Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1978

GEOLOGICAL SURVEY BULLETIN 1482-A

Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1978

By NORMAN F. SOHL *and* WILNA B. WRIGHT

CONTRIBUTIONS TO STRATIGRAPHY

GEOLOGICAL SURVEY BULLETIN 1482-A

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1979

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, *Secretary*

GEOLOGICAL SURVEY

H. William Menard, *Director*

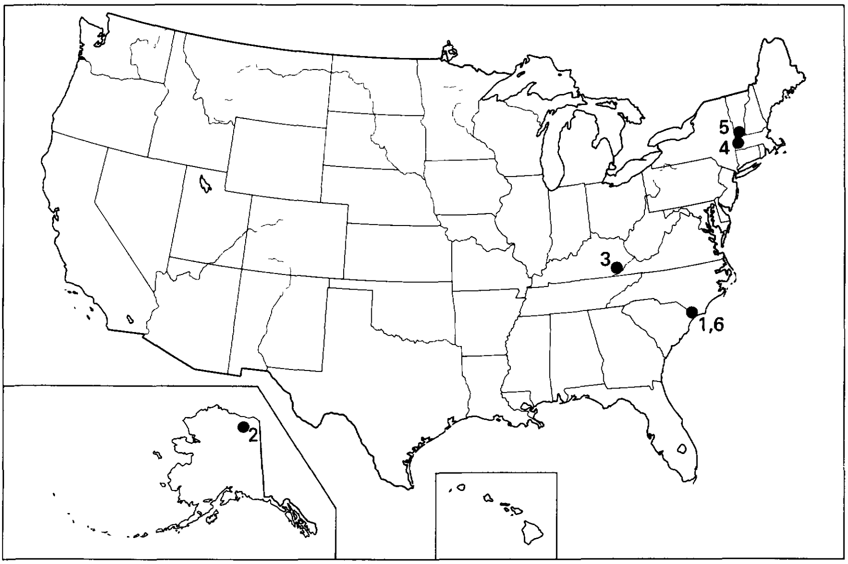
Library of Congress Catalog-card No. 80-600040

For sale by Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402

Stock Number 024-001-03302-0

CONTENTS

ILLUSTRATIONS



GEOGRAPHIC INDEX TO ARTICLES

CHANGES IN STRATIGRAPHIC NOMENCLATURE BY THE U.S. GEOLOGICAL SURVEY, 1978

By Norman F. Sohl and Wilna B. Wright

INTRODUCTION

At the 33rd annual meeting of the American Commission on Stratigraphic Nomenclature in Toronto, Canada, October 24, 1978, two new ammendments to the Code were approved:

> Note 45 concerns terminology for igneous and high-grade metamorphic rocks and approves the formal usage of complex and suite.
>
> Note 46, concerning the smallest formal rock-stratigraphic unit, flow, was also approved.

These notes have been published in issues of the Bulletin of the American Association of Petroleum Geologists.

One other item of special note was voted upon and implemented to change the name of the Commission to North American Commission on Stratigraphic Nomenclature.

MAJOR STRATIGRAPHIC AND TIME DIVISIONS

(Compiled by Geologic Names Committee, U.S. Geological Survey)

Terms designating time are in parentheses. Informal time terms ("early," "middle," and "late") may be used where there is no formal subdivision into Early, Middle, and Late for an eon, era, period, subperiod, or epoch. Informal rock terms ("lower," "middle," and "upper") may be used where there is no formal subdivision into Lower, Middle, and Upper for an eon, erathem, system, subsystem, or series.

Estimates for ages of stratigraphic and time boundaries are under continuous study and are subject to refinement and controversy. Two scales are given for comparison. If neither Geological Society of London nor Berggren reference is used, author should cite the published source that is followed. A useful time scale for North American mammalian ages is given by Evernden and others (1964, p. 145-198).

Subdivisions in use by the U.S. Geological Survey					Age estimates commonly used for boundaries (in million years before present)	
Eon (Eon)	Erathem (Era)	System (Period)	Subsystem (Subperiod)	Series (Epoch)	Geological Society of London (1964, p.222, 260-262)	Berggren (1972, p. 195-215)
Phanerozoic	Cenozoic	Quaternary		Holocene (Holocene)		
				Pleistocene (Pleistocene)		1.8
		Tertiary	Neogene	Pliocene (Pliocene)		5.0
				Miocene (Miocene)		22.5
			Paleogene	Oligocene (Oligocene)		37.5
				Eocene (Eocene)		53.5
				Paleocene (Paleocene)	65	65
	Mesozoic	Cretaceous[1]		Upper (Late) Lower (Early)	136	
		Jurassic		Upper (Late) Middle (Middle) Lower (Early)	190-195	
		Triassic		Upper (Late) Middle (Middle) Lower (Early)	225	
	Paleozoic	Permian[1]		Upper (Late) Lower (Early)	280	
		Pennsylvanian[1]		Upper (Late) Middle (Middle) Lower (Early)	320	
		Mississippian[1]		Upper (Late) Lower (Early)	345	
		Devonian		Upper (Late) Middle (Middle) Lower (Early)	395	
		Silurian[1]		Upper (Late) Middle (Middle) Lower (Early)	430-440	
		Ordovician[1]		Upper (Late) Middle (Middle) Lower (Early)	500	
		Cambrian[1]		Upper (Late) Middle (Middle) Lower (Early)	570	
Proterozoic		Proterozoic Z[2]			800	
		Proterozoic Y[2]			1,600	
		Proterozoic X[2]			2,500	
Archean						

[1] Includes provincial series accepted for use in U.S. Geological Survey reports.

[2] Informal time division.

In the following listing, stratigraphic names adopted, revised, reinstated, or abandoned are listed alphabetically. The time-stratigraphic classification (system or series) of the rock-stratigraphic unit, the area involved, and the action taken, along with reference citation of the author(s), are given. The capitalization of terms follows official rock-stratigraphic and time usage.

LISTING OF NOMENCLATURAL CHANGES

Absaroka Volcanic Supergroup (formation assigned to)
lower, middle, and upper Eocene
northwestern Wyoming

Love, J. D., Leopold, E. B., and Love, D. W., 1978, Eocene rocks, fossils, and geologic history, Teton Range, north-western Wyoming: U.S. Geol. Survey Prof. Paper 932-B, 40 p.

Hominy Peak Formation of middle Eocene age adopted and assigned to Absaroka Volcanic Supergroup in Teton Range area. Unconformably overlies Pinyon Conglomerate; unconformably underlies Conant Creek Tuff. Absaroka remains in good usage in south-central Montana.

Animikie Group (subdivided)
Precambrian X
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Divided into: Thomson Formation and (=) Rove Formation. Underlies Keweenawan Supergroup.

Antero Formation (name adopted)
Oligocene
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ} \times 2^{\circ}$ quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

Antero Formation of Johnson (1937) adopted as stratigraphically restricted by Stark and others (1949). Overlies Tallahassee Creek Conglomerate; underlies Wagontongue Formation.

Ardmore Beds (geographic extension)
(of Sharon Springs Member)
(of Pierre Shale)
Upper Cretaceous
northeastern Colorado

Kiteley, L. W., 1978, Stratigraphic sections of Cretaceous rocks of the northern Denver basin, northeastern Colorado and southeastern Wyoming: U.S. Geol. Survey Oil and Gas Inv. Chart OC-78, 3 sheets.

Geographically extended from South Dakota, North Dakota, Wyoming, and Montana into: Denver basin of northeastern Colorado.

Auld Lang Syne Group (age changed)
Upper Triassic and Lower Jurassic
northwestern Nevada

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada: Nevada Bur. Mines and Geology Bull. 89, 115 p.

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

Bailey Limestone (geographic extension and age changed)
Upper Silurian and Lower Devonian (varies locally)
Illinois basin, Illinois and Kentucky

Spirakis, C. S., 1978, Position of the sub-Kaskaskia unconformity in the Illinois basin: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 4, p. 705-708.

Geographically extended from Missouri and Kentucky into: southern and southwestern Illinois basin, Illinois, where age changed from Early Devonian to: Late Silurian and Early Devonian (varies locally elsewhere).

Bassick Agglomerate (name abandoned)
Oligocene
south-central Colorado

Sharp, W. N., 1978, Geologic map of the Silver Cliff and Rosita volcanic centers, Custer County, Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1081.

Bassick Agglomerate abandoned; its rocks now included in Rosita Andesite.

Beaucoup Formation (here named)
Upper Devonian
northern Alaska

Dutro, J. T., Jr., Brosgé, W. P., Reiser, H. N., and Detterman, R. L., Beaucoup Formation, a new Upper Devonian stratigraphic unit in the central Brooks Range, northern Alaska: this report.

Beaucoup Formation adopted. Unconformably overlies Skajit Limestone; conformably underlies Hunt Fork Shale.

Beaufort Formation (member adopted)
lower to upper Paleocene (Danian to Thanetian)
east-central North Carolina

Brown, P. M., Brown, D. L., Shufflebarger, T. E., Jr., and Sampair, J. L., 1977, Wrench-style deformation in rocks of Cretaceous and Paleocene age, North Carolina coastal plain: North Carolina Dept. Natural and Economic Resources Spec. Pub. 5, 47 p.

Jericho Run Member adopted as basal member of Beaufort Formation, disconformably overlying Peedee Formation.

Beekmantown Group (age changed)
Lower and Middle Ordovician (upper Canadian through Chazyan)
western Maryland and northern Virginia

Harris, A. G., and Harris, L. D., 1978, Lower-Middle Ordovician boundary in south-central Appalachian Basin—conformity and unconformity—the Beekmantown Group "updated," in Geological Survey research 1977: U.S. Geol. Survey Prof. Paper 1100, p. 231.

In western Maryland and northern Virginia where its Rockdale Run Formation (Lower and Middle Ordovician) and Pinesburg Station Dolomite (Middle Ordovician) are located, age of Beekmantown changed from Early Ordovician to: Early and Middle Ordovician (late Canadian through Chazyan). Elsewhere in Maryland and Virginia and in New York, New Jersey, Pennsylvania, Vermont, West Virginia, and Tennessee, age of Beekmantown Limestone/Shale/Dolomite/Group varies locally.

Belgrade Formation (here named)
lower Miocene
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Belgrade Formation adopted; includes rocks formerly assigned to Trent Marl (now abandoned). Divided into: Pollocksville Member (near-shore) and (=) Haywood Landing Member (off-shore) (penecontemporaneous in part; both new names). Unconformably overlies River Bend Formation (new name; also includes rocks formerly assigned to Trent Marl); underlies Duplin Formation.

Berg Creek Formation (here named)
Lower Cretaceous (Hauterivian or Hauterivian and Barremian)
south-central Alaska

MacKevett, E. M., Jr., Smith, J. G., Jones, D. L., and Winkler, G. R., 1978, Geologic map of the McCarthy C-8 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-1418.

Berg Creek Formation adopted. Unconformably overlies Triassic rocks or noncomformably overlies Chitina Valley batholith; gradationally underlies Kuskulana Pass Formation (new name) and, locally, cut by Tertiary plutons.

Bisbee Group (geographic extension and subdivided)
Lower Cretaceous
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico as Bisbee Group (Bisbee Group or Formation remains good usage in Arizona) where it includes (ascending): McGhee Peak Formation, Carbonate Hill Limestone, Still Ridge Formation, and Johnny Bull Sandstone.

Bisher Dolomite (name variation)
Middle Silurian
east-central Kentucky

Philley, J. C., 1978, Geologic map of the Salt Lick quadrangle, east-central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1499.

Name changed to Bisher Dolomite in report area. Bisher Limestone remains good usage elsewhere in Kentucky.

Boyer Ranch Formation (name adopted)
Middle Jurassic
northwestern Nevada

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada: Nevada Bur. Mines and Geology Bull. 89, 115 p.

Boyer Ranch Formation of Speed and Jones (1969) adopted. Unconformably overlies Auld Lang Syne Group; unconformably underlies unnamed basaltic tuff; intruded by Middle Jurassic mafic complex.

Breathitt Formation (member assigned to)
lower Middle Pennsylvanian
southeasternmost Kentucky

Ping, R. G., and Rice, C. L., Stoney Fork Member (new name) of the Breathitt Formation in southeasternmost Kentucky: this report.

Stoney Fork Member adopted and assigned to Breathitt Formation, replacing Lost Creek Limestone of Morse (1931) (formally preempted by prior usage). Stoney Fork overlies Magoffin Member of Breathitt and underlies unnamed sandstone and coal beds of Breathitt. Age of Stoney Fork is Middle Pennsylvanian (Atokan). Breathitt Formation or Group remains good usage elsewhere in Kentucky and in Tennessee and Virginia.

Bunker Trachyandesite (age changed)
Miocene
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo 1^{o} x 2^{o} quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

Age changed from Oligocene to: Miocene.

Burket Shale Member (geographic extension)
(of Harrell Formation)
Upper Devonian
west-central West Vriginia

Wallace, L. G., Roen, J. B., and de Witt, Wallace, Jr., 1978, Preliminary stratigraphic cross section showing radioactive zones in the Devonian black shales in south-eastern Ohio and west-central West Virginia: U.S. Geol. Survey Oil and Gas Inv. Chart OC-83.

Geographically extended from Pennsylvania and Maryland into: west-central West Virginia.

Caldwell Canyon Volcanics (name adopted)
Miocene or younger
Teton Range area, northwestern Wyoming

Love, J. D., Leopold, E. B., and Love, D. W., 1978, Eocene rocks, fossils, and geologic history, Teton Range, north-western Wyoming: U.S. Geol. Survey Prof. Paper 932-B, 40 p.

Caldwell Canyon Volcanics of Love (1939) adopted. Unconformably overlies Wiggins Formation.

Carbonate Hill Limestone (name adopted)
(of Bisbee Group)
Lower Cretaceous
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Carbonate Hill Limestone of Gillerman (1958) adopted as one of four formations of Bisbee Group. Overlies McGhee Peak Formation of Bisbee; underlies Still Ridge Formation of Bisbee.

Carlotta Formation (name adopted)
(of Wildcat Group)
upper Pliocene and lower Pleistocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

Castle Hayne Formation (redefined and subdivided)
middle Eocene (Claibornian)
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Castle Hayne redefined and subdivided. Name changed from Castle Hayne Limestone to: Castle Hayne Formation. Geographically restricted to Onslow Bay area of North Carolina Coastal Plain. Replaces rocks previously included in Trent Marl (now abandoned). Divided into (ascending): New Hanover, Comfort, and Spring Garden Members (all new names). Age changed from middle and late Eocene to: middle Eocene (Claibornian). Overlies Peedee Formation; underlies River Bend Formation (new name).

Chanac Formation (age changed)
Miocene
southern California

Bartow, J. A., and Doukas, M. P., 1978, Preliminary geologic map of the southeastern border of the San Joaquin Valley, California: U.S. Geol. Survey Misc. Field Studies Map MF-944.

Age changed from Pliocene to: Miocene.

Chelmsford Granite (name adopted)
Lower Devonian
northeastern Massachusetts and southeastern
New Hampshire

Robinson, G. R., Jr., 1978, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles, and part of the Ayer quadrangle, Massachusetts and New Hampshire: U.S. Geol. Survey Misc. Field Studies Map MF-957.

Chelmsford Granite of Lyons and Faul (1968) adopted. Overlies Paleozoic diorite-monzonite and Merrimack Formation.

Cleveland Member (geographic extension)
(of Ohio Shale)
Upper Devonian
eastern Kentucky

Provo, L. J., Kepferle, R. C., and Potter, P. E., 1978, Division of black Ohio Shale in eastern Kentucky: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 9, p. 1703-1713.

Geographically extended from Ohio into: eastern Kentucky. Overlies Three Lick Bed of Ohio Shale; underlies Berea Sandstone and Bedford Shale.

Cochiti Formation (age changed)
upper Miocene to lower Pliocene
north-central New Mexico

Manley, Kim, 1978, Geologic map of Bernalillo NW quadrangle, Sandoval County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-1446.

Age changed from early to middle Pliocene to: late Miocene to early Pliocene.

Colina Limestone (geographic extension)
(of Naco Group)
Lower Permian
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico. Overlies Earp Formation of Naco; underlies Scherrer Formation of Naco.

Comfort Member (here named)
(of Castle Hayne Formation)
upper middle Eocene (Claibornian)
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Comfort Member adopted as middle of three new members of Castle Hayne Formation (now redefined). Unconformably overlies New Hanover Member and underlies Spring Garden Member (both new names of Castle Hayne); correlates with part of Gosport Sand of Alabama and Santee Limestone of South Carolina.

Conant Creek Tuff (here named)
Pliocene
northwestern Wyoming and northeastern Idaho

Christiansen, R. L., and Love, J. D., 1978, The Pliocene Conant Creek Tuff in the northern part of the Teton Range and Jackson Hole, Wyoming: U.S. Geol. Survey Bull. 1435-C, p. C1-C9.

Conant Creek Tuff adopted. Unconformably overlies Hominy Peak, Teewinot, or intervening Bivouac Formation; unconformably underlies Huckleberry Ridge Tuff.

Concha Limestone (geographic extension)
(of Naco Group)
Lower Permian
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico as uppermost of five formations of Naco. Overlies Scherrer Formation of Naco; underlies McGhee Peak Formation of Bisbee Group.

Conejo Volcanics (name adopted)
middle Miocene
southern California

Greene, H. G., 1976, Late Cenozoic geology of the Ventura basin, California, in Howell, D. G., ed., Aspects of the geologic history of the California continental borderland: Am. Assoc. Petroleum Geologists Pacific Sec. Misc. Pub. 24, p. 499-529.

Conejo Volcanics of Taliaferro (1924) adopted. Overlies Topanga (Temblor?) Formation; underlies Monterey Shale.

Cooney Tuff (redefined)
Oligocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Name changed from Cooney Quartz Latite or Cooney Quartz Latite Tuff to: Cooney Tuff. Divided into (ascending): Whitewater Creek Member (reduced in rank from Whitewater Creek Rhyolite) and unnamed quartz latite member.

Crater Mountain Dacite (age changed)
Eocene
northwestern Wyoming

Pierce, W. G., 1978, Geologic map of the Cody $1^{\circ} \times 2^{\circ}$ quadrangle, northwestern Wyoming: U.S. Geol. Survey Misc. Field Studies Map MF-963.

Age changed from Tertiary to: Eocene.

Cripple Creek Quartz Monzonite (lithology changed)
Precambrian Y
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo $1^{\circ} \times 2^{\circ}$ quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

In report area only, lithologic name changed from Cripple Creek Granite to: Cripple Creek Quartz Monzonite; usage of Cripple Creek Granite remains unchanged elsewhere in Colorado.

Deadwood Gulch Member (reduced in rank, assigned to formation, and age refined)
(of Fanney Rhyolite)
Miocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Deadwood Gulch Rhyolite Tuff reduced in rank to: Deadwood Gulch Member and assigned to: Fanney Rhyolite as its upper member. Overlies unnamed basal unit of Fanney; underlies Last Chance Andesite. Age refined from Tertiary to: Miocene.

