: Virginia Minerals, v. 22, no. 4, p. 37-45.

Millboro Shale of Cooper (1939) adopted. Overlies Needmore Shale; underlies Brallier Formation.

MILLINGPORT FORMATION (of Albemarle Group)
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to: Cambrian.

MILTON FORMATION
New age: Middle or Late Jurassic
Former age: Jurassic
California and Nevada

Clark, L.D., 1976, Stratigraphy of the north half of the western Sierra Nevada metamorphic belt, California: U.S. Geol. Survey Prof. Paper 923, 26 p.

Age changed from Jurassic to: Middle or Late Jurassic.

MINERAL CREEK ANDESITE
New age: Miocene(?)
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Miocene(?).

MINERSVILLE TUFF MEMBER (of Needles Range Formation)
New age: middle to late Oligocene
Former age: middle Tertiary
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from middle Tertiary to: middle to late Oligocene.

MITTEN BLACK SHALE MEMBER (of Pierre Shale)
Late Cretaceous
northeastern Wyoming and southeastern Montana

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

MOBRIDGE MEMBER (of Pierre Shale)
Late Cretaceous
South Dakota and Nebraska

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

MOFFAT TRAIL LIMESTONE MEMBER (of Amsden Formation)
Late Mississippian (middle and late Chesterian)
west-central Wyoming

Sando, W.J., Gordon, Mackenzie, Jr., and Dutro, J.T., Jr., 1975, Stratigraphy and geologic history of the Amsden Formation (Mississippian and Pennsylvanian) of Wyoming, Part A: The Amsden Formation (Mississippian and Pennsylvanian) of Wyoming: U.S. Geol. Survey Prof. Paper 848-A, 83 p.

Moffat Trail Limestone Member adopted and restricted to mountain ranges of western Wyoming. Conformably overlies or is equivalent to part of Horseshoe Shale Member of Amsden; conformably underlies Ranchester Limestone Member of Amsden.

MOGOLLON ANDESITE
New age: Miocene and Miocene(?)
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Miocene and Miocene(?).

MOJADO FORMATION
Early Cretaceous (Albian Fredericksburg-Washita)
southwestern New Mexico

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Mojado Formation of Zeller (1958) adopted as described in detail by Zeller (1965). Conformably overlies U-Bar Formation; unconformably underlies Cowboy Spring Formation. Divided into two informal members, lower and upper.

MONMOUTH FORMATION or GROUP

Late Cretaceous
New Jersey, New York, Maryland, and Pennsylvania

Minard, J.P., Sohl, N.F., and Owens, J.P., Re-introduction of the Severn Formation (Upper Cretaceous) to replace the Monmouth Formation in Maryland: this report.

Geographically restricted from Maryland; its rocks now included in Severn Formation (now reintroduced and reinstated in northeastern Maryland and northern Delaware). Monmouth Group still remains in good usage in New Jersey, New York, and Pennsylvania.

MORGAN FORMATION

New age: Middle Pennsylvanian
Former age: Early, Middle, and Late Pennsylvanian
BOTH AGES in COLORADO only
Utah, Wyoming, and Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

In Colorado only, age changed from Early, Middle, and Late Pennsylvanian to: Middle Pennsylvanian. Age remains unchanged in Utah and Wyoming.

MOUNT BELKNAP RHYOLITE

New age: Miocene (K-Ar age 20 m.y.)
Former age: Pliocene(?)
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 197.
A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Pliocene(?) to: Miocene (K-Ar age 20 m.y.).

MOUNT DUTTON FORMATION
late Oligocene and (or) early Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Mount Dutton Formation adopted. Locally divided into (ascending): in northern Black Mountains, unnamed volcanic breccia member; in southern Tushar Mountains Beaver Member (new name) and unnamed flow-volcanic breccia and sandstone members; in Markagunt Plateau, unnamed volcanic breccia member; and in Awapa, Fish Lake, and Sevier Plateaus, Kingston Canyon and Antimony Tuff Members (both new names) intercalated with unnamed volcanic breccia member. Overlies Isom or Needles Range Formation; underlies Horse Valley (new name) or Dry Hollow Formation; underlies or intercalated with Condor Canyon Formation or Osiris Tuff (new name).

MOUNT LAUREL SAND (of Monmouth Group - New Jersey and Pennsylvania only)
Late Cretaceous
New Jersey, Maryland, Pennsylvania, and Delaware

Minard, J.P., Sohl, N.F., and Owens, J.P., Re-introduction of the Severn Formation (Upper Cretaceous) to replace the Monmouth Formation in Maryland: this report.

Stratigraphically restricted in Maryland and Delaware to its lower part; its rocks in upper part now included in Severn Formation (now reintroduced and reinstated in northeastern Maryland and northern Delaware). Mount Laurel Sand still remains in good usage as lowermost formation of Monmouth Group in New Jersey and Pennsylvania.

MOUNT LORD VOLCANICS
Late Cretaceous
southern Arizona

Dockter, R.D., Mount Lord Volcanics, Pima County, Arizona: this report.

Mount Lord Ignimbrite of Watson (1964a) adopted as Mount Lord Volcanics. Overlies Silver Bell Formation of Richard and Courtright (1960); unconformably underlies Tertiary sedimentary volcanic rocks.

MOWRY SHALE or FORMATION (of Colorado Group)
Early Cretaceous
Wyoming, Montana, South Dakota, Utah, and Colorado

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

NAGOG POND GNEISS MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Nagog Pond Gneiss Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Nashoba Brook Member and underlies Fort Pond Member (both new names of Nashoba).

NANKOWEAP FORMATION (of Grand Canyon Supergroup)
Precambrian
north-central Arizona

Elston, D.P., and Scott, G.R., 1976, Unconformity at the Cardenas-Nankoweap contact (Precambrian), Grand Canyon Supergroup, northern Arizona: Geol. Soc. America Bull., v. 87, no. 12, p. 1765-1772.

Nankoweap Group of Van Gundy (1934, 1951) adopted as Nankoweap Formation, middle division of Grand Canyon Supergroup. Includes unnamed discontinuous ferruginous member and upper member. Disconformably overlies Cardenas Lavas of Unkar Group; disconformably underlies Chuar Group.

NARROWS TUFF MEMBER (of Leach Canyon Formation) (of Quichapa Group)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of

Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Narrows Tuff Member of Williams (1967) adopted as lower of two members of Leach Canyon Formation of Quichapa Group (both now raised in rank). Overlies Hole-In-The-Wall Tuff Member of Isom Formation; underlies Table Butte Tuff Member of Leach Canyon.

NASHOBA FORMATION

New age: pre-Silurian
Former age: early Paleozoic
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Divided into (ascending): Boxford Member (now reduced from formation rank), Bellows Hill Member, Billerica Schist Member, Spencer Brook Member, Tophet Swamp Gneiss Member, Nashoba Brook Member, Nagog Pond Gneiss Member, Fort Pond Member, Long Pond Gneiss Member, and Beaver Brook Member (last nine new names). Age changed from early Paleozoic to: pre-Silurian.

NASHOBA BROOK MEMBER (of Nashoba Formation)

pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Nashoba Brook Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Tophet Swamp Gneiss Member and underlies Nagog Pond Gneiss Member (both new names of Nashoba).

NEEDLES RANGE FORMATION

New age: middle to late Oligocene (K-Ar age - 26.5-30.7 m.y.)

Former age: Tertiary

southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Tertiary to: middle to late Oligocene (K-Ar age 26.5-30.7 m.y.). Includes some rocks formerly assigned to Dry Hollow Formation (now stratigraphically restricted).

Best, M.G., 1976, Geologic map of the Lopers Spring quadrangle, Beaver County, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-739.

Lund Tuff Member of Best and others (1973) adopted as uppermost member of Needles Range Formation in map area. Conformably overlies Wah Wah Springs Tuff Member of Needles Range; unconformably underlies Isom Formation

NELSON MOUNTAIN TUFF

late Oligocene

southwestern and south-central Colorado

Steven, T.A., and Lipman, P.W., 1976, Calderas of the San Juan volcanic field, southwestern Colorado: U.S. Geol. Survey Prof. Paper 958, 35 p.

Equity Member removed from Rat Creek Tuff and reassigned to Nelson Mountain Tuff. Cochetopa Park Member removed from Nelson Mountain Tuff and raised to formation rank as Cochetopa Park Tuff.

NEWARK CANYON FORMATION
New age: Early and Late Cretaceous
Former age: Early Cretaceous
Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Age changed from Early Cretaceous to: Early and Late Cretaceous.

NEWBURY VOLCANIC COMPLEX
New age: Late Silurian (Pridoli) and Early Devonian(?) (Gedinnian?)
Former age: Late(?) Silurian or Early(?) Devonian
Massachusetts

Shride, A.F., 1976, Stratigraphy and correlation of the Newbury Volcanic Complex, northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 147-177.

Age changed from Late(?) Silurian or Early(?) Devonian to: Late Silurian (Pridoli) and Early Devonian(?) (Gedinnian?).

NEW RICHMOND SANDSTONE (of Prairie du Chien Group)
Early Ordovician
Minnesota, Illinois, Michigan, and Wisconsin

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

In southeastern Minnesota, reduced in rank to New Richmond Sandstone Member and assigned to Shakopee Formation of Prairie du Chien Group as lower of its two named members. Underlies Willow River Dolomite

Member of Shakopee.

NEWTON LAKE FORMATION
Precambrian W
northeastern Minnesota

Sims, P.K., 1976, Early Precambrian tectonic-igneous evolution in the Vermilion district, northeastern Minnesota: Geol. Soc. America Bull., v. 87, no. 3, p. 379-389.

Newton Lake Formation of Morey, Green, Ojakangas, and Sims (1970) adopted. Overlies Knife Lake Group or Lake Vermilion Formation; underlies granite.

NILAND TONGUE (of Wasatch Formation)
early Eocene
southwestern Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into northwestern Colorado.

NINEMILE FORMATION (of Pogonip Group)
New age: Early and early-Middle Ordovician
Former age: Early Ordovician
central Nevada

McKee, E.H., 1976, Geology of the northern part of the Toquima Range, Lander, Eureka, and Nye Counties, Nevada: U.S. Geol. Survey Prof. Paper 931, 49 p.

Geographically extended into northern Toquima Range, replacing Stoneberger Shale of Kay (1960) and Kay and Crawford (1964) and changing age at this location to Early and early-Middle Ordovician. Age remains Early Ordovician at type Ninemile.

NORWALK SANDSTONE MEMBER (of Jordan Sandstone)
Late Cambrian
western Wisconsin

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

Name changed to Norwalk Member of Jordan Sandstone. Geographically extended into east-central Minnesota.

OCCOQUAN ADAMELLITE
Early Cambrian
northeastern Virginia

Seiders, V.N., Mixon, R.B., Stern, T.W., Newell, M.F., and Thomas, C.B., Jr., 1975, Age of plutonism and tectonism and a new minimum age limit on the Glenarm Series in the northeast Virginia Piedmont near Occoquan: Am. Jour. Sci., v. 275, no. 5, p. 481-511.

Occoquan Granite of Lonsdale (1927) adopted as Occoquan Adamellite. Intrudes Wissahickon and Chopawamsic Formations.

ODANAH MEMBER (of Pierre Shale)
Late Cretaceous
North Dakota

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern South Dakota.

OQUIRRH FORMATION or GROUP
Late Mississippian to Early Permian
Utah and Idaho

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

In north-central Utah, Oquirrh Formation divided into (ascending): Bridal Veil Limestone Member, Bear Canyon Member (new name), Shingle Mill Limestone

Member, Wallsburg Ridge Member (new name), and Granger Mountain Member (new name). Age in this area is Middle Pennsylvanian to Early Permian (Atokan to Wolfcampian) only.

ORCA GROUP

New age: middle or late Paleocene and (or) early Eocene (varies)
Former age: early Tertiary
south-central Alaska

Winkler, G.R., and Plafker, George, 1974, Sedimentary and volcanic features of the Orca Group, in U.S. Geological Survey Alaska Program, 1974: U.S. Geol. Survey Circ. 700, p. 52-53.

Age changed from early Tertiary to: middle or late Paleocene.

Tysdal, R.G., Hudson, Travis, and Plafker, George, 1976, Geologic map of the Cordova B-2 quadrangle and northern part of the Cordova A-2 quadrangle, south-central Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-783.

Age changed from middle or late Paleocene to: middle or late Paleocene and (or) early Eocene (varies).

OROCOPIA SCHIST

Mesozoic(?)
southern California

Ross, D.C., 1976, Metagraywacke in the Salinian block, central Coast Ranges, California--and a possible correlative across the San Andreas fault: U.S. Geol. Survey Jour. Research, v. 4, no. 6, p. 683-696.

Orocopia Schist of Miller (1944) adopted.

ORR FORMATION

Late Cambrian
western Utah

Hintze, L.F., and Palmer, A.R., 1976, Upper Cambrian Orr Formation--its subdivisions and correlatives in western Utah: U.S. Geol. Survey Bull. 1405-G, 25 p.

In House Range, its type section, divided into five members (ascending): Big Horse Limestone (new name), Candland Shale (new name), Johns Wash Limestone, Corset Spring Shale, and Sneakover Limestone (new name) Members. In northern Wah Wah Mountains, divided into three members (ascending): Big Horse Limestone, Steamboat Pass Shale (new name), and Sneakover Limestone Members.

OSIRIS TUFF
Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Osiris Tuff adopted as named by Rowley (1968) and geographically restricted to Southern Tushar Mountains and Markagunt, Sevier, Awapa, and Fish Lake Plateaus. Overlies or intercalated with Mount Dutton Formation (new name); underlies Dry Hollow Formation or older unnamed basalt flows.

OYSTER RIDGE SANDSTONE MEMBER (of Frontier Formation)
Late Cretaceous
Wyoming

Ryer, T.A., 1977, Age of the Frontier Formation, in north-central Utah: Am. Assoc. Petroleum Geologists Bull., v. 61, no. 1, p. 112-116.

Geographically extended into north-central Utah.

PACIFIC QUARTZ LATITE
New age: Oligocene
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Oligocene.

PACKARD QUARTZ LATITE
New age: Oligocene
Former age: middle Eocene
north-central Utah

Morris, H.T., 1975, Geologic map and sections of the Tintic Mountain quadrangle and an adjacent part of the McIntyre quadrangle, Juab and Utah Counties, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-883.

Age changed from middle Eocene to: Oligocene.

PAINTBRUSH TUFF (of Piapi Canyon Group)
late Miocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Paintbrush Tuff and its affiliated Piapi Canyon Group stratigraphically restricted to exclude Stockade Wash Member (formerly lowermost member of Paintbrush, now raised in rank to Stockade Wash Tuff), unnamed tuffs and rhyolites of Area 20, and unnamed tuff of Blacktop Buttes. Paintbrush and Piapi Canyon stratigraphically extended to include uppermost local unit of unnamed tuff of Pinyon Pass.

PALESTINE SANDSTONE
Late Mississippian (Chesterian)
Kentucky and Illinois

Trace, R.D., 1976, Geologic map of the Lola quadrangle, Livingston and Crittenden Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1288.

Name changed to Palestine Formation for use in Lola quadrangle; remains Palestine Sandstone elsewhere.

PALISADE CANYON RHYOLITE
late Miocene
central Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol. Survey Prof. Paper 867-B, 48 p.

Palisade Canyon Rhyolite of Regnier (1960) adopted. Forms wedge of lava flows in Humboldt Formation (restricted).

PARK CITY FORMATION OR GROUP
New age: Early and Late Permian
Former age: Permian
Utah, Colorado, Idaho, Montana, Wyoming, and Nevada

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Permian to: Early and Late Permian.

PARUNUWEAP FORMATION
Pliocene(?)
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Parunuweap Formation abandoned; its rocks now included in Sevier River Formation (now geographically extended into all of southwestern High Plateaus region of Utah).

PASSAGASSAWAKEAG GNEISS
Precambrian
south-central Maine

Wones, D.R., 1974, Ordovician igneous activity in south-central Maine, in Geological Survey research 1974: U.S. Geol. Survey Prof. Paper 900, p. 23-24.

Passagassawakeag Gneiss of Bickel (1971, 1976) adopted. Intruded by numerous small bodies of granitic rock; unconformably underlies Hogback Schist or Bucksport Formation as used by Bickel (1976).

PASS PEAK FORMATION
early Eocene
northwestern Wyoming

Cox, E.R., 1976, Water resources of northwestern Wyoming: U.S. Geol. Survey Hydrol. Inv. Atlas HA-558, 3 sheets.

