Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1974

GEOLOGICAL SURVEY BULLETIN 1405-A

Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1974

By GEORGE V. COHEE *and* WILNA B. WRIGHT

CONTRIBUTIONS TO STRATIGRAPHY

GEOLOGICAL SURVEY BULLETIN 1405-A

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1975

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

V. E. McKelvey, *Director*

Library of Congress Cataloging in Publication Data
Cohee, George Vincent, 1907-
Changes in stratigraphic nomenclature by the U.S. Geological Survey, 1974.
(Contributions to stratigraphy) (Geological Survey bulletin; 1405-A)
Bibliography: p.
Supt. of Docs. no.: I 19.3:1405-A
1. Geology, Stratigraphic--Nomenclature--United States. I. Wright, Wilna B., joint author. II. Title. III. Title. IV. Series: United States. Geological Survey. Bulletin: 1405-A.
QE75.B9 no. 1405-A [QE645] 557.3'08s [551.7'001'4] 75-619237

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402
Stock Number 024-001-02705-4

CONTENTS

	Page
Listing of nomenclatural changes	A1
Early Miocene age of the Clallam Formation, western Washington, by W. O. Addicott	26
The Italian Mountain Intrusive Complex, west-central Colorado, by C. G. Cunningham, Jr., and C. W. Naeser	27
The Science Hill Sandstone Member of the Warsaw Formation, south-central Kentucky, by Richard Q. Lewis, Sr., and Alfred R. Taylor	28
The Point Pleasant Tongue of the Clays Ferry Formation, northern Kentucky, by W C Swadley, S. J. Luft, and A. B. Gibbons	30
References	30

ILLUSTRATIONS

	Page
FIGURE 1. Location of the Italian Mountain Intrusive Complex	A28
2. Intertonguing of Kope and Clays Ferry Formations	31

TABLE

	Page
TABLE 1. Fission track data from the Italian Mountain Intrusive Complex	A27

CONTRIBUTIONS TO STRATIGRAPHY

CHANGES IN STRATIGRAPHIC NOMENCLATURE BY THE U.S. GEOLOGICAL SURVEY, 1974

By George V. Cohee and Wilna B. Wright

LISTING OF NOMENCLATURAL CHANGES

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

The following formal designations of Precambrian time are now in use by the U.S. Geological Survey:

Precambrian Z—base of Cambrian to 800 m.y.
Precambrian Y—800 m.y. to 1,600 m.y.
Precambrian X—1,600 m.y. to 2,500 m.y.
Precambrian W—older than 2,500 m.y.

For depiction on maps, only the letter designations (W, X, Y, Z) will be shown as map symbols, and lowercase letters will indicate the group or formation names as appropriate. If a unit extends across the boundary between letter-designated units, both letters, the younger first, will be used in the map symbol. When geochronologic data are not adequate for unit assignment, only the general term Precambrian and the symbol p€ will be used. Rock units and events within a major time unit such as W, X, Y, or Z, keyed to geochronologic data as available, will be shown on map explanations by simple sequential arrangement.

Some previously used age designations for the Precambrian are given in the table because they were used by the authors in reports submitted to the Geologic Names Committee before the new scheme was adopted.

Name	Age	Location
Albion Schist Member (of Westboro Quartzite).	Precambrian(?)	Rhode Island
Alligator Back Formation	Precambrian and (or) Paleozoic.	Northwestern North Carolina and southwestern Virginia.
Alnwick Lake Beds	late Miocene and Pliocene.	Central Colorado
Amboy Stoneware Clay Member (of Magothy Formation).	Late Cretaceous	Northeastern New Jersey.
Aromas Sand	Pleistocene	West-central California
Aspen Shale	Early Cretaceous	Wyoming, Idaho, Utah, and Colorado.
Atchison Formation	Pleistocene (Kansan)	Northeastern Kansas and southern Nebraska.
Augustine Volcanics	Pleistocene and Holocene.	South-central Alaska
Badger Creek Tuff	Oligocene	Central Colorado
Baird Group	Ordovician(?) and Early Silurian to Late Devonian.	Northern Alaska
Bear River Formation	Early Cretaceous	Wyoming, Utah, and Colorado.
Bear Wallow Diorite Complex.	Jurassic	Northern California
Beidell Quartz Latite	Oligocene and older(?)	Southwestern Colorado
Belleview Member (of Pismo Formation).	late Pliocene	Southern California
Berry Formation	Oligocene(?)	West-central California
Big Snowy Formation	Late Mississippian	Montana and North Dakota.
Biwabik Iron-formation	Precambrian X	Northeastern Minnesota and northwestern Michigan.

Revision and reference
Albion Schist Member reassigned to Quinnville Quartzite. (Nelson, 1974.)
Alligator Back Formation adopted. Conformably overlies Ashe Formation; intruded by Spruce Pine plutonic group (informal). (Rankin and others, 1973.)
Alnwick Lake Beds abandoned; its rocks now included in Tallahassee Creek Conglomerate (new name). (Epis and Chapin, 1974.)
Amboy Stoneware Clay of Kümmel and Knapp (1904) adopted as Amboy Stoneware Clay Member of Magothy Formation. Overlies Old Bridge Sand Member of Magothy; underlies Morgan beds (informal name) of Magothy. (Sirkin, 1974.)
Aromas Red Sands of Allen (1946) and Bowen (1965) adopted as Aromas Sand. Uncomformably(?) overlies Paso Robles Formation; uncomformably underlies Pleistocene older surficial sediments. (Clark and others, 1974.)
In southwestern Wyoming only, geographically restricted to areas east of Absaroka fault. Equivalent to upper member of Cokeville, Quealy, and part of Sage Junction Formations (all three here named) west of Absaroka fault. Usage remains unchanged elsewhere. (Rubey, 1973.)
Atchison Formation of Moore and others (1951) adopted, overlying Nebraskan Till and underlying Nickerson Till. (Ward, 1973.)
Augustine Volcanics adopted; overlies upper Tertiary sedimentary rocks. (Detterman, 1973a.)
Badger Creek Tuff adopted. Generally overlies Antero Formation and underlies local unnamed latite flow. (Epis and Chapin, 1974.)
Age changed from Silurian to Late Devonian to Ordovician(?) and Early Silurian to Late Devonian. (Carter and others, 1973.)
In southwestern Wyoming only, geographically restricted to areas east of Absaroka fault. Equivalent to Smiths, Thomas Fork, and (lower member of) Cokeville Formations (all three here named) west of Absaroka fault. Usage remains unchanged elsewhere. (Rubey, 1973.)
Bear Wallow Diorite Complex adopted; intrudes Rattlesnake Creek terrane of Paleozoic and Triassic(?) age. (Irwin and others, 1974.)
Age changed from Oligocene to Oligocene and older(?). (Steven and others, 1974.)
Belleview Member of Hall (1973) adopted as one of five members of Pismo Formation. Conformably overlies and underlies Gragg and Squire Members of Pismo, respectively. (Hall, 1973a).
Reinstated and redefined to include rocks named Berry Conglomerate by Thorup (1941) and Berry Formation by Bramlette and Daviess (1944) (or former lower, unnamed member of Durham's (1963) Vaqueros Formation). Overlies Reliz Canyon Formation; underlies Vaqueros Formation (now stratigraphically restricted). Geographically restricted to south- central Monterey County. (Durham, 1974.)
Geographically extended into northeastern Idaho. (Staatz, 1973.)
Age changed from middle Precambrian to Precambrian X. (Sims and Morey, 1974.)

Name	Age	Location
Black Sulphur Tongue (of Green River Formation).	Eocene	Northwestern Colorado
Blind Bull Formation	Late Cretaceous	Southwestern Wyoming
Bolsa Quartzite	Middle Cambrian	Southeastern Arizona
Bonita Sandstone Member (of Franciscan Formation).	Jurassic and Cretaceous.	West-central California
Boston Bay Group	Late Silurian to Carboniferous.	Massachusetts
Bridal Veil Limestone Member (of Oquirrh Formation).	Early and Middle Pennsylvanian.	Wasatch Range, north-central Utah.
Bridger Formation	middle and late Eocene	Wyoming, Colorado, and Utah.
Brighton Melaphyre (of Boston Bay Group).	Devonian or Carboniferous.	Massachusetts
Brooks Lake Glaciation	Pleistocene	South-central Alaska
Bullion Canyon Volcanics	Oligocene	South-central Utah
By-Day Member (of Eureka Valley Tuff) (of Stanislaus Group).	late Miocene	East-central California and west-central Nevada.
Cahil Sandstone Member (of Franciscan Formation).	Jurassic and Cretaceous.	West-central California
Cambridge Slate (of Boston Bay Group).	Late Silurian to Carboniferous.	Massachusetts
Cedar Bluffs Till	Pleistocene (Kansan)	Southeastern Nebraska and northeastern Kansas.
Chapin Peak Formation	Late Triassic	Southeastern Alaska
Cherry Brook Formation	Precambrian Z to early Paleozoic (?).	Eastern Massachusetts
Chocolay Group (of Marquette Range Supergroup).	Precambrian X	Northern Michigan
Chopawamsic Formation (of Glenarm Series).	Early Cambrian	Northeastern Virginia
Clallam Formation	early Miocene	Western Washington