Denay Limestone (name adopted)
Middle Devonian
central Nevada

Johnson, J. G., and Sandberg, C. A., 1977, Lower and Middle Devonian continental-shelf rocks of the western United States, in Murphy, M. A., and others, eds., Western North America: Devonian: Riverside, Calif., California Univ. Riverside Campus Museum Contrib. no. 4, p. 121-143.

Denay Limestone of Johnson (1965) and as stratigraphically restricted by Johnson (1966) adopted. Overlies McColley Canyon Formation; underlies beds at Red Hill or unnamed dolomite.

Dixie Valley Formation (age changed)
upper Lower or lower Middle Triassic
northwestern Nevada

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada: Nevada Bur. Mines and Geology Bull. 89, 115 p.

Age changed from Middle Triassic to: late Early or early Middle Triassic.

Duluth Complex (assignment to supergroup)
(of Keweenawan Supergroup)
Precambrian Y
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Assigned to Keweenawan Supergroup in northeastern Minnesota. Overlies North Shore Volcanic Group of Keweenawan; underlies unnamed volcanic rocks, undivided, of Keweenawan; equivalent of unnamed mafic intrusive rocks of Keweenawan.

Earp Formation (geographic extension and age variation)
(of Naco Group)
Lower Permian
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico, where its age is Early Permian only (age remains Late Pennsylvanian and Early Permian in Arizona). Overlies Horquilla Limestone of Naco; underlies Colina Limestone of Naco.

Eel River Formation (name adopted)
(of Wildcat Group)
lower Pliocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

Eureka Canyon Tuff (here named)
Oligocene
western Nevada

Bingler, E. C., 1978, Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geol. Survey Bull. 1457-D, 19 p.

Eureka Canyon Tuff adopted. Disconformably overlies Nine Hills Tuff (new name); disconformably underlies unnamed tuffs.

Fanney Rhyolite (subdivided and age refined)
Miocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Divided into (ascending): unnamed basal unit and Deadwood Gulch Member (now reduced in rank from Deadwood Gulch Rhyolite Tuff). Overlies Mineral Creek Andesite; underlies Last Chance Andesite. Age refined from Miocene(?) to: Miocene.

Fifes Peak Formation (age changed)
uppermost Oligocene and lower Miocene
south-central Washington

Swanson, D. A., 1978, Geologic map of the Tieton River area, Yakima County, south-central Washington: U.S. Geol. Survey Misc. Field Studies Map MF-968.

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

Fitchburg Granite (age changed)
Lower, Middle, and Upper Devonian (varies locally)
northeastern Massachusetts

Robinson, G. R., Jr., 1978, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles, and part of the Ayer quadrangle, Massachusetts and New Hampshire: U.S. Geol. Survey Misc. Field Studies Map MF-957.

Age changed from late Carboniferous or post-Carboniferous to: Devonian (Early, Middle, and Late—varies locally).

Fond du Lac Formation (name adopted)
(of Keweenawan Supergroup)
Precambrian Y
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Fond du Lac sandstone of Winchell (1899) adopted as Fond du Lac Formation and assigned to Keweenawan Supergroup. Overlies Animikie Group and unnamed volcanic rocks of Keweenawan; underlies Hinckley Sandstone of Keweenawan.

Foreknobs Formation (geographic extension)
Upper Devonian
west-central Virginia

Perry, W. J., Jr., 1978, Sequential deformation in the central Appalachians, in Appalachian geodynamic research: Am. Jour. Sci., v. 278, no. 4, p. 518-542.

Geographically extended from northern West Virginia and southwestern Pennsylvania into: west-central Virginia.

Fortification Basalt Member (age changed)
(of Muddy Creek Formation)
upper Miocene and lower Pliocene
northwestern Arizona and southeastern Nevada

Anderson, R. E., 1978, Geologic map of the Black Canyon 15-minute quadrangle, Mohave County, Arizona, and Clark County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-1394.

Age changed from Pliocene to: late Miocene and early Pliocene.

Galiuro Volcanics (age changed)
Oligocene and lower Miocene
southeastern Arizona

Creasey, S. C., and Krieger, M. H., 1978, Galiuro Volcanics, Pinal, Graham, and Cochise Counties, Arizona: U.S. Geol. Survey Jour. Research, v. 6, no. 1, p. 115-131.

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

Gammon Member (geographic extension)
(of Pierre Shale)
Upper Cretaceous
northeastern Colorado

Kiteley, L. W., 1978, Stratigraphic sections of Cretaceous rocks of the northern Denver basin, northeastern Colorado and southeastern Wyoming: U.S. Geol. Survey Oil and Gas Inv. Chart OC-78, 3 sheets.

Geographically extended from Wyoming and Montana into: Denver basin of northeastern Colorado.

Geneseo Shale Member (stratigraphic restriction)
(of Genesee Formation)
Middle and Upper Devonian
central and western New York

de Witt, Wallace, Jr., and Colton, G. W., 1978, Stratigraphy and conodonts of the Genesee Formation (Devonian) in western and central New York, Chapter A in, Physical stratigraphy of the Genesee Formation (Devonian) in western and central New York: U.S. Geol. Survey Prof. Paper 1032-A, 22 p.

Stratigraphically restricted to exclude former upper bed now included in overlying Penn Yan Shale Member of Genesee.

Greylock Schist (age changed)
Proterozoic Z and Lower Cambrian
western Massachusetts

Ratcliffe, N. M., Age of Greylock Schist in western Massachusetts: this report.

Age changed from Middle Ordovician to: Proterozoic Z and Early Cambrian.

Hana Formation (name redesignated)
Pleistocene and Holocene
Maui, Hawaii

Macdonald, G. A., 1978, Geologic map of the crater section of Haleakala National Park, Maui, Hawaii: U.S. Geol. Survey Misc. Geol. Inv. Map I-1088, 8 p. text.

Name Hana Volcanic Series redesignated: Hana Formation.

Hartford Hill Rhyolite Tuff (name abandoned)
lower Miocene
western Nevada

Bingler, E. C., 1978, Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geol. Survey Bull. 1457-D, 19 p.

Hartford Hill Rhyolite Tuff abandoned; its rocks now included in Santiago Canyon Tuff (new name).

Haywood Landing Member (here named)
(of Belgrade Formation)
lower Miocene
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Haywood Landing Member adopted as one of two new members of Belgrade Formation (new name). Unconformably overlies River Bend Formation (new name); underlies Duplin Formation; in part penecontemporaneous with Pollocksville Member (new name) of Belgrade; correlates with Tampa Limestone of Florida.

Hignite Formation (reassignment of member to)
(of Breathitt Group)
Middle Pennsylvanian
southeastern Kentucky

Rice, C. L., and Maughan, E. K., 1978, Geologic map of the Kayjay quadrangle and part of the Fork Ridge quadrangle, Bell and Knox Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1505.

In area along and south of Pine Mountain, Magoffin Member reassigned to middle part of Hignite Formation of Breathitt Group; Magoffin overlies Hignite coal bed and underlies Low Splint coal bed, both in Hignite. In area north of Pine Mountain, Magoffin remains member of Breathitt Formation. Hignite Formation or Member of Breathitt Group or Formation remains good usage elsewhere in Kentucky and in Tennessee.

Hinckley Sandstone (assignment to supergroup)
(of Keweenawan Supergroup)
Precambrian Y
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Assigned to Keweenawan Supergroup in northeastern Minnesota. Overlies Fond du Lac Formation of upper part of Keweenawan; underlies Quaternary glacial drift.

Hominy Peak Formation (here named)
(of Absaroka Volcanic Supergroup)
middle Eocene
Teton Range area, northwestern Wyoming

Love, J. D., Leopold, E. B., and Love, D. W., 1978, Eocene rocks, fossils, and geologic history, Teton Range, north-western Wyoming: U.S. Geol. Survey Prof. Paper 932-B, 40 p.

Hominy Peak Formation adopted and assigned to Absaroka Volcanic Supergroup. Unconformably overlies Pinyon Conglomerate; unconformably underlies Conant Creek Tuff.

Honomanu Formation (name revised)
upper Tertiary(?)
Maui, Hawaii

Macdonald, G. A., 1978, Geologic map of the crater section of Haleakala National Park, Maui, Hawaii: U.S. Geol. Survey Misc. Geol. Inv. Map I-1088, 8 p. text.

Name Honomanu Volcanic Series redesignated: Honomanu Formation. Rocks in lower part of wall of Haleakala Crater previously assigned to Honomanu Volcanic Series reassigned to: Kumuiliahi Formation (new name); Honomanu Formation remains valid elsewhere.

Horse Bench Sandstone Bed (assignment to member)
(of Parachute Creek Member)
(of Green River Formation)
Eocene
northeastern Utah

Pipiringos, G. N., 1978, Preliminary geologic map of the Bates Knolls quadrangle, Uintah County, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-1025.

Assigned to Parachute Creek Member of Green River Formation.

Houston Andesite (named abandoned)
Tertiary
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Houston Andesite abandoned; its rocks now included locally in Mineral Creek Andesite or in unnamed andesite flows or in complicated mix of sandstone and andesite.

Hualapai Limestone Member (reduced in rank, assigned to formation, and age changed)
(of Muddy Creek Formation)
upper Miocene
northwestern Arizona and southeastern Nevada

Blair, W. N., 1978, Gulf of California in Lake Mead area of Arizona and Nevada during late Miocene time: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 7, p. 1159-1170.

Reduced in rank from Hualapai Limestone to: Hualapai Limestone Member and assigned to: Muddy Creek Formation as upper of two members. Age changed from Pliocene(?) to: late Miocene.

Huron Member (geographic extension)
(of Ohio Shale)
Upper Devonian
eastern Kentucky

Provo, L. J., Kepferle, R. C., and Potter, P. E., 1978, Division of black Ohio Shale in eastern Kentucky: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 9, p. 1703-1713.

Geographically extended from Ohio into: eastern Kentucky. Overlies Olentangy Shale; underlies Three Lick Bed of Ohio Shale.

Ijamsville Phyllite (geographic and stratigraphic extension)
lower Paleozoic(?)
north-central Maryland

Fisher, G. W., 1978, Geologic map of the New Windsor quadrangle, Carroll County, Maryland: U.S. Geol. Survey Misc. Geol. Inv. Map I-1037.

Geographically and stratigraphically extended northeastward from Maryland into: southeastern Pennsylvania to include rocks of former Marburg Schist (now abandoned).

Jericho Run Member (here named)
(of Beaufort Formation)
lower Paleocene (lower Danian)
east-central North Carolina

Brown, P. M., Brown, D. L., Shufflebarger, T. E., Jr., and Sampair, J. L., 1977, Wrench-style deformation in rocks of Cretaceous and Paleocene age, North Carolina coastal plain: North Carolina Dept. Natural and Economic Resources Spec. Pub. 5, 47 p.

Jericho Run Member adopted as basal member of Beaufort Formation; disconformably overlies Peedee Formation.

Johnny Bull Sandstone (name adopted)
(of Bisbee Group)
Lower Cretaceous
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Johnny Bull Sandstone of Gillerman (1958) adopted as uppermost of four formations of Bisbee Group; overlies Still Ridge Formation of Bisbee.

Kaena Limestone (name adopted)
Pleistocene (Sangamon)
Oahu, Hawaii

Stearns, H. T., and Dalrymple, G. B., 1978, The K-Ar age of the Black Point dike on Oahu, Hawaii, and its relation to the Yarmouth Interglaciation: Bernice P. Bishop Museum Occasional Papers, v. 24, no. 16, p. 307-313.

Kaena Formation of Lum and Stearns (1970) adopted as Kaena Limestone as used by Stearns (1974). Unconformably overlies Kahuku Point Formation of Lum and Stearns (1970); unconformably underlies Bellows Field Formation of Lum and Stearns (1970).

Keweenawan Supergroup (subdivided)
Precambrian Y
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

In northeastern Minnesota, divided into (ascending): North Shore Volcanic Group; Duluth Complex and (=) unnamed mafic intrusive rocks; unnamed volcanic rocks, undivided; and Fond du Lac Formation and Hinckley Sandstone, undivided. Overlies Animikie Group; underlies Quaternary glacial drift. Keweenawan remains good usage in northwestern Michigan and northern Wisconsin.

Kula Formation (name redesignated and age changed)
Pleistocene
Maui, Hawaii

Macdonald, G. A., 1978, Geologic map of the crater section of Haleakala National Park, Maui, Hawaii: U.S. Geol. Survey Misc. Geol. Inv. Map I-1088, 8 p. text.

Name Kula Volcanic Series redesignated: Kula Formation. Age changed from late Tertiary(?) to: Pleistocene.

Kumuiliahi Formation (here named)
Pleistocene
Maui, Hawaii

Macdonald, G. A., 1978, Geologic map of the crater section of Haleakala National Park, Maui, Hawaii: U.S. Geol. Survey Misc. Geol. Inv. Map I-1088, 8 p. text.

Kumuiliahi Formation adopted. Lower contact not exposed; unconformably underlies Kula Formation.

Kuskulana Pass Formation (here named)
Lower Cretaceous (upper Hauterivian and Barremian)
south-central Alaska

MacKevett, E. M., Jr., Smith, J. G., Jones, D. L., and Winkler, G. R., 1978, Geologic map of the McCarthy C-8 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-1418.

Kuskulana Pass Formation adopted. Gradationally overlies Berg Creek Formation (new name); disconformably, or with slight angular unconformity, underlies Kennicott Formation.

Lago Garzas Formation (subdivided)
Upper Cretaceous (Campanian? and Maestrichtian)
south-central Puerto Rico

Krushensky, R. D., and Monroe, W. H., 1978, Geology of the Peñuelas and Punta Cuchara quadrangles, Puerto Rico: U.S. Geol. Survey Misc. Geol. Inv. Map I-1042.

Divided into (ascending): Pastillo and Santas Pascuas Members (both new names).

Leach Formation (name abandoned)
Mississippian or older
north-central and northwestern Nevada

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada: Nevada Bur. Mines and Geology Bull. 89, 115 p.

Leach Formation abandoned; its rocks being reassigned to Valmy and undivided Pumpernickel and Hawallah Formations.

Leithsville Formation (age changed)
Lower and Middle Cambrian
eastern Pennsylvania and western New Jersey

Drake, A. A., Jr., 1978, The Lyon Station-Paulins Kill nappe—the frontal structure of Musconetong nappe system in eastern Pennsylvania and New Jersey: U.S. Geol. Survey Prof. Paper 1023, 20 p.

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

Lenihan Canyon Tuff (here named)
Oligocene
western Nevada

Bingler, E. C., 1978, Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geol. Survey Bull. 1457-D, 19 p.

Lenihan Canyon Tuff adopted. Disconformably overlies Mickey Pass Tuff; unconformably underlies Nine Hill Tuff (new name).

Lomita Marl Member (age changed)
(of San Pedro Formation)
upper Pliocene (Hallian)
southern California

Obradovich, J. D., Naeser, C. W., and Izett, G. A., 1978, Geochronology of late Neogene marine strata in California abs. , in Biostratigraphic datum-planes of the Pacific Neogene: Stanford Univ. Pubs. Geol. Sci., v. 14, p. 40-41.

Age changed from early Pleistocene to: late Pliocene.

Magoffin Member (reassignment to formation)
(of Hignite Formation)
(of Breathitt Group)
Middle Pennsylvanian
southeastern Kentucky

Rice, C. L., and Maughan, E. K., 1978, Geologic map of the Kayjay quadrangle and part of the Fork Ridge quadrangle, Bell and Knox Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-1505.

In area along and south of Pine Mountain, Magoffin reassigned to middle part of Hignite Formation of Breathitt Group; overlies Hignite coal bed and underlies Low Splint coal bed, both in Hignite. In area north of Pine Mountain, Magoffin remains member of Breathitt Formation.

Manistique Dolomite (geographic extension)
Middle Silurian (Niagaran)
northeastern Wisconsin

Sherrill, M. G., 1978, Geology and ground water in Door County, Wisconsin, with emphasis on contamination potential in the Silurian dolomite: U.S. Geol. Survey Water-Supply Paper 2047, 38 p.

Geographically extended from northern Michigan into: northeastern peninsula of Wisconsin.

Marburg Schist (name abandoned)
lower Paleozoic(?)
north-central Maryland

Fisher, G. W., 1978, Geologic map of the New Windsor quadrangle, Carroll County, Maryland: U.S. Geol. Survey Misc. Geol. Inv. Map I-1037.

Marburg Schist abandoned throughout its extent in north-central Maryland as well as southeastern Pennsylvania; its rocks now included in Ijamsville Phyllite (now geographically and stratigraphically extended).

Mayville Dolomite (lithology and age changed)
Lower Silurian (Alexandrian)
northeastern Wisconsin

Sherrill, M. G., 1978, Geology and ground water in Door County, Wisconsin, with emphasis on contamination potential in the Silurian dolomite: U.S. Geol. Survey Water-Supply Paper 2047, 38 p.

In Green Bay Peninsula area of northeastern Wisconsin, lithology of Mayville Limestone changed to: Mayville Dolomite; Mayville Limestone remains good usage elsewhere in Wisconsin. Age changed from Early and Middle Silurian to: Early Silurian (Alexandrian).

McGhee Peak Formation (name adopted)
(of Bisbee Group)
Lower Cretaceous
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

McGhee Peak Formation of Gillerman (1958) adopted as lowermost of four formations of Bisbee Group. Overlies Naco Group; underlies Carbonate Hill Limestone of Bisbee.

McGregor Limestone Member (geographic extension)
(of Platteville Formation)
Middle Ordovician
southeastern Minnesota

Tuftin, S. E., and Kyllo, L. R., 1978, Problematical fossils in the Ordovician of Minnesota: Jour. Paleontology, v. 52, no. 4, p. 846-849.

Geographically extended from Iowa and Wisconsin into: southeastern Minnesota.

Merrimack Formation (lithology and age changed)
Silurian and Lower Devonian
northeastern Massachusetts

Robinson, G. R., Jr., 1978, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles, and part of the Ayer quadrangle, Massachusetts and New Hampshire: U.S. Geol. Survey Misc. Field Studies Map MF-957.

In report area, lithology changed from Merrimack Quartzite to: Merrimack Formation. Remains good usage as Merrimack Quartzite or Group elsewhere in Massachusetts and as Merrimack Group in New Hampshire. Age changed from Ordovician(?) and Silurian(?) to: Silurian and Early Devonian.

Millboro Shale (geographic extension)
Middle and Upper Devonian
south-central West Virginia

Perry, W. J., Jr., 1978, Mann Mountain anticline—probable western limit of detachment in south-central West Virginia abs.: Geol. Soc. America Abs. with Programs, v. 10, no. 4, p. 194.

Geographically extended from north-central Virginia into: south-central West Virginia.

Mineral Creek Andesite (stratigraphic extension and age changed)
Miocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Stratigraphically extended locally to include rocks of Houston Andesite (now abandoned). Age of Mineral Creek changed from Miocene or Oligocene to: Miocene.