Pass Peak Conglomerate of Eardley and others (1944) adopted as Pass Peak Formation as redefined by Steidtmann (1971). Overlies Hoback Formation; underlies Camp Davis Formation or Quaternary glacial-moraine deposits.

PAYNES HAMMOCK SAND
New age: late Oligocene
Former age: early Miocene
Alabama and Mississippi

Poag, C.W., 1975, The Chickasawhay Stage, in Gulf Coast Assoc. Geol. Socs. Field Trip no. 3 Tertiary type localities of east-central Mississippi: Field Trip Guidebook, p. 87-131.

Name changed from Paynes Hammock Sand to: Paynes Hammock Formation in this report area, east-central Mississippi. Age changed from early Miocene to: late Oligocene.

PELONA SCHIST

New age: Mesozoic(?)
Former age: Precambrian(?)
southern California

Ross, D.C., 1976, Metagraywacke in the Salinian block, central Coast Ranges, California--and a possible correlative across the San Andreas fault: U.S. Geol. Survey Jour. Research, v. 4, no. 6, p. 683-696.

Age changed from Precambrian(?) to: Mesozoic(?).

PIAPI CANYON GROUP

late Miocene and early Pliocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Paintbrush Tuff and its affiliated Piapi Canyon Group stratigraphically restricted to exclude Stockade Wash Member (formerly lowermost member of Paintbrush, now raised in rank to Stockade Wash Tuff), unnamed tuffs and rhyolites of Area 20, and unnamed tuff of Blacktop Buttes. Paintbrush and Piapi Canyon stratigraphically extended to include uppermost local unit of unnamed tuff of Pinyon Pass. Timber Mountain Tuff and its affiliated Piapi Canyon Group stratigraphically extended to include two informal tuffs of Timber Mountain caldera (Crooked Canyon and Buttonhook Wash) as their uppermost units, overlying Ammonia Tanks Member of Timber Mountain (also stratigraphically extended to include two informal tuffs of Cat Canyon and Transvaal at base, formerly unnamed middle unit of Timber Mountain).

PICAYUNE FORMATION
late Oligocene
southwestern Colorado

Lipman, P.W., 1976, Caldera-collapse breccias in the western San Juan Mountains, Colorado: Geol. Soc. America Bull., v. 87, no. 10, p. 1397-1410.

Reduced in rank to Picayune Megabreccia Member and assigned as lower of two members of Sapinero Mesa Tuff, underlying its Eureka Member.

PINNACLE FORMATION (of Camels Hump Group)
Early Cambrian(?)
Vermont

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Tibbit Hill Volcanic Member adopted and assigned to Pinnacle Formation of Camels Hump Group.

PLACER RIVER SILT
Holocene
southwestern Alaska

Ovenshine, A.T., Lawson, D.E., and Bartsch-Winkler, S.R., 1976, The Placer River Silt: an intertidal deposit caused by the 1964 Alaska earthquake: U.S. Geol. Survey Jour. Research, v. 4 , no. 2, p. 151-162.

Placer River Silt adopted. Overlies soil horizon rich in organic material; in 1973 Placer River Soil was still being deposited.

PLAINVIEW SANDSTONE MEMBER
(of South Platte Formation)
(of Dakota Group)

Early Cretaceous
Colorado

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

POGONIP GROUP
Late Cambrian and Early and Middle Ordovician
Nevada, Utah, and California

Compton, R.R., 1975, Geologic map of the Park Valley quadrangle, Box Elder County, Utah, and Cassia County, Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I-873, 6 p. text.

Geographically extended into southeastern Idaho. Age is Ordovician only in this area.

POINT HEY MEMBER (of Katalla Formation)
Oligocene
Alaska

Miller, D.J., 1975, Geologic map and sections of the central part of the Katalla district, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-722, 2 sheets.

Point Hey Member of Katalla Formation (now stratigraphically restricted) abandoned; its rocks being reassigned to upper unit of Burls Creek Shale Member of Katalla and an unnamed sandstone member of Redwood Formation.

PONY TRAIL GROUP
New age: Late Jurassic and Late(?) Jurassic
Former age: Late(?) Jurassic
north-central Nevada

Smith, J.F., Jr., and Ketner, K.B., 1976, Stratigraphy of post-Paleozoic rocks and summary of resources in the Carlin-Pinon Range area, Nevada: U.S. Geol.

Survey Prof. Paper 867-B, 48 p.

Frenchie Creek Rhyolite, uppermost of three formations in Pony Trail Group, stratigraphically extended to include formerly unnamed rhyolite plug in Pony Trail Group. Age of Pony Trail changed from Late(?) Jurassic to: Late Jurassic and Late(?) Jurassic.

PRICE RIVER FORMATION (of Mesaverde Group)
New age: Late Cretaceous to Paleocene
Former age: Late Cretaceous
Utah

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Age changed from Late Cretaceous to: Late Cretaceous to Paleocene.

PRINCIPIO CREEK MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Principio Creek Member adopted as one of eight members of James Run Formation of Glenarm Group. Underlies unnamed felsite member at top of James Run; probably partly equivalent to Big Elk Creek Member and Happy Valley Branch Member (both new names) of James Run.

PRINCIPIO FURNACE MEMBER
(of James Run Formation)
(of Glenarm Group)
early Paleozoic
northeastern Maryland

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Principio Furnace Member adopted as lowermost of eight members of James Run Formation of Glenarm Group. Underlies Frenchtown Member of James Run; probably partly equivalent to Little Northeast Creek Member (new name) of James Run.

PROW PASS MEMBER (of Crater Flat Tuff)
Miocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Prow Pass Member adopted as upper of two members of Crater Flat Tuff (new name). Overlies Bullfrog Member (new name) of Crater Flat; underlies tuffs of Sleeping Butte.

PUFFY MEMBER (of Katalla Formation)
New age: late Oligocene(?) and Miocene
Former age: Oligocene
Alaska

Miller, D.J., 1975, Geologic map and sections of the central part of the Katalla district, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-722, 2 sheets.

Removed from Katalla Formation (now stratigraphically restricted) and reassigned to Redwood Formation as upper of its two members. Age changed from Oligocene to: late Oligocene(?) and Miocene.

PURITAN QUARTZ MONZONITE
Precambrian W
northwestern Michigan

Schmidt, R.G., 1976, Geology of the Precambrian W (lower Precambrian) rocks in western Gogebic County, Michigan: U.S. Geol. Survey Bull. 1407, 40 p.

Puritan Quartz Monzonite adopted. Intrudes Ramsay Formation (new name).

QUICHAPA FORMATION
Miocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Raised in rank to Quichapa Group. Includes (ascending): Leach Canyon Formation (now raised in rank), with its Narrows and Table Butte Tuff Members; Condor Canyon Formation, with its Swett and Bauers Tuff Members; and Harmony Hills Tuff. Age changed from Oligocene or Miocene to: Miocene.

RAMSAY FORMATION
Precambrian W
northwestern Michigan

Schmidt, R.G., 1976, Geology of the Precambrian W (lower Precambrian) rocks in western Gogebic County, Michigan: U.S. Geol. Survey Bull. 1407, 40 p.

Ramsay Formation adopted. Intruded by Puritan Quartz Monzonite (new name).

RANCHESTER LIMESTONE MEMBER (of Amsden Formation)
New age: Late Mississippian to Middle Pennsylvanian (Chesterian to Atokan)
Former age: Early and Middle Pennsylvanian (Morrowan and Atokan)
central and northwestern Wyoming

Sando, W.J., Gordon, Mackenzie, Jr., and Dutro, J.T., Jr., 1975, Stratigraphy and geologic history of the

Amsden Formation (Mississippian and Pennsylvanian) of Wyoming, Part A: The Amsden Formation (Mississippian and Pennsylvanian) of Wyoming: U.S. Geol. Survey Prof. Paper 848-A, 83 p.

Age changed from Early and Middle Pennsylvanian (Morrowan and Atokan) to: Late Mississippian to Middle Pennsylvanian (Chesterian to Atokan).

RAT CREEK TUFF
late Oligocene
southwestern and south-central Colorado

Steven, T.A., and Lipman, P.W., 1976, Calderas of the San Juan volcanic field, southwestern Colorado: U.S. Geol. Survey Prof. Paper 958, 35 p.

Equity Member removed from Rat Creek Tuff and reassigned to Nelson Mountain Tuff.

RED LION FORMATION
Late Cambrian
southwestern Montana

Tysdal, R.G., 1976, Paleozoic and Mesozoic stratigraphy of the northern part of the Ruby Range, southwestern Montana: U.S. Geol. Survey Bull. 1405-I, 26 p.

Divided into (ascending): Dry Creek Shale and Sage Dolomite Members.

REDROCK VALLEY TUFF
Miocene (K-Ar 15.7 m.y.)
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Redrock Valley Tuff adopted. Overlies unnamed Miocene tuff; underlies Bullfrog Member of Crater Flat Tuff (both new names).

REDWOOD FORMATION
late Oligocene(?) and Miocene
Alaska

Miller, D.J., 1975, Geologic map and sections of the central part of the Katalla district, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-722, 2 sheets.

Redwood Formation of Taliaferro (1932) adopted. Conformably overlies Katalla Formation (now stratigraphically restricted). Divided into (ascending): unnamed sandstone member and Puffy Member (now reassigned from Katalla).

REEDSVILLE SHALE
Late Ordovician
Pennsylvania, Virginia, and Tennessee

Perry, W.J., Jr., 1975, Tectonics of the western Valley and Ridge foldbelt, Pendleton County, West Virginia--a summary report: U.S. Geol. Survey Jour. Research, v. 3, no. 5, p. 538-588.

Geographically extended into West Virginia.

REINECKER RIDGE VOLCANIC MEMBER
(of South Park Formation)
Paleocene
central Colorado

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

Reinecker Ridge Volcanic Member adopted as lowermost of four members of South Park Formation. Overlies Laramie Formation or Fox Hills Sandstone; underlies unnamed conglomeratic member of South Park.

RENO MEMBER (of Franconia Sandstone)
Late Cambrian
southeastern Minnesota and south-central Wisconsin

Mcleod, R.S., 1976, A digital-computer model for estimating hydrologic changes in the aquifer system in Dane County, Wisconsin: Univ. Wisconsin Extension--Geol. and Nat. History Survey Inf. Circ. 30, 40 p.

Reno Member of Berg (1951) adopted as uppermost of three members of Franconia Sandstone. Overlies Mazomanie Sandstone Member of Franconia; underlies Trempealeau Formation.

RICHARD SANDSTONE MEMBER (of Pierre Shale)
Late Cretaceous
northeastern Colorado

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

RINCON SHALE
New age: Oligocene and early Miocene
Former age: early Miocene
southern California

Bohannon, R.G., 1975, Mid-Tertiary conglomerates and their bearing on Transverse Range tectonics, southern California, in Crowell, J.C., ed., San Andreas fault in southern California; a guide to San Andreas fault from Mexico to Carrizo Plain: California Div. Mines and Geology, Spec. Rept., no. 118, p. 75-82.

Age changed from early Miocene to: Oligocene and early Miocene.

ROCKLAND VALLEY BASALT
middle(?) Pliocene
southeastern Idaho

Trimble, D.E., and Carr, W.J., 1976, Geology of the Rockland and Arbon quadrangles, Power County, Idaho: U.S. Geol. Survey Bull. 1399, 115 p.

Rockland Valley Basalt abandoned; its rocks now replaced by Massacre Volcanics.

ROCKY RIDGE SANDSTONE MEMBER (of Pierre Shale)
Late Cretaceous
northeastern Colorado

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

ROGER PARK BASALTIC BRECCIA
New age: Miocene
Former age: Pliocene(?)
southwestern Utah

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from Pliocene(?) to: Miocene.

ROME FORMATION
Early and Middle Cambrian
Georgia, Tennessee, North Carolina, Virginia, Alabama, and Kentucky (subsurface)

Perry, W.J., Jr., 1975, Tectonics of the western Valley and Ridge foldbelt, Pendleton County, West Virginia--a summary report: U.S. Geol. Survey Jour. Research, v. 3, no. 5, p. 583-588.

Geographically extended into West Virginia.

ROSE HILL FORMATION
Middle Silurian
Pennsylvania, Maryland, and West Virginia

Miller. R.L., 1976, Silurian nomenclature and correlations in southwest Virginia and northeast Tennessee: U.S. Geol. Survey Bull. 1405-H, 25 p.

Geographically extended into southwestern Virginia and northeastern Tennessee, replacing Clinton Formation (now geographically restricted). Overlies Clinch Sandstone; correlates with upper part of Rockwood Formation.

ROSKRUGE RHYOLITE
Late Cretaceous
southern Arizona

Keith, W.J., 1976, Reconnaissance geologic map of the San Vicente and Cocoraque Butte 15' quadrangles, Arizona: U.S. Geol. Survey Misc. Field Studies Map MF-769.

Name changed from Roskruge Rhyolite to: Roskruge Volcanics.

SAGE LIMESTONE MEMBER
(of Snowy Range Formation)
(of Gallatin Group)
Late Cambrian
northwestern Wyoming and south-central Montana

Tysdal, R.G., 1976, Paleozoic and Mesozoic stratigraphy of the northern part of the Ruby Range, southwestern Montana: U.S. Geol. Survey Bull. 1405-I, 26 p.

Geographically extended into southwestern Montana, name changed to Sage Dolomite Member, and reassigned to Red Lion Formation as upper of two members. Usage remains unchanged elsewhere.

ST. JOE LIMESTONE MEMBER
(of Boone Formation)
(of Fern Glen Limestone)
Early Mississippian
Arkansas, Oklahoma, Kansas, and Missouri

Gordon, Mackenzie, Jr., Walls Ferry Limestone Bed or the St. Joe Limestone Member of the Boone Formation: this report.

Walls Ferry Limestone redefined as and reduced in rank to Walls Ferry Limestone Bed and assigned to St. Joe Limestone Member of Boone Formation in Arkansas only.

ST. LAWRENCE FORMATION
ST. LAWRENCE MEMBER (of Trempealeau Formation)
Late Cambrian
Minnesota, Wisconsin, Michigan, Iowa, and Wisconsin

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

In southeastern Minnesota, St. Lawrence Formation includes (ascending): Black Earth Member (now reinstated) and Lodi Member.

SALEM GABBRO-DIORITE
New age: Devonian(?)
Former age: Late Silurian(?) to Carboniferous(?)
Massachusetts

Nelson, A.E., 1975, Bedrock geologic map of the Framingham quadrangle, Middlesex and Worcester Counties, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-1274.

Age changed from Late Silurian(?) to Carboniferous(?) to Devonian(?).

SALT LAKE FORMATION
New age: Miocene and Pliocene
Former age: Pliocene
Utah, Idaho, Wyoming, and Nevada

Williams, P.L., Mabey, D.R., Zohdy, A.A.R., Hoover, D.B., Pierce, K.L., and Oriel, S.S., 1976, Geology and geophysics of southern Raft River Valley geothermal area, Idaho, USA, in United Nations Symposium on the Development and Use of Geothermal Resources, 2d, San Francisco, California, USA, Map 20-29, 1975: Proc., v. 2, p. 1273-1282.

Age changed from Pliocene to: Miocene and Pliocene.

SALUDA LIMESTONE
SALUDA DOLOMITE MEMBER (of Drakes Formation)
Late Ordovician
Kentucky and Indiana

Kepferle, R.C., 1976, Geologic map of the Fisherville quadrangle, north-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1321.

In Kentucky only, Hitz Limestone Member reduced in rank to Hitz Limestone Bed of Saluda Dolomite Member of Drakes Formation. In Indiana, Hitz remains Hitz Limestone Member of Saluda Formation (name changed from Saluda Limestone to agree with Indiana State usage).

SANDY POND AMPHIBOLITE MEMBER (of Marlboro Formation)
pre-Silurian (Precambrian Z? to early Paleozoic)
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Sandy Pond Amphibolite Member adopted as upper of two members of Marlboro Formation (now stratigraphically restricted and redefined). Overlies unnamed lower member of Marlboro; underlies Shawsheen Gneiss (new name).

SANGRE DE CRISTO FORMATION

New age: Middle and Late Pennsylvanian and Early Permian

Former age: Late Pennsylvanian and Early Permian

Colorado and New Mexico

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Late Pennsylvanian and Early Permian to: Middle and Late Pennsylvanian and Early Permian (or Middle Pennsylvanian to Early Permian).

SAPINERO MESA TUFF

late Oligocene

southwestern Colorado

Lipman, P.W., 1976, Caldera-collapse breccias in the western San Juan Mountains, Colorado: Geol. Soc. America Bull., v. 87, no. 10, p. 1397-1410.