Revision and reference
Black Sulphur Tongue adopted as uppermost of four newly named tongues of Green River Formation; intertongues with Uinta Formation. (Duncan and others, 1974.)
Blind Bull Formation adopted. Divided into upper and lower parts by overlying tongues of Hilliard Shale; overlies Aspen Shale. (Rubey, 1973.)
Geograhically extended into Vekol Mountains; includes rocks formerly assigned to Troy Quartzite (now geographically restricted from Vekol Mountain). (Chaffee, 1974.)
Bonita Sandstone Member abandoned for its inability to be used as a stratigraphic marker bed. (Schlocker, 1974.)
Age changed from Devonian or Carboniferous to Late Silurian to Carboniferous. (Nelson, 1974.)
Age changed from Early Pennsylvanian to Early and Middle Pennsylvanian (Atokan and older). (Baker, 1973.)
Geographically restricted from eastern Uinta basin, Utah, and Piceance Creek basin, Colorado; its rocks now included in Uinta Formation (now geographically extended). (Cashion and Donnell, 1974.)
Age changed from Devonian or Carboniferous to Late Silurian to Carboniferous. (Nelson, 1974.)
Divided into (ascending): Kvichak, Iliamna, Newhalen (all three new), and Iliuk (not new) Stades. (Detterman and Reed, 1973.)
Age changed from Miocene(?) to Oligocene (Hackman and Wyant, 1973.)
By-Day Member adopted as one of three members of Eureka Valley Tuff. Overlies Tollhouse Flat Member (new name) of Eureka Valley; underlies unnamed upper member of Eureka Valley. (Noble and others, 1974.)
Cahil Sandstone Member abandoned for its inability to be used as a stratigraphic marker bed. (Schlocker, 1974.)
Age changed from Devonian or Carboniferous to Late Silurian to Carboniferous. (Nelson, 1974.)
Cedar Bluffs Till of Reed and Dreeszen (1965) adopted. Overlies Nickerson Till or, locally, unnamed glaciofluvial deposits; underlies Nortonville Clay. (Ward, 1973.)
Chapin Peak Formation adopted; geographically restricted to area southwest of Bostwick-Vallenar Valley. Conformably or possibly disconformably overlies Nehenta Formation (new name); unconformably underlies Upper Jurassic unnamed slaty detrital rocks. (Berg, 1973.)
Cherry Brook Formation adopted; divided into two unnamed parts—upper amphibolite and lower felsic tuff. Conformably overlies Kendal Green Formation (newly renamed); unconformably underlies Claypit Hill Formation (new name). (Nelson, 1974.)
In Marquette area, Reany Creek Formation assigned to lowermost part of Chocolay Group and probably correlative with Enchantment Lake Formation. (Puffett, 1974.)
Age changed from Early Cambrian to Ordovician(?) to Early Cambrian. (Pavlides and others, 1974.)
Age changed from middle Miocene to early Miocene (Saucesian). (Addicott, this report, p. A26.)

Name	Age	Location
Claypit Hill Formation	Precambrian Z to early Paleozoic (?).	Eastern Massachusetts
Clays Ferry Formation	Middle and Late Ordovician.	Kentucky
Cockalorum Wash Formation.	Middle Devonian	East-central Nevada
Cokeville Formation	Early Cretaceous	Southwestern Wyoming
Concepcíon Formation	Late Cretaceous (Campanian-Maestrichtian).	West-central Puerto Rico.
Dale Canyon Formation	Mississippian	East-central Nevada
Dardanelles Formation (of Stanislaus Group).	late Miocene	East-central California and west-central Nevada.
Dry Fork Tongue (of Green River Formation).	Eocene	Northwestern Colorado
Dry Hollow Formation	Miocene	South-central Utah
Duffey Dome Formation	Paleozoic (?)	Northern California
Duluth Gabbro Complex	Precambrian Y	Northeastern Minnesota
East Gulch Tuff	Oligocene	Central Colorado
Echo Park Alluvium	Eocene	Central Colorado
Edna Member (of Pismo Formation).	late Miocene and early Pliocene (Mohnian and Delmontian).	Southern California
Eldorado Dolomite	Middle Cambrian	East-central Nevada
Entrada Sandstone (of San Rafael Group).	Late Jurassic	Utah, Colorado, New Mexico, and Arizona.

Revision and reference
Claypit Hill Formation adopted. Unconformably overlies Cherry Brook Formation (new name); upper part of formation truncated by fault and underlies thick cover of glacial deposits. (Nelson, 1974.)
In north-central Kentucky, Point Pleasant Formation reduced in rank to Point Pleasant Tongue and assigned to Clays Ferry Formation. Elsewhere Point Pleasant usage remains unchanged. (Swadley and others, this report, p. A 30.)
Cockalorum Wash Formation adopted. Lower and upper contacts are faulted. Overlies possible correlative of Nevada Formation; underlies Devils Gate Formation. (Merriam, 1973.)
Cokeville Formation adopted for use west of Absaroka fault (geographic restriction). Intertongues with and grades into underlying Thomas Fork or Smiths Formations and overlying Quealy and Sage Junction Formation (all four here named). (Rubey, 1973.)
Redefined and geographically and stratigraphically restricted to include only those rocks of Late Cretaceous age in Barrio Purísima Concepcíon (San Sebastián quadrangle) and other directly related rocks in adjacent areas. Rocks of early Tertiary (Eocene?) age westward in Central la Plata quadrangle formerly included in Concepcíon now grouped in Palma Escrita Formation (new). Age changed from Eocene to Late Cretaceous (Campanian-Maestrichtian). (McIntyre, 1974.)
Dale Canyon Formation adopted. Probably unconformably overlies Joana Limestone; conformably underlies Chainman Shale. (Nolan and others, 1974.)
Dardanelles Member of Stanislaus Formation of Slemmons (1966) adopted and raised in rank to Dardanelles Formation, uppermost of three formations of Stanislaus Group. Overlies Eureka Valley Tuff; underlies Disaster Peak Formation of Slemmons (1966). (Noble and others, 1974.)
Dry Fork Tongue adopted as one of four newly named tongues of Green River Formation; intertongues with Uinta Formation. (Duncan and others, 1974.)
Age changed from Pliocene(?) to Miocene. (Hackman and Wyant, 1973.)
Duffey Dome Formation adopted. Overlies Calaveras Formation; presumably underlies Horseshoe Bend Formation (new name). (Hietanen, 1973.)
Name changed from Duluth Gabbro Complex to Duluth Complex. Age changed from late Precambrian to Precambrian Y. (Sims and Morey, 1974.)
East Gulch Tuff adopted. Generally overlies Antero Formation and underlies Thorn Ranch Tuff (new name). (Epis and Chapin, 1974.)
Echo Park Alluvium adopted. Overlies unnamed Precambrian rocks and underlies Wall Mountain Tuff (new name). (Epis and Chapin, 1974.)
Edna Member of Hall (1973) adopted as lowermost of five members of Pismo Formation. Unconformably overlies Monterey Formation; conformably underlies and intertongues with Miguelito Member of Pismo. (Hall, 1973a.)
Name changed from Eldorado Dolomite to Eldorado Limestone in east-central Nevada. Eldorado Dolomite remains in good usage in Eureka district. (Brokaw and others, 1973.)
In New Mexico Entrada divided into (ascending): Iyanbito Member (new name) and unnamed middle siltstone and upper sandstone members. Iyanbito includes rocks formerly assigned to Lukachukai Member of Wingate Sandstone (no longer used in report area). (Green, 1974.)

Name	Age	Location
Eureka Valley Tuff (of Stanislaus Group).	late Miocene	East-central California and west-central Nevada.
Evacuation Creek Member (of Green River Formation).	Eocene	Northeastern Utah and western Colorado.
Farmington Canyon Complex.	Precambrian	North-central Utah
Fisher Quartz Latite	late Oligocene	Southwestern Colorado
Forelle Limestone	Late Permian	Colorado, Wyoming, and Nebraska.
Forelle Limestone Member (of Goose Egg Formation).		
Fort Lowell Formation	early and middle Pleistocene.	Southeastern Arizona
Franciscan Formation	Eocene to Late Jurassic (varies locally).	California
Franklin Canyon Formation.	Paleozoic(?)	Northern California
Frontier Formation	Late Cretaceous	Wyoming, Colorado, Utah, Idaho, and Montana.
Frontier Sandstone Member (of Mancos Shale).		
Gabilan Limestone	Paleozoic(?)	West-central California.
Gannett Group	Early Cretaceous	Southeastern Idaho and southwestern Wyoming.
Gilmore Gulch Formation.	Oligocene	Nevada
Glen Creek Gabbro-Ultramafic Complex.	Jurassic	Northern California
Gragg Member (of Pismo Formation).	late Pliocene	Southern California
Gravina Island Formation.	Middle or Late Jurassic.	Southeastern Alaska