Mitten Member (geographic extension)
(of Pierre Shale)
Upper Cretaceous
northeastern Colorado

Kiteley, L. W., 1978, Stratigraphic sections of Cretaceous rocks of the northern Denver basin, northeastern Colorado and southeastern Wyoming: U.S. Geol. Survey Oil and Gas Inv. Chart OC-78, 3 sheets.

Geographically extended from Wyoming and Montana into: Denver basin of northeastern Colorado.

Mogollon Andesite (name abandoned)
Miocene and Miocene(?)
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Mogollon Andesite abandoned; its rocks now included in Last Chance Andesite.

Montezuma Quartz Monzonite (age changed)
Oligocene
central Colorado

Lovering, T. S., Tweto, Ogden, and Lovering, T. G., 1978, Ore deposits of the Gilman district, Eagle County, Colorado: U.S. Geol. Survey Prof. Paper 1017, 90 p.

Age changed from Eocene to: Oligocene.

Mount Princeton Quartz Monzonite (age changed)
Oligocene
central Colorado

Lovering, T. S., Tweto, Ogden, and Lovering, T. G., 1978, Ore deposits of the Gilman district, Eagle County, Colorado: U.S. Geol. Survey Prof. Paper 1017, 90 p.

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

Muddy Creek Formation (age changed)
upper Miocene and lower Pliocene
southeastern Nevada and northwestern Arizona

Anderson, R. E., 1978, Geologic map of the Black Canyon 15-minute quadrangle, Mohave County, Arizona, and Clark County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-1394.

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

Muddy Creek Formation (member assigned to)
upper Miocene and lower Pliocene(?)
southeastern Nevada and northwestern Arizona

Blair, W. N., 1978, Gulf of California in Lake Mead area of Arizona and Nevada during late Miocene time: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 7, p. 1159-1170.

Haulapai Limestone reduced in rank to: Hualapai Limestone Member and assigned to: Muddy Creek Formation as upper of two members. Age of Muddy Creek changed from late Miocene and early Pliocene to: late Miocene and early Pliocene(?).

Muddy Creek Formation (geographic extension)
upper Miocene and lower Pliocene(?)
southwestern Utah

Shawe, D. R., Rowley, P. D., Heyl, A. V., and Poole, F. G., 1978, Road log of Field Excursion C-2 route, Aug. 21-25, 1978, southwestern Utah, in Shawe, D. R., and Rowley, P. D., eds., Guidebook to mineral deposits of southwestern Utah: Utah Geol. Assoc. Pub. 7, p. 9-33.

Geographically extended from southeastern Nevada and northwestern Arizona into: southwestern Utah.

Naches Formation (age changed)
upper Eocene and Oligocene(?)
central Washington

Tabor, R. W., Frizzell, V. A., Jr., Gaum, W. C., and Marcus, K. L., 1978, Revision of Naches Formation, in Geological Survey research 1977: U.S. Geol. Survey Prof. Paper 1100, p. 78-79.

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

Naco Group (geographic extension)
Pennsylvanian and Lower Permian
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico where it includes (ascending): Horquilla Limestone, Earp Formation, Colina Limestone, Scherrer Formation, and Concha Limestone.

Needle Mountain Granodiorite (age refined)
Eocene
northwestern Wyoming

Pierce, W. G., 1978, Geologic map of the Cody 1^{o} x 2^{o} quadrangle, northwestern Wyoming: U.S. Geol. Survey Misc. Field Studies Map MF-963.

Age changed from Tertiary to: Eocene.

Needmore Shale (geographic extension)
Lower and Middle Devonian
north-central Virginia

Perry, W. J., Jr., 1978, Sequential deformation in the central Appalachians, in Appalachian geodynamic research: Am. Jour. Sci., v. 278, no. 4, p. 518-542.

Geographically extended from Pennsylvania, Maryland and West Virginia into: north-central Virginia.

New Hanover Member (here named)
(of Castle Hayne Formation)
middle middle Eocene (Claibornian)
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

New Hanover Member adopted as lowermost of three new members of Castle Hayne Formation (now redefined). Overlies and occupies erosional channels in Peedee Formation; underlies Comfort Member (new name) of Castle Hayne; probably correlates with Lisbon Formation of Alabama.

Nine Hill Tuff (here named)
Oligocene
western Nevada

Bingler, E. C., 1978, Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geol. Survey Bull. 1457-D, 19 p.

Nine Hill Tuff adopted. Unconformably overlies Lenihan Canyon Tuff (new name) or underlying Cretaceous rocks; disconformably underlies Eureka Canyon Tuff (new name) or younger Tertiary rocks.

North Shore Volcanic Group (assignment to supergroup)
(of Keweenawan Supergroup)
Precambrian Y
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Assigned to Keweenawan Supergroup in northeastern Minnesota. Overlies Animikie Group; intruded by Duluth Complex and unnamed mafic intrusive rocks of Keweenawan.

Norton Formation (member assigned to)
Lower(?) and Middle Pennsylvanian
southwestern Virginia

Meissner, C. R., Jr., 1978, Geologic map of Duty quadrangle, Dickenson, Russell, and Buchanan, Counties, Virginia: U.S. Geol. Survey Geol. Quad Map GQ-1458.

Puncheon Camp Sandstone Member adopted and assigned as uppermost named member of Norton Formation; age of Puncheon Camp is Middle Pennsylvanian.

Oakdale Formation (lithology and age changed)
Silurian(?) or Devonian(?)
northeastern Massachusetts

Robinson, G. R., Jr., 1978, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles, and part of the Ayer quadrangle, Massachusetts and New Hampshire: U.S. Geol. Survey Misc. Field Studies Map MF-957.

In report area, Oakdale Quartzite changed to: Oakdale Formation. Oakdale Quartzite remains good usage elsewhere in Massachusetts. Age changed from Carboniferous to: Silurian(?) or Devonian(?).

Pacific Quartz Latite (name abandoned)
Oligocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Pacific Quartz Latite abandoned; its rocks now included in tuffs of Davis Canyon and Shelley Peak (informal names) and Bloodgood Canyon Rhyolite Tuff of Elston (1968).

Page Sandstone (geographic extension)
(of San Rafael Group)
Middle Jurassic (Bajocian and Bathonian)
Arizona, Utah, and Wyoming

Pipiringos, G. N., and O'Sullivan, R. B., 1978, Principal unconformities in Triassic and Jurassic rocks, Western Interior United States—a preliminary survey: U.S. Geol. Survey Prof. Paper 1035-A, 29 p.

Geographically extended from northeastern Arizona and central Utah into: southwestern Wyoming (Uinta and Sweetwater Counties).

Panther Canyon Formation (name abandoned)
Middle Triassic
northwestern Nevada

Johnson, M. G., 1977, Geology and mineral deposits of Pershing County, Nevada: Nevada Bur. Mines and Geology Bull. 89, 115 p.

Panther Canyon Formation abandoned; its rocks being reassigned to middle part of Augusta Mountain Formation.

Parachute Creek Member (assignment of bed to)
(of Green River Formation)
Eocene
northeastern Utah

Pipiringos, G. N., 1978, Preliminary geologic map of the Bates Knolls quadrangle, Uintah County, Utah: U.S. Geol. Survey Misc. Field Studies Map MF-1025.

In northeastern Utah only, Horse Bench Sandstone Bed assigned to Parachute Creek Member of Green River Formation. Parachute Creek remains in good usage in western Colorado.

Pastillo Member (here named)
(of Lago Garzas Formation)
Upper Cretaceous (Campanian? and Maestrichtian)
south-central Puerto Rico

Krushensky, R. D., and Monroe, W. H., 1978, Geology of the Peñuelas and Punta Cuchara quadrangles, Puerto Rico: U.S. Geol. Survey Misc. Geol. Inv. Map I-1042.

Pastillo Member adopted as lower of two members of Lago Garzas Formation; underlies Santas Pascuas Member (new name) of Lago Garzas.

Pecatonica Member (geographic extension)
(of Platteville Formation)
Middle Ordovician
southeastern Minnesota

Tuftin, S. E., and Kyllo, L. R., 1978, Problematical fossils in the Ordovician of Minnesota: Jour. Paleontology, v. 52, no. 4, p. 846-849.

Geographically extended from Wisconsin, Illinois, and Iowa into: southeastern Minnesota.

Peedee Formation (member assigned to)
Upper Cretaceous
North and South Carolina

Ward, L. W., and Blackwelder, B. W., Scotts Hill Member (new name) of the Cretaceous Peedee Formation of southeasternmost North Carolina and east-central South Carolina: this report.

Scotts Hill Member adopted and assigned to Peedee Formation, replacing Rocky Point Member of Wheeler and Curran (1974) (formally preempted by prior usage). Scotts Hill's lower contact gradational with Peedee; Scotts Hill unconformably underlies Castle Hayne Formation; its upper contact is Cretaceous-Tertiary boundary.

Penn Yan Shale Member (stratigraphic extension)
(of Genesee Formation)
Upper Devonian
central and western New York

de Witt, Wallace, Jr., and Colton, G. W., 1978, Stratigraphy and conodonts of the Genesee Formation (Devonian) in western and central New York, Chapter A in, Physical stratigraphy of the Genesee Formation (Devonian) in western and central New York: U.S. Geol. Survey Prof. Paper 1032-A, 22 p.

Stratigraphically extended to include former upper bed of underlying Geneseo Shale Member of Genesee.

Pierre Shale (geographic extension of its members)
Upper Cretaceous
northeastern Colorado and southeastern Wyoming

Kiteley, L. W., 1978, Stratigraphic sections of Cretaceous rocks of the northern Denver basin, northeastern Colorado and southeastern Wyoming: U.S. Geol. Survey Oil and Gas Inv. Chart OC-78, 3 sheets.

Gammon, Sharon Springs with its Ardmore Beds, and Mitten Members of Pierre Shale geographically extended from Wyoming and Montana into: Denver basin of northeastern Colorado. Pierre usage remains unchanged elsewhere in Colorado and in South Dakota, Wyoming, Montana, Nebraska, Kansas, and New Mexico.

Pilgrim Dolomite (geographic extension)
Upper Cambrian
southwestern Montana and east-central Idaho

Witkind, I. J., 1977, Structural pattern of the Centennial Mountains, Montana-Idaho, in Heisey, E. L. (Roy), ed., and others, Rocky Mountain thrust belt, geology and resources, Wyoming Geol. Assoc. in conjunction with Montana Geol. Soc. and Utah Geol. Soc. Guidebook, 29th Ann. Field Conf., Teton Village, Wyo., 1977: p. 531-536.

Geographically extended from Montana and Wyoming into: eastern Centennial Mountains of east-central Idaho. Pilgrim Limestone or Dolomite usage remains unchanged elsewhere.

Pinesburg Station Dolomite (geographic extension and age changed)
(of Beedmantown Group)
Middle Ordovician (Whiterockian and Chazyan)
western Maryland and northern Virginia

Harris, A. G., and Harris, L. D., 1978, Lower-Middle Ordovician boundary in south-central Appalachian Basin—conformity and unconformity—the Beekmantown Group "updated," in Geological Survey research 1977: U.S. Geol. Survey Prof. Paper 1100, p. 231.

Geographically extended from western Maryland into: northern Virginia. Age changed from Early Ordovician to: Middle Ordovician (Whiterockian and Chazyan).

Piper Formation (geographic extension)
(of Ellis Group)
Middle Jurassic (Bajocian and Bathonian)
Montana, North Dakota, and Wyoming

Pipiringos, G. N., and O'Sullivan, R. B., 1978, Principal unconformities in Triassic and Jurassic rocks, Western Interior United States—a preliminary survey: U.S. Geol. Survey Prof. Paper 1035-A, 29 p.

Geographically extended from Montana and North Dakota into: north-central Wyoming (east and west flanks of Bighorn Mountains).

Pollocksville Member (here named)
(of Belgrade Formation)
lower Miocene
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Pollocksville Member adopted as one of two new members of Belgrade Formation (new name). Overlies River Bend Formation (new name); underlies Duplin Formation; in part penecontemporaneous with Haywood Landing Member (new name) of Belgrade; correlates with Tampa Limestone of Florida.

Popotosa Formation (group assignment and age changed)
(of Santa Fe Group)
lower to upper(?) Miocene
west-central New Mexico

Machette, M. N., 1978, Geologic map of the San Acacia quadrangle, Socorro County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-1415.

Assigned to Santa Fe Group as lower of two formations. Unconformably underlies Sierra Ladrones Formation of Santa Fe. Age changed from late Miocene to: early to late(?) Miocene.

Pringle Latite (age changed)
Miocene
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo 1^{o} x 2^{o} quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

Age changed from Oligocene to: Miocene.

Pullen Formation (name adopted)
(of Wildcat Group)
lower Pliocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

Puncheon Camp Sandstone Member (here named)
(of Norton Formation)
Middle Pennsylvanian
southwestern Virginia

Meissner, C. R., Jr., 1978, Geologic map of Duty quadrangle, Dickenson, Russell, and Buchanan Counties, Virginia: U.S. Geol. Survey Geol. Quad. Map GQ-1458.

Puncheon Camp Sandstone Member adopted and assigned as uppermost named member of Norton Formation. Overlies Puncheon Camp No. 1 coal bed; underlies Puncheon Camp No. 2 coal bed.

Río Blanco Formation (name abandoned)
Upper Cretaceous
northwestern Puerto Rico

Krushensky, R. D., and Monroe, W. H., 1978, Geology of the Peñuelas and Punta Cuchara quadrangles, Puerto Rico: U.S. Geol. Survey Misc. Geol. Inv. Map I-1042.

Because of inclusion of Cretaceous and Tertiary rocks of highly varied types, Río Blanco Formation abandoned in favor of other names appropriate to specific areas.

Rio Dell Formation (name adopted)
(of Wildcat Group)
upper Pliocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

River Bend Formation (here named)
middle and upper Oligocene
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

River Bend Formation adopted; includes rocks formerly assigned to Trent Marl (now abandoned). Overlies Castle Hayne Formation (now redefined; also including rocks formerly assigned to Trent Marl); underlies Belgrade Formation (new name; also including rocks formerly assigned to Trent Marl); correlates with Byram Formation, upper beds of Cooper Formation, Suwannee Limestone, Chickasawhay Formation, and Paynes Hammock Sand.

Rockdale Run Formation (geographic extension and
(of Beekmantown Group) age changed)
Lower and Middle Ordovician (upper Canadian
through middle Whiterockian) (varies locally)
western Maryland and northern Virginia

Harris, A. G., and Harris, L. D., 1978, Lower-Middle Ordovician boundary in south-central Appalachian Basin—conformity and unconformity—the Beekmantown Group "updated," in Geological Survey research 1977: U.S. Geol. Survey Prof. Paper 1100, p. 231.

Geographically extended from western Maryland and south-central Pennsylvania into: northern Virginia. Age changed from Early Ordovician to: Early and Middle Ordovician (late Canadian through middle Whiterockian) (varies locally).

Rove Formation (lithology changed)
(of Animikie Group)
Precambrian X
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Lithology changed from Rove Slate to: Rove Formation. Equivalent of Thomson Formation of Animikie; underlies Keweenawan Supergroup.

Russell Ranch Formation (name adopted)
pre-Tertiary
south-central Washington

Swanson, D. A., 1978, Geologic map of the Tieton River area, Yakima County, south-central Washington: U.S. Geol. Survey Misc. Field Studies Map MF-968.

Russell Ranch Formation of Simmons (1950) adopted. Base not exposed; unconformably underlies Ohanapecosh Formation.

St. Clair Limestone (geographic extension)
Silurian
Missouri and Illinois

Spirakis, C. S., 1978, Position of the sub-Kaskaskia unconformity in the Illinois basin: Am. Assoc. Petroleum Geologists Bull., v. 62, no. 4, p. 705-708.

Geographically extended from Arkansas and Oklahoma into: Missouri (by inference) and Illinois.

Sand Wells Formation (age refined)
Cretaceous(?)
southern Arizona

Haxel, Gordon, Briskey, J. A., Rytuba, J. J., Bergquist, J. R., Blacet, P. M., and Miller, S. T., 1978, Reconnaissance geologic map of the Comobabi quadrangle, Pima County, Arizona: U.S. Geol. Survey Misc. Field Studies Map MF-964.

Age refined from Mesozoic to: Cretaceous(?).

San Pedro Formation (age changed)
upper Pliocene and lower Pleistocene
south California

Obradovich, J. D., Naeser, C. W., and Izett, G. A., 1978, Geochronology of late Neogene marine strata in California abs. , in Biostratigraphic datum-planes of the Pacific Neogene: Stanford Univ. Pubs. Geol. Sci., v. 14, p. 40-41.

Age changed (by inference) from early Pleistocene to: late Pliocene and early Pleistocene.

San Rafael Group (geographic extension)
Middle Jurassic (Bajocian, Bathonian, and Callovian)
Utah, Colorado, Arizona, New Mexico and Wyoming

Pipiringos, G. N., and O'Sullivan, R. B., 1978, Principal unconformities in Triassic and Jurassic rocks, Western Interior United States—a preliminary survey: U.S. Geol. Survey Prof. Paper 1035-A, 29 p.

Geographically extended from Utah, Colorado, Arizona, and New Mexico into: southwestern Wyoming (Uinta and Sweetwater Counties) with its Page Sandstone.

Santa Fe Group (subdivided)
lower Miocene to middle Pleistocene
west-central New Mexico

Machette, M. N., 1978, Geologic map of the San Acacia quadrangle, Socorro County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-1415.

In west-central New Mexico, Santa Fe Group divided into (ascending): Popotosa Formation (lower to upper Miocene) and Sierra Ladrones Formation (new name; lower Pliocene to middle Pleistocene). Santa Fe Formation remains good usage in Colorado.

Santas Pascuas Member (here named)
(of Lago Garzas Formation)
Upper Cretaceous (Campanian? and Maestrichtian)

Krushensky, R. D., and Monroe, W. H., 1978, Geology of the Peñuelas and Punta Cuchara quadrangles, Puerto Rico: U.S. Geol. Survey Misc. Geol. Inv. Map I-1042.

Santas Pascuas Member adopted as upper of two members of Lago Garzas Formation; overlies Pastillo Member (new name) of Lago Garzas.

Santiago Canyon Tuff (here named)
uppermost Oligocene or lowermost Miocene
western Nevada

Bingler, E. C., 1978, Abandonment of the name Hartford Hill Rhyolite Tuff and adoption of new formation names for middle Tertiary ash-flow tuffs in the Carson City-Silver City area, Nevada: U.S. Geol. Survey Bull. 1457-D, 19 p.

Santiago Canyon Tuff adopted; includes rocks of former Hartford Hill Rhyolite Tuff (now abandoned). Disconformably overlies older Tertiary ash flows or Mesozoic rocks; unconformably underlies Alta Formation.