Picayune Formation reduced in rank to Picayune Megabreccia Member and assigned as lower of two members to Sapinero Mesa Tuff, underlying its Eureka Member.

SATANKA SHALE or FORMATION

New age: Early Permian

Former age: Permian

Wyoming and Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Permian to: Early Permian.

SEVERN FORMATION

Late Cretaceous (Maestrichtian)

Maryland

Minard, J.P., Sohl, N.F., and Owens, J.P., Re-introduction of the Severn Formation (Upper Cretaceous) to replace the Monmouth Formation in Maryland: this report.

Severn Formation re-introduced and reinstated to replace entire Monmouth Formation (or Group) on western shore of Chesapeake Bay, Maryland, and to replace certain correlative units on Maryland eastern shore, extending into northern Delaware. These include upper part of Mount Laurel Sand (now stratigraphically restricted in Maryland and Delaware). Overlies Matawan Formation; underlies Brightseat or Aquia Formation.

SEVIER RIVER FORMATION
New age: Miocene, Pliocene, and Pleistocene
Former age: late Pliocene or early Pleistocene
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Geographically extended into all of southwestern High Plateaus region replacing Parunuweap Formation (now abandoned). Age changed from late Pliocene or early Pleistocene to: Miocene, Pliocene, and Pleistocene.

SHAKOPEE DOLOMITE (of Prairie du Chien Group)
Early Ordovician
Minnesota, Illinois, Wisconsin, Iowa, and Michigan

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

In southeastern Minnesota, name changed to Shakopee Formation; and Shakopee includes (ascending): New Richmond Sandstone Member (reduced in rank) and Willow River Dolomite Member.

SHAWSHEEN GNEISS
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Shawsheen Gneiss adopted. Overlies Marlboro Formation (now stratigraphically restricted and redefined); underlies Fish Brook Gneiss.

SHOO FLY FORMATION
New age: Silurian
Former age: Silurian(?)
California

Clark, L.D., 1976, Stratigraphy of the north half of the western Sierra Nevada metamorphic belt, California: U.S. Geol. Survey Prof. Paper 923, 26 p.

Age changed from Silurian(?) to: Silurian.

SIL NAKYA FORMATION
New age: Late Cretaceous
Former age: Mesozoic
southern Arizona

Keith, W.J., 1976, Reconnaissance geologic map of the San Vicente and Cocoraque Butte 15' quadrangles, Arizona: U.S. Geol. Survey Misc. Field Studies Map MF-769.

Age changed from Mesozoic to: Late Cretaceous.

SKULL CREEK SHALE
Early Cretaceous
Wyoming, South Dakota, and Montana

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

SLIPPERY CREEK GREENSTONE (of Evington Group)
early Paleozoic(?)
south-central Virginia

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Slippery Creek Greenstone Volcanics of Brown (1953) adopted as Slippery Creek Greenstone and assigned to Evington Group as its uppermost unit.

SNEAKOVER LIMESTONE MEMBER (of Orr Formation)
Late Cambrian
western Utah

Hintze, L.F., and Palmer, A.R., 1976, Upper Cambrian Orr Formation--its subdivisions and correlatives in western Utah: U.S. Geol. Survey Bull. 1405-G, 25 p.

Sneakover Limestone Member adopted as uppermost member of Orr Formation. Conformably overlies Corset Spring or Steamboat Pass (new name) Shale Member of Orr; conformably underlies Notch Peak Formation.

SOOKE FORMATION
New age: early Miocene
Former age: early Miocene(?)
Oregon and Washington

Addicott, W.O., 1976, Molluscan paleontology of the lower Miocene Clallam Formation, northwestern Washington: U.S. Geol. Survey Prof. Paper 976, 44 p.

Age changed from early Miocene(?) to: early Miocene.

SOUDAN IRON-FORMATION
New age: Precambrian W
Former age: early Precambrian
northeastern Minnesota

Sims, P.K., 1976, Early Precambrian tectonic-igneous evolution in the Vermilion district, northeastern Minnesota: Geol. Soc. America Bull., v. 87, no. 3, p. 379-389.

Reduced in rank to Soudan Iron-formation Member and assigned to Ely Greenstone as its middle member; overlies and underlies unnamed lower and upper members of Ely, respectively. Age changed from early Precambrian to: Precambrian W.

SOUTH FORK MOUNTAIN SCHIST
New age: Early Cretaceous
Former age: Late(?) Cretaceous
northwestern California

Lanphere, M.A., Blake, M.C., Jr., and Irwin, W.P., 1976, Early Cretaceous metamorphic age, South Fork Mountain Schist, northern Coast Ranges [California], _in_ Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 77-78.

Age changed from Late(?) Cretaceous to: Early Cretaceous.

SOUTH PARK FORMATION
Paleocene
central Colorado

Wyant, D.G., and Barker, F., 1976, Geologic map of the Milligan Lakes quadrangle, Park County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-1343.

South Park Formation of DeVoto (1971; from Sawatzky, 1967) adopted. Divided into (ascending): Reinecker Ridge Volcanic Member (new name), unnamed conglomeratic member, Link Spring Tuff Member (new name), and unnamed arkosic member. Overlies Laramie Formation or Fox Hills Sandstone; underlies unnamed conglomeratic member of South Park.

SOUTH PLATTE FORMATION (of Dakota Group)
Early Cretaceous
Colorado

Kiteley, L.W., 1976, Marine shales and sandstones in the Upper Cretaceous Pierre Shale at the Francis Ranch, Laramie County, Wyoming: Mtn. Geologist, v. 13, no. 1, p. 1-19.

Geographically extended into southeastern Wyoming.

SPENCER BROOK MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, _in_ Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Spencer Brook Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Billerica Schist Member and underlies Tophet Swamp Gneiss Member (both new names of Nashoba).

STANLEY SHALE
Mississippian
Oklahoma and Arkansas

Haley, B.R., 1976, Geologic map of Arkansas: U.S. Geol. Survey Spec. Map.

In Arkansas only, Hot Springs Sandstone reduced in rank to Hot Springs Sandstone Member and assigned to Stanley Shale near its top.

STATE BRIDGE FORMATION
New age: Early and Late Permian and Early Triassic
Former age: Permian and Early Triassic
northwestern Colorado

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Age changed from Permian and Early Triassic to: Early and Late Permian and Early Triassic (or Early Permian to Early Triassic).

STEAMBOAT PASS SHALE MEMBER (of Orr Formation)
Late Cambrian
western Utah

Hintze, L.F., and Palmer, A.R., 1976, Upper Cambrian Orr Formation--its subdivisions and correlatives in western Utah: U.S. Geol. Survey Bull. 1405-G, 25 p.

Steamboat Pass Shale Member of Orr Formation adopted. Conformably overlies and underlies Big Horse and Sneakover Limestone Members (both new names) of Orr, respectively. Correlates with (ascending): Candland Shale (new name), Johns Wash Limestone, and Corset Spring Shale Members of Orr in House Range.

STERLING FORMATION (of Kenai Group)
New age: late Miocene and Pliocene
Former age: Tertiary
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Age changed from Tertiary to: late Miocene and Pliocene (Homerian and Clamgulchian Floral Stages).

STOCKADE WASH MEMBER
(of Paintbrush Tuff)
(of Piapi Canyon Group)
late Miocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Raised in rank to Stockade Wash Tuff and removed from Paintbrush Tuff and Piapi Canyon Group (both now stratigraphically restricted at their bases and stratigraphically extended in their upper parts).

SUNSET CREEK INTRUSIVE COMPLEX
Precambrian W
northwestern Michigan

Schmidt, R.G., 1976, Geology of the Precambrian W (lower Precambrian) rocks in western Gogebic County, Michigan: U.S. Geol. Survey Bull. 1407, 40 p.

Sunset Creek Intrusive Complex adopted. Dikes occur in Puritan Quartz Monzonite, Whiskers Creek Gneiss, and Ramsay Formation (all new names).

SWETT TUFF MEMBER
(of Condor Canyon Formation)
(of Quichapa Group)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, _in_ Cenozoic geology of southwestern High Plateaus of

Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Swett Tuff Member of Mackin (1960) adopted as lower of two members of Condor Canyon Formation of Quichapa Group (now raised in rank). Overlies Bear Valley Formation; underlies Bauers Tuff Member of Condor Canyon.

TABLE BUTTE TUFF MEMBER
(of Leach Canyon Tuff)
(of Quichapa Group)
Miocene
southwestern Utah and southeastern Nevada

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Table Butte Tuff Member of Williams (1967) adopted as upper of two members of Leach Canyon Formation of Quichapa Group (both now raised in rank). Overlies Narrows Tuff Member of Leach Canyon; underlies Bear Valley Formation.

TADMUCK BROOK SCHIST
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Tadmuck Brook Schist adopted. Overlies Nashoba Formation (Beaver Brook Member); faulted at top.

TEMPLE BUTTE LIMESTONE
New age: late Middle or early Late Devonian
Former age: Late(?) Devonian
Arizona

Elston, D.P., and Bressler, S.L., 1976, Correlations of basal Cambrian and Devonian sedimentary rocks, central and northern Arizona, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 158.

Age changed from Late(?) Devonian to: late Middle or early Late Devonian.

TESLA FORMATION
New age: Paleocene and early Eocene
Former age: middle Eocene
California

Nilsen, T.H., and Clarke, S.H., Jr., 1975, Sedimentation and tectonics in the early Tertiary continental borderland of central California: U.S. Geol. Survey Prof. Paper 925, 64 p.

Age changed from middle Eocene to: Paleocene and early Eocene.

TETELNA VOLCANICS
New age: Pennsylvanian and Early Permian
Former age: Pennsylvanian
southern Alaska

Richter, D.H., 1976, Geologic map of the Nabesna quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-932.

Age changed from Pennsylvanian to: Pennsylvanian and Early Permian.

TIBBIT HILL VOLCANIC MEMBER
(of Pinnacle Formation)
(of Camels Hump Group)
Early Cambrian(?)
southern Quebec and northwestern Vermont

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Tibbit Hill Schist of Clark (1934) adopted as Tibbit Hill Volcanic Member of Pinnacle Formation of Camels Hump Group as used by Cady (1969). Tibbit Hill geographically extended into Vermont as Tibbit Hill Schist by Booth (1950).

TILLERY FORMATION (of Albemarle Group)
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to: Cambrian.

TIMBER MOUNTAIN TUFF (of Piapi Canyon Group)
early Pliocene
southern Nevada

Byers, F.M., Jr., Carr, W.J., Orkild, P.P., Quinlivan, W.D., and Sargent, K.A., 1976, Volcanic suites and related cauldrons of Timber Mountain-Oasis Valley caldera complex, southern Nevada: U.S. Geol. Survey Prof. Paper 919, 70 p.

Stratigraphically extended to include two informal tuffs of Timber Mountain caldera--Crooked Canyon and Buttonhook Wash--as its uppermost unit, overlying its Ammonia Tanks Member (also stratigraphically extended to include two informal tuffs of Cat Canyon and Transvaal at base; formerly unnamed middle unit of Timber Mountain).

TONASKET GNEISS
Late Cretaceous
north-central Washington

Fox, K.F., Jr., Rinehart, C.D., Engels, J.C., and Stern, T.W., 1976, Age of emplacement of the Okanogan gneiss dome, north-central Washington: Geol. Soc. America Bull., v. 87, no. 9, p. 1217-1224.

Tonasket Gneiss of Snook (1965) adopted and restricted to layered gneiss (excluding enveloping granitoid gneiss). In fault contact with rocks of Tertiary to Triassic age.

TOPHET SWAMP GNEISS MEMBER (of Nashoba Formation)
pre-Silurian
northeastern Massachusetts

Bell, K.G., and Alvord, D.C., 1976, Pre-Silurian stratigraphy of northeastern Massachusetts, in Page, L.R., ed., Contributions to the stratigraphy of New England: Geol. Soc. America Mem. 148, p. 179-216.

Tophet Swamp Gneiss Member adopted and assigned to Nashoba Formation as one of ten members. Overlies Spencer Brook Member and underlies Nashoba Brook Member (both new names of Nashoba).

TOPSY FORMATION
New age: middle Miocene
Former age: post-early Oligocene(?) to pre-middle Miocene
Alaska

Marincovich, L.N., Plafker, George, and Hudson, T.L., 1976, Fauna of Miocene age from the Topsy Formation, Alaska, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 195.

Age changed from post-early Oligocene(?) to pre-middle Miocene to: middle Miocene.

TOR LIMESTONE

New age: Early Devonian
Former age: Silurian and Devonian
central Nevada

McKee, E.H., 1976, Geology of the northern part of the Toquima Range, Lander, Eureka, and Nye Counties, Nevada: U.S. Geol. Survey Prof. Paper 931, 49 p.

Age changed from Silurian and Devonian to: Early Devonian.

TRENTON LIMESTONE or GROUP

Middle Ordovician
New York, New Jersey, Maine, Pennsylvania, Indiana, Michigan, Ohio, Kentucky, Tennessee, Virginia, and Georgia

Perry, W.J., Jr., 1975, Tectonics of the western Valley and Ridge foldbelt, Pendleton County, West Virginia--a summary report: U.S. Geol. Survey Jour. Research, v. 3, no. 5, p. 583-588.

Geographically extended as Trenton Group into West Virginia.

TRUCKEE FORMATION

early Pliocene
Nevada

Whitebread, D.H., 1976, Alteration and geochemistry of Tertiary volcanic rocks in parts of the Virginia City quadrangle, Nevada: U.S. Geol. Survey Prof. Paper 936, 43 p.

Geographically restricted from Virginia Range, Storey County, western Nevada; replaced by Coal Valley Formation of Axelrod (1956; newly adopted).

TUPMAN SHALE MEMBER (of Etchegoin Formation)

New age: late Pliocene
Former age: late Miocene
southern California

Lanphere, M.A., and Dalrymple, G.B., 1976, Correlative late Cenozoic tephra, California and western Nevada, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 79-80.

Age of Etchegoin and its members changed from late Miocene to: late Pliocene.

TYONEK FORMATION (of Kenai Group)
New age: late Oligocene and early and middle Miocene
Former age: Tertiary
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Age changed from Tertiary to: late Oligocene and early and middle Miocene (Angoonian and Seldovian Floral Stages).

U-BAR FORMATION
Early Cretaceous (Aptian-Albian Trinity-Fredericksburg)
southwestern New Mexico

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

U-Bar Formation of Zeller (1958) adopted as described in detail by Zeller (1965). Conformably overlies Hell-to-Finish Formation; conformably underlies Mojado Formation. Divided into five informal members (ascending): brown limestone, oyster limestone, limestone-shale, reef limestone, and suprareef limestone.

UCROSS FORMATION
New age: Pleistocene
Former age: Holocene(?)
Wyoming

Ebaugh, W.F., 1976, Preliminary surficial and bedrock geologic map of the Big Horn quadrangle, Sheridan County, Wyoming: U.S. Geol. Survey Misc. Field Studies Map MF-801.

Age changed from Holocene(?) to: Pleistocene.

UNKAR GROUP (of Grand Canyon Supergroup)
Precambrian
northern Arizona

Elston, D.P., and Scott, G.R., 1976, Unconformity at the Cardenas-Nankoweap contact (Precambrian), Grand Canyon Supergroup, northern Arizona: Geol. Soc. America Bull., v. 87, no. 12, p. 1765-1772.

Cardenas Lavas (Cardenas Lava Series of Keyes, 1938) adopted as uppermost of six formations of Unkar; Cardenas unconformably underlies Nankoweap Formation of Grand Canyon Supergroup (formerly Nankoweap Group of Van Gundy, 1934, 1951) and conformably overlies Dox Sandstone of Unkar.

UWHARRIE FORMATION
New age: Cambrian
Former age: Ordovician(?)
central North Carolina

Stromquist, A.A., and Sundelius, H.W., 1975, Interpretive geologic map of the bedrock, showing radioactivity, and aeromagnetic map of the Salisbury, Southmont, Rockwell, and Gold Hill quadrangles, Rowan and Davidson Counties, North Carolina: U.S. Geol. Survey Misc. Geol. Inv. Map I-888, 2 sheets.

Age changed from Ordovician(?) to: Cambrian.

VAN BUSKIRK GNEISS
Precambrian W
northwestern Michigan

Schmidt, R.G., 1976, Geology of the Precambrian W (lower Precambrian) rocks in western Gogebic County, Michigan: U.S. Geol. Survey Bull. 1407, 40 p.

Van Buskirk Gneiss adopted. Gradational into Puritan Quartz Monzonite.