Revision and reference
Eureka Valley Member of Stanislaus Formation of Slemmons (1966) adopted and raised in rank to Eureka Valley Tuff, middle of three formations of Stanislaus Group. Overlies Table Mountain Latite; underlies Dardanelles Formation. Divided into (ascending): Tollhouse Flat Member (new name), By-Day Member (new name), and unnamed upper member. (Noble and others, 1974.)
Evacuation Creek Member abandoned; its rocks now included in upper part of Parachute Creek Member of Green River Formation in eastern Uinta basin, Utah, and in lower part of Uinta Formation in Piceance Creek basin, Colorado. (Cashion and Donnell, 1974.)
Farmington Canyon Complex of Eardley and Hatch (1940) adopted. Lowermost formation in report area; underlies Tintic Quartzite. (Mullens and Laraway, 1973.)
Age changed from Oligocene to late Oligocene. (Steven and others, 1974.)
Included as member of Lykins Formation in central Colorado, east of Front Range. Remains in good usage as member of Goose Egg Formation in northeasternmost Colorado and southeastern Wyoming and as formational rank in north-central Colorado, south-central Wyoming, and Nebraska. (Bryant and others, 1973.)
Fort Lowell Formation adopted. Unconformably overlies older rocks; unconformably underlies upper Pleistocene surficial deposits. (Davidson, 1973.)
Cahil Sandstone, Sausalita Chert, Marin Sandstone, Ingleside Chert, and Bonita Sandstone Members of Franciscan Formation abandoned for their inability to be used as stratigraphic marker beds. (Schlocker, 1974.)
Franklin Canyon Formation adopted. Overlies Calaveras Formation; presumably underlies Horseshoe Bend Formation (new name). (Hietanen, 1973.)
In southwestern Wyoming only, Frontier Formation is geographically restricted to areas east of Absaroka fault. Equivalent to lower part of Blind Bull Formation and possibly equivalent to uppermost part of Sage Junction Formation (both here named) west of Absaroka Fault. Usage remains unchanged elsewhere. (Rubey, 1973.)
Age changed from pre-Franciscan to Paleozoic(?). (Clark and Rietman, 1973.)
In southeastern Idaho where Tygee Sandstone (now abandoned) was former upper formation of Gannett Group, Gannett stratigraphically restricted by removal of Tygee rocks (now reassigned as unnamed upper sandstone member of Smiths Formation, newly adopted and not part of Gannett). Gannett usage remains unchanged in southwestern Wyoming, as Tygee not extended thereto. (Rubey, 1973.)
Age changed from Tertiary(?) to Oligocene. (Ekren and others, 1973.)
Glen Creek Gabbro-Ultramafic Complex adopted; intrudes Galice(?) Formation. (Irwin and others, 1974.)
Gragg Member of Hall (1973) adopted as middle of five members of Pismo Formation. Conformably overlies and underlies Miguelito and Belleview Members of Pismo, respectively. (Hall, 1973a.)
Gravina Island Formation adopted; geographically restricted to area northeast of Bostwick-Vallenar Valley. Lower and upper contacts are faulted or not exposed. (Berg, 1973.)

Name	Age	Location
Grays Canyon Limestone Member (of Nevada Formation).	Early and Middle Devonian.	East-central Nevada
Greendale Lentil (of Lexington Limestone).	Middle Ordovicion	Central Kentucky
Green River Formation	early and middle Eocene.	Wyoming, Colorado, and Utah.
Green River Formation	early and middle Eocene.	Wyoming, Colorado, and Utah.
Greenwater Volcanics	Pliocene	Southern California
Gribbles Park Tuff	Oligocene	Central Colorado
Hailey Conglomerate Member (of Wood River Formation).	Middle Pennsylvanian	South-central Idaho.
Hames Member (of Monterey Formation).	Miocene	West-central California.
Helmet Fanglomerate	Oligocene	Southeastern Arizona
High Park Lake Beds	late Miocene or Pliocene.	Central Colorado
Hilliard Shale	Late Cretaceous	Southwestern Wyoming and northeastern Utah.
Hole-In-The-Wall Tuff Member (of Isom Formation).	Oligocene or Miocene	Southwestern Utah
Horseshoe Bend Formation.	Paleozoic(?)	Northern California
Iliamna Stade (of Brooks Lake Glaciation).	Pleistocene	South-central Alaska
Iliuk Glaciation	Pleistocene (late Wisconsin).	South-central Alaska
Ingleside Chert Member (of Franciscan Formation).	Jurassic and Cretaceous.	West-central California.
Isom Formation	Oligocene or Miocene	Southwestern Utah
Italian Mountain Intrusive Complex.	Oligocene	West-central Colorado

Revision and reference
Grays Canyon Limestone Member adopted as one of seven members of Nevada Formation. Overlies Beacon Peak Dolomite Member; upper contact is fault contact. (Nolan and others, 1974.)
Greendale Limestone Member of Cynthiana Formation of Foerste (1906) redefined and adoted as Greendale Lentil of Lexington Limestone. (Cressman, 1973.)
In northwestern Colorado only, divided into four newly named tongues (ascending): Yellow Creek, Dry Fork, Thirteenmile Creek, and Black Sulphur, all four intertonguing with Uinta Formation, which overlies and intertongues with Parachute Creek Member of Green River. (Duncan and others, 1974.)
Geograhically and stratigraphically restricted by abandonment of its Evacuation Creek Member; its rocks now included in: Parachute Creek Member of Green River in eastern Uinta basin, Utah, and lower part of Uinta Formation in Piceance Creek basin, Colorado. (Cashion and Donnell, 1974.)
Age changed from Pliocene(?) to Pliocene. (McAllister, 1973.)
Gribbles Park Tuff underlies unnamed andesite from Waugh Mountain. (Epis and Chapin, 1974.)
Hailey Conglomerate Member of Thomasson (1959a,b) adopted as lowermost (unit 1) of seven units of Wood River Formation. Disconformably overlies Milligen Formation; conformably underlies unnamed unit 2 (Hall and others, 1974.)
Hames Member adopted. Conformably overlies Sandholt Member of Monterey; underlies Buttle Member of Monterey or, where missing, Santa Margarita or Pancho Rico Formations. (Durham, 1974.)
Age changed from early Miocene(?) to Oligocene. (Cooper, 1973.)
High Park Lake Beds abandoned; its rocks now included in Tallahassee Creek Conglomerate (new name). (Epis and Chapin, 1974.)
In southwestern Wyoming in area along Hams Fork only, divided into (ascending): unnamed lower member, Shurtliff Sandstone Member (previously used by Smith, 1965), and unnamed upper member. Usage remains unchanged elsewhere. (Ruby, 1973.)
Age changed from Eocene or early Oligocene to Oligocene or Miocene. (Averitt and Threet, 1973.)
Horseshoe Bend Formation adopted. Presumably overlies Duffey Dome Formation and Franklin Canyon Formation (both new names); underlies Jurassic and Cretaceous ultramafic and plutonic rocks. (Hietanen, 1973.)
Iliamna Stade adopted as one of four distinguished advances of Brooks Lake Glaciation. Followed Kvichak Stade (new name); preceded Newhalen Stade (new name). (Detterman and Reed, 1973.)
Name changed from Iliuk advance to Iliuk Stade and included as uppermost stade of Brooks Lake Glaciation. Followed Newhalen Stade (new name). (Detterman and Reed, 1973.)
Ingleside Chert Member abandoned because it cannot be used as a stratigraphic marker bed. (Schlocker, 1974.)
Age changed from Eocene or early Oligocene to Oligocene or Miocene. (Averitt and Threet, 1973.)
Italian Mountain Intrusive Complex adopted. (Cunningham and Naeser, this report, p. A27.)

Name	Age	Location
Iyanbito Member (of Entrada Sandstone) (of San Rafael Group)	Late Jurassic	Northwestern New Mexico.
James Run Formation (of Glenarm Series).	Early Cambrian	Piedmont province of Maryland.
Juana Lopez Member (of Carlile Shale).	Late Cretaceous	New Mexico and southern Colorado.
Kendal Green Formation	Precambrian Z(?)	Eastern Massachusetts
Kinter Formation	early Miocene	Southwestern Arizona and southeastern California.
Kroenke Granodiorite	Precambrian X	Colorado
Kukaklek Stade (of Mak Hill Glaciation)	Pleistocene	South-central Alaska
Kvichak Stade (of Brooks Lake Glaciation).	Pleistocene	South-central Alaska
Lambert Shale	early Miocene	Western California
Larsen Quartzite	Middle Pennsylvanian	Southwestern Colorado
Leach Canyon Tuff Member (of Quichapa Formation).	early Miocene	Southwestern Utah
Lexington Limestone	Middle and Late Ordovician.	Central Kentucky
Lovejoy Basalt	Miocene	Northern California
Lykins Formation	Permian and Triassic(?).	Colorado
Magothy Formation	Late Cretaceous	Maryland, Delaware, New Jersey, New York, and Massachusetts.
Magpie Hill Basalt	Miocene	East-central Nevada
Mak Hill Glaciation	Pleistocene	South-central Alaska
Mammoth Mountain Tuff	late Oligocene	South-central Colorado