Santiago Canyon Tuff (age changed)
Miocene
western Nevada

Bingler, E. C., Silberman, M. L., and McKee, E. H., 1978, K-Ar ages of Tertiary ash-flow tuffs in the Carson City-Silver City area, central western Nevada: Isochron/West, no. 22, p. 23-24.

Age changed from latest Oligocene or earliest Miocene to: Miocene.

Scherr Formation (geographic extension)
Upper Devonian
west-central Virginia

Perry, W. J., Jr., 1978, Sequential deformation in the central Appalachians, in Appalachian geodynamic research: Am. Jour. Sci., v. 278, no. 4, p. 518-542.

Geographically extended from northern West Virginia and southwestern Pennsylvania into: west-central Virginia.

Scherrer Formation (geographic extension)
(of Naco Group)
Lower Permian
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Geographically extended from southeastern Arizona into: southwestern New Mexico. Overlies Colina Limestone of Naco; underlies Concha Limestone of Naco.

Scotia Bluffs Sandstone (name adopted)
(of Wildcat Group)
upper Pliocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

Scotts Hill Member (here named)
(of Peedee Formation)
Upper Cretaceous
southeasternmost North Carolina and east-central South Carolina

Ward, L. W., and Blackwelder, B. W., Scotts Hill Member (new name) of the Cretaceous Peedee Formation of southeasternmost North Carolina and east-central South Carolina: this report.

Scotts Hill Member adopted and assigned to Peedee Formation, replacing Rocky Point Member of Wheeler and Curran (1974) (formally preempted by prior usage). Lower contact gradational with Peedee; unconformably underlies Castle Hayne Formation; upper contact is Cretaceous-Tertiary boundary.

Sherman Marble (name adopted)
Proterozoic Y
southern Vermont and adjacent northwestern Massachusetts

Ratcliffe, Nicholas M., Adoption and redefinition of the Sherman Marble and regional correlations of Plymouth- and Sherman-type marbles in Vermont and Massachusetts: this report.

Sherman Marble of Hubbard (1924) adopted, redefined, and stratigraphically and geographically restricted to include only rocks at type locality and adjacent Whitingham area as used by Skehan (1961). Other occurrences outside type locality and shown as Sherman Marble by Skehan, interbedded with albitic schists, are probably Proterozoic Z or Early Cambrian in age and may be regarded as correlatives of part of Hoosac Formation. Sherman interbedded within Wilmington Gneiss of Skehan (1961) and unconformably underlies Readsboro Formation of Skehan (1961).

Sierra Ladrones Formation (here named)
(of Santa Fe Group)
lower Pliocene to middle Pleistocene
west-central New Mexico

Machette, M. N., 1978, Geologic map of the San Acacia quadrangle, Socorro County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-1415.

Sierra Ladrones Formation adopted and assigned to Santa Fe Group as upper of two formations. Unconformably overlies Popotosa Formation of Santa Fe.

Skolai Group (age changed)
Pennsylvanian and Lower Permian
southeastern Alaska

MacKevett, E. M., Jr., 1978, Geologic map of the McCarthy quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1032.

Age changed from Early Permian (Sakmarian and Artinskian) to: Pennsylvanian and Early Permian.

Slaven Chert (age changed)
Lower to Upper Devonian
north-central Nevada

Wrucke, C. T., Jr., and Jones, D. L., 1978, Allochthonous Devonian chert in northern Shoshone Range, north-central Nevada, in Geological Survey research 1977: U.S. Geol. Survey Prof. Paper 1100, p. 70-71.

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

Spring Garden Member (here named)
(of Castle Hayne Formation)
uppermost middle Eocene (Clairbornian)
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Spring Garden Member adopted as uppermost of three new members of Castle Hayne Formation (now redefined). Overlies Comfort Member (new name) of Castle Hayne; underlies Duplin Formation or River Bend Formation (new name); probably correlates with part of Gosport Sand of Alabama.

Station Creek Formation (age changed)
(of Skolai Group)
Pennsylvanian and Lower Permian
southeastern Alaska

MacKevett, E. M., Jr., 1978, Geologic map of the McCarthy quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-1032.

Age changed from Early Permian (Sakmarian and Artinskian) to: Pennsylvanian and Early Permian.

Still Ridge Formation (name adopted)
(of Bisbee Group)
Lower Cretaceous
southwestern New Mexico

Armstrong, A. K., Silberman, M. L., Todd, V. R., Hoggatt, W. C., and Carten, R. B., 1978, Geology of central Peloncillo Mountains, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Circ. 158, 18 p.

Still Ridge Formation of Gillerman (1958) adopted as one of four formations of Bisbee Group. Overlies Carbonate Hill Limestone of Bisbee; underlies Johnny Bull Sandstone of Bisbee.

Stoney Fork Member (new name)
(of Breathitt Formation)
Middle Pennsylvanian (Atokan)
southeasternmost Kentucky

Ping, R. G., and Rice, C. L., Stoney Fork Member (new name) of the Breathitt Formation in southeasternmost Kentucky: this report.

Stoney Fork Member adopted and assigned to Breathitt Formation, replacing Lost Creek Limestone of Morse (1931) (formally preempted by prior usage). Overlies Magoffin Member of Breathitt; unconformably underlies unnamed sandstone and coal beds of Breathitt.

Tachilni Formation (age changed)
upper Miocene to lower Pliocene
southwestern Alaska

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Age changed from late Tertiary to: late Miocene to early Pliocene.

Teewinot Formation (age changed)
upper Miocene
Teton Range area, northwestern Wyoming

Love, J. D., Leopold, E. B., and Love, D. W., 1978, Eocene rocks, fossils, and geologic history, Teton Range, northwestern Wyoming: U.S. Geol. Survey Prof. Paper 932-B, 40 p.

Age changed from middle Pliocene to: late Miocene.

Thomson Formation (name adopted)
(of Animikie Group)
Precambrian X
northeastern Minnesota

Olcott, P. G., Ericson, D. W., Felsheim, P. E., and Broussard, W. L., 1978, Water resources of the Lake Superior watershed, northeastern Minnesota: U.S. Geol. Survey Hydrol. Inv. Atlas HA-582, 2 sheets.

Thomson slates of Spurr (1894) adopted as Thomson Formation as redefined by Schwartz (1942) and assigned to Animikie Group. Equivalent of Rove Formation of Animikie; underlies Keweenawan Supergroup.

Todilto Limestone (age changed)
Middle Jurassic
New Mexico, Arizona, Utah, and Colorado

Pipiringos, G. N., and O'Sullivan, R. B., 1978, Principal unconformities in Triassic and Jurassic rocks, Western Interior United States—a preliminary survey: U.S. Geol. Survey Prof. Paper 1035-A, 29 p.

Age changed from Late Jurassic to: Middle Jurassic (Callovian).

Trent Marl (name abandoned)
upper Oligocene and lower Miocene
southeastern North Carolina

Ward, L. W., Lawrence, D. R., and Blackwelder, B. W., 1978, Stratigraphic revision of the middle Eocene, Oligocene, and lower Miocene—Atlantic Coastal Plain of North Carolina: U.S. Geol. Survey Bull. 1457-F, 23 p.

Trent Marl abandoned; its rocks now included in (ascending): Castle Hayne Formation (now redefined), with its New Hanover, Comfort, and Spring Garden Members (all new names); River Bend Formation (new name); and Belgrade Formation (new name), with its Pollocksville and (=) Haywood Landing Members (both new names).

Tugidak Formation (age changed)
upper Pliocene and lower Pleistocene
south-central Alaska

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Age changed from Pliocene to: late Pliocene and early Pleistocene.

Vermilion Granitic Complex (lithology changed)
Precambrian W
northeastern Minnesota

Sims, P. K., and Mudrey, M. G., Jr., 1978, Geologic map of the Shagawa Lake quadrangle, St. Louis County, Minnesota: U.S. Geol. Survey Geol. Quad. Map GQ-1423.

Lithology changed from Vermilion Granite to: Vermilion Granitic Complex for heterogeneous mixtures of rocks; Vermilion Granite remains good usage for homogeneous granite.

Waccamaw Formation (redefined)
lower Pleistocene
eastern North and South Carolina

Blackwelder, B. W., Stratigraphic revision of lower Pleistocene marine deposits of North and South Carolina: this report.

Redefined and stratigraphically restricted to include only those lower Pleistocene deposits of its original type area. Rocks formerly included in its lower (upper Pliocene) part now included in Bear Bluff Formation. Overlies Bear Bluff Formation; unconformably underlies Canepatch Formation; correlates with James City Formation in northeastern North Carolina. Age changed from late Pliocene and early Pleistocene to: early Pleistocene.

Wagontongue Formation (name adopted)
Miocene
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo 1^{o} x 2^{o} quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

Wagontongue Formation of Johnson (1937) adopted as used by Stark and others (1949). Overlies Antero Formation or Gribbles Park Tuff; underlies Quaternary alluvium.

Whitewater Creek Member (reduced in rank and assigned to formation)
(of Cooney Tuff)
Oligocene
southwestern New Mexico

Ratté, J. C., and Finnell, T. L., 1978, Third day: Road log from Silver City to Reserve via Glenwood and the Mogollon mining district, in Field guide to selected cauldrons and mining districts of the Datil-Mogollon volcanic field, New Mexico: New Mexico Geol. Soc. Spec. Pub. 7, p. 49-63.

Whitewater Creek Rhyolite reduced in rank to: Whitewater Creek Member and assigned to: Cooney Tuff as its lower member, underlying unnamed quartz latite member of Cooney.

Wildcat Group (name adopted)
lower Pliocene to lower Pleistocene
northwestern California

Nelson, C. M., 1978, Neptunea (Gastropoda: Buccinacea) in the Neogene of the North Pacific and adjacent Bering Sea: Veliger, v. 21, no. 2, p. 203-215.

Wildcat Group and its five formations of Ogle (1953) and as used by Faustman (1964) adopted. Ogle's five formations are (ascending): Pullen Formation (lower Pliocene), Eel River Formation (lower Pliocene), Rio Dell Formation (upper Pliocene), Scotia Bluffs Sandstone (upper Pliocene), and Carlotta Formation (upper Pliocene and lower Pleistocene). Overlies Mesozoic rocks; underlies Quaternary deposits.

Williams Canyon Formation (or Limestone) (age changed)
Devonian
south-central Colorado

Scott, G. R., Taylor, R. B., Epis, R. C., and Wobus, R. A., 1978, Geologic map of the Pueblo 1^{o} x 2^{o} quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-1022, 2 sheets.

Age changed from Mississippian to: Devonian.

Worcester Formation (or Phyllite) (age changed)
Ordovician(?) to Devonian(?)
northeastern Massachusetts

Robinson, G. R., Jr., 1978, Bedrock geologic map of the Pepperell, Shirley, Townsend quadrangles, and part of the Ayer quadrangle, Massachusetts and New Hampshire: U.S. Geol. Survey Misc. Field Studies Map MF-957.

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

Zia Sand (name adopted)
lower and middle Miocene
north-central New Mexico

Manley, Kim, 1978, Geologic map of Bernalillo NW quadrangle, Sandoval County, New Mexico: U.S. Geol. Survey Geol. Quad. Map GQ-1446.

Zia Marl of Regan (1903) abandoned and replaced by Zia Sand Formation of Galusha (1966), adopted as Zia Sand, and redefined to include Galusha's Zia and Santa Fe Formation. Unconformably overlies Permian, Triassic, and Eocene rocks; underlies Cochiti Formation to east and south and Miocene volcanic rocks to north.

REFERENCES CITED

Bergren, W. A., 1972, A Cenozoic time-scale—Some implications for regional geology and paleobiogeography: Lethaia, v. 5, no. 2, p. 195-215.

Elston, W. E., 1968, Terminology and distribution of ash flows of the Mogollon-Silver City-Lordsburg region, New Mexico, in Southern Arizona Guidebook III—Geol. Soc. America Cordilleran Sec., 64th Ann. Mtg., Tucson, 1968: Tucson, Ariz., Arizona Geol. Soc., p. 231-240.

Evernden, J. F., Savage, D. E., Curtis, G. H., and James, G. T., 1964, Potassium-argon dates and the Cenozoic mammalian chronology of North America: Am. Jour. Sci., v. 262, 145-198.

Faustman, W. F., 1964, Paleontology of the Wildcat Group at Scotia and Centerville Beach, California: California Univ. Pubs. Geol. Sci., v. 41, no. 2, p. 97-160.

Galusha, Ted, 1966, The Zia Sand Formation, new early to medial Miocene beds in New Mexico: American Museum Novitates 2271, 12 p.

Geological Society of London, 1964, Summary of the Phanerozoic time scale—the Geological Society Phanerozoic time-scale, 1964, in Harland, W. B., Smith, A. G., and Wilcock, Bruce, eds., The Phanerozoic time scale—a symposium: Geol. Soc. London Quart. Jour., v. 120s, p. 222, 260-262.

Gillerman, Elliot, 1958, Geology of the central Peloncillo Mountains, Hidalgo County, New Mexico, and Cochise County, Arizona: New Mexico Bur. Mines and Mineral Res. Bull. 57, 152 p.

Johnson, J. G., 1965, Lower Devonian stratigraphy and correlation, northern Simpson Park Range, Nevada: Canadian Petroleum Geologists Bull., v. 13, no. 3, p. 365-381.

Johnson, J. G., 1966, Middle Devonian brachiopods from the Roberts Mountains, central Nevada: Paleontology, v. 9, pt. 1, p. 152-181.

Johnson, J. H., 1937, The Tertiary deposits of South Park, Colorado, with a description of the Oligocene algal limestone: Univ. Colorado Bull., v. 25, no. 1, p. 77.

Love, J. D., 1939, Geology along the southern margin of the Absaroka Range, Wyoming: Geol. Soc. America Spec. Paper 20, 134 p.

Lum, Daniel, and Stearns, H. T., 1970, Pleistocene stratigraphy and eustatic history based on cores at Waimanalo, Oahu, Hawaii: Geol. Soc. America Bull., v. 81, no., 1, p. 1-16.

Lyons, J. B., and Faul, H., 1968, Isotope geochronology of the northern Appalachians, Chap. 23 in Studies of Appalachian geology, northern and maritime (Zen, E-an, and others, editors): New York, Interscience Publishers, p. 305-318.

Morse, W. C., 1931, The Pennsylvanian invertebrate fauna of Kentucky, in Jillson, W. R., and others, Paleontology of Kentucky: Kentucky Geol. Survey, ser. 6, v. 36, p. 293-348.

Ogle, B. A., 1953, Geology of the Eel River Valley area, Humboldt County, California: California Dept. Nat. Resources, Div. Mines Bull. 164, 128 p.

Regan, A. B., 1903, Geology of the Jemez-Albuquerque region, New Mexico: Am. Geologist, v. 31, p. 67-111.

Schwartz, G. M., 1942, Correlation and metamorphism of the Thomson Formation, Minnesota: Geol. Soc. America Bull., v. 53, no. 7, p. 1001-1020.

Simmons, G. C., 1950, The Russell Ranch formation: Washington State College, Pullman, unpub. M.S. thesis, 21 p.

Speed, R. C., and Jones, T. A., 1969, Synorogenic quartz sandstone in the Jurassic mobile belt of western Nevada—Boyer Ranch Formation: Geol. Soc. America Bull., v. 80, no. 12, p. 2551-2584.

Spurr, J. E., 1894, The stratigraphic position of the Thomson slates: Am. Jour. Sci., 3d, v. 48, p. 159-166.

Stark, J. T., Johnson, J. H., Behre, C. H., Jr., Powers, W. E., Howland, A. L., Gould, D. B., and others, 1949, Geology and origin of South Park, Colorado: Geol. Soc. America Mem. 33, 188 p.

Stearns, H. T., 1974, Submerged shorelines and shelves in the Hawaiian Islands and a revision of some of the eustatic emerged shorelines: Geol. Soc. America Bull., v. 85, no. 5, p. 795-804.

Taliaferro, N. L., 1924, Notes on the geology of Ventura County, California: Am. Assoc. Petroleum Geologists Bull., v. 8, no. 6, p. 789-810.

Wheeler, W. H., and Curran, H. A., 1974, Relation of Rocky Point Member (Peedee Formation) to Cretaceous-Tertiary boundary in North Carolina: Am. Assoc. Petroleum Geologists Bull., v. 58, no. 9, p. 1751-1757.

Winchell, N. H., 1899, The geology of the Duluth plate, in Winchell, N. H., and others, The geology of Minnesota, volume IV of the final report: St. Paul, Minnesota Geol. and Nat. History Survey, p. 566-580.

STRATIGRAPHIC REVISION OF LOWER PLEISTOCENE MARINE DEPOSITS OF NORTH AND SOUTH CAROLINA

By Blake W. Blackwelder

Abstract

A lectostratotype on the Waccamaw River, S.C., is proposed for the Waccamaw Formation (lower Pleistocene). The Waccamaw Formation is redefined because a large portion of the beds included in the original description of the Waccamaw was subsequently named the Bear Bluff Formation. The Waccamaw Formation is an extensive fluviomarine sedimentary complex in South Carolina and in adjacent parts of North Carolina.

Introduction

Lower Pleistocene shelly marine sands and related barrier and back-barrier deposits that are found throughout the eastern half of the Coastal Plain in southeastern North Carolina and in South Carolina have generally been assigned to the Waccamaw Formation. The term "Waccamaw" was informally introduced in the late 1800's into the geologic literature and has usually referred to beds with a particular fossil assemblage. Clarification of the stratigraphic nomenclature used for lower Pleistocene deposits is necessary before a precise description of the geologic history of the region can be made.