VAN OSER MEMBER (of Jordan Sandstone)
Late Cambrian
southeastern Minnesota and southwestern Wisconsin

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

Van Oser Member of Jordan Sandstone of Winchell (1874) adopted as redefined by Stauffer and Thiel (1941). Upper of two named members of Jordan; overlies Norwalk Member of Jordan.

VANPORT LIMESTONE (of Allegheny Group)
VANPORT LIMESTONE MEMBER (of Allegheny or Breathitt Formation)
Middle Pennsylvanian
Pennsylvania, Ohio, West Virginia, Maryland, and Kentucky

Rice, C.L., The Vanport Limestone as used by Phalen (1912) in northeastern Kentucky: this report.

Name abandoned in Kentucky; still remains good usage elsewhere. In Kentucky only, informal usage as "Vanport Limestone as used by Phalen (1912)" will be used henceforth.

VASQUEZ FORMATION
New age: Oligocene and early Miocene
Former age: Oligocene and early Miocene(?)
California

Bohannon, R.G., 1975, Mid-Tertiary conglomerates and their bearing on Transverse Range tectonics, southern California, in Crowell, J.C., ed., San Andreas fault in southern California; a guide to San Andreas fault from Mexico to Carrizo Plain: California Div. Mines and Geology, Spec. Rept., no. 118, p. 75-82.

Age changed from Oligocene and early Miocene(?) to: Oligocene and early Miocene.

VIRGIN CREEK MEMBER (of Pierre Shale)
Late Cretaceous
South Dakota

Rice, D.D., 1976, Correlation chart of Cretaceous and Paleocene rocks of the northern Great Plains: U.S. Geol. Survey Oil and Gas Inv. Chart OC-70.

Geographically extended into eastern North Dakota.

WAH WAH LIMESTONE (of Pogonip Group)
New age: Middle Ordovician
Former age: Early Ordovician
southwestern Utah

Berdan, J.M., and Hintze, L.F., 1976, Middle Ordovician ostracodes, western Utah, in Geological Survey research 1976: U.S. Geol. Survey Prof. Paper 1000, p. 196.

Age changed from Early Ordovician to: Middle Ordovician.

WAH WAH SPRINGS TUFF MEMBER
(of Needles Range Formation)
New age: middle to late Oligocene
Former age: middle Tertiary
southwestern Utah

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geol. Survey Bull. 1405-B, 20 p.

Anderson, J.J., and Rowley, P.D., 1975, Cenozoic stratigraphy of southwestern High Plateaus of Utah, in Cenozoic geology of southwestern High Plateaus of Utah: Geol. Soc. America Spec. Paper 160, p. 1-51.

Age changed from middle Tertiary to: middle to late Oligocene.

WALLSBURG RIDGE MEMBER (of Oquirrh Formation)
Late Pennsylvanian (Missourian to Virgilian)
north-central Utah

Baker, A.A., 1976, Geologic map of the west half of the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Wallsburg Ridge Member adopted as one of five named members of Oquirrh Formation. Overlies Shingle Mill Limestone Member of Oquirrh; underlies Granger Mountain Member (new name) of Oquirrh.

WALLS FERRY LIMESTONE
Early Mississippian
northeastern Arkansas

Gordon, Mackenzie, Jr., Walls Ferry Limestone Bed of the St. Joe Limestone Member of the Boone Formation: this report.

Redefined as and reduced in rank to Walls Ferry Limestone Bed and assigned to St. Joe Limestone Member of Boone Formation.

WANRHODES VOLCANICS
Oligocene
north-central Utah

Baker, A.A., 1976, Geologic map of the west half of

the Strawberry Valley quadrangle, Utah: U.S. Geol. Survey Misc. Geol. Inv. Map I-931, 11 p. text.

Wanrhodes Volcanics of Neighbor (1959) adopted. Overlies Uinta(?) Formation; underlies Quaternary deposits.

WARAMAUG FORMATION
late Precambrian or Early Cambrian
northwestern Connecticut

Rankin, D.W., 1976, Appalachian salients and recesses: late Precambrian continental breakup and the opening of the Iapetus Ocean: Jour. Geophysical Research, v. 81, no. 32, p. 5605-5619.

Waramaug Formation of Gates (1952) adopted as used by Stanley (1964).

WASATCH FORMATION
Paleocene and Eocene (varies)
Utah, Colorado, Wyoming, New Mexico, Idaho, and Montana

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Niland Tongue of Wasatch geographically extended into northwestern Colorado.

WAYAN FORMATION
New age: Early and Late Cretaceous
Former age: Late Cretaceous
southeastern Idaho

Ash, S.R., and Read, C.B., 1976, North American species of *Tempskya* and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Age changed from Late Cretaceous to: Early and Late Cretaceous.

WEST FORELAND FORMATION (of Kenai Group)
New age: early Eocene
Former age: Oligocene
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Removed from Kenai Group (now stratigraphically restricted). Age changed from Oligocene to: early Eocene (Franklian Floral Stage).

WHISKERS CREEK GNEISS
Precambrian W
northwestern Michigan

Schmidt, R.G., 1976, Geology of the Precambrian W (lower Precambrian) rocks in western Gogebic County, Michigan: U.S. Geol. Survey Bull. 1407, 40 p.

Whiskers Creek Gneiss adopted. Derived from Ramsay Formation and forms rather simple envelope around Puritan Quartz Monzonite (both new names).

WHITEWATER CREEK RHYOLITE
New age: Oligocene
Former age: Tertiary
New Mexico

Ratté, J.C., and Gaskill, D.L., 1975, Reconnaissance geologic map of Gila Wilderness study area, southwestern New Mexico: U.S. Geol. Survey Misc. Inv. Map I-886, 2 sheets.

Age changed from Tertiary to: Oligocene.

WILDCAT PEAK FORMATION
Early, Middle, and Late Pennsylvanian
central Nevada

McKee, E.H., 1976, Geology of the northern part of the Toquima Range, Lander, Eureka, and Nye Counties, Nevada: U.S. Geol. Survey Prof. Paper 931, 49 p.

Wildcat Peak Formation of Kay (1960) and Kay and Crawford (1964) adopted. Unconformably overlies Vinini Formation; top is erosion surface.

WILD COW FORMATION (of Madera Group)
New age: Late Pennsylvanian and Early Permian
Former age: Late Pennsylvanian
central New Mexico

Myers, D.A., and McKay, E.J., 1976, Geologic map of the north end of the Manzano Mountains, Tijeras and Sedillo quadrangles, Bernalillo County, New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I-968.

Age changed from Late Pennsylvanian to: Late Pennsylvanian and Early Permian.

WILKINS PEAK MEMBER (of Green River Formation)
early and middle Eocene
southwestern Wyoming

Tweto, Ogden, compiler, 1976, Preliminary geologic map of Colorado: U.S. Geol. Survey Misc. Field Studies Map MF-788, 2 sheets.

Geographically extended into northwestern Colorado.

WILLIAMSPORT FORMATION or SANDSTONE (of Cayuga Group)
Late Silurian
western Maryland, northwestern Virginia, south-central Pennsylvania, and northeastern West Virginia

Perry, W.J., Jr., The Massanutten Sandstone in Rockinham, Page, Shenandoah, and Warren Counties, Virginia: this report.

Williamsport Sandstone of Reger (1924) adopted as Williamsport Formation or Sandstone of Cayuga Group. Includes Cedar Cliff Limestone Member. Overlies

Mifflintown Formation; underlies Wills Creek Shale.

WILLOW RIVER DOLOMITE MEMBER
(of Shakopee Formation)
(of Prairie du Chien Group)
Early Ordovician
west-central Wisconsin and east-central Minnesota

Winter, T.C., and Pfannkuch, H.O., 1976, Hydrogeology of a drift-filled bedrock valley near Lino Lakes, Anoka County, Minnesota: U.S. Geol. Survey Jour. Research, v. 4, no. 3, p. 267-276.

Willow River Beds of Wooster (1882) adopted as Willow River Dolomite Member of Shakopee Formation of Prairie du Chien Group and geographically extended into east-central Minnesota. Overlies New Richmond Sandstone Member (reduced in rank) of Shakopee.

WILLOW TANK FORMATION
New age: Early Cretaceous (Albian)
Former age: Late Cretaceous
southern Nevada

Ash, S.R., and Read, C.B., 1976, North American species of Tempskya and their stratigraphic significance: U.S. Geol. Survey Prof. Paper 874, 42 p.

Age changed from Late Cretaceous to: Early Cretaceous (Albian).

WISHBONE FORMATION
New age: late Paleocene and early Eocene
Former age: Paleocene(?) and Eocene(?)
southern Alaska

Magoon, L.B., Adkison, W.L., and Egbert, R.M., 1976, Map showing geology, wildcat wells, Tertiary plant fossil localities, K-Ar age dates, and petroleum operations, Cook Inlet area, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1019, 3 sheets.

Age changed from Paleocene(?) and Eocene(?) to: late Paleocene and early Eocene.

WISSAHICKON FORMATION (of Glenarm Group)
New age: latest Precambrian to early Paleozoic
Former age: Precambrian to Early Ordovician
Pennsylvania, New Jersey, Maryland, Delaware, and Virginia

Higgins, M.W., Six new members of the James Run Formation, Cecil County, northeastern Maryland: this report.

Age changed from Precambrian to Early Ordovician to: latest Precambrian to early Paleozoic.

WOODMAN FORMATION
New age: Early and Late Mississippian
Former age: Late Mississippian
western Utah

Rose, P.R., 1976, Mississippian carbonate shelf margins, Western United States: U.S. Geol. Survey Jour. Research, v. 4, no. 4, p. 449-466.

Age changed from Late Mississippian to: Early and Late Mississippian.

WOODSTOCK GRANITE or GRANODIORITE
Carboniferous(?)
Maryland

Higgins, M.W., Sinha, A.K., Zartman, R.E., and Kirk, W.S., 1977, U-Pb zircon dates from the central Appalachian Piedmont: a possible case of inherited radiogenic lead: Geol. Soc. America Bull., v. 88, no. 1, p. 125-132.

Name changed from Woodstock Granite/Granodiorite to: Woodstock Quartz Monzonite.

AGE OF THE HOOD BAY FORMATION, ALASKA

By Claire Carter

A single piece of black argillite from the Hood Bay Formation collected in 1974 by E. R. Chipp (Resources Associates of Alaska, Inc.) from the northern end of Pybus Bay (fig. 1) on Admiralty Island yielded a Middle Ordovician graptolite fauna. The graptolites include *Glossograptus hincksii* (Hopkinson), *Cryptograptus tricornis* (Carruthers), *Corynoides tricornis* Ruedemann, *Didymograptus cf. D. subtenuis* (Hall), *Pseudoclimacograptus scharenbergi* (Lapworth), *Climacograptus* sp., and *Glyptograptus* (?). This assemblage represents the lower Caradocian zone of *Climacograptus biocornis.* Formerly the Hood Bay Formation was considered Devonian (?) by Loney (1964, p. 22, pl. 1, table 1) on the basis of poorly preserved corals and stromatoporoids indicative of a middle Paleozoic age; he questionably correlated it with the Gambier Bay Formation (Devonian).

MOUNT LORD VOLCANICS, PIMA COUNTY, ARIZONA

By Roger D. Dockter

The Mount Lord Ignimbrite, as named and defined by Watson (1964), includes volcanic rocks overlying the Silver Bell and Claflin Ranch Formations of Richard and Courtright (1960) on Silver Bell Peak, the highest peak in the Silver Bell Mountains. This peak was formerly known as Mount Lord (Watson, 1964a, p. 1853; 1964b, p. 63). The Mount Lord Ignimbrite is here redefined and renamed the Mount Lord Volcanics because of the varied lithology found by tracing Watson's unit westward into the West Silver Bell Mountains. The type section, as here designated, overlies the Silver Bell Formation and extends from sec. 25, T. 11 S., R. 7 E., and ends in the W½ sec. 30, T. 11 S., R. 8 E., West Silver Bell Mountains, Vaca Hills 15-minute quadrangle, Arizona (fig. 2). The type section strikes N. 3° E. to N. 40° W. and dips 20°–70° E. to NE. Computed thickness for the section is approximately 1,158 m (3,800 ft), uncorrected for complex faulting which was not resolved during reconnaissance geologic mapping.

The Mount Lord Volcanics is made up of a lower and an upper unit. The lower unit consists of several, probably five or more, welded ashflow tuff cooling units with interbedded nonwelded tuff, water-laid tuff, flow rocks, and coarse clastic beds, including buff arkosic sandstone, breccia, and conglomerate. A more complete section of the lower unit, with a computed thickness of approximately 808 m (2,650 ft), is in secs. 15 and 22, T. 11 S., R. 7 E., and is designated a reference section (fig. 2). The upper unit consists of flow-banded white, lavender, and buff quartz latite and rhyolite flows interbedded with dark-gray to drab-brick-red rhyodacite and quartz latite flows. The lower and upper units are exposed in the

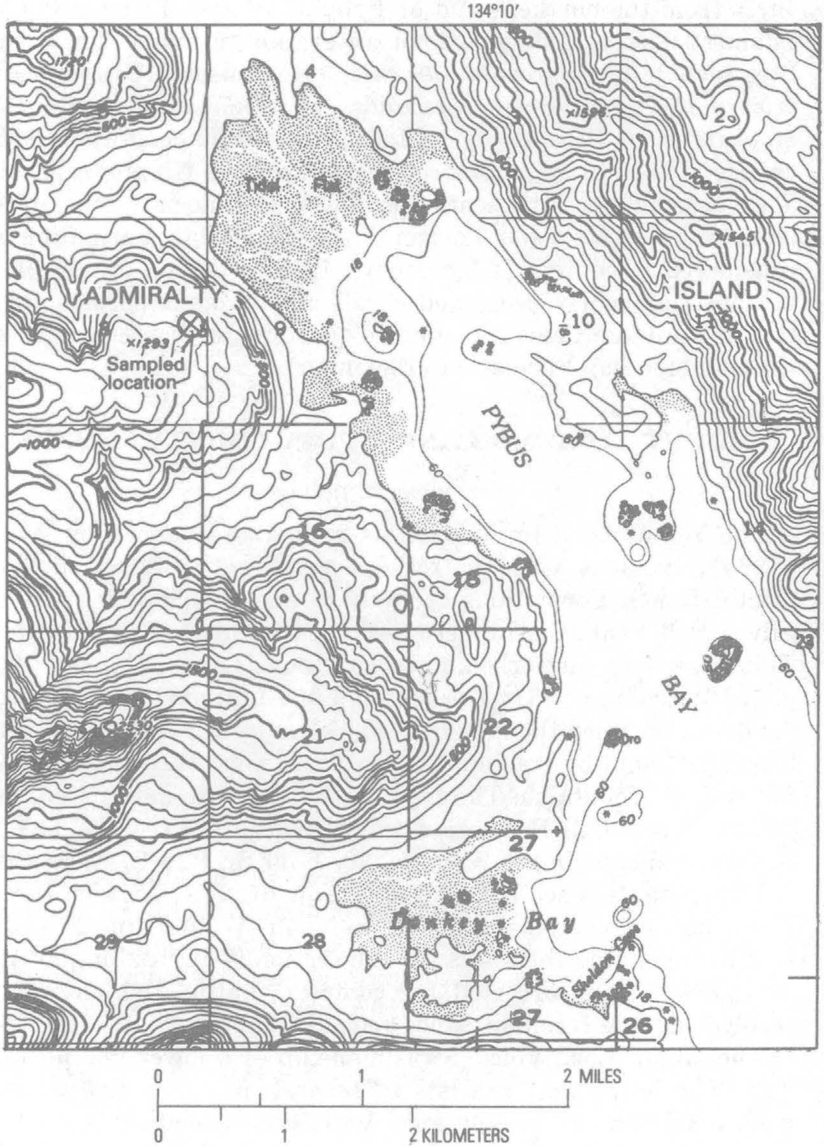

FIGURE 1.—Map showing location of sampled black argillite from the Hood Bay Formation on Admiralty Island in Alaska. Base from U.S. Geological Survey, 1:63,360, Sitka (B-1) Alaska, 1951.