Revision and reference
Iyanbito Member adopted as lowermost of three members of Entrada Sandstone in northwestern New Mexico. Iyanbito includes rocks formerly assigned to Lukachukai Member of Wingate Sandstone (no longer used in this area). Unconformably overlies Chinle Formation; conformably underlies unnamed middle siltstone member of Entrada. (Green, 1974.)
Age changed from Late Cambrian to Late Ordovician to Early Cambrian. (Pavlides and others, 1974.)
Geographically extended northward into north-central Colorado. (Bryant and others, 1973.)
Kendall Green Slate of Hobbs (1899) adopted and renamed as Kendal Green Formation (spelling corrected). Conformably overlies Westboro Quartzite; conformably underlies Cherry Brook Formation (new name). (Nelson, 1974.)
Kinter Formation adopted. Overlies volcanic rocks of Tertiary age; unconformably(?) underlies Bouse Formation. (Olmstead and others, 1973.)
Age changed from Precambrian to Precambrian X. (Barker and others, 1974.)
Kukaklek Stade adopted as only advance of Mak Hill Glaciation. (Detterman and Reed, 1973.)
Kvichak Stade adopted as lowermost of four stades of Brooks Lake Glaciation; preceded Iliamna Stade (new name). (Detterman and Reed, 1973.)
Age changed from Oligocene and (or) Miocene to early Miocene. (Clark and Rietman, 1973.)
Larsen Quartzite adopted. Unconformably overlies Leadville Limestone; conformably underlies Hermosa Formation. (McKnight, 1974.)
Age changed from Oligocene or Miocene to early Miocene. (Averitt and Threet, 1973.)
Greendale Limestone Member of Cynthiana Formation of Foerste (1906) redefined and adopted as Greendale Lentil of Lexington; age is Middle Ordovician. Stamping Ground Member (new name) adopted; age is Middle Ordovician. Nicholas Limestone Member reduced in rank to Nicholas Bed of Tanglewood Limestone Member; age changed from Middle Ordovician to Late Ordovician. (Cressman, 1973.)
Lovejoy Formation or Basalt of Durrell (1959) adopted and extended into area of this report as Lovejoy Basalt. Overlies unnamed Eocene auriferous stream gravels; underlies unnamed Pliocene pyroclastic andesite. (Hietanen, 1973.)
In central Colorado, east of Front Range, Forelle Limestone included as member of Lykins Formation. (Bryant and others, 1973.)
In northeastern New Jersey only, Amboy Stoneware Clay of Kümmel and Knapp (1904) adopted as Amboy Stoneware Clay Member of Magothy Formation. Overlies Old Bridge Sand Member of Magothy; underlies Morgan beds (informal name) of Magothy. (Sirkin, 1974.)
Magpie Hill Basalt adopted. Unconformably overlies Pancake Summit Tuff; unconformably underlies Tertiary and Quaternary deposits. (Nolan and others, 1974.)
Kukaklek Stade (new name) adoptd as only advance of Mak Hill Glaciation. (Detterman and Reed, 1973.)
Age changed from Oligocene to late Oligocene. (Steven and others, 1974.)

Name	Age	Location
Marin Sandstone Member (of Franciscan Formation).	Jurassic and Cretaceous.	West-central California
Mattapan Volcanic Complex.	Late Silurian to Carboniferous.	Massachusetts
Miguelito Member (of Pismo Formation).	late Miocene and early Pliocene (Mohnian and Delmontian).	Southern California
Milligen Formation	Devonian	Idaho and Montana
Mona Schist	Precambrian W	Northern Michigan
Monterey Formation	Miocene	Southern Salinas Valley area, west-central California.
Nealy Creek Member (of Mona Schist).	Precambrian W	Northern Michigan
Nehenta Formation	Late Triassic	Southeastern Alaska
Nevada Formation	Early and Middle Devonian.	Central Nevada
Newhalen Stade (of Brooks Lake Glaciation).	Pleistocene	South-central Alaska
Nicholas Limestone Member (of Lexington Limestone).	Late Ordovician	Central Kentucky
Nickerson Till	Pleistocene (Kansan)	Southeastern Nebraska and northeastern Kansas.
Nogales Formation	late Tertiary	Southeastern Arizona
Nortonville Clay	Pleistocene (Kansan)	Northeastern Kansas
Oquirrh Formation/ Group.	Early Pennsylvanian to Early Permian (Atokan and older to Wolfcampian).	Wasatch Range, north-central Utah.

Revision and reference
Marin Standstone Member abandoned for its inability to be used as a stratigraphic marker bed. (Schlocker, 1974.)
Age changed from Devonian (?) to Late Silurian to Carboniferous. (Nelson, 1974.)
Miguelito Member of Hall (1973) adopted as one of five members of Pismo Formation. Conformably overlies and intertongues with Edna Member of Pismo; conformably underlies Gragg Member of Pismo. (Hall, 1973a.)
Age changed from Early Mississippian to Devonian. (Hall and Sandburg, 1973.)
In Marquette area, Nealy Creek Member (new) adopted as member of Mona Schist. Mona members include (ascending): unnamed lower member, Nealy Creek Member, sheared rhyolite tuff member, and Lighthouse Point Member. Mona overlies Kitchi Schist; underlies Compeau Creek Gneiss. (Puffett, 1974.)
In southern Salinas Valley area, divided into (ascending): Sandholt Member, Hames Member (new name), and Buttle Member. Monterey usage remains unchanged elsewhere. (Durham, 1974.)
In Marquette area, Nealy Creek Member adopted. Overlies unnamed lower member of Mona; underlies unnamed sheared rhyolite tuff member of Mona .(Puffett, 1974.)
Nehenta Formation adopted; geographically restricted to area southwest of Bostwick-Vallenar Valley. Unconformally overlies unnamed Paleozoic rocks; conformably or possibly disconformably underlies Chapin Peak Formation (new name). (Berg, 1973.)
Two newly-named members adopted and assigned to Nevada Formation. Formation now includes (ascending): unnamed basal quartzite unit; Beacon Peak Dolomite Member; Grays Canyon Limestone Member (new); Oxyoke Canyon Limestone Member; Sentinel Mountain Dolomite Member; South Hill Sandstone Member (new) in Grays Canyon area and Woodpecker Limestone Member elsewhere; and Bay State Dolomite Member. (Nolan and others, 1974.)
Newhalen Stade adopted as one of four distinguished advances of Brooks Lake Glaciation. Followed Iliamna Stade (new name); preceded Iliuk Stade. (Detterman and Reed, 1973.)
Nicholas Limestone Member reduced in rank to Nicholas Bed of Tanglewood Limestone Member of Lexington Limestone. Age changed from Middle Ordovician to Late Ordovician. (Cressman, 1973.)
Nickerson Till of Reed and Dreeszen (1965) adopted. Overlies Atchison Formation; underlies Cedar Bluffs Till. (Ward, 1973.)
Nogales Formation adopted. Rests on, and in part derived from, Grosvenor Hills Volcanics; underlies poorly consolidated alluvium of probable late Tertiary and Quaternary age. (Simons, 1974.)
Nortonville Clay of Frye and Leonard (1952) adopted. Overlies Cedar Bluffs Till; underlies Peoria Loess. (Ward, 1973.)
In Wasatch Range in north-central Utah, age of Oquirrh Formation changed from Pennsylvanian to Early Pennsylvanian to Early Permian (Atokan and older to Wolfcampian). Age of Oquirrh Group in Oquirrh Mountains (its type locality) remains unchanged. (Baker, 1973.)

Name	Age	Location
Oriskany Sandstone/ Formation/Group.	Early Devonian	New York, Pennsylvania, Maryland, Virginia, West Virginia, and New Jersey.
Outlet Tunnel Member (of La Garita Tuff).	late Oligocene	South-central Colorado
Palma Escrita Formation.	Eocene(?)	West-central Puerto Rico.
Pancake Summit Tuff	Oligocene	East-central Nevada
Parachute Creek Member (of Green River Formation).	Eocene	Northeastern Utah and western Colorado.
Persimmon Fork Formation.	Precambrian or Paleozoic.	Central South Carolina
Pinto Basin Tuff Member (of Pinto Peak Rhyolite).	Oligocene	East-central Nevada
Pinto Peak Rhyolite	Oligocene	East-central Nevada
Pismo Formation	late Miocene to late Pliocene.	Southern California
Pitts Meadow Granodiorite.	Precambrian X	Colorado
Point Pleasant Formation/ Limestone.	Middle and Late Ordovician.	Kentucky and Ohio
Potosi Volcanic Group	Oligocene and Miocene	Southwestern Colorado
Prospect Mountain Quartzite.	Precambrian Z and Early Cambrian.	Nevada, Utah, and California.
Puppets Formation	middle Paleozoic	Southeastern Alaska
Quealy Formation	Early Cretaceous	Southwestern Wyoming.
Quinnville Quartzite (of Blackstone Series).	Precambrian(?)	Rhode Island

Revision and reference
Ridgeley Sandstone reduced in rank to Ridgeley Member and assigned to Oriskany Sandstone in western Maryland. (Yochelson and Kriz, 1974.)
Age changed from Oligocene to late Oligocene. (Steven and others, 1974.)
Palma Escrita Formation adopted. Includes rocks of early Tertiary (Eocene?) age in Central la Plata quadrangle formerly included in Concepcíon Formation (now redefined and restricted); also includes directly related rocks eastward in Maricao quadrangle. Lower contact mostly faulted; concordantly and probably conformably underlies Mal Paso Formation. (McIntyre, 1974.)
Pancake Summit Tuff of Armstrong (1970) adopted. Unconformably underlies Bates Mountain Tuff. (Nolan and others, 1974.)
Geographically and stratigraphically extended into eastern Uinta Basin, Utah, to include rocks formerly assigned to Evacuation Creek Member (now abandoned) of Green River. (Cashion and Donnell, 1974.)
Persimmon Fork Formation of Secor and Wagener (1968) adopted. Grades into overlying Richtex Formation; unconformably(?) overlies Wildhorse Branch Formation. (Bell and Siple, 1973.)
Pinto Basin Tuff Member adopted as lowermost member of Pinto Peak Rhyolite. Underlies Sierra Springs Tuff Member (new). (Nolan and others, 1974.)
Pinto Peak Rhyolite of Iddings (1892) redefined and adopted. Includes lithic breccia, Pinto Basin Tuff Member (new), intrusive rhyolite domes, vitrophyre and vent breccias, rhyolite flows and dikes, and Sierra Springs Tuff Member (new). Unconformably overlies Ratto Spring Rhyodacite (new); unconformably underlies Richmond Mountain Andesite (new). (Nolan and others, 1974.)
Divided into five members (ascending): Edna, Miguelito, Gragg, Belleview, and Squire Members. (Hall, 1973a.)
Age changed from Precambrian to Precambrian X. (Barker and others, 1974.)
In north-central Kentucky, Point Pleasant Formation reduced in rank to Point Pleasant Tongue and assigned to Clays Ferry Formation. Elsewhere Point Pleasant usage remains unchanged. (Swadley and others, this report, p. A30.)
Age changed from Oligocene to Oligocene and Miocene. (Steven and others, 1974.)
Age changed from Early Cambrian to Precambrian Z and Early Cambrian. (Stewart, 1974.)
Puppets Formation adopted; geographically restricted to area southwest of Bostwick-Vallenar Valley. Unconformably overlies unnamed Silurian or older Paleozoic rocks; conformably underlies unnamed dolomitic limestone (Devonian?) or unconformably underlies Nehenta Formation (new name). (Berg, 1973.)
Quealy Formation adopted for use west of Absaroka fault. Overlies Cokeville Formation and underlies Sage Junction Formation (both here named). (Rubey, 1973.)
Albion Schist Member reassigned from Westboro to Quinnville Quartzite. Quinnville replaces Westboro Quartzite in Rhode Island and is tentatively correlated with Westboro in eastern Massachusetts. (Nelson, 1974.)