Previous Work

Dall (1892) proposed the term "Waccamaw beds" for units along the Waccamaw River above the Cretaceous as "sectionized" by Tuomey (1848) and by C. W. Johnson (unpublished sections). Dall listed five stratigraphic sections, one of which was subsequently designated the type section for the Bear Bluff Formation (upper Pliocene) (DuBar, 1969; DuBar and others, 1974). Swain (1968, p. 2) considered a locality 0.2 miles downstream from Tilly Lake to be the type locality of the Waccamaw. However, no such designation had been made by previous authors, and any subsequent designation would have to be termed a lectostratotype. The lack of a type section for the Waccamaw Formation and the assignment of part of the original Waccamaw to another formation (DuBar and others, 1974) necessitate a redefinition of the Waccamaw Formation. The American Commission on Stratigraphic Nomenclature, Article 14, states that, when a rock unit is divided into two or more units of the same rank as the original, the original name should not be used for any of the divisions. I believe, however, that applying a new name to these lower Pleistocene deposits would not clarify the terminology. Because of the distribution and nature of the deposits originally included in the Waccamaw Formation, the name "Waccamaw" has been applied

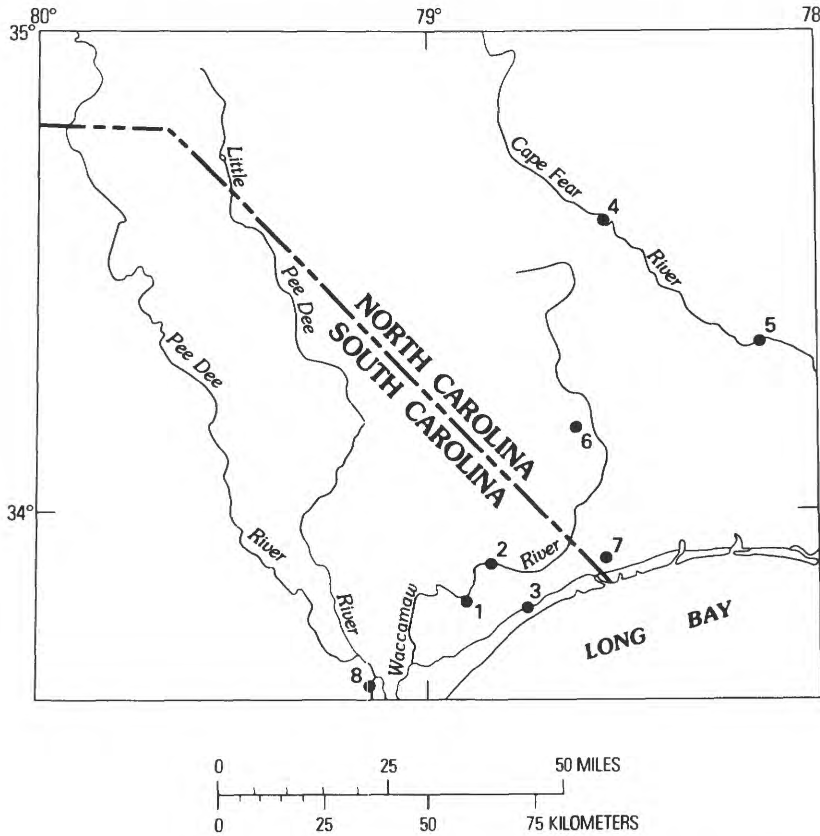


Figure 1.—Localities of Waccamaw Formation referenced in the "Locality Register".

almost exclusively to lithically related lower Pleistocene deposits (DuBar and others, 1974). For this reason, retention and stratigraphic restriction of the name "Waccamaw" for these lower Pleistocene deposits will result in no confusion in terminology.

Waccamaw Formation

The Waccamaw Formation is here redefined to include the shelly medium-grained quartz sands of the original type area of the Waccamaw Formation, which are not included in the Bear Bluff Formation. The Waccamaw Formation unconformably underlies the Canepatch Formation (upper Pleistocene) and is underlain by the Bear Bluff Formation (upper Pliocene).

An exposure 180 m downstream from Tilly Lake on the Waccamaw River, Horry County (Nixonville 15-minute quadrangle), is designated the lectostratotype (loc. 1, fig. 1). At this locality the gray sands of the Upper Cretaceous (Peedee Formation; fig. 2) are overlain by very shelly quartz sands of the Waccamaw (see "Measured Section"). In the basal part of the Waccamaw are reworked Cretaceous fossils (<u>Exogyra</u> sp.) and phosphate pebbles.

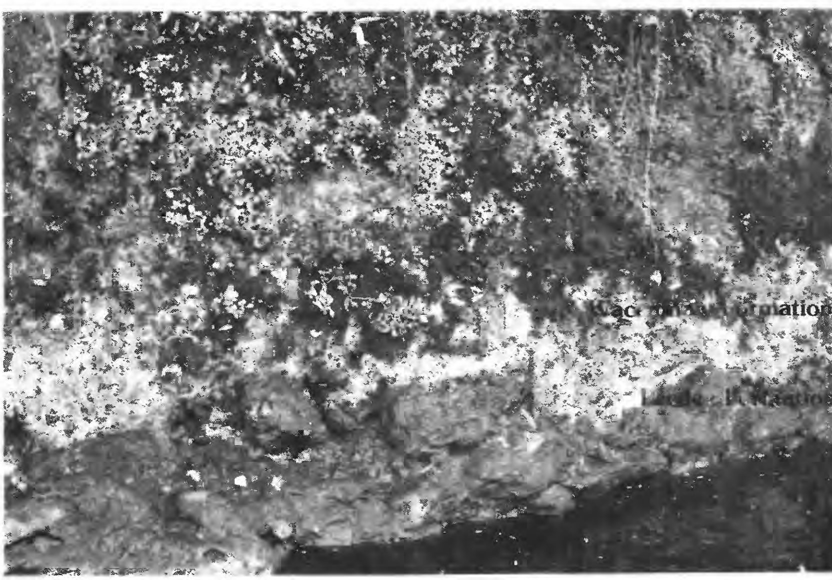


Figure 2.—Dark-gray indurated surface of the Peedee Formation (Upper Cretaceous) unconformably overlain by the Waccamaw Formation (light-colored unit) below Tilly Lake, left bank of the Waccamaw River, S. C. (loc. 1).

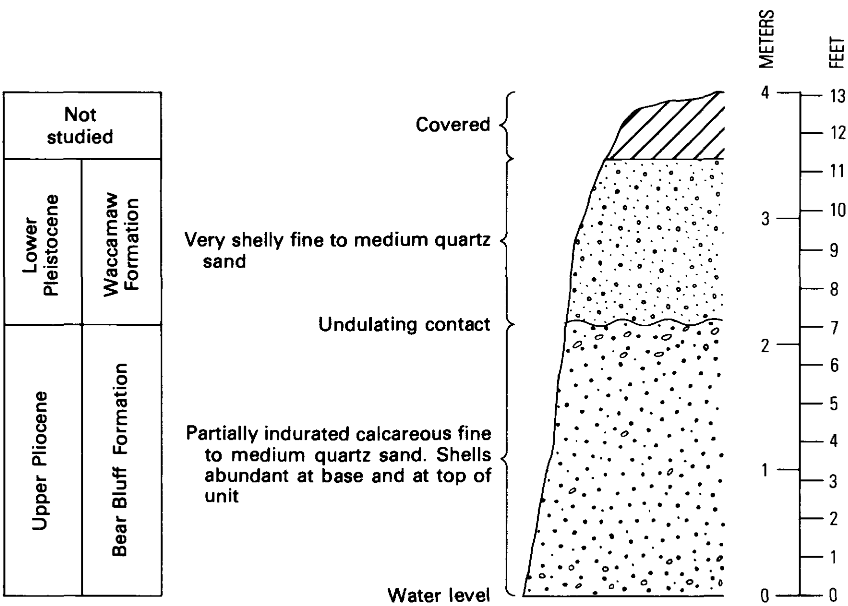


Figure 3.—Outcrop near Parker Landing, right bank of Waccamaw River, Horry County, S.C. (loc. 2).

Upriver from the lectostratotype section, at Parker Landing (loc. 2, fig. 1) and on the Intracoastal Waterway at Myrtle Beach-Windy Hill air strip (loc. 3, fig. 1), the Waccamaw Formation overlies the Bear Bluff Formation (fig. 3, 4). At Windy Hill, the upper surface of the Bear Bluff is indurated and bored. Also at Windy Hill, the light-colored calcareous very shelly, fine- to medium-grained sands of the Waccamaw are unconformably overlain by darker colored nearshore and marginal marine clayey sands of the Canepatch Formation. Characteristics of the beds herein assigned to the Waccamaw Formation, including mollusk assemblages and regional distribution of different lithic units, have been discussed by DuBar and others (1974). The Bear Bluff Formation was formally proposed in the same article and was adopted for U.S. Geological Survey usage by Blackwelder and Ward (1979).

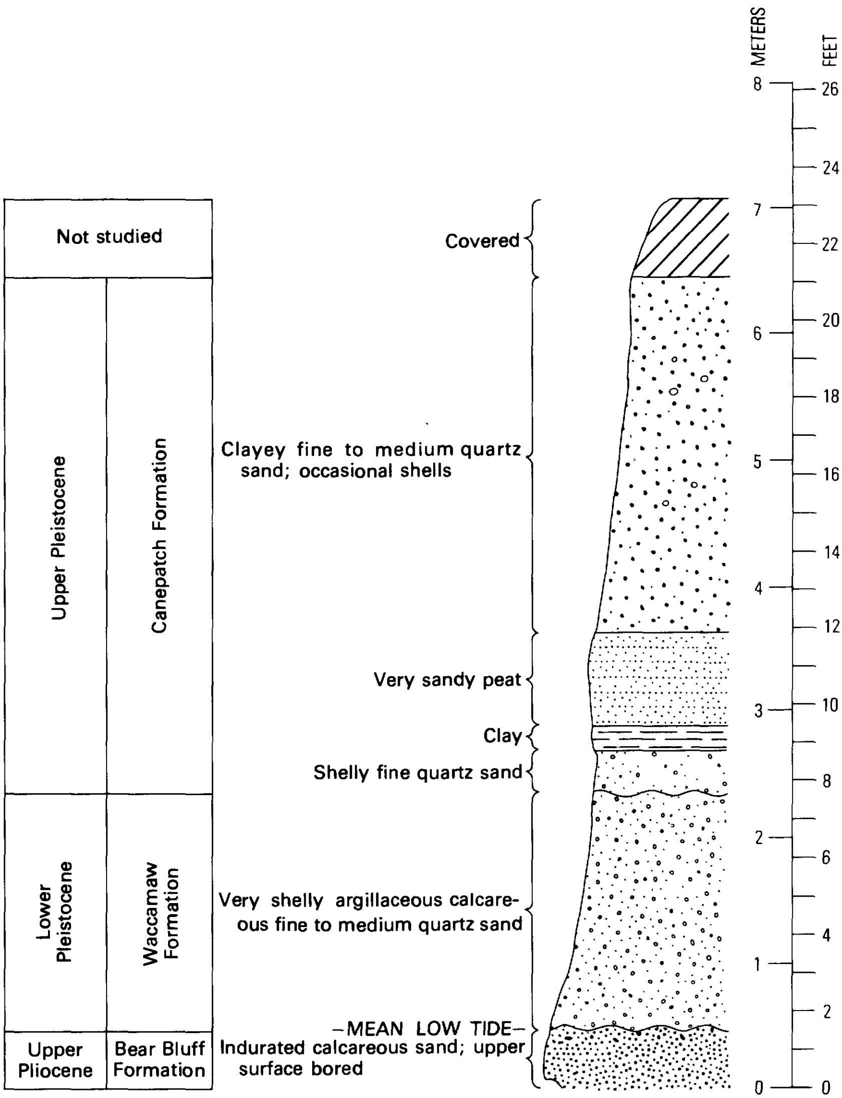


Figure 4.—Composite section, right bank of Intracoastal Waterway at Myrtle Beach-Windy Hill air strip, Horry County, S.C. (loc. 3).

A partial list of localities where the Waccamaw Formation crops out is included in the "Locality Register." The Waccamaw is correlated with the James City Formation in eastern North Carolina and with deposits of the Caloosahatchee Formation (upper part) in Florida in its type area. The Waccamaw Formation crops out intermittently on the Cape Fear River, N.C., from Walkers Bluff (loc. 4, fig. 1) downriver to Neils Eddy Landing (loc. 5, fig. 1). It is found overlying the Peedee Formation (Upper Cretaceous) in borrow pits near Old Dock, N.C. (loc. 6, fig. 1), where the upper surface of the Peedee is burrowed and infilled with Waccamaw sediments. The Waccamaw overlies the Bear Bluff Formation at Calabash, N.C. (loc. 7, fig. 1), and on the Waccamaw River at Parker Landing, S.C. (loc. 2, fig. 1). To the south, the Waccamaw crops out at Yauhannah Landing, S.C. (loc. 8, fig. 1).

DuBar and others (1974) have shown that the Waccamaw is a distinct time-transgressive stratal unit composed of a variety of lithic facies. They traced this member under the Horry Barrier, where the Waccamaw overlies the Bear Bluff Formation; under the Rosindale Barrier, where it overlies the Black Creek and Peedee Formations; under the Kingstree Barrier, where it overlies the Peedee, Bear Bluff, Yorktown, and Black Mingo Formations; and under the Summerville and Dorchester Barriers, where it overlies the Cooper Formation or the Raysor Formation.

DuBar and others (1974) indicated that the Waccamaw extends beneath the Green Swamp Shoal and the Nakina-Pleasant Hill and Horry Barrier systems and grades upward to generally unfossiliferous sediments, which form the surfaces of these morphological features.

Biostratigraphically distinctive species of the Waccamaw include the mollusks Argopecten eboreus (Conrad, 1833), Mulinia lateralis, (Say, 1822), and Noetia limula (Conrad, 1832). Glycymeris subovata of Thomas (1975, pl. 38, fig. 7) and Spisula modicella (Conrad, 1833) became extinct in this region before the deposition of the Waccamaw Formation. Also the subgenus Anadara (Lunarca) does not appear in the Atlantic Coastal Plain until after deposition of the Waccamaw Formation. The mollusks in the Waccamaw in its type area indicate subtropical marine conditions.

Akers (1972) found the planktic foraminifers Globigerinoides obliquus obliquus Bolli and Globorotalia truncatulinoides (d'Orbigny) in the Waccamaw Formation at Walkers Bluff, N.C. (loc. 4, fig. 1). These foraminifers indicate an age of about 1.6 to 1.8 m.y. for these Waccamaw beds (Newton and others, 1978). Beds of the correlative Caloosahatchee Formation have yielded vertebrate remains indicative of a Pleistocene age (DuBar, 1974) and Pleistocene vertebrate fossils were reported from beds of Dall's "Waccamaw Formation" by C. T. Berry (1931).

Locality Register

1. Left bank of the Waccamaw River 180 m below Tilly Lake, Horry County, S.C. Nixonville 15-minute quadrangle. Lat 33°49'30" N., long 78°54'45" W. Lectostratotype of the Waccamaw Formation. USGS 26132

2. Right bank of the Waccamaw River, Parker Landing, Horry County, S.C. Nixonville 15-minute quadrangle. Lat 33°54'00" N., long 78°51'30" W. USGS 26133

3. Right bank of the Intracoastal Waterway at Myrtle Beach-Windy Hill air strip, 6.5 km southwest of S.C. Hwy. 9 bridge, Horry County, S.C. Wampee 7 1/2-minute quadrangle. Lat 33°49'15" N., long 78°43'00" W. USGS 26134

4. Walkers Bluff, right bank of Cape Fear River, Bladen County, N.C. White Lake 15-minute quadrangle. Lat 34°34'00" N., long 78°29'15" W. USGS 26135

5. Neils Eddy Landing, right bank of Cape Fear River 0.8 km west of Columbus-Brunswick County line, N.C. Acme 15-minute quadrangle. USGS 26136

6. Dug pit north of Old Dock, Columbus County, N.C. Old Dock 7 1/2-minute quadrangle. Lat 34°11'70" N., long 78°36'15" W. USGS 26137

7. Dug pit at Calabash, Brunswick County, N.C. Calabash 7 1/2-minute quadrangle. Lat 33°53'30" N., long 78°34'30" W. USGS 26138

8. Yauhannah Landing, Georgetown County, N.C., right bank of Pee Dee River immediately below Rte. 701 bridge. Yauhannah 7 1/2-minute quadrangle. USGS 26139

Measured Section

Locality 1

[Lectostratotype of the Waccamaw Formation, Nixonville 15-minute quadrangle, Horry County, S.C. Bluff on left bank of Waccamaw River about 180 m (200 yards) downstream from Tilly Lake (section modified from DuBar and Howard, 1963)]

Unit	Description	Thickness in meters (feet)
	Upper(?) Pleistocene	
	Canepatch(?) Formation	
9.	Sand, quartz, fine, silty, micaceous, very slightly consolidated, well sorted, grayish-orange (10 YR 7/4); no fossils observed	1.4(4.5)
8.	Silt, argillaceous, arenaceous, micaceous, slightly consolidated, brittle when dry, plastic when wet, grayish-orange (10 YR 7/4); no fossils observed	0.8(2.5)
7.	Sand, quartz, fine, subrounded, very slightly consolidated, well sorted, grayish-orange (10 YR 7/4); no fossils observed	0.9(3.0)
6.	Sand, quartz, fine to medium, subangular to subrounded, well sorted, unconsolidated, grayish-orange (10 YR 7/4); no fossils observed	0.2(0.5)
5.	Sand, quartz, medium, subrounded, unconsolidated, well sorted, light brown (5 YR 5/6); no fossils observed	0.8(2.5)
4.	Sand, quartz, medium to coarse, subrounded to subangular, micaceous, slightly consolidated, fair sorting, moderate brown (5 YR 4/4); no fossils observed	0.1(0.4)
	Total Canepatch(?) Formation	4.2(13.4)

Unconformity
Lower Pleistocene
Waccamaw Formation

3.	Sand, calcareous silty quartz, medium, subrounded, fairly well consolidated, fair sorting, light-gray (N 7); fossils abundant, well preserved	2.1(7.0)
2.	Sand, calcareous, quartz, fine to medium, silty, unconsolidated, fair sorting, medium blue-gray (5 B 5/1); contains lumps of Peedee (Upper Cretaceous) argillaceous sand reworked from below and small caliche nodules; fossils abundant, well preserved, most are small but not worn; some specimens of reworked _Exogyra_ sp.	0.6(2.0)
	Total Waccamaw Formation	2.7(9.0)

Unconformity
Upper Cretaceous
Peedee Formation

1.	Silty gray sand	0.3(1.0)

REFERENCES CITED

Akers, W. H., 1972, Planktonic Foraminifera and biostratigraphy of some Neogene formations, northern Florida and Atlantic Coastal Plain: Tulane Studies Geology and Paleontology, v. 9, 140 p.

Berry, C. T., 1931, Metatarsal of _Equus_ from marine Pliocene of North Carolina: Pan-American Geologist, v. 56, no. 5, p. 340-342.

Blackwelder, B. W., and Ward, L. W., 1979, Stratigraphic revision of the Pliocene deposits of North and South Carolina: Geol. Notes, v. 23, no. 1, p. 33-49.

Dall, W. H., 1892, Contributions to the Tertiary fauna of Florida: Wagner Free Inst. Sci. of Philadelphia Trans., v. 3, pt. 2, p. 201-473.

DuBar, J. R., 1969, Biostratigraphic significance of Neogene macrofossils from two dug ponds, Horry County, South Carolina: South Carolina Div. Geology Geol. Notes, v. 13, no. 3, p. 67-80.

DuBar, J. R., 1974, Summary of the Neogene stratigraphy of southern Florida in Oaks, R. Q., Jr., and DuBar, J. R., Post-Miocene stratigraphy, central and southern Atlantic Coastal Plain: Logan, Utah, Utah State Univ. Press, p. 206-231.

DuBar, J. R., Johnson, H. S., Jr., Thom, Bruce, and Hatchell, W. O., 1974, Neogene stratigraphy and morphology, south flank of the Cape Fear Arch, North and South Carolina in Oaks, R. Q., Jr., and DuBar, J. R., eds. Post-Miocene stratigraphy, central and southern Atlantic Coastal Plain: Logan, Utah, Utah State Univ. Press, p. 139-173.