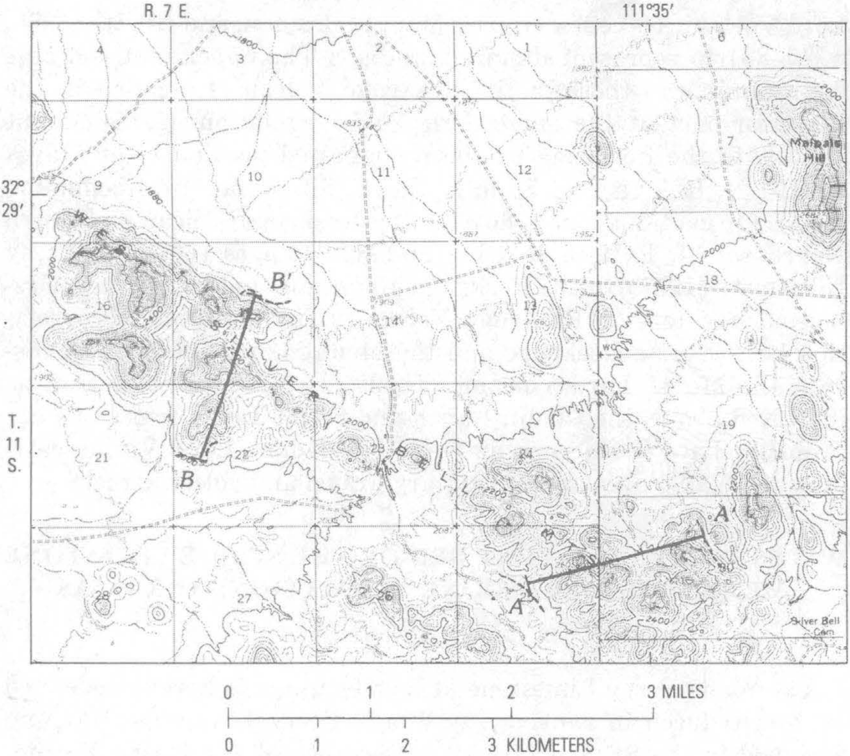

FIGURE 2.—*A–A'*, type section of Mount Lord Volcanics. *B–B'*, reference section of lower unit of Mount Lord Volcanics. Base from U.S. Geological Survey 1:62,500, Vaca Hills, 1959.

type section. Flows similar to the dark-gray flows of the upper unit are also interbedded with the lower unit. Buff to dark-brown xenolith-rich dikes thought to be fissure vents for the ash-flow tuffs cut the lower unit.

Richard and Courtright (1960) believed the Mount Lord to be lithologically identical to the Cat Mountain Rhyolite in the Tucson Mountains. These authors (1966) also noted similar K-Ar age relations between these two units. The interbedded flows and clastic beds are also very similar to those in the Claflin Ranch and Silver Bell Formations of Richard and Courtright (1960). Both of these underlying formations, furthermore, have tuffs (welded, nonwelded, and water-laid) that appear identical to those in the Mount Lord Volcanics but are less abundant. These relations suggest close age, genetic, and depositional ties between the three formations. A K-Ar age of 59.7 m.y. for altered K-feldspar (7.4 percent potassium) from one of the welded tuffs in the Mount

Lord Volcanics is considered by Mauger, Damon, and Giletti (1965, p. 84–85) to represent its minimum age. The upper unit contains flows similar to those in the Roskruge Volcanics exposed in the southern part of the quadrangle, and correlation of the Mount Lord with the Roskruge has been suggested previously by Hayes (1970). A K-Ar age of 70 m.y. (M. L. Silverman, oral commun., 1975) for biotite from a flow in the Roskruge Volcanics (Cerro Negro, sec 14, T. 13 S., R. 7 E.) and similar ages (66–74 m.y.) by Bikerman (1967) in the Roskruge Mountains indicate a Late Cretaceous age for the Roskruge Volcanics If the tentative correlation between the Roskruge and the Mount Lord Volcanics is correct, the Mount Lord Volcanics is also Late Cretaceous, and, as indicated above, the Claflin Ranch and Silver Bell Formations are probably Late Cretaceous as well. The Mount Lord Volcanics is unconformably overlain by Tertiary gravel and volcanic rocks.

WALLS FERRY LIMESTONE BED OF THE ST. JOE LIMESTONE MEMBER OF THE BOONE FORMATION, ARKANSAS

By MACKENZIE GORDON, JR.

The Walls Ferry Limestone of former usage is hereby redefined as, and reduced in rank to, the Walls Ferry Limestone Bed and assigned to the St. Joe Limestone Member of the Boone Formation. At its type locality, on the east side of the White River, Independence County, Ark., about 1 km south of Walls Ferry and about 19 km west-northwest of Batesville, this distinctive bed is 32 cm thick. The rock is a gray to buff-gray fine-grained limestone, containing some coarse-grained to granule-sized fossil clasts. It contains a varied invertebrate fauna, the cephalopods of which have been described by Gordon (1964) and the conodonts by Thompson and Fellows (1969).

It differs from the typical rock of the St. Joe Limestone Member, which is a pinkish- to reddish-gray encrinital limestone of early Osagean age. Because of its different lithology, distinctive fauna, and partial Kinderhookian age, and because it generally is present where the St. Joe is not typically developed or present at all, it is regarded as worthy of a separate designation.

At the time this stratigraphic unit was named, "bed" was not part of the formal stratigraphic heirarchy, so, despite the limited size of this unit, it had to be called "limestone." Not long ago, however (Oriel, 1975), the name "bed" was formalized, and it is very well suited to this particular rock unit.

A lenticular bed of similar lithology to the Walls Ferry, 10 cm thick, and interbedded with green shale, has been found in a small western tributary of Polk Bayou, about 2½ km northwest of Batesville and not quite 18 km east-southeast of the type locality. The limestone contains some of the brachiopod and trilobite species of the type Walls Ferry, but lacks the ammonoids.

The megafauna of the Walls Ferry Limestone Bed includes some unidentified horn corals and *Cladochonus*;[1] the brachiopods *Rhipidomella, Rugosochonetes,* a small spinose productoid,[1] *Coledium, Sedenticellula, Composita*?, *Tylothyris, Brachythyris,*[1] *Crassumbo*[1] and *Cranaena;* the pelecypods *Dexiobia*[1] and an unidentified pectenoid; the gastropods *Rhineoderma*?, *Glabrocingulum* (*Glabrocingulum*), *Hesperiella,* and *Platyceras* (*Orthonychia*);[1] the cephalopods *Michelinoceras,*[1] *Mitorthoceras,*[1] *Rineceras*?, *Imitoceras, Irinoceras, Gattendorfia, Kazakhstania, Pericyclus, Muensteroceras,*[1] and *Protocanites;* and the trilobites *Proetus* (*Pudoproetus*)[1] and *Thigriffithides.*

Gordon (1964, p. 8) considered these fossils to be Early Mississippian (Kinderhookian) in age because the ammonoid fauna is similar in composition to that of the well-known Rockford ammonoid fauna of Indiana, which for more than 100 years had been regarded as coming from Kinderhookian rocks. Also, such genera as *Sedenticellula* and *Dexiobia* had not been recorded previously from rocks younger than Kinderhookian.

Thompson and Fellows (1969, p. 76, 222–229) studied the conodonts of the Walls Ferry Limestone Bed and assigned the lower 11 cm to the Kinderhookian *Siphonodella cooperi hassi-Gnathodus punctatus* Zone and the upper 21 cm to the Osagean *Gnathodus semiglaber-Polygnathus communis carinus* Zone. The megafossils listed above occur in the Osagean part.

The seeming discrepancy between the dating based upon ammonoids versus that based upon conodonts has been resolved by the discovery (Manger, 1977) that the Rockford, Indiana, goniatite fauna comes from the base of the New Providence Shale, immediately overlying the Rockford Limestone. In Manger's opinion (oral commun., 1976), those faunas having *Muensteroceras* predominating are Osagean in age, whereas those having *Imitoceras* predominating and including *Karagandoceras* and *Prodromites* are Kinderhookian in age.

The type Walls Ferry Limestone Bed, therefore, straddles the Kinderhookian-Osagean boundary, about two-thirds of it Osagean in age. Its precise relationship to the typical St. Joe Limestone Member of the Boone Formation is yet to be determined.

[1] Common forms.

SIX NEW MEMBERS OF THE JAMES RUN FORMATION, CECIL COUNTY, NORTHEASTERN MARYLAND

By MICHAEL W. HIGGINS

INTRODUCTION

Southwick and Fisher (1967) gave the name James Run Gneiss to interlayered quartz amphibolite and biotite-quartz-plagioclase gneisses of volcanic and volcaniclastic origin well exposed along James Run in Harford County, Md. (See Southwick and Owens, 1968.) Earlier, Hopson (1964) had suggested a volcanic and volcaniclastic origin for similar rocks in Baltimore, Md. Southwick (1969, p. 47–55) recognized the similarity between his James Run Gneiss, Hopson's (1964) "Baltimore paragneiss," parts of the "volcanic complex of Cecil County" (Marshall, 1937), and some of the rocks of the "Wilmington complex" (Ward, 1959) in Delaware. Southwick (1969) proposed that all these rocks are correlative. Later, Southwick and others (1971) named similar rocks in northern Virginia the Chopawamsic Formation and suggested a possible correlation with the James Run Gneiss of Maryland. In 1972, I changed the name from James Run Gneiss to James Run Formation based on detailed mapping in Cecil County, Md., and on reconnaissance in Maryland and Delaware, and proposed formal correlation with the Chopawamsic Formation. I (Higgins, 1971) named the most easily mappable unit within the James Run in Cecil County the Gilpins Falls Member. Mapping of Cecil County has been completed, and the purpose of this paper is to name and define six new members of the James Run Formation within the county. One mappable felsite unit is left unnamed. Figure 3 shows the distribution of these units in Cecil County and gives their probable stratigraphic relations based chiefly on top and bottom criteria from pillow basalts in the Gilpins Falls Member.

AGE OF THE JAMES RUN FORMATION

On the basis of discordant zircon dates, Tilton and others (1970 proposed a Cambrian age for the James Run Formation. Higgins and others (1971) "confirmed' the Cambrian age with more zircon dates. Later workers have followed this proposal and assigned a Cambrian age to the James Run. However, more zircon age dating and a reevaluation of the reliability of the dates led Higgins and others (1976) to conclude that the James Run could not be restricted to the Cambrian. Therefore, the James Run Formation is here considered early Paleozoic in age; it could be either Cambrian or Ordovician in age.

LITTLE NORTHEAST CREEK MEMBER

Generally fine- to medium-grained, massive, grayish white to gray granofels with relict phenocrysts of plagioclase and (or) quartz are best exposed along Little Northeast Creek in central Cecil County (fig. 3). These rocks are here named the Little Northeast Creek Member of the James Run Formation, and the type section is designated as the section along Little Northeast Creek between outcrop belts of the Gilpins Falls Member on the flanks of the major anticline (synformal anticline) that trends northeast from near Theodore, Md. (fig. 3). Because these rocks have been subjected to at least four phases of folding (Higgins, 1973), true stratigraphic thicknesses are impossible to determine. However, the present thickness approximates 1,370 m (4,500 ft).

The rocks of the Little Northeast Creek Member appear to be stratigraphically overlain by the Gilpins Falls Member. To the northeast they appear to grade into biotite gneiss of probable sedimentary origin and to the east into the Frenchtown Member of the James Run Formation (named and described below). Chemical composition, petrography, petrology, and field relations indicate that the rocks of the Little Northeast Creek are metavolcanic or metasubvolcanic; they are dacitic to rhyolitic (Higgins, unpub. data).

FRENCHTOWN MEMBER

Interbedded green mafic, dark to medium gray intermediate, and light gray felsic metamorphosed volcanic, volcaniclastic, and volcanic epiclastic rocks with relict phenocrysts of plagioclase, and (or) quartz, and (or) amphibole and locally with relict pumice lapilli, accretionary lapilli, and amygdules are here named the Frenchtown Member of the James Run Formation for good exposures near Frenchtown, Cecil County, Md. Grimsley (1894) previously used the name Frenchtown diorite for some of these rocks because he did not recognize their extrusive origin; the name Frenchtown diorite is here redefined and adapted as the Frenchtown Member.

The type section of the Frenchtown Member is designated as the exposures in the gorge of the Susquehanna River from just northwest of U.S. Interstate 95 to the village of Frenchtown, Md. Again, because of multiple folding, the true thickness of the Frenchtown Member is indeterminable; present thickness is approximately 915 m (3,000 ft).

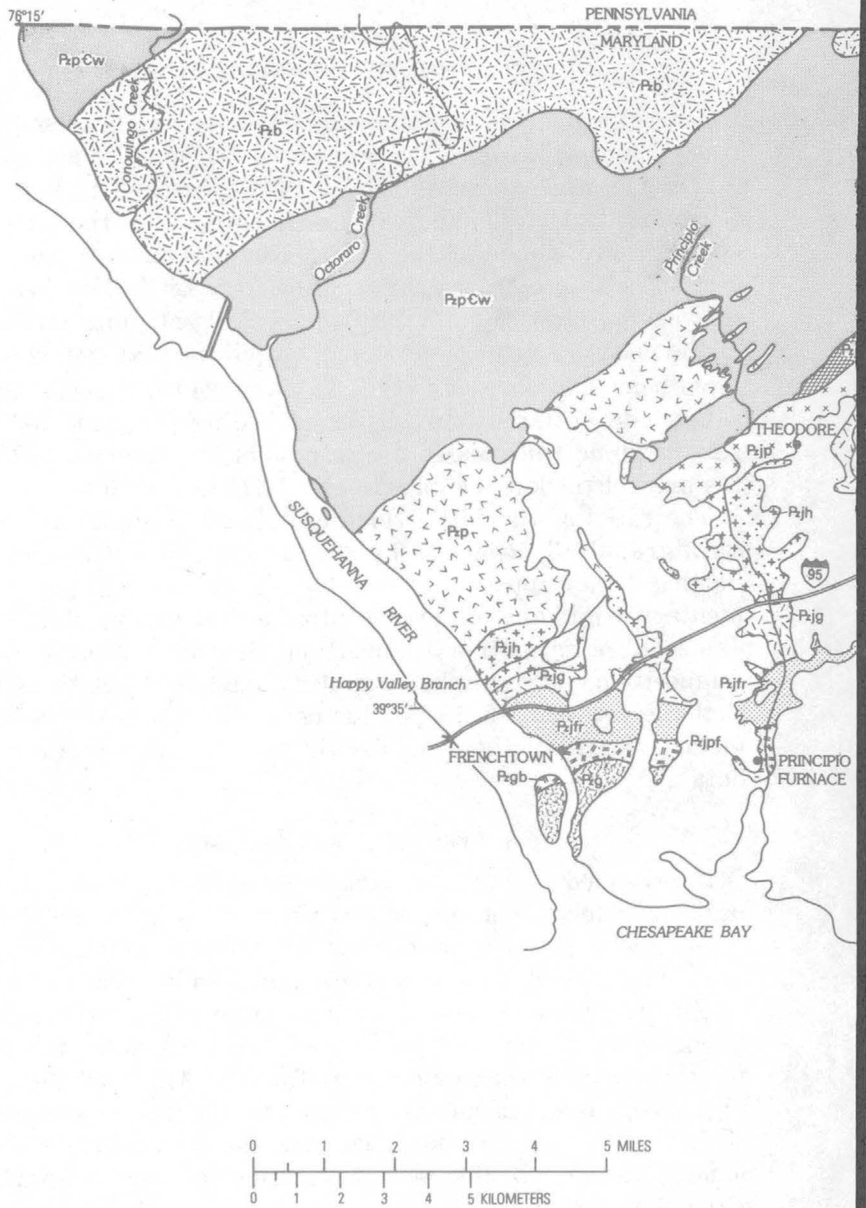

FIGURE 3.—Generalized geologic map of Cecil County, Md., showing members of the James Run Formation.

The Frenchtown Member appears to lie stratigraphically below the Gilpins Falls Member and to be approximately stratigraphically equivalent to part of the Little Northeast Creek Member. It is apparently mostly underlain by the Principio Furnace Member (see below).