Name	Age	Location
Raritan Formation	Late Cretaceous	New Jersey, New York, Pennsylvania, and Massachusetts.
Ratto Spring Rhyodacite	Oligocene	East-central Nevada
Reany Creek Formation	Precambrian X	Northern Michigan
Rice Gneiss	Precambrian Z	Eastern Massachusetts
Richmond Mountain Andesite.	Oligocene	East-central Nevada
Richtex Formation	Precambrian or Paleozoic.	Central South Carolina
Ridgeley Sandstone (of Oriskany Group).	Early Devonian	West Virginia, Pennsylvania, Maryland, and Virginia.
Rockhouse Valley Sandstone Member (of Wise Formation).	Pennsylvanian	Southwestern Virginia and southeastern Kentucky.
Roxbury Conglomerate	Late Silurian to Carboniferous.	Massachusetts and Rhode Island.
Sadlerochit Formation	late Early Permian to Early Triassic.	Northern Alaska
Sage Junction Formation	Early Cretaceous	Southwestern Wyoming.
Sandholdt Member (of Monterey Formation).	middle Miocene	West-central California
Sausalito Chert Member (of Franciscan Formation).	Jurassic and Cretaceous.	West-central California
Science Hill Sandstone Member (of Warsaw Formation).	Late Mississippian	South-central Kentucky
Shurtliff Sandstone Member (of Hilliard Shale).	Late Cretaceous	Southwestern Wyoming.
Sierra Springs Tuff Member (of Pinto Peak Rhyolite).	Oligocene	East-central Nevada
Smith Prairie Basalt	Pleistocene	Southwestern Idaho

Revision and reference
In northeastern New Jersey only, South Amboy Fire Clay and Woodbridge Clay of Cook and Smock (1877) adopted as members of Raritan. In northeastern New Jersey, Raritan includes (ascending): Farrington Sand Member, Woodbridge Clay Member, Sayreville Sand Member, and South Amboy Fire Clay Member. (Sirkin, 1974.)
Ratto Spring Rhyodacite adopted. Unconformably underlies Pinto Peak Rhyolite. (Nolan and others, 1974.)
In Marquette area, Reany Creek Formation assigned as lowermost formation of Chocolay Group of Marquette Range Supergroup; probably correlative with Enchantment Lake Formation. (Puffett, 1974.)
Rice Gneiss adopted. Lower part intruded by Dedham Granodiorite; conformably underlies Westboro Quartzite. (Nelson, 1974.)
Richmond Mountain Andesite adopted. Unconformably overlies Pinto Basin Tuff Member (new) of Pinto Peak Rhyolite. (Nolan and others, 1974.)
Richtex Formation of Secor and Wagener (1968) adopted. Grades into underlying Persimmon Fork Formation; top is eroded (Bell and Siple, 1973.)
In western Maryland, Ridgeley Sandstone reduced in rank to Ridgeley Member and assigned to Oriskany Sandstone; Ridgeley usage remains unchanged elsewhere. (Yochelson and Kriz, 1974.)
Rockhouse Valley Sandstone Member adopted as member of Wise Formation. Overlies Marcum Hollow Sandstone Member; underlies Jesse(?) or Reynolds Sandstone Member. (Miller and Roen, 1973.)
Age changed from Devonian or Carboniferous to Late Silurian to Carboniferous. (Nelson, 1974.)
Age changed from Late Permian and Early Triassic to late Early Permian to Early Triassic. (Detterman, 1973b.)
Sage Junction Formation adopted for use west of Absaroka fault (geographic restriction). Overlies Quealy Formation north of Cokeville and Cokeville Formation south of Cokeville (both here named); underlies Tertiary rocks. (Rubey, 1973.)
Age changed from early, middle, and late Miocene to middle Miocene. (Durham, 1974.)
Sausalito Chert Member abandoned because it cannot be used as a stratigraphic marker bed. (Schlocker, 1974.)
Science Hill Sandstone Member adopted as basal unit of Warsaw Formation (or Salem Limestone-Warsaw Formation, undivided). (Lewis, this report, p. A28.)
Shurtliff Member of Smith (1965) adopted as Shurtliff Sandstone Member of Hilliard Shale. Geographically restricted to area along Hams Fork; overlies and underlies unnamed lower and upper members, respectively. (Rubey, 1973.)
Sierra Springs Tuff Member adopted as uppermost member of Pinto Peak Rhyolite. Overlies Pinto Basin Tuff Member (new). (Nolan and others, 1974.)
Smith Prairie Basalt adopted. Unconformably overlies unnamed Pleistocene or Pliocene rocks or Steamboat Rock Basalt (new name); unconformably underlies unnamed Pleistocene gravel. (Howard and Shervais, 1973.)

Name	Age	Location
Smiths Formation	Early Cretaceous	Southwestern Wyoming.
South Amboy Fire Clay Member (of Raritan Formation).	Late Cretaceous	Northeastern New Jersey.
South Hill Sandstone Member (of Nevada Formation).	Middle Devonian	Central Nevada
Squire Member (of Pismo Formation).	late Pliocene	Southern California
Stamping Ground Member (of Lexington Limestone).	Middle Ordovician	Central Kentucky
Stanislaus Group	late Miocene	East-central California and west-central Nevada.
Steamboat Rock Basalt	Pliocene or Pleistocene	Southwestern Idaho
Stone Cabin Formation	Oligocene	Eastern Nevada
Strelna Formation	Permian	South-central Alaska
Sunshine Peak Tuff (of Potosi Volcanic Group).	early Miocene	Southwestern Colorado
Table Mountain Latite (of Stanislaus Group).	late Miocene	East-central California and west-central Nevada.
Tallahassee Creek Conglomerate.	Oligocene	Central Colorado
Tanglewood Limestone Member (of Lexington Limestone).	Middle and Late Ordovician.	Central Kentucky
Thirteenmile Creek Tongue (of Green River Formation).	Eocene	Northwestern Colorado

Revision and reference
Smiths Formation adopted for use west of Absaroka fault. Divided into (ascending): unnamed lower shale and upper sandstone members. Overlies Draney Limestone; underlies Thomas Fork Formation (here named). (Rubey, 1973.)
South Amboy Fire Clay of Cook and Smock (1877) adopted as South Amboy Fire Clay Member of Raritan Formation. Overlies Sayreville Sand Member of Raritan; underlies Old Bridge Sand Member of Magothy Formation. (Sirkin, 1974.)
South Hill Sandstone Member adopted as one of seven members of Nevada Formation. Overlies Sentinel Mountain Dolomite Member; underlies Bay State Dolomite Member; correlative with Woodpecker Limestone Member. (Nolan and others, 1974.)
Squire Member of Hall (1973) adopted as uppermost of five members of Pismo Formation. Conformably overlies Belleview Member of Pismo; unconformably underlies Paso Robles(?) Formation. (Hall, 1973a).
Stamping Ground Member adopted. Conformably overlies Tanglewood Limestone Member lens of Lexington; gradationally underlies Tanglewood. (Cressman, 1973.)
Stanislaus Formation of Slemmons (1966) adopted and raised in rank to Stanislaus Group. Its three formerly named members of Slemmons (1966) also adopted, raised to formation rank, and assigned to Stanislaus Group (ascending): Table Mountain Latite, Eureka Valley Tuff (with its lower Tollhouse Flat Member (new name), middle By-Day Member (new name), and upper unnamed member), and Dardanelles Formation. Overlies Relief Peak Formation of Slemmons (1966); underlies Disaster Peak Formation of Slemmons (1966). (Noble and others, 1974.)
Steamboat Rock Basalt adopted. Unconformably overlies unnamed pre-Pliocene rocks; unconformably underlies unnamed Pleistocene or Pliocene gravel or Smith Prairie Basalt (new name). (Howard and Shervais, 1973.)
Age changed from middle Tertiary to Oligocene. (Quinlivan and others, 1974.)
Age changed from Mississippian to Permian. (MacKevett and Plafker, 1974.)
Age changed from Oligocene to early Miocene. (Steven and others, 1974.)
Table Mountain Latite Member of Stanislaus Formation of Slemmons (1966) adopted and raised in rank to Table Mountain Latite, lowermost of three formations of Stanislaus Group. Overlies Relief Peak Formation of Slemmons (1966); underlies Tollhouse Flat Member (new name) of Eureka Valley Tuff. (Noble and others, 1974.)
Tallahassee Creek Conglomerate adopted and includes former rocks of Alnwick and High Park Lake Beds (now abandoned). Generally overlies Wall Mountain Tuff (new name) and underlies Thirtynine Mile Andesite. (Epis and Chapin, 1974.)
Nicholas Limestone Member of Lexington Limestone reduced in rank to Nicholas Bed of Tanglewood Limestone Member of the Lexington. Age of Tanglewood changed from Middle Ordovician to Middle and Late Ordovician. (Cressman, 1973.)
Thirteenmile Creek Tongue adopted as one of four newly named tongues of Green River Formation; intertongues with Uinta Formation. (Duncan and others, 1974.)