DuBar, J. R., and Howard, J. F., 1963, Paleoecology of the type Waccamaw (Pliocene?) outcrops, South Carolina: Southeastern Geology, v. 5, no. 1, p. 27-68.

DuBar, J. R., and Solliday, J. R., 1963, Stratigraphy of the Neogene deposits, lower Neuse Estuary, North Carolina: Southeastern Geology, v. 4, no. 4, p. 213-233.

Newton, C. R., Belknap, D. F., and Lynts, G. W., 1978, Early Pleistocene (Calabrian) age of the Waccamaw Formation at Walker's Bluff, Elizabethtown, N.C. [abs.]: Geol. Soc. America Abs. with Programs, v. 10, no. 4, p. 194.

Swain, F. M., 1968, Ostracoda from the upper Tertiary Waccamaw Formation of North Carolina and South Carolina: U.S. Geol. Survey Prof. Paper 573-D, 37 p.

Thomas, R. D. K., 1975, Functional morphology, ecology, and evolutionary conservatism in the Glycymerididae (Bivalvia): Palaeontology, v. 18, pt. 2, p. 217-254.

Tuomey, Michael, 1848, Report on the geology of South Carolina: Columbia, S.C., 293 p.

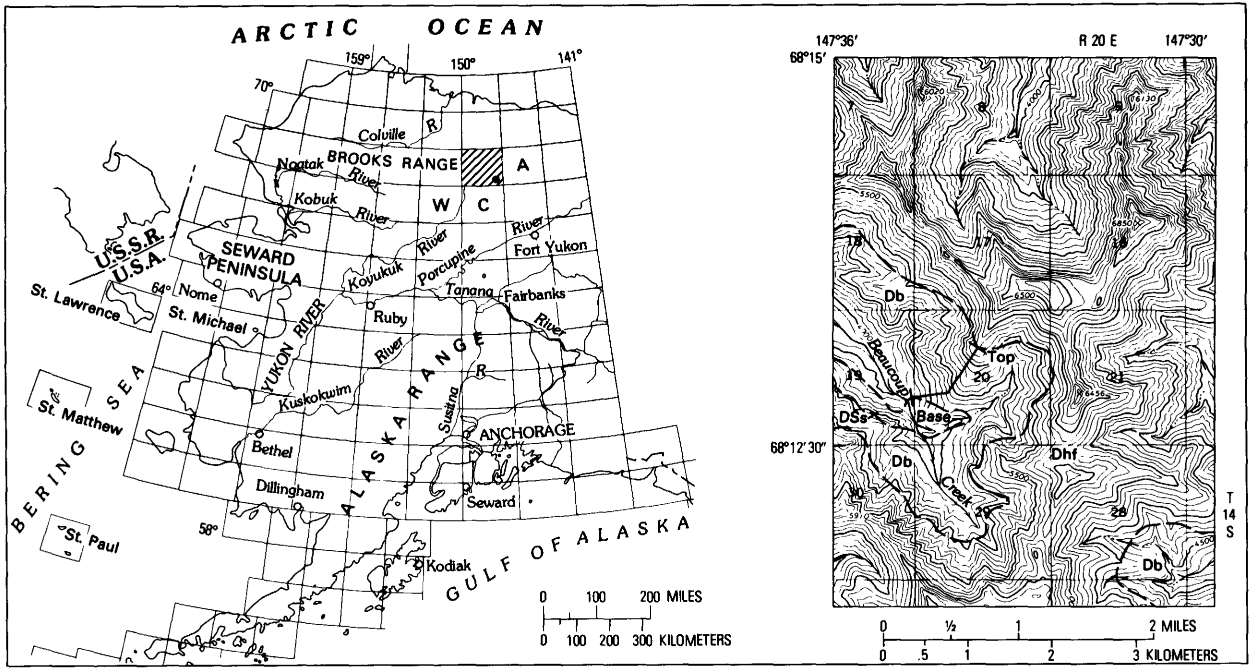


Figure 5.—Index map of Alaska showing location of Philip Smith Mountains quadrangle (cross-hatched); Arctic (A), Chandalar (C), and Wiseman (W) quadrangles; and the type locality of the Beaucoup Formation (dot). Inset map shows location of type section in the northwest corner of the Philip Smith Mountains A–1 quadrangle, and the contacts of the Beaucoup Formation (Db) with the underlying Skajit Limestone (DSs) and the overlying Hunt Fork Shale (Dhf) as enlarged from the original 1:250,000 scale mapping. Contacts of other rocks with the Hunt Fork Shale are omitted.

BEAUCOUP FORMATION, A NEW UPPER DEVONIAN STRATIGRAPHIC UNIT IN THE CENTRAL BROOKS RANGE, NORTHERN ALASKA

By J. Thomas Dutro, Jr., William P. Brosgé,
Hillard N. Reiser, and Robert L. Detterman

About 545 m of assorted clastic and carbonate rocks that form a mappable stratigraphic unit at the base of the Upper Devonian marine sequence in the Philip Smith Mountains area of northern Alaska (Dutro and others, 1977) are here named the Beaucoup Formation for exposures at its type locality in the valley of Beaucoup Creek. The type section (fig. 5) is designated as the section on the northeast side of Beaucoup Creek in sec. 19 and sec. 20, T. 14 S., R. 20 E., in the Philip Smith Mountains A-1 quadrangle, and the type area as the Philip Smith Mountains.

At its type section, the Beaucoup Formation is conformably overlain by the Upper Devonian Hunt Fork Shale (fig. 6) and rests unconformably on the Skajit Limestone, which in this area is Late(?) Silurian to Middle(?) Devonian in age on the basis of fossils found in the Philip Smith Mountains quadrangle (Brosgé and others, 1979). The lithologic heterogeneity of the basal part of the Beaucoup in other parts of the type area probably reflects a mixture of source rocks for this early Late Devonian period of sedimentation.

LITHOLOGY

Four different rock types are found in the type section. The most striking are the reefs and reefoid layers that occur throughout the section in the Beaucoup Creek area and also extend into nearby parts of the Philip Smith Mountains. The dominant, and geographically most persistent, rock type is the fine-grained clastic rocks represented by the yellow-brown weathering calcareous siltstone, silty limestone, and shale in the upper part of the section. Coarser clastic rocks in the upper part of the section are chert- and quartz-pebble conglomerate in a siliceous, ferruginous matrix and fine- to medium-grained ripple-marked sandstone. The fourth rock type is black, thin-bedded, cross-laminated limestone and calcareous black shale with calcareous siltstone nodules, which forms most of the lower third of the section.

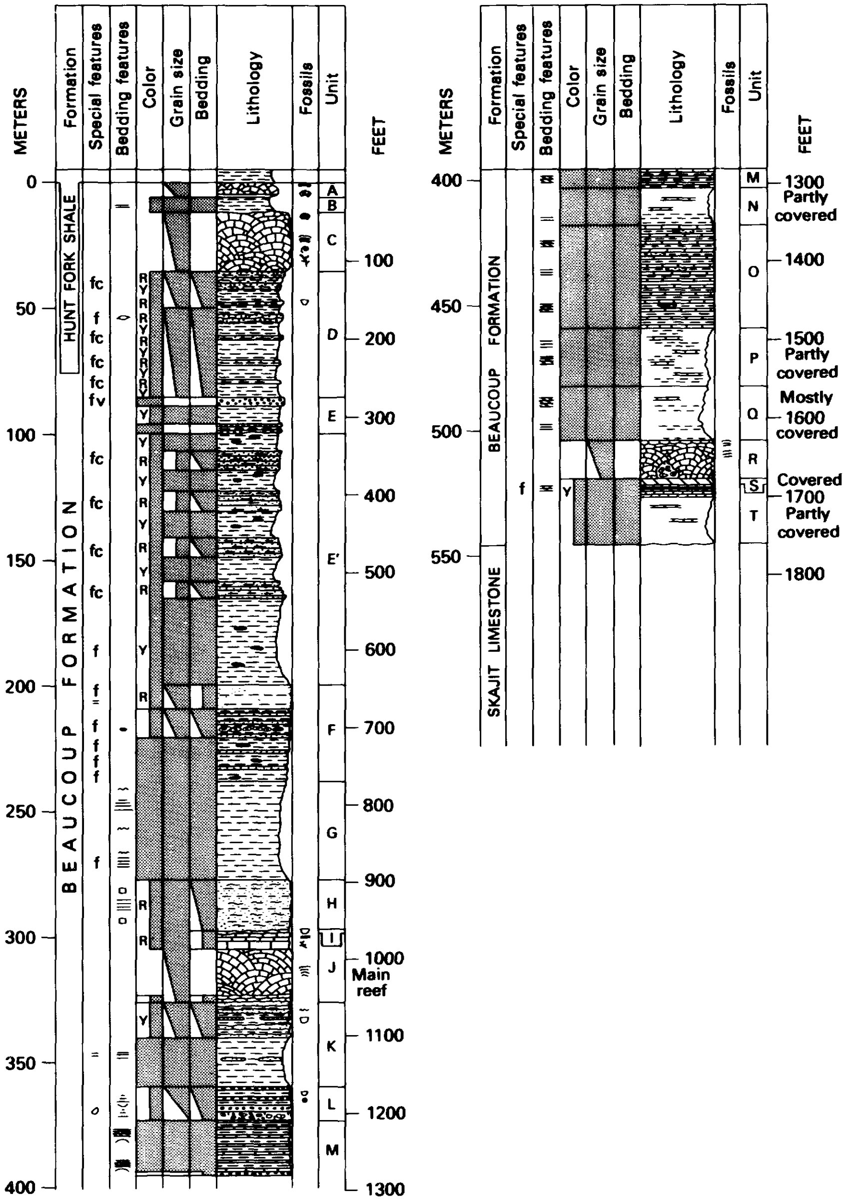


Figure 6.—Type section of Beaucoup Formation.

EXPLANATION FOR FIGURE 6

Lithologic symbols

- Limestone
- Coquinoid limestone
- Sandy limestone
- Reef limestone
- Limestone breccia
- Silty shale
- Sandstone
- Quartzitic sandstone
- Silty sandstone
- Calcareous sandstone
- Conglomerate
- Pebbles of chert and limestone
- Clay ironstone concretions
- Siliceous concretions

Special features

- c Calcareous
- f Ferruginous
- v Siliceous
- = Micaceous
- Shale fragments

Bedding features

- Lenticular
- Clay ironstone
- Wave ripple marks
- Laminated
- Blocky fracture
- Graded bedding
- Channeled
- Cross laminated
- Load casts
- Platy fracture
- Shaly fracture

Color

- Black and dark gray
- Medium gray
- Light gray
- R Medium red
- Y Medium yellow

Grain size

- Fine to very fine
- Medium
- Coarse
- Fine to medium
- Fine to coarse

Bedding

- Thin (less than 1 cm)
- Medium (1 to 10 cm)
- Thick (more than 10 cm)
- Thin to medium

Fossils

- Corals
- Stromatoporoids
- Gastropods
- Bryozoans
- Brachiopods
- Crinoid stems
- Worm trails

In the upper two-thirds of the type section at least four depositional cycles, each initiated by sandy or conglomeratic strata, are present. In each cycle, these clastic rocks grade upward into dark-gray to black noncalcareous shale with siliceous nodules. Two of the cycles are capped by major carbonate reef units 25 to 30 m thick. Two other reefoid bodies, although present in the type section, do not extend far beyond the immediate area of Beaucoup Creek valley.

The basal 25 m of the type section, although mostly covered, consists of thin-bedded ferruginous calcareous fine-grained sandstone that weathers yellowish brown. These beds are immediately overlain by a 15-m-thick stromatoporoid reef that is not found beyond the Beaucoup Creek valley. The next 140 m is thin-bedded black cross-laminated limestone and calcareous shale. Fifteen meters of conglomeratic strata initiate the lowest distinct cycle above the black limestone unit. This cycle is about 75 m thick and is capped by the main reef, about 20 m thick. Reefs at this horizon are mapped throughout most of the southeast part of the Philip Smith Mountains quadrangle (A-1 and A-2, 1:63,360 quadrangles).

Two succeeding cycles above the main reef consist of basal sandstone that grades upward into dark-gray shale. No reefs were formed in these cycles, and the upper cycle is a compound one. Black shale deposited in these cycles contains dark siliceous and ironstone nodules at several levels. The lower cycle is about 90 m thick, and the upper compound cycle is about 125 m thick.

An uppermost cycle is well shown in the type section. A 3-m-thick conglomerate at the base of the cycle is overlain by calcareous ferruginous siltstone, shale, and silty limestone that weather yellowish brown. Discrete reef bodies as much as 25 m thick and several hundred meters in diameter are found high in this cycle. In the type section, and at a few other places, small patch reefs as much as 6 m thick cap the formation. They are separated from the larger reefs below by 5 to 10 m of noncalcareous black shale like that in the overlying Hunt Fork Shale.

The Beaucoup Formation at its type section is conformably overlain by the Hunt Fork Shale. The upper boundary of the Beaucoup is drawn at the top of the highest reef or, in the absence of reefs, at the level where the dominantly calcareous, yellow-weathering beds are succeeded by the dark-gray, noncalcareous siltstone and shale of the Hunt Fork. Where mapped only on the change in lithologic character of the shale beds, this boundary is not sharp and has probably been located at slightly different horizons in different places.

Four other rock types occur in the Beaucoup Formation in the type area, but are not present in the type section. Limestone-pebble conglomerate and conglomeratic limestone near the base of the formation are exposed in an anticlinal area on the north side of the structural high composed of Skajit

Limestone about 5 to 10 km west of the type section. Phyllite-pebble conglomerate is developed locally at the base of the formation and is especially conspicuous about 5 km southwest of the type section on the south side of the same structural high. Mafic volcaniclastic rocks and flows, including pillow basalt, are found in the upper and middle parts of the formation at scattered localities west and south of the type section in the southern Philip Smith Mountains quadrangle. Finally, maroon and green mudstone and siltstone are found in a few places in the quadrangle, usually associated with the coarser clastic rocks near the base of the formation.

DISTRIBUTION AND MAPPING

The Beaucoup Formation includes several units that were mapped by Brosgé, Reiser, Dutro, and Detterman (1979) in the Philip Smith Mountains quadrangle as four of the members of an unnamed unit of brown calcareous clastic rocks. Most of the strata in the type section were mapped as the "brown sandstone, shale, and limestone member" of this unit. The main reef limestone and other larger reefoid masses were mapped as the "limestone member." In other places, where the reefs are missing and the sandstone is inconspicuous, the yellow-weathering calcareous shale directly beneath the darker Hunt Fork Shale was mapped as the "brown shale member." Where conspicuous, the conglomeratic limestone and limestone-pebble conglomerate were mapped separately as the "conglomerate member" of this unit. The largest area where this conglomerate was mapped is along an anticlinal trend 5 to 10 km west of the type section. Phyllite-pebble conglomerate, which occurs 5 km southwest of the type section, was mapped as part of the "conglomerate member."

The Beaucoup Formation also includes several units that previously were mapped separately in the Chandalar and Arctic quadrangles. These units are: in the northern part of the Chandalar quadrangle (Brosgé and Reiser, 1964), the "limestone and siltstone" unit (Dl) and the brown-weathering phyllite member of that unit (Dls), the green phyllite member (Dsp), black siltstone member (Dst), basal conglomerate member and some of the slates of the "slate and sandstone" unit (Ds); in the southwestern Arctic quadrangle (Brosgé and Reiser, 1965), both members of the "slate, conglomerate, and limestone" unit (Dsc and Dlf) and all the "calcareous shale and limestone" unit (Dsl). Recognition of the depositional continuity of these rocks in the southern part of the Philip Smith Mountains quadrangle and to the south and east clarifies the stratigraphic relations among most of these pre-Hunt Fork Upper Devonian units.

At this time, we are excluding from the Beaucoup Formation the wackes of Frasnian Age mapped separately in the eastern Philip Smith Mountains and southwestern Arctic quadrangles (Brosgé and others, 1979; Brosgé and Reiser, 1965), because their relations to the Beaucoup are not yet clearly established. For the same reason we are, at this time, also excluding the conglomerate in the Savioyuk synclinorium south of Slatepile Mountain in the Wiseman quadrangle, which has been described previously as the basal conglomerate of the Hunt Fork Shale (Tailleur and others, 1967; Dutro and others, 1976). Although this conglomerate rests on red and green shale and Upper Devonian reefs correlative with the Beaucoup Formation, whether the conglomerate itself is within the Beaucoup Formation or within the Hunt Fork Shale is not clear.

AGE AND CORRELATION

Fossils are abundant at several levels in the type section. The reefs themselves are composed predominantly of stromatoporoids. The upper two reefs contain rugose and tabulate corals of Frasnian (early Late Devonian) Age. Among these are Pachyphyllum, Macgeea, and Alveolites. Shelly beds occur both above and below the reefy masses and include the brachiopods Schizophoria, Nervostrophia, Atrypa, Spinatrypa, Warrenella, and Gypidula together with the coral Macgeea and bryozoan and echinoderm debris. These assemblages are also of Frasnian Age.

As the overlying shaly beds of the Hunt Fork Shale also contain Frasnian fossils (Atrypa, Spinatrypa, and Macgeea), the Beaucoup is Late Devonian, probably early Frasnian, in age; the occurrence of Warrenella supports this conclusion because that genus is not known in beds of late Frasnian Age.

REFERENCES CITED

Brosgé, W. P., and Reiser, H. N., 1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-375, 1:250,000.

__________ 1965, Preliminary map of the Arctic quadrangle, Alaska: U.S. Geol. Survey Open-File Report, 1:250,000.

Brosgé, W. P., Reiser, H. N., Dutro, J. T., Jr., and Detterman, R. L., 1979, Bedrock geologic map of the Philip Smith Mountains quadrangle, Alaska: U.S. Geol. Survey Misc. Field Studies Map MF-879-B, 1:250,000.

Dutro, J. T., Jr., Brosgé, W. P., and Reiser, H. N., 1977, Upper Devonian depositional history, central Brooks Range, Alaska, *in* Accomplishments during 1976: U.S. Geol. Survey Circ. 751-B, p. B16-B18.

Dutro, J. T. Jr., Brosgé, W. P., Lanphere, M. A., and Reiser, H. N., 1976, Geologic significance of Doonerak structural high, central Brooks Range, Alaska: Am. Assoc. Petroleum Geologists Bull., v. 60, no. 6, p. 952-961.

Tailleur, I. L., Brosgé, W. P., and Reiser, H. N., 1967, Palinspastic analysis of Devonian rocks in northwestern Alaska, *in* Oswald, D. H., ed., v. 2 of International symposium on the Devonian System (Proc.), Calgary, Alberta, Alberta Soc. Petroleum Geologists, v. 2, p. 1345-1361.