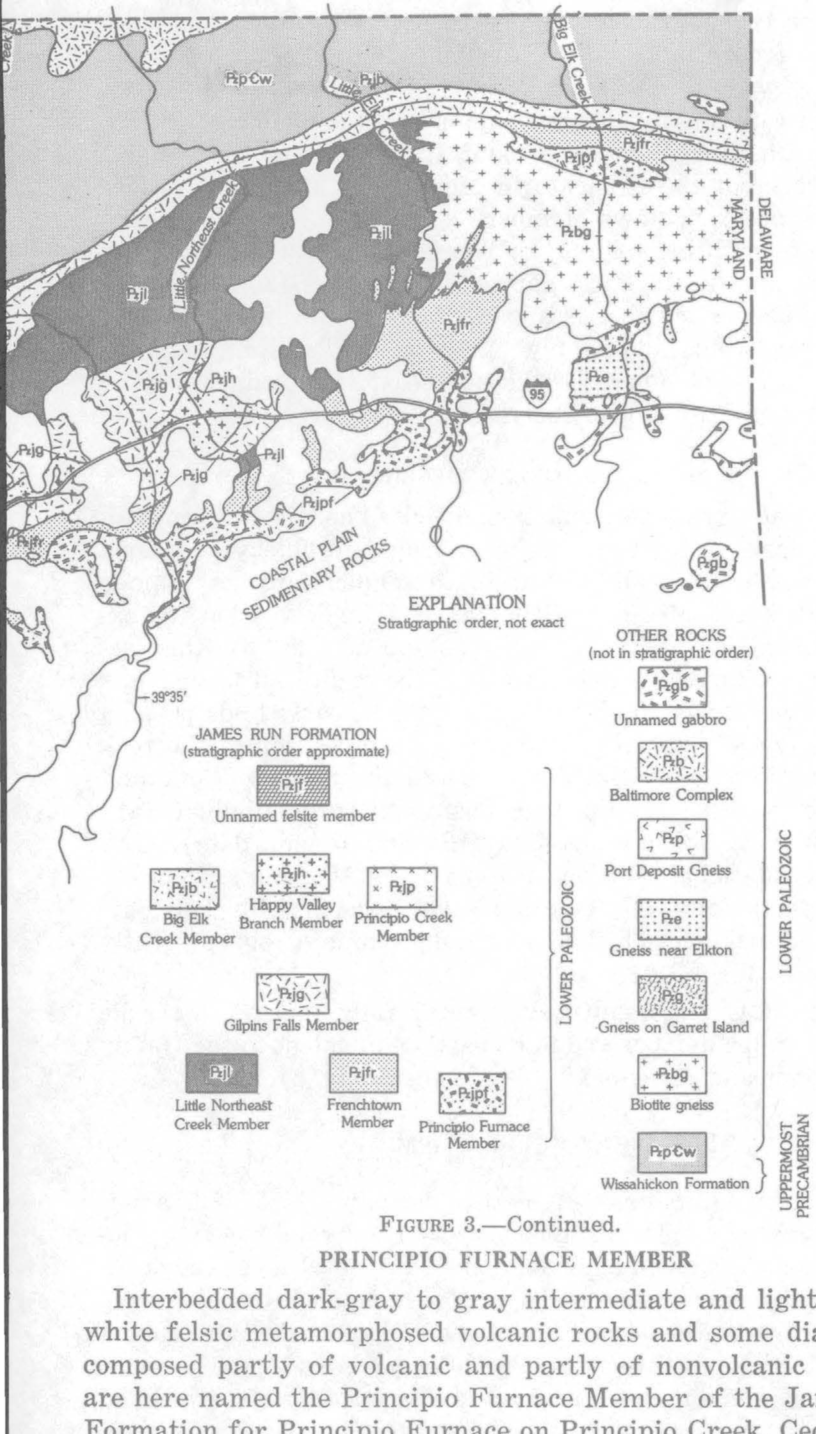

FIGURE 3.—Continued.

PRINCIPIO FURNACE MEMBER

Interbedded dark-gray to gray intermediate and light gray to white felsic metamorphosed volcanic rocks and some diamictites composed partly of volcanic and partly of nonvolcanic material are here named the Principio Furnace Member of the James Run Formation for Principio Furnace on Principio Creek, Cecil County, Md. The type section is designated as the exposures in Principio Creek from just south of Maryland Highway 7 to just north of U.S. Highway 40. Relict phenocrysts of plagioclase, and (or) quartz, and (or) amphibole are common in the metavolcanic rocks, but volcaniclastic features and mafic rocks are rare in contrast with the rocks of the Frenchtown Member. Contacts are gradational with the Frenchtown Member.

Because of multiple folding, thickness of the unit is also indeterminable; present thickness approximates 760 m (2,500 ft). The Principio Furnace Member is apparently overlain by the Frenchtown Member, but is probably partly equivalent to the Little Northeast Creek Member. To the northeast it interfingers (and possibly grades) into biotite gneiss.

BIG ELK CREEK MEMBER

Interlayered dark green quartz-plagioclase-hornblende amphibolites and dark- to light-gray felsites composed chiefly of quartz and plagioclase but locally containing amphibole are here named the Big Elk Creek Member of the James Run Formation for exposures along Big Elk Creek, Cecil County, Md. (fig. 3) ; this section is also designated the type section. The mafic and felsic rocks typically occur in layers about 3–12 cm thick; early folds parallel to the bedding are common. Texture and composition of the rock suggest that the amphibolites were originally mafic volcanic and volcaniclastic rocks and that the felsites were metasedimentary rocks with much volcanic detritus (Higgins, unpub. data). Contacts are gradational with the Gilpins Falls Member and locally appear gradational with metagraywacke of the Wissahickon Formation to the north. Thickness is indeterminate, but presently approximates 305 m (1,000 ft).

The Big Elk Creek Member stratigraphically appears to overlie the Gilpins Falls Member and to be partly equivalent to the Happy Valley Branch and Principio Creek Members (fig. 3).

PRINCIPIO CREEK MEMBER

Dark-gray medium-grained biotite-feldspar schist with abundant small relict plagioclase phenocrysts, numerous blocky epidosite inclusions (as much as 30 cm long), and local layers of dark-green mafic metavolcanic rocks are here named the Principio Creek Member of the James Run Formation for exposures along Principio Creek northwest of Port Deposit Road (see Map of Cecil County, showing topography and election districts, Maryland Geologic Survey, 1963, scale 1:62,500; also fig. 3, this paper).

This same section is here designated the type section. Chemical composition and local relict textures (Higgins, unpub. data) suggest this is a metaandesite (perhaps pyroclastic). Contacts with other units appear relatively sharp.

The Principio Creek Member apparently underlies unnamed felsite member of the James Run Formation and locally pelitic schist of the Wissahickon Formation (fig. 3). It is probably partly equivalent to parts of the Happy Valley Branch Member and partly equivalent to parts of the fine-grained phase of Port Deposit Gneiss. True thickness is indeterminable, but present thickness is approximately 610 m (2,000 ft).

HAPPY VALLEY BRANCH MEMBER

Chiefly fine-grained, medium- to thin-bedded light-grey to white metamorphosed felsic volcaniclastic rocks with relict phenocrysts (mostly broken) of sodic plagioclase and quartz, and locally amphibole, are here named the Happy Valley Branch Member of the James Run Formation for Happy Valley Branch, a tributary of the Susquehanna River in Cecil County, Md. (fig. 3). The type section is exposed from just north of Happy Valley Branch to the contact with the Gilpins Falls Member about 1,220 m (4,000 ft) northwest of U.S. interstate 95. Relict pumice lapilli and accretionary lapilli are locally present in these rocks and their composition and texture (Higgins, unpub. data) suggest that they are epiclastic and contain much nonvolcanic detritus. Some subvolcanic rocks may also be present. Contacts are gradational with the fine-grained phase of Port Deposit Gneiss but are relatively sharp with other units. True thickness is indeterminable, but present thickness is approximately 915 m (3,000 ft).

Stratigraphically, the Happy Valley Branch Member overlies the Gilpins Falls Member and is the youngest unit of the James Run Formation exposed in Cecil County. However, it is apparently partly equivalent to parts of the Principio Creek Member (fig. 3).

THE BALTIMORE COMPLEX, MARYLAND AND PENNSYLVANIA

By Michael W. Higgins

In 1886, Williams gave the name Baltimore gabbro to a wide variety of metamorphosed gabbroic rocks in and around Baltimore, Md. Leonard (1901), Bascom (1902a, b), Bascom and Miller (1920), Insley (1928), and Knopf and Jonas (1929) left the gabbros, serpentinites, and other mafic and ultramafic rocks unnamed in their studies of different parts of the complex. Cloos and

Hershey (1936) were perhaps first to reuse the name Baltimore gabbro. Shortly afterward it was used by Cloos (1937) and by Cohen (1937). The name Baltimore gabbro was in common use for the complex through the 1950's. (See Herz, 1951.) Hopson (1964) used the name Baltimore Gabbro Complex, realizing the heterogeneous nature of the body. Thayer (1967) later called it the Baltimore gabbro-State Line complex to emphasize the relationship of the rocks around Baltimore to the rocks of the "State Line chromite district" (Pearre and Heyl, 1960). Southwick (1970) used the name Baltimore-State Line Gabbro-Peridotite Complex, and, most recently, Crowley (1976) has used the name Baltimore Mafic Complex.

The name of this complex of mafic and ultramafic rocks that extends from south of Baltimore to southeastern Pennsylvania (fig. 4) is here changed to the Baltimore Complex. The name Baltimore is retained because of its long usage, despite the fact that nearby Precambrian gneisses of the "basement complex" are formally known as Baltimore Gneiss (Williams, 1892; Hopson, 1964). Baltimore Gneiss is quite distinct from rocks of the Baltimore Complex, and, moreover, is always overlain by units of the Glenarm Group. (See Hopson, 1964; Higgins, 1972; Crowley, 1976.) The name Baltimore Complex is adopted to reflect the diverse petrographic nature of the metamorphosed mafic and ultramafic rocks in the mass and also their complex arrangement.

The thickness of the Baltimore Complex is completely unknown, and, for the present, its age must remain simply early Paleozoic. Petrographic descriptions of many of the rocks of the complex are found in Williams (1886), Hopson (1964), and Southwick (1969, 1970).

GEOLOGIC CHARACTER AND REVISED AGE OF THE GLASTONBURY GNEISS, MASSACHUSETTS AND CONNECTICUT

By GERHARD W. LEO

The Glastonbury Gneiss (Herz, 1955) crops out in a long, narrow belt trending north-northeast for about 65 km through Connecticut and Massachusetts along the west side of the Bronson Hill anticlinorium. The Glastonbury is overlain by Paleozoic rocks of the New Hampshire Plutonic Series; it intrudes the Ammonoosuc Volcanics (Middle Ordovician) and may intrude the overlying so-called "Collins Hill Formation" (Eaton and Rosenfeld, 1972). Structurally and stratigraphically the Glastonbury is generally comparable to the domes of the Oliverian Plutonic Series in New Hampshire. The northern part of the Glastonbury body

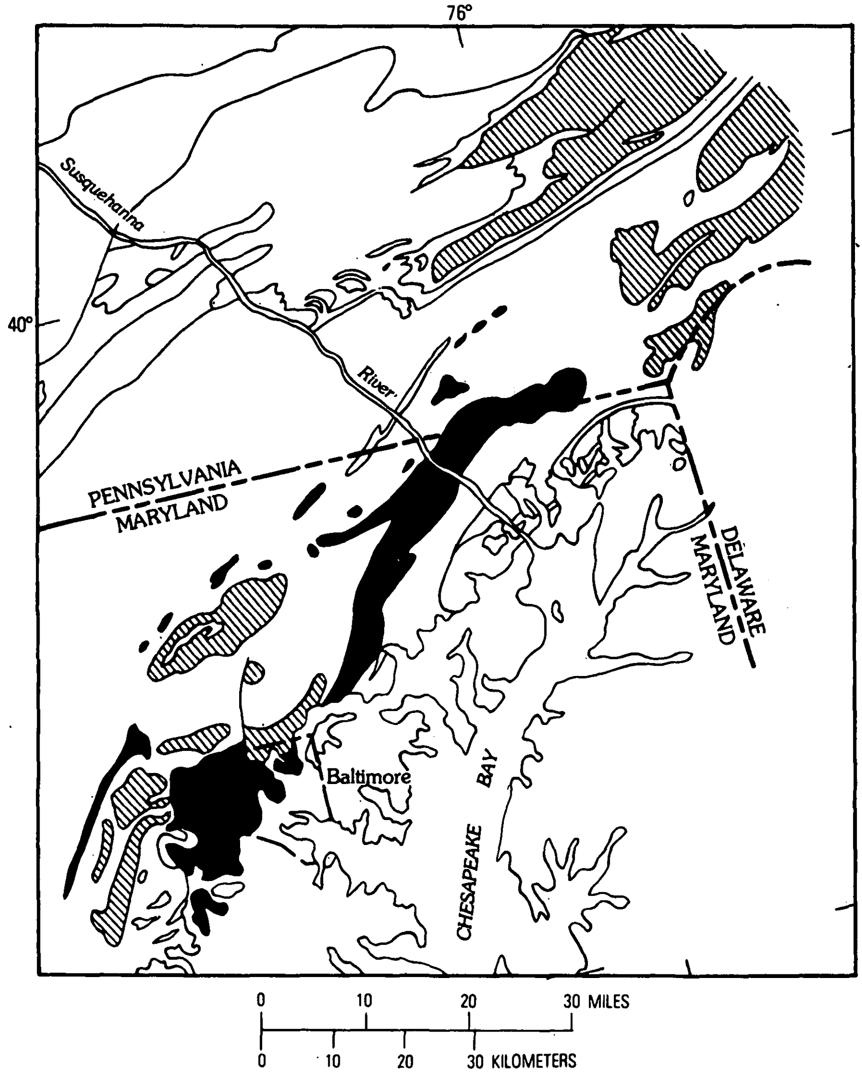

FIGURE 4.—Generalized geologic map showing extent of the Baltimore Complex (black) in Maryland and Pennsylvania. Ruled pattern indicates Baltimore Gneiss. Other units include plutons in the Maryland Piedmont, rocks of the Glenarm Group, and rocks of the Lancaster Valley.

typically consists of leucocratic, granoblastic, granitic-looking gneiss that appears compositionally homogeneous in outcrop but proves to be chemically and modally inhomogeneous over short distances (Leo, 1974; Leo and others, 1976; Leo, 1977). Strong foliation and (or) lineation with accompanying cataclastic(?) textures are typical. The gneiss is metatrondhjemite in part, consisting dominantly of quartz and calcic oligoclase (generally less than 10 percent K-feldspar) and additionally contains biotite, epidote, muscovite, and minor accessories; it approaches the composition of the Monson Gneiss and felsic layers in the Ammonoosuc Volcanics (New Hampshire sequence) and is quite distinct from calc-alkaline granitic rocks. By contrast, gneiss in the southern part of the body is consistently more potassic, and calc-alkaline compositions range from granite to granodiorite. It also shows textural and structural variations and is likewise possibly of cataclastic origin.

The origin of the Glastonbury rocks is evidently complex. The northern gneiss is believed to have consolidated from a crystal mush produced by anatexis in a water-deficient system. The postulated gneiss protolith (Monson Gneiss and, possibly, underlying units), is similar to other major gneiss units in the northern and central Appalachians (for example, the James Run Formation (Higgins, 1972) in eastern Maryland) and has a composition comparable to that of marine volcanic-volcaniclastic sediments of eugeosynclinal environments, as well as that of some Archean trondhjemites. The southern granitic gneiss appears to represent a distinct calc-alkaline intrusion, but its trace-element characteristics are clearly related to those of the northern part of the Glastonbury and the Monson Gneiss.

There have been several attempts to date the Glastonbury Gneiss radiometrically. An Rb-Sr whole-rock isochron age of 355±10 m.y. was determined by Brookins and Hurley (1965), and was later modified to 362±10 m.y. by Brookins and Methot (1971). This isochron was heavily weighted by four samples from the southern gneiss body with high Rb/Sr and Sr^{87}/Sr^{86} ratios (D. G. Brookins, written commun., 1975). These highly radiogenic samples, which are chemically very different from most other Glastonbury, are suspected of being possibly contaminated by pegmatite (Brookins, *in* Leo, 1977); consequently, the circa 360-m.y. age cannot be regarded as representative for the bulk of the Glastonbury Gneiss.

Subsequent Rb-Sr dating of additional samples from both the northern and southern parts of the gneiss yielded a composite isochron age (omitting the radiogenic samples mentioned earlier) of 440±20 m.y. (Leo and others, 1976). This age determination, used in conjunction with the earlier 360 m.y. age as well as field relations of the Glastonbury Gneiss, gave rise to the Ordovician to Devonian age designation for the Glastonbury on some recent maps (Leo and others, 1977; Peper, 1976 and 1977a, b). Rb-Sr dating of additional Glastonbury samples, however, has again shifted the position of the isochron to 383±41 m.y. (D. G. Brookins, *in* Leo, 1977). This age, corresponding to early Middle Devonian, is in satisfactory agreement with field relations of the Glastonbury Gneiss as presently known as well as with the postulated anatectic origin of the northern gneiss (Leo, 1977). Nevertheless, some questions remain regarding the large amount of scatter in the data points (reflected in the large margin of error [2]) and the possibility that the northern and southern parts of the Glastonbury may have different ages. An isochron plot for five data points representing the northern part of the Glastonbury Gneiss only (Brookins, *in* Leo, 1977, fig. 14) suggests an age of 548±90 m.y. at the 1σ confidence level. Although this "age" is improbably high in terms of presently known ages and geologic relationships in the region as a whole, and its validity cannot be assessed without further data for the northern part of the Glastonbury Gneiss, it does point up the uncertainties in the Rb-Sr systematics and suggests the possibility that the northern part of the Glastonbury is, indeed, older than the southern part.