Name	Age	Location
Thirtynine Mile Andesite	Oligocene	Central Colorado
Thomas Fork Formation	Early Cretaceous	Southwestern Wyoming.
Thorn Ranch Tuff	Oligocene	Central Colorado
Tierra Redonda Formation.	middle Miocene	West-central California
Toiyabe Quartz Latite	Miocene	South-central Nevada
Tollhouse Flat Member (of Eureka Valley Tuff) (of Stanislaus Group).	late Miocene	East-central California and west-central Nevada.
Tracy Creek Quartz Latite.	Oligocene and older(?).	Southwestern Colorado
Treasure Mountain Tuff (of Potosi Volcanic Group).	late Oligocene	South-central Colorado and north-central New Mexico.
Troy Quartzite	Precambrian	Southeastern Arizona
Tule Creek Granite Complex.	Jurassic or older	Northern California
Twin River Formation	late Eocene to early Miocene.	Western Washington
Tygee Sandstone (of Gannett Group).	Early Cretaceous	Southeastern Idaho
Uinta Formation	late Eocene	Utah and Colorado
Vaqueros Formation	Oligocene and Miocene	Central California
Wales Group	pre-Middle Ordovician	Southeastern Alaska
Wall Mountain Tuff	Oligocene	Central Colorado

Revision and reference
Thirtynine Mile Volcanic Series of Stark and others (1949) adopted as Thirtynine Mile Andesite. Divided into: tuff of Stirrup Ranch, unnamed lower and upper members. Overlies mainly Precambrian rocks and some intermediate domes and flows of Guffey volcanic center; direct contact with younger formations of field not observed for upper member. (Epis and Chapin, 1974.)
Thomas Fork Formation adopted for use west of Absaroka fault. Overlies Smiths Formation and underlies Cokeville Formation (both here named). Consists of main body and upper tongue separated by lower tongue of Cokeville. (Rubey, 1973.)
Thorn Ranch Tuff adopted. Overlies Antero Formation; underlies Gribbles Park Tuff (new name). (Epis and Chapin, 1974.)
Age changed from early and middle Miocene to middle Miocene. (Durham, 1974.)
Age changed from Pliocene(?) to Miocene. (McKee, 1973.)
Tollhouse Flat Member adopted as lowermost of three members of Eureka Valley Tuff. Overlies Table Mountain Latite; underlies By-Day Member (new name) of Eureka Valley. (Noble and others, 1974.)
Age changed from Oligocene to Oligocene and older(?). (Steven and others, 1974.)
Age changed from Oligocene to late Oligocene. (Steven and others, 1974.)
Geographically restricted from Vekol Mountains; its rocks now included in Bolsa Quartzite (now geographically extended into Vekol Mountains). (Chaffee, 1974.)
Tule Creek Granite Complex adopted; intrudes Rattlesnake Creek terrane of Paleozoic and Triassic(?) age. (Irwin and others, 1974.)
Age changed from late Eocene to late Oligocene to late Eocene to early Miocene. (Addicott, this report, p. A26.)
Tygee Sandstone abandoned. As former upper formation of Gannett Group, Tygee rocks reassigned as unnamed upper sandstone member of Smiths Formation (newly adopted and not part of Gannett Group). (Rubey, 1973.)
Geographically and stratigraphically extended to Piceance Creek basin, Colorado, to include rocks previously assigned to Green River Formation (its Evacuation Creek Member, now abandoned) and Bridger Formation (both now stratigraphically or geographically restricted). (Cashion and Donnell, 1974.)
In southern Salinas Valley area only, stratigraphically restricted to exclude former unnamed lower member of Durham (1963), now included in underlying Berry Formation (reinstated). Age is Miocene only in this area. Age and usage unchanged elsewhere. (Durham, 1974.)
Age changed from probably pre-Ordovician to Devonian to pre-Middle Ordovician. (Eberlein and Churkin, 1973.)
Wall Mountain Tuff adopted. Overlies Echo Park Alluvium and underlies Tallahassee Creek Conglomerate (both new names). (Epis and Chapin, 1974.)

Name	Age	Location
Wapiti Formation (of Sunlight Group) (of Absaroka Volcanic Supergroup).	middle Eocene	South-central Montana and northwestern Wyoming.
Warsaw Formation	Late Mississippian (Meramecian).	South-central Kentucky
Westboro Quartzite	Precambrian Z	Eastern Massachusetts
Whitehall Formation	Late Silurian and Early Ordovician.	East-central New York
Whitehorn Granodiorite	Late Cretaceous	Central Colorado
Wildhorse Branch Formation.	Precambrian or Paleozoic.	Central South Carolina
Williamson Canyon Volcanics.	Late Cretaceous	Southeastern Arizona
Windermere Group	Precambrian Z	Northeastern Washington and adjacent Idaho.
Windous Butte Formation.	Oligocene	Eastern Nevada
Wingate Sandstone (of Glen Canyon Group).	Late Triassic	Arizona, Utah, Colorado, and New Mexico.
Wise Formation	Pennsylvanian	Virginia and Kentucky
Woodbridge Clay Member (of Raritan Formation).	Late Cretaceous	Northeastern New Jersey.
Wood River Formation	Middle and Late Pennsylvanian and Early Permian.	Idaho
Yachats Basalt	late Eocene	West-central Oregon
Yellow Creek Tongue (of Green River Formation).	Eocene	Northwestern Colorado
Zayante Sandstone	Oligocene	Central California

Revision and reference
Stratigraphically restricted, its lower part now being assigned to Lamar River Formation. (Pierce and others, 1973.)
Science Hill Sandstone Member adopted as basal unit of Warsaw Formation (or Salem Limestone-Warsaw Formation, undivided). (Lewis, this report, p. A28.)
Westboro replaced by Quinnville Quartzite in northeastern Rhode Island, and the two formations are tentatively correlated. Albion Schist Member of Westboro reassigned to Quinnville. Age of Westboro changed from Precambrian(?) to Precambrian Z. (Nelson, 1974.)
Whitehall Formation of Rodgers (1937) adopted. Overlies Ticonderoga Formation; underlies Cutting Formation. (Taylor and Halley, 1974.)
Whitehorn Granodiorite adopted; intrudes Precambrian igneous and metamorphic rocks and Paleozoic sedimentary rocks. (Wrucke, 1974.)
Wildhorse Branch Formation of Secor and Wagener (1968) adopted. Unconformably(?) underlies Persimmon Fork Formation; bottom is not exposed. (Bell and Siple, 1973.)
Age changed from Late Cretaceous and (or) early Tertiary to Late Cretaceous. (Krieger, 1974.)
Age changed from Precambrian Y to Precambrian Z. (Harrison and others, 1974.)
Age changed from middle Tertiary to Oligocene. (Ekren and others, 1973.)
In northwestern New Mexico, rocks formerly called Lukachukai Member of Wingate Sandstone now reassigned to Iyanbito Member (new name) of Entrada Sandstone. (Green, 1974.)
Rockhouse Valley Sandstone Member (new name) adopted as member of Wise Formation. Overlies Marcum Hollow Sandstone Member; underlies Jesse(?) or Reynolds Sandstone Member. (Miller and Roen, 1973.)
Woodbridge Clay of Cook and Smock (1877) adopted as Woodbridge Clay Member of Raritan Formation. Overlies Farrington Sand Member of Raritan; underlies Sayreville Sand Member of Raritan. (Sirkin, 1974.)
Hailey Conglomerate Member of Thomasson (1959a,b) adopted as lowermost (unit 1) of seven numbered units of Wood River; disconformably overlies Milligen Formation and conformably underlies unnamed unit 2 of Wood River. Wood River stratigraphically restricted; noncalcareous Permian rocks removed from its upper part. Age changed from Pennsylvanian and Permian to Middle Pennsylvanian to Early Permian. (Hall and others, 1974.)
Yachats Basalt adopted. Overlies Tyee Formation; overlaps Nestucca Formation; underlies unnamed basaltic sandstone and marine siltstone. (Snavely and MacLeod, 1974.)
Yellow Creek Tongue adoted as lowermost of four newly named tongues of Green River Formation; intertongues with Uinta Formation. (Duncan and others, 1974.)
Zayante Sandstone of Clark (1966) adopted. Overlies San Lorenzo Formation conformably or Butano Sandstone unconformably; underlies Vaqueros Sandstone. (Clark and Rietman, 1973.)

EARLY MIOCENE AGE OF THE CLALLAM FORMATION, WESTERN WASHINGTON

By W. O. Addicott

New faunal data from the Clallam Formation, a 600- to 800-m (2,000–2,600 ft)-thick marine sequence of shallow-water sandstone and minor siltstone and conglomerate exposed along the Strait of Juan de Fuca in the northern part of the Olympic Peninsula, indicate reassignment from the provincial middle Miocene to the early Miocene. A small molluscan fauna had previously been correlated with the middle Miocene Astoria Formation of Oregon and the so-called Temblor Stage of California (Etherington, 1931; Durham, 1944; Moore, 1963).