STONEY FORK MEMBER (NEW NAME) OF THE BREATHITT FORMATION IN SOUTHEASTERNMOST KENTUCKY

By Russell G. Ping[1] and Charles L. Rice

Morse (1931, p. 304) gave the name Lost Creek Limestone to a bed of limestone cropping out on the ridge between Lost Creek and Big Branch of the North Fork of the Kentucky River in eastern Kentucky. The limestone occurs in the upper part of the Breathitt Formation of Pennsylvanian age and is a very useful lithostratigraphic unit for mapping and correlation. The Lost Creek Limestone was listed in a glossary of stratigraphic names by Wanless (1939, p. 91) and has been mapped in several quadrangles prepared for the U.S. Geological Survey-Kentucky Geological Survey cooperative mapping program. The name has been used informally to include both the limestone and the overlying shale and siltstone.

The name Lost Creek Limestone is formally preempted by prior usage (American Commission on Stratigraphic Nomenclature, 1970, Art. 11(c), p. 31), and therefore the unit is herein renamed the Stoney Fork Member of the Breathitt Formation. The name is taken from the settlement of Stoney Fork in the Balkan (7 1/2-minute) quadrangle, Kentucky, about 8 km south of the type section of the new member.

The Stoney Fork Member has been recognized and mapped in an oblong area including all or part of 28 (7 1/2-minute) quadrangles in southeastern Kentucky (fig. 7). The member occurs near the tops of the hills in the area shown in figure 7 and is absent on the east, south, and west owing to erosion; the arbitrary boundary on the north is subject to change because the member is difficult to recognize in that direction.

The Stoney Fork Member commonly ranges from about 6 m to 12 m in thickness and is composed of a generally upward coarsening sequence of shale, limestone, siltstone, and sandstone. The clayey to silty shale and limestone in the lower part of the unit contain marine fossils, mostly brachiopods, pelecypods, crinoids, and bryozoans. This fossiliferous zone ranges from about 0.3 m to 4.6 m in thickness. Microcrystalline limestone commonly occurs in a massive bed near

[1]Kentucky Geological Survey, Lexington, Ky.

the base of the member and is as much as 1.8 m thick in the western part of the 28-quadrangle area; in the eastern part of the area it is confined to a narrow elongated trough and laterally grades into small discontinuous lenses as much as 0.3 m thick and 2.4 m long (fig. 8). The bedded limestone facies contains a diverse fauna and is sparsely to abundantly fossiliferous. In contrast, the limestone lens facies contains fewer fossils and has a restricted fauna. Silty shale above the fossiliferous zone commonly contains thin<.05 m siderite layers and nodules in a zone as much as 16 m thick, although 0.9 m to 2.4 m is more common.

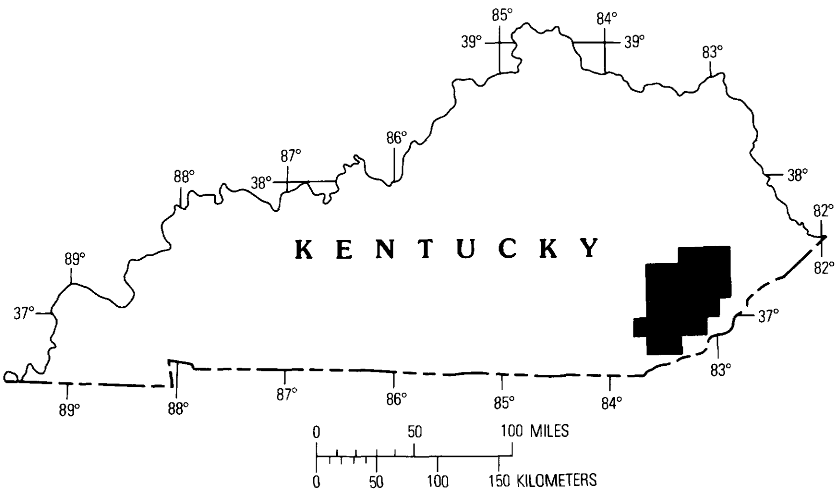


Figure 7.—Index map of Kentucky showing the quadrangle area in which the Stoney Fork Member of the Breathitt Formation is exposed.

The lower contact of the member is placed at the base of the fossiliferous zone that overlies coal, commonly the Hindman (Hazard No. 9) coal bed, underclay, or sandstone. The upper contact, in places a disconformity, is placed where even-bedded siltstone (locally interbedded with thin-bedded sandstone) of the member is overlain by cross-bedded channel-fill sandstone, thick-bedded or massive sandstone, or an unnamed coal bed.

In the type area the member is about 171 m above the Magoffin Member of the Breathitt Formation and about 232 m above the Fire Clay coal bed, a coal recognized regionally because of its distinctive flint clay parting.

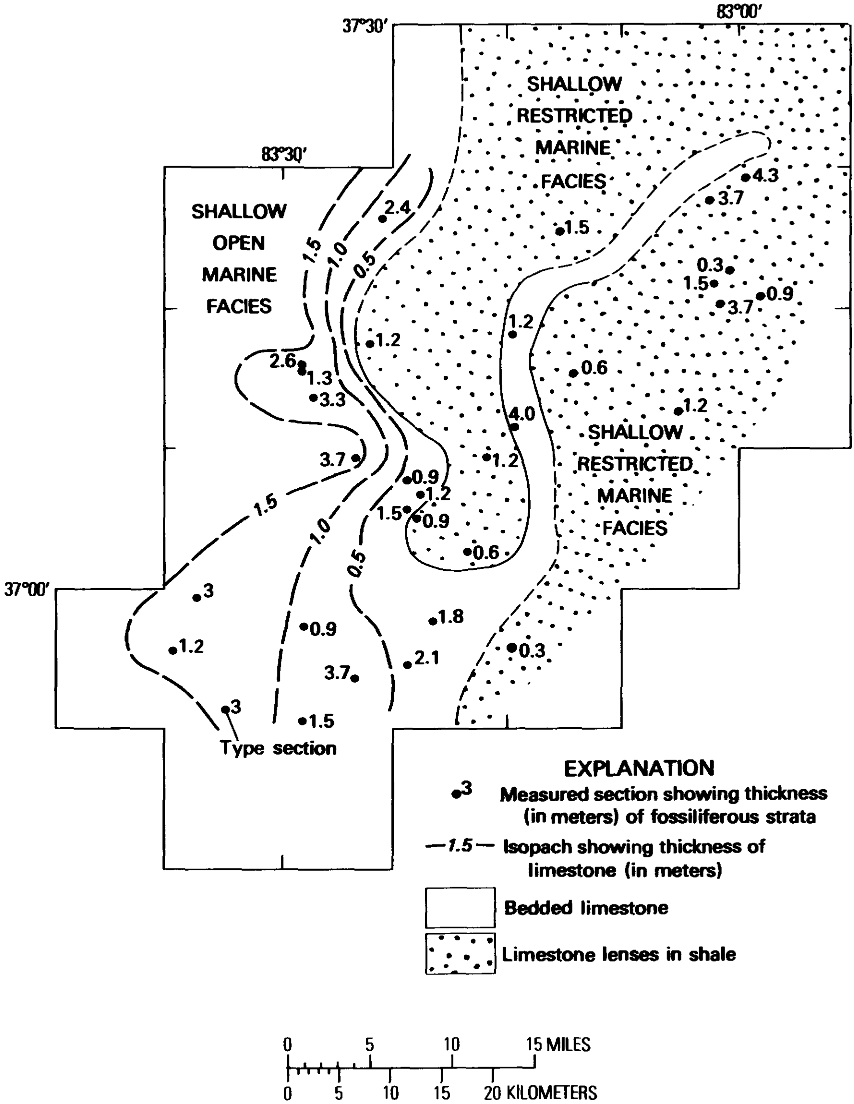


Figure 8.—Marine facies of the Stoney Fork Member of the Breathitt Formation (modified from Ping, 1978, fig. 12).

The limestone of the Stoney Fork Member contains a microfauna characterized by foraminifers, including the fusiform species. These fusulinids are the oldest yet found in the Pennsylvanian section in eastern Kentucky and provide a valuable tool for basinal and interbasinal correlation. These fusulinids, with attributes of both Profusulinella and Fusulinella, indicate that the member is Atokan in age and "closely related" to Ohio's "Boggs Limestone Member" of the Pottsville Formation (Douglass, 1979). Although no corresponding fusulinid-bearing limestone is present in the Eastern Interior Basin, the Stoney Fork Member is considered to have a stratigraphic position in the Tradewater Formation in western Kentucky between its Profusulinella-bearing "Lead Creek Limestone Member" and its Fusulinella-bearing Curlew Limestone Member (Rice and others, 1979).

A shale unit near the Kentucky-West Virginia border containing linguloid brachiopods at this stratigraphic position was tentatively identified as equivalent to the "Kanawaha Black Flint" of White (1891) of Middle Pennsylvanian age by Huddle and Englund (1966, p. 41 and table 4).

Measured Section

[Type section of the Stoney Fork Member of the Breathitt Formation measured at a strip bench in Bell County about 350 m southeast of Kentucky State Highway 1201 at the head of Red Bird Creek approximately 4.8 km southwest of the community of Beverly in the Beverly (7 1/2-minute) quadrangle, lat 36°53'46" N., long 83°33'36" E., by R. G. Ping, 1976]

Unit	Description	Thickness in meters
Pennsylvanian:		
	Breathitt Formation (incomplete):	
	Coal, not measured.	
18.	Sandstone, massive, very fine grained; unconformable on member below	3.6
	Stoney Fork Member:	
17.	Siltstone, medium-dark-gray (N 4)[1]	3.0
16.	Shale, silty, medium-dark-gray (N 4); lower 2.4 m contain siderite layers and nodules; gradational with siltstone above	3.4

Unit	Description	Thickness in meters
15.	Shale, clayey, medium-dark-gray (N 4), sparsely fossiliferous in lower part; contains siderite nodules; gradational with silty shale above	1.5
14.	Shale, clayey, dark-gray (N 3) to medium-dark-gray (N 4), sparsely fossiliferous; upper 0.3 m contains siderite nodules	0.9
13.	Limestone, medium-dark-gray (N 4), grades from mudstone (at base only) to wackestone; limestone generally ranges from 50-75 percent fossil tests: crinoids, pelecypods, bryozoans, brachiopods, and microfossils .	1.3
12.	Shale, clayey, olive-gray (5 Y 4/1), many small unidentified fossils; contains scattered limestone nodules, microcrystalline, 0.1 m in diameter	0.2
11.	Limestone, medium-dark-gray (N 4), packstone; fossils mostly brachiopods, pelecypods, and crinoid fragments; limestone is about 10 percent pyrite (as replacement of fossil tests) and 10 percent quartz grains	0.1
10.	Shale, medium-dark-gray (N 4), "gritty," many broken fossils coquina-like; contains some dark-yellowish-orange (10 YR 6/6) streaks . .	0.03
	Total Stoney Fork Member . .	10.43

Unit	Description	Thickness in meters
	Breathitt Formation (incomplete):	
9.	Coal	0.1
8.	Shale, coaly, dark-gray (N 3) to grayish-black (N 2)	0.03
7.	Coal	0.03
6.	Shale, medium-light-gray (N 6); contains much carbonized plant material	0.3
5.	Coal	0.2
4.	Shale, medium-dark-gray (N 4); contains carbonized plant material, also striated surfaces that resemble slickensides	0.2
3.	Coal	0.1
2.	Shale, medium-dark-gray (N 4); contains carbonized plant material	0.03
1.	Sandstone and siltstone, interbedded; sandstone, medium-gray (N 5), fine grained, poorly sorted, micaceous, massive; siltstone, medium-dark-gray (N 4); sandstone predominates	8.8
	Total Breathitt Formation (incomplete)	24.12

Strip mine bench, Hindman coal bed, unexposed.

[1]Color designations are based upon the rock color chart of Goddard and others (1948).

REFERENCES CITED

American Commission on Stratigraphic Nomenclature, 1970, Code of stratigraphic nomenclature: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 22 p.

Douglass, R. C., 1979, The distribution of fusulinids and their correlation between the Illinois Basin and the Appalachian Basin, in Palmer, J. E., and Dutcher, R. R., eds., [1979], Depositional and structural history of the Illinois Basin: Internat. Cong. of Carboniferous Stratigraphy and Geology, 9th, Urbana, Ill., Field Trip 9, pt. 2, p. 15-20.

Goddard, E. N., and others, 1948, Rock-color chart: Washington D. C., National Research Council, 6 p. (Republished by Geological Society of America, 1951).

Huddle, J. W., and Englund, K. J., 1966, Geology and coal reserves of the Kermit and Varney area, Kentucky: U.S. Geol. Survey Prof. Paper 507, 83 p.

Morse, W. C., 1931, The Pennsylvanian invertebrate fauna of Kentucky, in Jillson, W. R., and others, Paleontology of Kentucky: Kentucky Geol. Survey, ser. 6, v. 36, p. 293-348.

Ping, R. G., 1978, Stratigraphic and structural relationships of the Stoney Fork Member of the Breathitt Formation in southeastern Kentucky (M.S. thesis): Lexington, Univ. Kentucky, 125 p.

Rice, C. L., Kehn, T. M., and Douglass, R. C., 1979, Pennsylvanian correlations between the Eastern Interior and Appalachian Basins, in Palmer, J. E., and Dutcher, R. R., eds., [1979], Depositional and structural history of the Illinois Basin: Internat. Cong. of Carboniferous Stratigraphy and Geology, 9th, Urbana, Ill., Field Trip 9, pt. 2, p. 103-105.

White, I. C., 1891, Stratigraphy of the bituminous coal field of Pennsylvania, Ohio, and West Virginia: U.S. Geol. Survey Bull. 65, 212 p.

Wanless, H. R., 1939, Pennsylvanian correlations in the Eastern Interior and Appalachian coal fields: Geol. Soc. America Spec. Paper 17, 130 p.

AGE OF GREYLOCK SCHIST IN WESTERN MASSACHUSETTS

By Nicholas M. Ratcliffe

The name Greylock Schist (Dale, 1891, p. 5) has been applied to greenish and gray chlorite schists that contain albite or chloritoid on Mount Greylock in the Williamstown, Cheshire, and North Adams quadrangles in Massachusetts.

The rock originally was assigned to the Middle Ordovician because it was thought to overlie conformably the Stockbridge Formation and the black carbonaceous schists of the Walloomsac Formation (previously included in the Berkshire Schist) (Dale, 1891, p. 6).

Prindle and Knopf (1932) showed that the Greylock Schist discordantly overlies both the Stockbridge and the Walloomsac Formations, and they correlated the Greylock with the Hoosac Schist (Formation) on Hoosac Mountain. Both were assigned a probable Early Cambrian age. In addition, small areas of chloritoid-rich green phyllite on Mount Greylock were assigned to the Rowe Schist, also of probable Early Cambrian age.

Herz (1958, 1961), in remapping the peripheral areas around Mount Greylock, chose to return to Dale's usage, accepted a conformable sequence, and assigned a Middle Ordovician age to the Greylock.

Restudy (N. M. Ratcliffe, 1979, unpub. data) of the main mass of Mount Greylock and of the area mapped by Herz (1958, 1961) confirms Prindle and Knopf's (1932) conclusion that the Greylock Schist discordantly overlies the Stockbridge and Walloomsac Formations. In addition, restudy of the type Hoosac Formation on Hoosac Mountain shows that correlation between albitic and chloritoid schists of the Hoosac and Greylock is likely. Three members informal are now recognized within the Greylock Schist: a green lustrous chloritoid phyllite member; a dark-grey albitic schist and metaconglomerate member, locally containing distinctive beds of salmon pink- to orangish-tan-weathering dark blue-gray dolostone as much as 1 m thick; and a lower green to gray albitic schist member. The total thickness exposed on Mount Greylock is approximately 1000 ft. (300 m). Internal structure of the Greylock Schist is discordant to its lower contact that also truncates folds in the underlying Stockbridge and Walloomsac Formations. Therefore Prindle and Knopf's (1932) conclusion that a fault separates the Greylock Schist from the underlying rocks has been verified.

On the basis of these data and the probable correlation of the Greylock Schist with the Hoosac Formation of Early Cambrian or older age (Norton, 1976), we recommend that the age designation of Greylock Schist be changed to Proterozoic Z and Early Cambrian in general agreement with earlier usage (Prindle and Knopf, 1932).

REFERENCES CITED

Dale, T. N., 1891, The Greylock synclinorium: American Geologist, v. 8, p. 1-7.

Herz, N. L., 1958, Bedrock geolgy of the Cheshire quadrangle, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-108.

________, 1961, Bedrock geology of the North Adams quadrangle, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-139.

Norton, S. A., 1976, Hoosac Formation (Early Cambrian or older) on the east limb of the Berkshire massif, western Massachusetts, in Page, L. R., ed., Contributions to stratigraphy of New England: Geol. Soc. America Mem. 148, p. 357-371.

Prindle, L. M., and Knopf, E. B., 1932, Geology of the Taconic quadrangle: Am. Jour. Sci., 5th Ser., v. 24, p. 257-302.

ADOPTION AND REDEFINITION OF THE SHERMAN MARBLE AND REGIONAL CORRELATIONS OF PLYMOUTH- AND SHERMAN-TYPE MARBLES IN VERMONT AND MASSACHUSETTS

By Nicholas M. Ratcliffe

Type locality and description

The name Sherman Marble was proposed by Hubbard (1924, p. 269) for occurrences of calcitic and dolomitic marble and calcium silicate rocks in southern Vermont in the Whitingham Township just north of the Massachusetts State line. The type locality is an abandoned quarry on the northeast shore of Sherman Reservoir east of the abandoned Hoosac Tunnel and Wilmington Railroad in Windham County.

Skehan (1961, p. 5) believed that the Sherman Marble is interbedded with albitic schists of his Readsboro Formation (redefined Readsboro Schist of Hubbard, 1924) and identified the Sherman Marble as a member of his Readsboro. Local occurrences of Sherman-like marble outside Skehan's Readsboro outcrop belt and within the dark nonalbitic Heartwellville Schist as used by Skehan (1961) were identified as marble within Skehan's Heartwellville from two occurrences northeast of Mount Pisgah (Mount Snow) in west Dover, Vt. (fig. 9, col. 2 and 6).

According to Skehan, the Sherman Marble is calcitic and dolomitic marble and actinolite, diopside, or phlogopite calcium silicate rock containing coarse graphite. The limesilicated and coarse graphite marble is best exposed at the type locality and in the valley that extends from Whitingham south to the Sherman Reservoir. According to Hubbard (1924) and Skehan (1961), the Sherman Marble is interbedded most commonly with gray albitic schists that are assignable to Skehan's Readsboro Formation of probable Proterozoic Z age (Skehan, 1961).

Rationale for restricted usage

Reexamination of the type Sherman Marble and other occurrences shown by Skehan as Sherman suggests that not all marble exposures included in this unit are comparable. Two principal belts of marble apparently exist. One is probably Proterozoic Y in age and another occurrence is probably Proterozoic Z or Early Cambrian.