In view of the complex history of the Glastonbury Gneiss, including pervasive Acadian metamorphic recrystallization following its anatexis and intrusion, further Rb-Sr dating would probably not significantly clarify the picture. Conceivably, age determinations of zircons from the gneiss might yield new information, zircons from the northern part of the gneiss might reflect inherited ages of the postulated Monson Gneiss protolith.

Field relations of the Glastonbury Gneiss are compatible with an early Middle Devonian age of intrusion but are ambiguous especially in connection with a maximum age. The lower age limit on the Glastonbury based on field relations is post-Ammonoosuc (460±10 m.y., Brookins, 1968) and the upper limit is pre-Belchertown pluton (380±5 m.y.; R. E. Zartman, cited in Leo and others, 1977). The contact between the southern part of the Glastonbury Gneiss and the so-called "Collins Hill Formation" in the Middle Haddam quadrangle, Connecticut (424±41 m.y.; Brookins and Methot, 1971 [3]) may or may not be intrusive (Leo, 1977). The contact between the Glastonbury and Clough Quartzite (Lower Silurian) in the Marlborough quadrangle, Connecticut, is faulted (Snyder, 1970) and may have been either depositional or intru-

[2] The indicated uncertainty is at the 67 percent (1σ) confidence level. However, the scatter of data on the isochron plot (D. G. Brookins, *in* Leo, 1977) is such that the uncertainty may be better stated at the 95 percent (2σ) confidence level (J. G. Arth, oral commun., 1977)). The resulting radiometric "age" spans the approximate range of 300 m.y.-465 m.y.

[3] The unit for which the 424±41 m.y. age is reported actually is referred to by Brookins and Methot (1971) as Brimfield Schist(?); the dated rocks, however, are from Collins Hill, Connecticut, and are currently designated as the so-called "Collins Hill Formation" (Eaton and Rosenfeld, 1972) (D. G. Brookins, oral commun., 1977).

sive originally. Snyder (1970) assumed the latter alternative and designated the Glastonbury as "Devonian or Mississippian." In the light of the lower age limit on the northern part of the Glastonbury imposed by the age of the Belchertown pluton, the possibility of a Mississippian age can be safely abandoned.

RE-INTRODUCTION OF THE SEVERN FORMATION (UPPER CRETACEOUS) TO REPLACE THE MONMOUTH FORMATION IN MARYLAND

By JAMES P. MINARD, NORMAN F. SOHL, and JAMES P. OWENS

It is proposed that the name Severn Formation be given to the entire Monmouth Formation on the western shore of Chesapeake Bay, Md., and to certain correlative units on the Eastern Shore and extending into Delaware. These include the upper part of the Mount Laurel Sand, as mapped and described by Minard (1974, pl. 1, p. 21–24) in the Betterton quadrangle and at Gregg Neck and Bohemia Mills, Md., and at Odessa, Del. Its type locality is designated the east bank of the Severn River at Round Bay (in the Round Bay, Md., 7½-minute quadrangle) 0.64 km (0.4 mile) north of Swan Point. The entire thickness is well exposed here in a single continuous outcrop. The total thickness (about 2.7 m or 9 ft) of the glauconitic gray clayey sand of the Matawan Formation (Campanian) is exposed at the base of the outcrop. It lies directly on the light gray lignitic sand and clay of the Magothy Formation, the top of which is at high-tide level. Overlying the Matawan is the Severn Formation of Maestrichtian Age; it is 12.6 m (42 ft) thick. The Severn is overlain by a combined thickness of about 9 m (30 ft) of the Brightseat Formation and lower part of the Aquia Formation, both of Paleocene age.

At its type section the Severn Formation consists of dark gray to medium gray, clayey and silty, poorly sorted, mostly fine to medium grained sparingly glauconitic quartz sand containing a fair amount of both very fine and coarse to very coarse quartz grains and granules, colorless mica, and carbonaceous matter. Grain size increases upward towards the middle of the section, whereas glauconite content decreases upwards through the middle but increases again near the top. Several shellbeds or former shellbeds are present, and near the top is a distinctive bed of medium to light gray clay or clay layers about 30 cm (1 ft) thick.

On the Eastern Shore of Chesapeake Bay, the Severn Formation is as much as 24 m (80 ft) thick and has at the base a distinctive bed, several feet thick, of very glauconitic, coarse to very coarse quartz sand with granules and small pebbles (Minard, 1974, p. 21–24).

The name Severn Formation was proposed by Darton (1891, p. 438–439) for exposures herein designated the type locality. However, he originally included both the Matawan and the Monmouth Formations of current usage within his Severn Formation. Thus, in the original description the total stratigraphic section between the Potomac Group and the Pamunkey Group (lower Tertiary) was assigned to the formation. Subsequently Darton (1893) named the upper part of his Potomac Group the "Magothy Formation" and later (1891, p. 439) noted that it underlaid the Severn. Darton noted (1891, p. 439) that "In Maryland it is a stratigraphic unit, distinctly separable from the New Jersey series as a whole by its homogeneity of constitution; * * *." The point to make here is that in New Jersey the Monmouth can be readily divided into several distinctive lithologic units, whereas in Maryland, although fossils suggest correlation with both the Red Bank Sand and the Navesink Formation of New Jersey, lithologic homogeneity does not make it feasible to divide the Monmouth on this basis; rather it is a lithologic unit unique to Maryland and part of Delaware. Contrasted with this is the presence of distinctively different lithologies in the thin Matawan section, still traceable from New Jersey.

THE WILLIAMSPORT FORMATION OR SANDSTONE (UPPER SILURIAN) IN EASTERN WEST VIRGINIA

By WILLIAM J. PERRY, JR.

INTRODUCTION

Recent geologic mapping east of Allegheny Front (fig. 5) in Grant, Mineral, and Pendleton Counties, W. Va. (Clark, 1967; Perry, 1971; Sites, 1971) has demonstrated that a thin clastic unit, termed Williamsport Sandstone by Woodward (1941; after Reger, 1924, p. 395–398) provides an excellent mapping and correlation horizon at the base of the Wills Creek Shale of the Cayuga Group, of Late Silurian age. Petrology by N. Lampiris (unpub. data, 1971) shows that at its designated type section (fig. 6) just east of Williamsport, Grant County, W. Va. (Reger, 1924, p. 396) this unit is chiefly gray siltstone. I have remeasured the type section (described below) and find that Lampiris is correct. A small increase in modal grain size of quartz within this unit occurs to the west and south of the type locality which resolves the apparent conflict (that is, siltstone vs. sandstone). The purpose of this

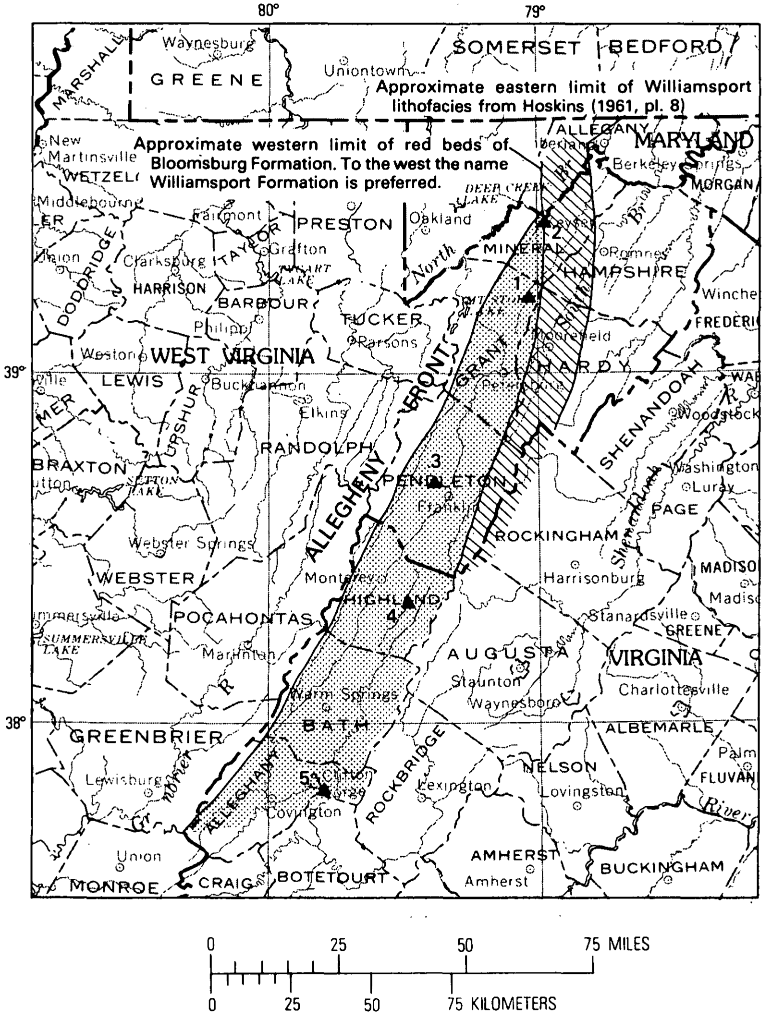

FIGURE 5.—Reference localities. Williamsport Formation: (1) Williamsport, Grant County, W. Va. (type section), and (2) Keyser, Mineral County, W. Va. Williamsport Sandstone: (3) Friends Run section, Pendleton County, W. Va., and (4) McDowell section, Highland County, Va. "Keefer" Sandstone: (5) Iron Gate section of Lesure (1957), Alleghany County, Va. Ruled area is approximate overlap of the intertonguing Williamsport and Bloomsburg Formations. Stippled area is approximate area of sandstone distribution in Williamsport Formation east of Allegheny Front.

report is to briefly state reasons for using the term Williamsport Formation for the olive-gray siltstones that occur as a distinct stratigraphic unit between the overlying Wills Creek Shale and underlying Mifflintown Formation near Williamsport, W. Va. To

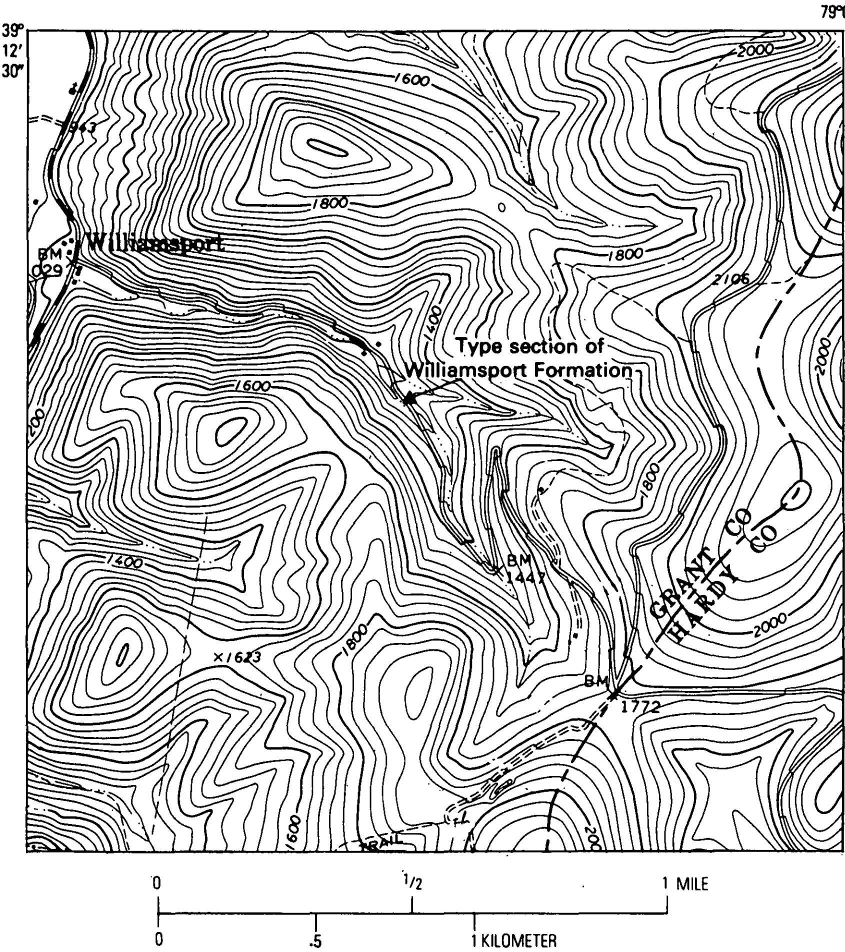

Figure 6.—Map showing location of the type section of the Williamsport Formation. Base from U.S. Geological Survey, 1:24,000, Medley, W. Va., 1967.

the south as well as to the west, where sandstone becomes the dominant lithology in this unit, the term Williamsport Sandstone is appropriate.

PREVIOUS WORK

Reger (1924, p. 396) proposed the term Williamsport Sandstone for the basically gray "extremely hard, and very fine-grained" quartzose unit in which "pebbles or coarse sand grains are entirely lacking" exposed on a short branch of Patterson Creek 0.6 mile east of Williamsport, Grant County. His brief description leaves no doubt that this is the locality shown in figure 6 and the unit described below. The absence of coarse sand grains and pebbles in this resistant clastic unit is the major field criterion for distinguishing it from the Keefer Sandstone at the base of the underlying Mifflintown Formation.

Woodward (1941) discussed the stratigraphy and areal distribution of the Williamsport Sandstone but nowhere mentioned (nor did Reger and Tucker) that in its type section the Williamsport is chiefly siltstone.

The lateral transition northeastward from the grey to buff Williamsport lithofacies in Mineral County, W. Va., into red beds of the Bloomsburg Formation in Allegany County, Md., and adjacent Bedford County, Pa., is shown by Hoskins (1961, fig. 6) in his comprehensive report on the Bloomsburg Formation. In plate 8 of the same study, Hoskins shows the eastern limit of the Williamsport (see also fig. 5, present report, after Hoskins). This lies west of the Evitts Creek and Patterson Creek quadrangles, Maryland, Pennsylvania, and West Virginia mapped by de Witt and Colton (1964), where the red Bloomsburg (rather than olive-gray Williamsport) lithofacies is present. The approximate western limit of Bloomsburg red beds is also shown on figure 5. The ruled area (fig. 5) shows the overlap of the two intertonguing lithofacies. Dennison (1970) discussed the areal distribution and facies relations within the Cayugan Series in his brief report on Silurian stratigraphy of the central Appalachian Basin. In this discussion, Dennison (1970, p. 12) reported that the Williamsport Sandstone in southern West Virginia merges eastward with the thick so-called "Keefer" Sandstone "from which it is a tongue." This is not the typical Keefer Sandstone of Maryland but rather a more than 70-m thick sandstone unit bounded above by the Wills Creek Shale and below by the Rose Hill Formation (as designated by Lesure, 1957, p. 37–39) in northwestern Botetourt and Alleghany Counties, Va. In Lesure's measured section of the "Keefer" Sandstone at Iron Gate, Alleghany County (Lesure, 1957, table 8, p. 39, and locality 5, fig. 5, present report), his unit 9, a thin to medium bedded, very fine to medium grained resistant sandstone, 16 m (52 ft) thick in the top of the "Keefer" represents the Williamsport Sandstone of Dennison (1970). This sandstone is underlain by shaly beds. This suggestions a southeastern source area and is consistent with my observation of a definite southward increase in percent sandstone in the Williamsport south of its type section, first at locality 3 (fig. 5, reference section described below) in central

Pendleton County, W. Va., and second at locality 4 (fig. 5) just east of McDowell on U.S. Route 250, Highland County, Va., where the Williamsport is chiefly a pale-gray orthoquartzite, intermediate in lithology and thickness between that at locality 3 and unit 9 of Lesure's "Keefer" at locality 5.