Mollusks are abundant in the lowest few hundred metres of the Clallam and also occur near the exposed upper part of the formation. The highest exposed beds contain coal seams and are presumed to be nonmarine. The moderately large molluscan fauna of the Clallam contains several species that are restricted to the so-called Vaqueros Stage (lower Miocene) of California and to coeval strata in more northern latitudes. Among these are *Vertipecten fucanus* (Dall), a new species of *Mytilus* allied to *M. tichanovitchi* Makiyama, *Spisula sookensis* Clark and Arnold, *Epitonium clallamense* Durham, and *Ancistrolepis rearensis* Kanno. Early Miocene species are found in the stratigraphically highest assemblages from the Clallam.

This sequence of fossiliferous rock represents a previously unrecognized time-stratigraphic unit in coastal Oregon and Washington that is of at least zonal, if not stage, magnitude. The Clallam is referable to the upper part of the provincial lower Miocene. It is readily distinguished, on the basis of fauna, from the upper part of the upper member of the Twin River Formation, which conformably underlies the Clallam and which is referable to the lower Miocene part of the so-called Blakeley Stage. Benthonic foraminiferal assemblages from the Clallam (Rau, 1964) represent the low part of the Saucesian Stage of the provincial microfaunal sequence (Kleinpell, 1938), which is also referred to the upper part of the provincial lower Miocene (Addicott, 1974).

THE ITALIAN MOUNTAIN INSTRUSIVE COMPLEX, WEST-CENTRAL COLORADO

By C. G. CUNNINGHAM, JR., and C. W. NAESER

The name Italian Mountain Intrusive Complex is given here to a heterogeneous assemblage of cogenetic intrusive rocks that are well exposed in the vicinity of Italian Mountain, Gunnison County, Colo. The type locality is the north peak of Italian Mountain, 20 km (12 miles) northeast of Crested Butte. It is accessible by a jeep road from Taylor Park.

GEOLOGIC SETTING AND LITHOLOGY

The Italian Mountain Intrusive Complex, of Oligocene age, is at the juncture of the Sawatch Range, Elk Mountains, and Colorado mineral belt (fig. 1). It consists of simple and composite plutons which range in composition from quartz diorite to quartz monzonite, dikes which range in composition from dacite to rhyodacite, and spatially associated hydrothermal lead-silver deposits.

Field relationships indicate that the oldest plutonic rock is a quartz diorite pluton 0.5 km (0.3 miles) south of the north peak of Italian Mountain. South of the quartz diorite is a granodiorite pluton which has a fine-grained border facies. The bulk of Italian Mountain consists of a composite pluton of quartz monzonite which has a melagranodiorite rim and a porphyritic quartz monzonite core. The plutons are cut by younger dikes.

AGE

The porphyritic quartz monzonite of the Italian Mountain Intrusive Complex has been dated at 33.0±1.8 m.y., by using the fission-track dating method of zircons, as described by Naeser (1969). These data are given in table 1.

TABLE 1.—*Fission-track data from the Italian Mountain Intrusive Complex*

[C. G. Cunningham, Jr., and C. W. Naeser, analysts]

Sample No.	Mineral	ρs[a]	ρi[b]	ϕ[c]	Age $\pm\sigma$[d] (m.y.)	U (ppm)
I–368 -------	Zircon	4.31×10^6 [e](694)	8.72×10^6 [e](702)	1.09×10^{15}	33.0±1.8	2.4×10^3

[a] Fission tracks/cm^2.
[b] Induced tracks.
[c] Thermal neutron dose.
[d] $\lambda_f=6.85\times10^{-17}\text{yr}^{-1}$ (decay constant).
[e] Number of tracks counted.

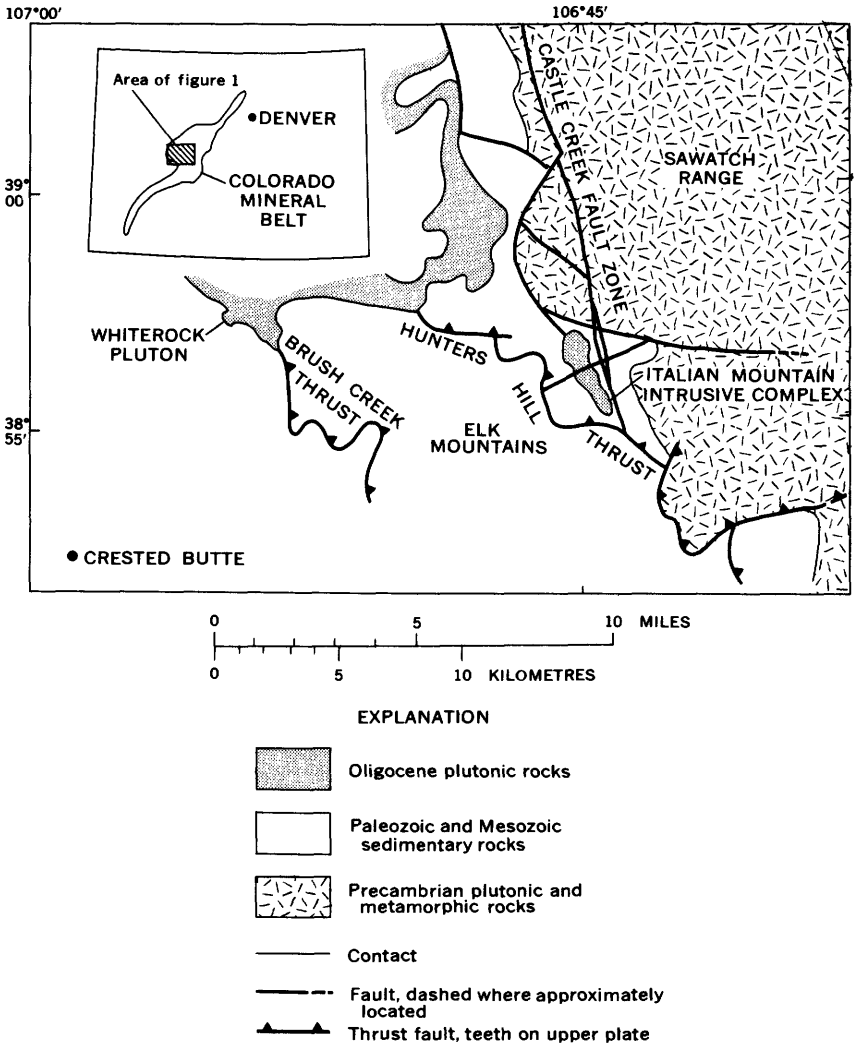

FIGURE 1.—Location of the Italian Mountain Intrusive Complex.

THE SCIENCE HILL SANDSTONE MEMBER OF THE WARSAW FORMATION, SOUTH-CENTRAL KENTUCKY

By RICHARD Q. LEWIS, SR., and ALFRED R. TAYLOR

The rocks of Mississippian age below the St. Louis Limestone and above the Fort Payne and Borden Formations in Kentucky have been mapped as Warsaw Limestone (Lewis and Thaden, 1962), Warsaw Formation (Butts, 1922), Salem and Warsaw Limestones (Taylor and others, 1968), Salem and Warsaw Forma-

tions (Lewis and Thaden, 1966), Salem Limestone (Lewis and Taylor, 1971), and Salem Formation (Weir, 1972).

The names Salem and Warsaw Limestones or Salem and Warsaw Formations were adopted by the U.S. Geological Survey for use in Kentucky in 1962, when it was recognized that the unit in Kentucky was at least partly equivalent to both the Salem and Warsaw at their respective type localities in Indiana and Illinois This followed an informal usage suggested by Weller (1931).

It is the purpose of this paper to describe and name a distinctive sandstone within the Salem and Warsaw in south-central Kentucky. The sandstone crops out over an area larger than 2,600 sq km (1,000 sq miles). It ranges from 0 to more than 13 m (0–4.3 ft) in thickness.

Because the sandstone is the basal unit of the formation and contains fossils typical of the Warsaw, it is considered to be part of the Warsaw Formation.

The sandstone is herein named the Science Hill Sandstone Member of the Warsaw Formation of Late Mississippian age. The name is taken from the town of Science Hill, Pulaski County, Ky. The type section is about 10 km (6.2 miles) northwest of the town of Science Hill in the northwestern part of the Science Hill 7½-minute quadrange. The section is along the upper part of Sams Branch and across State road 1246 on the northeast side of Bethel Knob (lat 37°13′42″N., long 84°44′32″W.), Carter Coordinates (6–I–58) 300 m (1,000 ft) from West line 525 m (1,750 ft) from North line.

MEASURED SECTION

[Type section of the Science Hill Sandstone Member of the Warsaw Formation. Measured with barometer, hand level, and tape by R. Q. Lewis, Sr., and A. R. Taylor, July 20, 1973, along the upper part of Sams Branch, across State road 1246 and hillside on northeast side of Bethel Knob]

	Thickness in metres (ft)
Upper Mississippian.	
Salem and Warsaw Formations (incomplete):	
5. Limestone, calcarenite, medium-gray to dark-gray, cross-bedded; fossils fragmental; poorly exposed at section, well exposed 365 m (1,200 ft) to west on road 1246	4.75 (15)
Science Hill Sandstone Member:	
4. Sandstone, quartzose, reddish-brown, medium- to coarse-grained, thin- to thick-bedded; in part steeply crossbedded in sets about 30 cm (1 ft) thick. Lower 61 cm (2 ft) of unit contains abundant scattered well-rounded quartz granules and pebbles	6.40 (21)
3. Mudstone, medium- to dark-gray, massive bedded; contains scattered, medium to coarse quartz sand grains	1 (3)

	Thickness in metres (ft)
2. Sandstone, quartzose, reddish-brown, very fine to medium-grained, thin- to medium-bedded; abundant quartz geodes (10–20 cm (4–8 in) diameter) scattered in lower 1–2 m (3.3–6.6 ft)	5.59 (19)
Total Science Hill Sandstone Member	17.56 (43)
Borden Formation, Muldraugh Member:	
1. Siltstone, dolomitic, light- to medium-gray, medium- to thick-bedded; cherty	2+ (6+, incomplete)

THE POINT PLEASANT TONGUE OF THE CLAYS FERRY FORMATION, NORTHERN KENTUCKY

By W C Swadley, S. J. Luft, and A. B. Gibbons

The Point Pleasant Formation is herein reduced in rank and made a tongue of the Clays Ferry Formation. The change will be made on all subsequent Kentucky geologic quadrangle maps on which the Point Pleasant is mapped.