Coarse white graphite calcite-dolomite marble containing diopside at the type locality at Sherman Reservoir and at scattered localities running northeast from Sherman Reservoir to Whitingham are interlayered with well-layered biotite felsic gneiss, amphibolite, calc-silicate rock and well-layered biotite quartz plagioclase paragneiss. The marbles are separated from rusty albitic schists assignable to Skehan's Readsboro at many localities by compact gneisses of probable Proterozoic Y age. These gneiss outcrops are traceable northeastward into the main belt of Wilmington Gneiss of Skehan (1961). Thus, the coarsely crystalline marble at Sherman Reservoir, the type locality, and numerous occurrences in small quarries southwest of Whitingham closely resemble one another and at least in that part of the area are not interbedded with albitic schist as Skehan (1961) indicated. Instead, Skehan's Wilmington Gneiss and the type Sherman Marble apparently are both unconformably overlain by his Readsboro.

These occurrences of marble at or closest to the type locality differ from the Sherman Marble shown elsewhere by Skehan (1961, pl. 1).

For example, excellent exposures of Sherman Marble as shown by Skehan south of Medburyville are beige- to orangish-tan-weathering phyllitic dolostone, locally veined with white calcitic marble that results in a brecciated or blocky appearance. Numerous exposures show that this nongraphitic, phlogopitic fine-grained dolomitic marble is interbedded with gray to black nonalbitic schists of Skehan's Heartwellville Schist on the west and in contact with gray and green biotite or muscovite albitic quartz schist to the east (the Readsboro as used by Skehan, 1961).

On the basis of these observations, the Sherman Marble as mapped by Skehan (1961) apparently consists of at least two stratigraphically dissimilar units. The finer grained dolomitic marble at Medburyville closely resembles dolomitic marble of the Plymouth Marble, shown in east-central Vermont as a member of the Hoosac Formation (Doll and others, 1961). Likewise, it resembles dolostone in the Netop Formation of Shumaker and Thompson (1967) in the Dorset Mountain nappe of the Taconic allochthon as well as certain unnamed dolostone beds in the Greylock Schist (Ratcliffe, 1979a) of the Greylock slice of the Taconic allochthon in Massachusetts.

Recommended changes

Because of the uncertainty in the usage of the Sherman Marble and because of the probable restriction of the type Sherman Marble of the reservoir area and of the Whitingham belt to rocks of probable Proterozoic Y age, I recommend:

(1) that the Sherman Marble be redefined and stratigraphically and geographically restricted to include only rocks at the type locality and the adjacent Whitingham area,

(2) that the age of the type Sherman Marble be changed from late Precambrian [Proterozoic Z] and Early Cambrian(?) to Proterozoic Y; this change is based on recognition that Skehan's Wilmington Gneiss, which contains the type Sherman, is regarded by Skehan (1961) and by the writer as Proterozoic Y in age, and

(3) that other occurrences outside the type locality shown as Sherman Marble by Skehan (1961) that are interbedded with albitic schists are probably Proterozoic Z or Early Cambrian in age and may be regarded as correlatives of the Plymouth Member of the Hoosac Formation of Chang and others (1965).

Regional correlations of Plymouth- and Sherman-type marbles

The type Sherman Marble may be correlated with calcium silicate rocks and marble known in the Proterozoic Y gneiss sequence of the Berkshire massif (Ratcliffe and Zartman, 1976) and with similar marbles in the Mount Holly Complex of the Green Mountains of Vermont (Doll and others, 1961).

Figure 9 shows stratigraphic sections and age assignments of various authors for Proterozoic Y and Z and Lower Cambrian rocks at the eastern border of the Green Mountains massif in Vermont. Lenses of marble are rare but are found at various positions in formations regarded as Proterozoic Z or Early Cambrian in age. Correlation of these units is complicated by the lack of continuity between exposures and by uncertainty in the stratigraphy, principally regarding the Cavendish Formation as used by Doll and others (1961). The Cavendish as used on the Vermont State geologic map includes Skehan's Readsboro Formation proper, with its Searsburg conglomerate member, its Readsboro schist member, and its Sherman marble member, and his Heartwellville Schist with its rare occurrences of dolomitic marble. Skehan (1961, p. 63-65) noted that he had mapped two nearly identical sequences of rocks, his Tyson Formation-Hoosac Formation sequence and his Readsboro-Heartwellville sequence, but had assigned them different ages as shown in figure 9, column 2. He suggested as an alternate interpretation (1961, p. 65) that the problem could be somewhat simplified by making the Hoosac as mapped by Skehan (1961) a partial lateral equivalent of the Readsboro-Heartwellville sequence as shown in figure 9, columns 3 and 4, an interpretation in which Zen concurred (1967). This usage would require that a fault separate the two sequences in the Wilmington area but would bring the stratigraphy in the Wilmington area into conformity with that of Chang and others

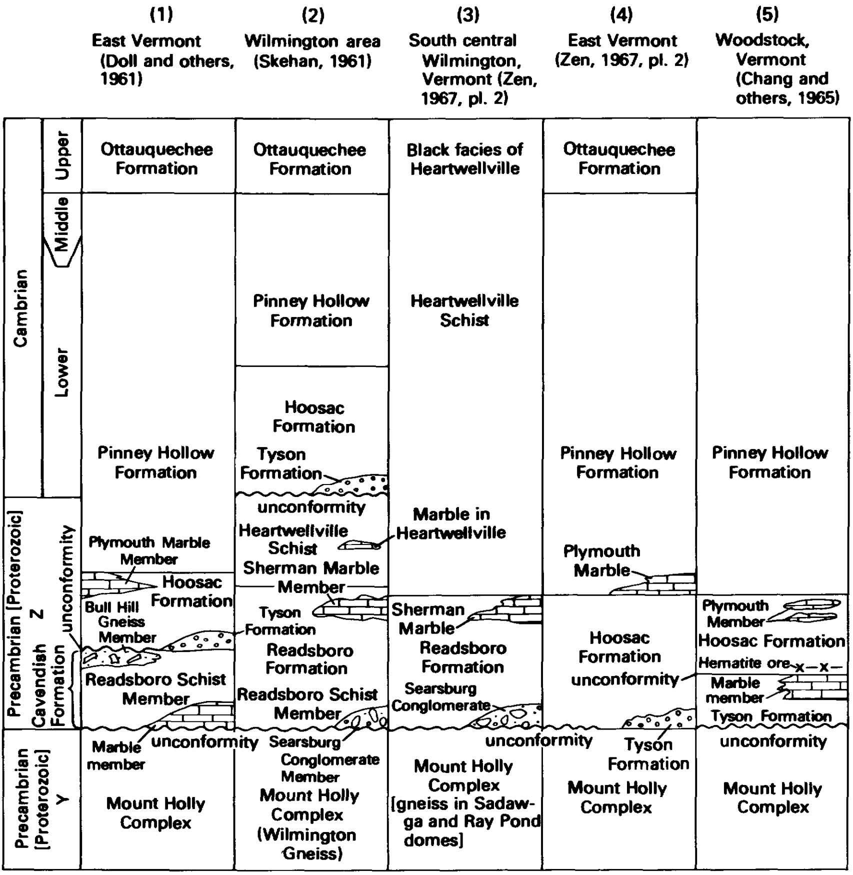
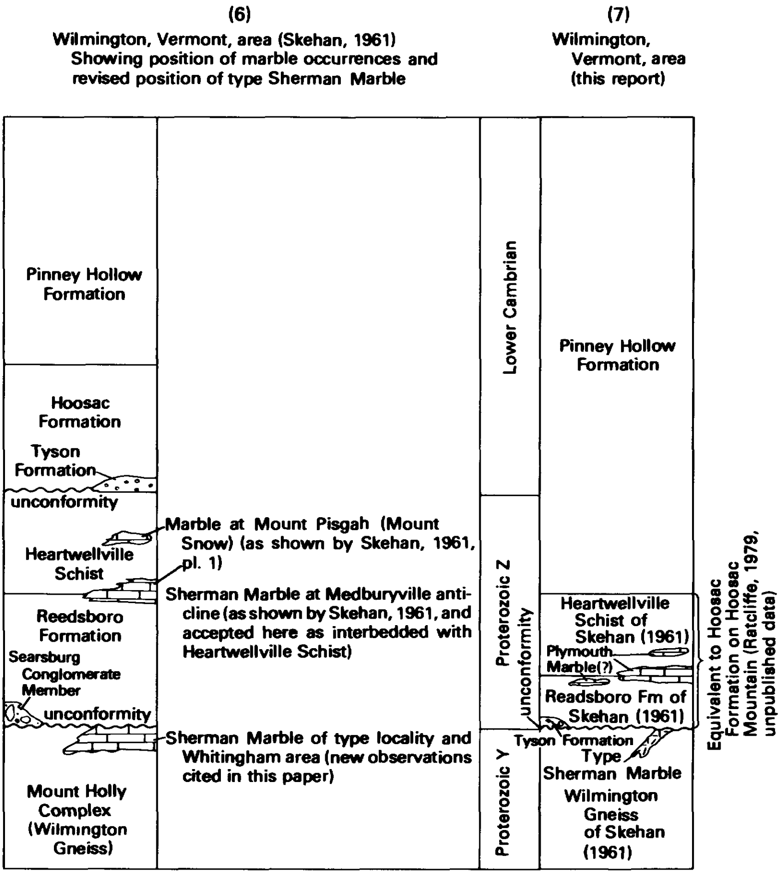


Figure 9.—Correlation chart showing age assignments of Proterozoic Y, Proterozoic Wilmington, Vt., area. Principal occur-



Z, and Cambrian rocks in the east Vermont sequence and in the
rences of carbonate rocks.

(1965) in the type area of the Plymouth Marble (Plymouth Member of Hoosac Formation, fig. 9, col. 5).

Figure 9, column 6, shows the marble units at 3 positions in the Wilmington, Vt., area according to Skehan's stratigraphic scheme.

Reconnaisance study of the marble occurrences in the Wilmington area shows that the two upper horizons of dolomitic marble are interbedded, as Skehan (1961) stated, with the Readsboro Formation and the Heartwellville Schist. However, detailed mapping of the type Hoosac Formation immediately south of the Wilmington area has shown that the gray albitic granofels of Skehan's Readsboro and the aluminous schists of his Heartwellville are both traceable into the main mass of the Hoosac Formation at its type locality (Ratcliffe, 1979b).

These relationships suggest strongly that the Hoosac Formation is in fact equivalent to the Readsboro-Heartwellville sequence of Skehan (1961). This relationship suggests that Zen's (1967) correlation of the Heartwellville with the Pinney Hollow and Ottaquechee Formations (fig. 9, col. 3 and 4) is probably not necessary.

The interpretation favored here is shown in figure 9, column 7.

The Medburyville occurrences of Sherman Marble of probable Proterozoic Z or Early Cambrian age, shown by Skehan (1961, pl. 1) as interbedded with albitic schists, are probably correlative with the Plymouth marble member of the Hoosac formation as shown by Doll and others (1961; fig. 9, col. 1) and with dolostone beds within Shumaker and Thompson's (1967) Netop Formation in the Dorset Mountain nappe of the Taconic allochthon.

Dolostone beds similar to the Netop Mountain and Medburyville occurrences are also found in the Greylock Schist in the Greylock allochthon in northwestern Massachusetts (Ratcliffe, 1979b). Recent mapping (Ratcliffe, 1979b) has shown that the dolostone units in the Greylock are not the same as the Bellowspipe Limestone, referred to by Pumpelly, Wolf, and Dale (1894) and Prindle and Knopf (1932), that Shumaker and Thompson (1967) and Zen (1967) mistakenly correlated with the Plymouth Marble.

The major occurrences of marble and dolostone on Mount Greylock in the Bellowspipe and at Jones' Nose are assignable to either the calcitic marble member of the Walloomsac Formation or to the Stockbridge Formation (Ratcliffe, 1979b). The rare occurrences of dolostone within the Greylock Schist clearly are not the exposures assigned by either Pumpelly, Wolf, and Dale (1894) or Prindle and Knopf (1932) to the Bellowspipe Limestone, but are newly discovered localities (Ratcliffe, 1979b). These unnamed occurrences of dolostone in beds that are a maximum of 1 m thick are probably correlative with the Plymouth Marble, Shumaker and Thompson's Netop dolostone, and the Medburyville-type "Sherman" marble occurrences.

The occurrence of distinctive buff-weathering, dark-blue dolostone and quartzite beds of the Plymouth Marble type with gray albitic schist and green to gray lustrous aluminous phyllite at Plymouth and Wilmington, Vt., east of the Green Mountains and in the Taconic allochthon on Dorset Mountain and Mount Greylock, supports correlation of dolostone in Shumaker and Thompson's Netop Formation and the Greylock Schist with the Plymouth Marble at Plymouth and with the Medburyville-type "Sherman" marble of Skehan (1961). The physical continuity between Skehan's Readsboro-Heartwellville sequence and with the type Hoosac Formation in turn supports the general equivalence of the Hoosac Formation with the Netop and St. Catherine Formations of Shumaker and Thompson (1967), with the Greylock Schist, and with the Readsboro and Heartwellville Formations as used by Skehan (1961). A Proterozoic Z and (or) Early Cambrian age is likely for all these units, as suggested by Zen (1967).

REFERENCES CITED

Chang, P. H., Ern, E. H., Jr., and Thompson, J. B., Jr., 1965, Bedrock geology of the Woodstock Quadrangle, Vermont: Vermont Geol. Survey Bull. 29, 65 p.

Doll, C. G., Cady, W. M., Thompson, J. B., Jr., and Billings, M. P., compilers and editors, 1961, Centennial geologic map of Vermont: Vermont Geol. Survey, scale 1:250,000.

Hubbard, G. D., 1924, Geology of a small tract in south-central Vermont [Whitingham area], *in* 14th Report of the State Geologist on the mineral industries and geology of Vermont 1923-1924: Vermont Geol. Survey, p. 260-343.

Prindle, L. M., and Knopf, E. B., 1932, Geology of the Taconic quadrangle: Am. Jour. Sci., 5th ser., v. 24, p. 257-302.

Pumpelly, Raphael, Wolff, J. E., and Dale, T. N., 1894, Geology of the Green Mountains in Massachusetts: U.S. Geol. Survey Mon. 23, 206 p.

Ratcliffe, N. M., 1979a, Age of the Greylock Schist in western Massachusetts: this report.

Ratcliffe, N. M., 1979b, Field guide to the Chatham and Greylock slices of the Taconic allochthon in western Massachusetts and their relationship to the Hoosac-Rowe sequence, in Friedman, G. M., ed., Joint Ann. Mtg., Oct. 5-7, 1979, New York State Geological Association, 51st Ann. Mtg., and New England Intercollegiate Geological Conference, 71st Ann. Mtg., Troy, N.Y.: p. 388-425.

Ratcliffe, N. M. and Zartman, R. E., 1976, Stratigraphy, isotopic ages and deformational history of basement and cover rocks of the Berkshire massif, southwestern Massachusetts, in Page, L. R., ed., Contributions to stratigraphy of New England: Geol. Soc. America Mem. 148, p. 373-412.

Shumaker, R. C. and Thompson, J. B., Jr., 1967, Bedrock geology of the Pawlet Quadrangle, Vermont: Vermont Geol. Survey Bull. 30, 98 p.

Skehan, J. W., 1961, The Green Mountain anticlinorium in the vicinity of Wilmington and Woodford, Vermont: Vermont Geol. Survey Bull. 17, 159 p.

Zen, E-an, 1967, Time and space relationships of the Taconic allochthon and autochthon: Geol. Soc. America Spec. Paper 97, 107 p.

SCOTTS HILL MEMBER (NEW NAME) OF THE CRETACEOUS PEEDEE FORMATION OF SOUTHEASTERNMOST NORTH CAROLINA AND EAST-CENTRAL SOUTH CAROLINA

By Lauck W. Ward and Blake W. Blackwelder

The term "Rocky Point" has been used for a number of different lithic units including upper Oligocene beds of northwestern Oregon (Libby and others, 1945, p. 8-9), Pennsylvanian beds of southern Oklahoma (Jacobsen, 1959, p. 28, 35; and Tomlinson and McBee, 1959, p. 32-33), Cretaceous beds in southwestern Oregon (Koch, 1963; 1966, p. 30-49) and Cretaceous beds in southeastern North Carolina (Swift and Heron, 1969; Wheeler and Curran, 1974). The American Code of Stratigraphic Nomenclature (1970, Art. 11(c), p. 31) states that duplication of names should be avoided throughout North America. A name previously applied to any unit should not later be applied to another. Use of the term "Rocky Point" for two different units of Cretaceous age is especially undesirable. The name "Rocky Point Member" of the Peedee Formation in North Carolina was not formally proposed until 1974 and lacks priority. We propose here that the name Scotts Hill Member be used for the "sandy pelecypod biosparrudite" and "quartz arenite" that were termed the "Rocky Point Member" of the Peedee Formation by Wheeler and Curran (1974). These rocks crop out only along the northeast Cape Fear River near Scotts Hill, the town for which it is named, in New Hanover County, N. C., and are present in the subsurface of adjoining counties, including Pender County, N. C. Harris (1978, p. 225-226) discussed the distribution of these units now assigned to the Scotts Hill Member of the Peedee Formation.

REFERENCES CITED

American Commission on Stratigraphic Nomenclature, 1970, Code of stratigraphic nomenclature: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 22 p.

Harris, W. B., 1978, Stratigraphic and structural framework of the Rocky Point Member of the Cretaceous Peedee Formation, North Carolina: Southeastern Geology, v. 19, no. 4, p. 207-229.

Jacobsen, Lynn, 1959, Petrology of Pennsylvanian sandstones and conglomerates of the Ardmore Basin: Oklahoma Geol. Survey Bull. 79, 144 p.

Koch, J. G., 1963, Late Mesozoic orogenesis and sedimentation, Klamath province, southwest Oregon coast [abs.] : Dissert. Abs., v. 24, no. 4, p. 1572.

______, 1966, Late Mesozoic stratigraphy and tectonic history, Port Orford-Gold Beach area, southwest Oregon coast: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 25-71.

Libby, F. W., Lowry, W. D., and Mason, R. S., 1945, Ferruginous bauxite deposits in northwestern Oregon: Oregon Department Geology and Mineral Industries Bull. 29, 97 p.

Swift, D. J. P., and Heron S. D., Jr., 1969, Stratigraphy of the Carolina Cretaceous: Southeastern Geology, v. 10, no. 4, p. 201-245.

Tomlinson, C. W., and McBee, William, 1959, Pennsylvanian sediments and orogenies of Ardmore district, Oklahoma, in v. 2 of Ardmore Geol. Soc. Petroleum Geology of Southern Oklahoma—a symposium: Tulsa, Okla., Am. Assoc. Petroleum Geologists, v. 2, p. 3-52.

Wheeler, W. H., and Curran, H. A., 1974, Relation of Rocky Point Member (Peedee Formation) to Cretaceous-Tertiary boundary in North Carolina: Am. Assoc. Petroleum Geologists Bull., v. 58, no. 9, p. 1751-1757.

AUTHOR INDEX

*Senior author of paper with multiple authorship

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980 O— 311-344/43