Patchen (1973) briefly discussed the petrology and stratigraphy of the Williamsport Sandstone throughout West Virginia. He found that the Williamsport in and near the type section was finer grained, immature, and contained a greater admixture of silt and clay than the Williamsport to the south and west of Allegheny Front, where it is chiefly a gray to white coarser grained, better sorted, sandstone. He concluded that two source areas were present: (1) the Bloomsburg delta to the northeast, and (2) a southerly source for the coarser sands. The lithology of the Williamsport Formation in and near the type section was attributed to rapid deposition at the seaward margin of the Bloomsburg delta. Berry and Boucot (1970, p. 123 and 256) also discuss the Williamsport Sandstone and its relationship to the Bloomsburg Formation. Based on the detailed work by Hoskins (1961) and ostracodes collected by J. M. Dennison, they agree with Dennison that the Williamsport Sandstone is late Ludlovian in age.

DISCUSSION

I propose that the term Williamsport Formation be used for the resistant olive-gray, chiefly silica-cemented siltstone, very fine grained sandstone, and interbedded silty shale below the Wills Creek Shale and above gray shales and carbonate rocks of the upper part of the Mifflintown Formation in West Virginia north of Pendleton County and in adjacent parts of western Maryland and Pennsylvania west of the western limit of the red beds of the Bloomsburg. Near Cedar Cliff, Md., in the Williamsport-Bloomsburg transition area (ruled area, fig. 5) a shaly limestone unit occurs in the middle of the Williamsport, the Cedar Cliff Limestone Member of Swartz (1923; Woodward, 1941), herein adopted for U.S. Geological Survey usage. This is the Cedar Cliff Limestone Member of the Bloomsburg Formation to the northeast. The Cedar Cliff Limestone Member has also been described, but not named, by Hoskins (1961, p. 62, unit 3, locality 20) "three-quarters of a mile east of Keyser," W. Va., 1.5 to 2.1 m (5 to 7 feet) below the top of the Williamsport Formation, which is 8.2 m (27 ft) thick at this locality.

Between Williamsport, Grant County, W. Va., and the Silurian outcrop belts of Pendleton County, W. Va., to the southwest, the modal grain size of quartz in the Williamsport Formation increases from coarse silt to fine to very fine sand. Resistant silty sandstone beds are present in the Williamsport in Pendleton County (locality 3, fig. 5, described below). In this area and also to the west and south of Pendleton County where sandstone is the predominant lithology present in this unit, I suggest that the term Williamsport Sandstone is entirely appropriate. Work in progress by Smosna, Patchen, Warshauer, and Perry indicates that the Williamsport Sandstone is widely distributed in the subsurface in West Virginia west of Allegheny Front and is an excellent marker horizon for correlation purposes, confirming many of the correlations of Patchen (1974). Where, for a variety of reasons related to the environment of deposition, sandstone is not the dominant lithofacies, Williamsport Formation is the appropriate designation.

The Williamsport, although only 6 to 9 m (20 to 30 ft) thick, forms low ridges in Grant and Pendleton Counties, W. Va., and in Highland County, Va. (fig. 5). It forms an excellent unit for correlation purposes at least as far west as Harrison County, W. Va., and as far south as Greenbrier County, W. Va., in the subsurface. For these reasons it is no longer appropriate to consider it the basal member of the Wills Creek Shale as designated by Hoskins (1961) and Perry (1971).

New documentation of the type section in Grant County, W. Va., and a measured reference section of Williamsport Sandstone (Friends Run section) in Pendleton County, W. Va., respectively localities 1 and 3 (fig. 5) are described as follows:

Type section of Williamsport Formation. On county road 1.2 km (0.75 mile) east of Williamsport, Grant County, W. Va. (fig. 5, locality 1), on Medley, W. Va. 7½′ quadrangle (fig. 6), 1.22 km (4,000 ft) south of lat 39°12′30″ N, 1.37 km (4,520 ft) west of long 79°00′ W.

Williamsport Formation (overlain by Willis Creek Shale)*

Unit	*Unit thickness m (ft)*	*Cumulative thickness m (ft)*
7. Siltstone, light to medium gray, argillaceous, blocky, dark buff weathered	0.79 (2.6)	0.79 (2.6)
6. Siltstone, coarse, light yellowish gray, silica-cemented, thin to medium bedded, slightly argillaceous, very fine sandy in part	1.07 (3.5)	1.86 (6.1)

* Woodward (1941, p. 165) includes 1.5 to 2.1 m (5 to 7 ft) more Williamsport at the top than given here. Above unit 7 he recognizes "3 to 5 feet of calcareous shale and limestone, upon which lies a 2-foot sandstone" comparable to the Keyser section (locality 2, fig. 5) about 27 km (17 miles) NNE described by Woodward (1941, p 162) and Hoskins (1961, p 62), in which the shaly beds (silty claystone and shaly limestone are much thicker.

Williamsport Formation (overlain by Willis Creek Shale)*—Continued

Unit	*Unit thickness m (ft)*	*Cumulative thickness m (ft)*
5. Siltstone, coarse, very fine sandy, and very fine silty sandstone, light olive gray to pale buff, thin to medium bedded, rippled, cross-laminated in part	1.28 (4.2)	3.14 (10.3)
4. Siltstone, coarse, light olive gray, very fine sandy in part, thin pinch-and-swell bedded	1.1 (3.6)	4.24 (13.9)
3. Siltstone, medium to light gray, argillaceous near base	0.73 (2.4)	4.97 (16.3)
2. Covered (with scattered silty shale chips)	0.85 (2.8)	5.34 (17.5)
1. Siltstone, gray, argillaceous near base and top, silica-cemented in center, thin bedded with shaly partings	0.85 (2.8)	6.19 (20.3)

Reference section of Williamsport Sandstone. On the north side of U.S. 33, 3.0 miles west of junction of U.S. 33 and U.S. 220 north of Franklin, Pendleton County, W. Va., locality 3 (fig. 5).

Williamsport Sandstone (top not exposed)

Unit	*Unit thickness m (ft)*	*Cumulative thickness m (ft)*
8. Sandstone, light olivine gray (5Y 6/1) to light gray (N6), silty, very fine to fine grained, in beds 1.9–9.5 cm (0.75 to 3.8 in.) thick, with abundant vertical burrows	0.27 (0.91)	0.27 (0.91)
7. Sandstone, silty, very fine to fine grained, in single bed, silica-cemented in part	0.17 (0.56)	0.44 (1.47)
6. Sandstone, very fine grained, silty and sandy siltstone, including 0.13 m (0.42 ft) of very thin sandy siltstone beds with shaly partings at base	0.51 (1.67)	0.95 (3.14)
5. Sandstone, very fine grained, silty, silica-cemented in part, in 0.52 m (1.7 ft) bed, with discontinuous partings	0.52 (1.7)	1.47 (4.84)
4. Sandstone, very fine grained, silty, in beds 4.6-18.3 cm (0.15 to 0.6 ft) thick	0.43 (1.4)	1.90 (6.24)
3. Sandstone, very fine grained, silty, in two thin beds interstratified with silty shale	0.27 (0.9)	2.17 (7.14)
2. Sandstone, fine to very fine grained, silty, silica-cemented, thin-bedded in resistant ledge	0.91 (3.0)	3.08 (10.1)
1. Siltstone, light gray, very fine sandy, with very thin silty sandstone stringers, becoming increasingly argillaceous towards base	1.07 (3.5)	4.15 (13.6)
Mudstone, medium dark gray, calcareous (top of Mifflintown Formation)	0.15 (0.5)	

THE MASSANUTTEN SANDSTONE IN ROCKINGHAM, PAGE, SHENANDOAH, AND WARREN COUNTIES, VIRGINIA

By William J. Perry, Jr.

The designation "Tuscarora Sandstone and associated sandstones, of Silurian age" (Butts, 1933), along Massanutten Mountain and adjoining ridges in Rockingham, Page, Shenandoah, and Warren Counties, Va., is here abandoned and the name Massanutten Sandstone is reinstated for the thick sequence of sandstone and conglomerate occurring between the overlying Bloomsburg Formation (Upper Silurian) and underlying Martinsburg Shale (Middle and Upper Ordovician) of this isolated Silurian outcrop belt (fig. 7).

The term Tuscarora Sandstone was originally applied by Darton and Taff (1896) to outcrops on New Creek Mountain in Mineral and Grant Counties, W. Va., of a white sandstone bounded above by the "Cacapon Sandstone," now included in the basal part of the Rose Hill Formation (lower Middle Silurian), and bounded below by the red beds of the Juniata Formation (Upper Ordovician). It is named for Tuscarora Mountain on the common border line of Juniata and Perry Counties, Pa. This usage applies for exposures in Virginia, West Virginia, Maryland, and Pennsylvania north and west of the Shenandoah Valley where the bounding Rose Hill Formation (above) and Juniata Formation (below) are present. These bounding formations are absent in the more easterly Upper Ordovician and Silurian outcrop belts—Massanutten Mountain and associated ridges in the Shenandoah Valley, Va. The Massanutten Sandstone, now considered to be entirely Silurian in age (Pratt and others, 1975), is apparently correlative with the Tuscarora Sandstone (Lower Silurian), Rose Hill Formation (Middle Silurian), overlying Keefer Sandstone (Middle Silurian), and possibly younger Silurian rocks in the outcrop belts west of the Shenandoah Valley (Butts, 1940; Brent, 1960; Dennison, 1970). Stratigraphic implications of the Massanutten Sandstone are summarized by Dennison (1970).

The term Massanutten Sandstone was originally used by Geiger and Keith (1891) for Lower Cambrian sandstone in the Harpers Ferry, West Virginia, Maryland, and Virginia area which they correlated with the Silurian sandstone of Massanutten Mountain, a misconception later corrected by Keith (1894). Darton (1892, p. 14) applied the term Massanutten Sandstone, named "from the prominent Massanutten Mountains in which it is typically developed" to Upper Ordovician through Middle Silurian clastic

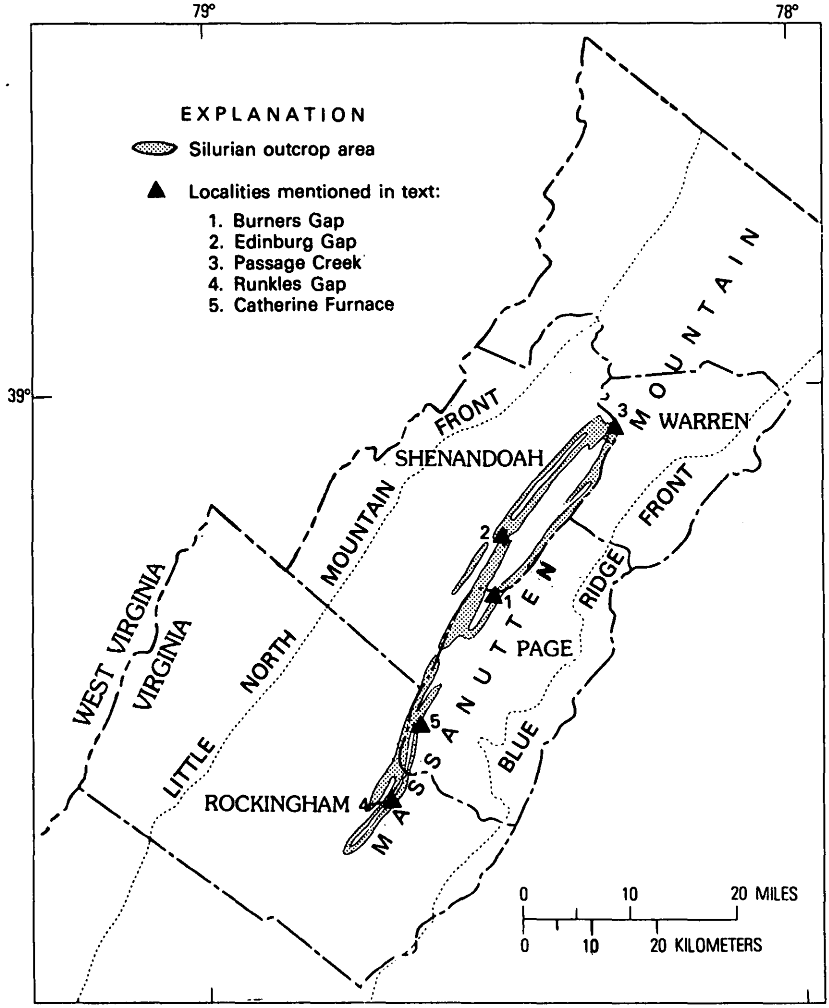

FIGURE 7.—Index map showing Page, Rockingham, Shenandoah, and Warren Counties, Va.; the Silurian outcrop area on Massanutten Mountain and adjoining ridges; and localities mentioned in the text.

rocks west of Shenandoah Valley, a practice soon abandoned (Darton and Taff, 1896).

Spencer (1897) was the first to study the geology of the Massanutten Mountain area. His usage of the name Massanutten has been followed by more recent workers (Woodward, 1941; Brent, 1960; Allen, 1967) to refer to the sandstone and conglomerate above the Martinsburg Shale and below the "Rockwood" (now Bloomsburg Formation) of Massanutten Mountain. However, his fossil-bearing "lower member," less than 70 m thick (Spencer, 1897, p. 9), is assigned herein to the Martinsburg Shale. I have examined these beds at Passage Creek and Catherine Furnace (localities 3 and 5, fig. 7), where they are silty, argillaceous, lithic arenites with interbedded gray shale, lithologies representative of the upper part of the Martinsburg of the area. Spencer's upper Massanutten "indurated sandstone, composed entirely of well-washed and sorted quartz, in which crossbedding is characteristic throughout" is the "Tuscarora-Clinton (Massanutten)" interval of Butts (1940, p. 234).

A reference section of the Massanutten Sandstone has been designated and described (Thornton, 1953, unpublished thesis) at Burners Gap, Page County, Va., 4.8 km N. 25° W. of Hamburg. Brent (1960) reported the following thicknesses: 197 m (646 ft) in a description of the section at Runkles (Ruckles) Gap, Rockingham County; 213 m (700 ft) at Burners Gap, Page County; and 256 m (840 ft) at Edinburg Gap, Shenandoah County (fig. 7). The unit thickens eastward and northward (Rader, written commun., 1976) to approximately 365 m (1,200 ft) along Passage Creek on Virginia Route 687, Warren County. This locality at lat 38° 57′ N., long 78° 18′ W., was studied by Pratt and others (1975 and unpub. data), who found Silurian plant material in carbonaceous shale partings 21 to 253 m above the base of the Massanutten.

THE VANPORT LIMESTONE MEMBER AS USED BY PHALEN (1912) IN NORTHEASTERN KENTUCKY

By CHARLES L. RICE

The Vanport Limestone Member of the Breathitt Formation (Pennsylvanian) in Kentucky is herein changed to the informal "Vanport Limestone Member as used by Phalen (1912)." The change will be made on all subsequent Kentucky geologic quadrangle maps on which the Vanport Limestone is shown.

The Vanport Limestone Member of the Breathitt Formation was formally accepted for use in Kentucky by the U.S. Geological Survey in 1964, on the basis of its mention in a water-supply paper by Price, Mull, and Kilburn, 1962. In a chart on page 12 of this publication, the unit is listed under a heading of "Member [1]"; the footnote erroneously attributes the usage to Stockdale (1939), a paper devoted entirely to Lower Mississippian rocks. In a hydrologic investigations atlas (Price, Kilburn, and Mull, 1962), the Vanport Limestone Member is footnoted as "Member, as used by

Stockdale (1939)." In both publications the appropriate notation and reference should have been "as used by Phalen (1912)."

Phalen (1912), described this unit from a section at Coalgrove, Ohio, opposite Ashland, Ky., as "equivalent to the Vanport ('Ferriferous') limestone of Pennsylvania"; the unit referred to by Phalen is the Vanport Limestone Member of the Clarion Formation as defined by White (1878). Seven U.S. Geological Survey geologic quadrangle maps published from 1962 to 1971 showed this unit; five (Carlson, 1965; Carlson, 1971; Sharps, 1967; Sheppard and Ferm, 1962; Whittington and Ferm, 1967) have referred to it as the Vanport Limestone Member of the Breathitt Formation, and two (Dobrovolny, Sharps, and Ferm, 1963; Dobrovolny, Ferm, and Eroskay, 1966) as the Vanport Limestone of White (1878). All these publications refer to the stratigraphic unit described by Phalen.

Examination of the fauna contained in the limestone at Coalgrove, Ohio, suggests that this unit is younger than the Vanport Limestone Member of the Allegheny Formation as mapped in east-central Ohio; the unit is considered by R. C. Douglass (written commun., 1976) to be more closely related faunally to the so-called "Columbiana Limestone Member" of the Allegheny Formation of that area. Since the unit has not properly met the criteria required for a formal member and since its stratigraphic position is unclear, the unit is retained as the Vanport Limestone Member as used by Phalen (1912).

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