Along the Ohio River valley in northern Kentucky, the Point Pleasant is a stratiform body of interbedded limestone and shale underlain by the Lexington Limestone and overlain by the Kope Formation. Its lithology is essentially that of the Clays Ferry Formation of central Kentucky. The Point Pleasant maintains its typical contact relations and a fairly uniform thickness of

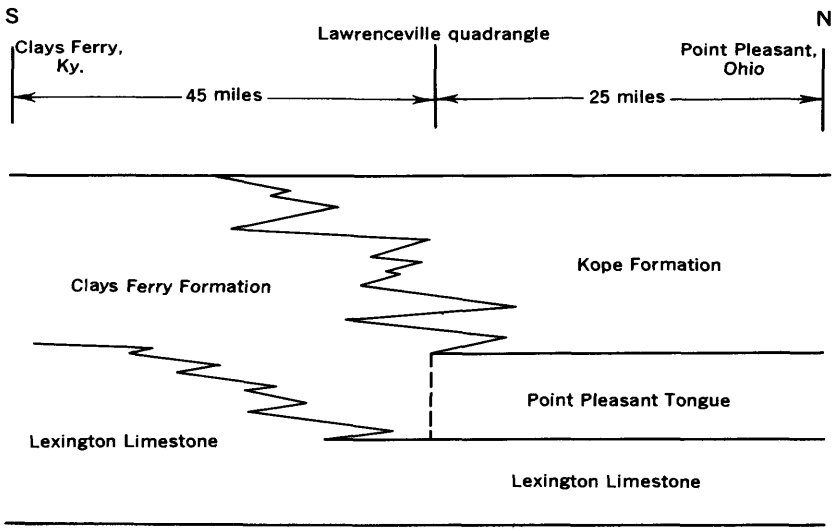

Figure 2.—Intertonguing of Kope and Clays Ferry Formations.

about 30 m (100 ft) southward along two main lines of exposure—the valleys of Eagle Creek and the Licking River.

The Point Pleasant is clearly related to the Clays Ferry as a tongue to the main mass in several quadrangles. At about the middle latitude of the Lawrenceville quadrangle, the Point Pleasant passes directly into the lower part of the Clays Ferry without change of lithology. The Point Pleasant loses its identity where the overlying Kope Formation begins to grade laterally into intertongues with Clay Ferry strata; contrast between the rocks above and those below the top of the Point Pleasant is very slight here, and the Point Pleasant can no longer be mapped as a separate unit.

The name Point Pleasant Tongue will be dropped at a scratch boundary with Clays Ferry where the tongue is no longer mappable. These relations are shown in figure 2.

REFERENCES

Addicott, W. O., 1974, Giant pectinids of the eastern North Pacific margin: significance in Neogene zoogeography and chronostratigraphy: Jour. Paleontology, v. 48, no. 1, p. 180–194.

Allen, J. E., 1946, Geology of the San Juan Bautista quadrangle, California: California Div. Mines Bull. 133, p. 9–75.

Armstrong, R. L., 1970, Geochronology of Tertiary igneous rocks, eastern Basin and Range Province, western Utah, eastern Nevada, and vicinity, U.S.A.: Geochim. et Cosmochim. Acta, v. 34, no. 2, p. 203–232.

Averitt, Paul, and Threet, R. L., 1973, Geologic map of the Cedar City quadrangle, Iron County, Utah: U.S. Geol. Survey Geol. Quad. Map GQ–1120.

Baker, A. A., 1973, Geologic map of the Springvile quadrangle, Utah County, Utah: U.S. Geol. Survey Geol. Quad. Map GQ–1103, text, 5 p.

Barker, Fred, Peterman, Z. E., Henderson, W. T., and Hildreth, R. E., 1974, Rubidium-strontium dating of the trondhjemite of Rio Brazos, New Mexico, and of the Kroenke Granodiorite, Colorado: U.S. Geol. Survey Jour. Research, v. 2, no. 6, p. 705–709.

Bell, Henry, III, and Siple, G. E., 1973, Geochemical prospecting using water from streams in central South Carolina: U.S. Geol. Survey Bull. 1378, 26 p.

Berg, H. C., 1973, Geology of Gravina Island, Alaska: U.S. Geol. Survey Bull. 1373, 41 p.

Bowen, O. E., Jr., 1965, Stratigraphy, structure, and oil possibilities in Monterey and Salinas quadrangles, California: Am. Assoc. Petroleum Geologists, Pacific Sec., 40th Ann. Mtg., Bakersfield, Calif., p. 48–67; abs., Am. Assoc. Petroleum Geologists Bull., v. 49, no. 7, p. 1081, 1965.

Bramlette, M. N., and Daviess, S. N., 1944, Geology and oil possibilities of the Salinas Valley, California: U.S. Geol. Survey Oil and Gas Inv. Prelim. Map 24.

Brokaw, A. L., Bauer, H. L., and Breitrick, R. A., 1973, Geologic map of the Ruth quadrange, White Pine County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ–1085.

Bryant, Bruce, Miller, R. D., and Scott, G. R., 1973, Geologic map of the Indian Hills quadrangle, Jefferson County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ–1073.

Butts, Charles, 1922, The Mississippian Series of eastern Kentucky * * *: Kentucky Geol. Survey, ser. 6, v. 7, 188 p.

[Carter, Claire, Churkin, Michael, Jr., Tailleur, I. L., and Pessel, G. H.], 1973, Biostratigraphic record extended to Early Silurian or Ordovician in western Brooks Range, Alaska, *in* U.S. Geol. Survey, Geological Survey Research, 1973: U.S. Geol. Survey Prof. Paper 850, p. 63–64.

Cashion, W. B., and Donnell, J. R., 1974, Revision of nomenclature of the upper part of the Green River Formation, Piceance Creek Basin, Colorado, and eastern Uinta Basin, Utah: U.S. Geol. Survey Bull. 1394–G, p. G1–G9.

Chaffee, M. A., 1974, Stratigraphic relations of the Bolsa Quartzite, Vekol Mountains, Pinal County, Arizona: U.S. Geol. Survey Jour. Research, v. 2, no. 2, p. 143–146.

Clark, J. C., 1966, Tertiary stratigraphy of the Felton-Santa Cruz area, Santa Cruz Mountains, California [abs]: Dissert. Abs., Sec. B, Sci. and Engineering, v. 27, no. 4, p. 1184–B.

Clark, J. C., and Rietman, J. D., 1973, Oligocene stratigraphy, tectonics, and paleogeography southwest of the San Andreas fault, Santa Cruz Mountains and Gabilan Range, California Coast Ranges: U.S. Geol. Survey Prof. Paper 783, 18 p.

Clark, J. C., Dibblee, T. W., Jr., Greene, H. G., and Bowen, O. E., Jr., 1974, Preliminary geologic map of the Monterey and Seaside 7.5-minute quadrangles, Monterey County, California, with emphasis on active faults: U.S. Geol. Survey Misc. Field Studies Map MF–577, 2 sheets.

Cook, G. H., and Smock, J. C., 1877, Map of clay district of Middlesex County: Trenton, New Jersey Geol. Survey.

Cooper, J. R., 1973, Geologic map of the Twin Buttes quadrangle, southwest of Tucson, Pima County, Arizona: U.S. Geol. Survey Misc. Geol. Inv. Map I–745.

Cressman, E. R., 1973, Lithostratigraphy and depositional environments of the Lexington Limestone (Ordovician) of central Kentucky: U.S. Geol. Survey Prof. Paper 768, 61 p.

Davidson, E. S., 1973, Geohydrology and water resources of the Tucson basin, Arizona: U.S. Geol. Survey Water-Supply Paper 1939–E, p. E1–E81, 7 pls. (under separate cover).

Detterman, R. L., 1973a, Geologic map of the Iliamna B–2 quadrangle, Augustine Island, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ–1068, with text, 4 p.

[Detterman, R. L.], 1973b, Upper Lower Permian rocks discovered in northeastern Alaska, *in* U.S. Geol. Survey, Geological Survey Research 1973: U.S. Geol. Survey Prof. Paper 850, p. 65.

Detterman, R. L., and Reed, B. L., 1973, Surficial deposits of the Iliamna quadrangle, Alaska: U.S. Geol. Survey Bull. 1368–A, p. A1–A64.

Duncan, D. C., Hail, W.J., Jr., O'Sullivan, R. B., and Pipiringos, G. N., 1974, Four newly named tongues of Eocene Green River Formation, northern Piceance Creek basin, Colorado: U.S. Geol. Survey Bull. 1394–F, p. F1–F13.

Durham, D. L., 1963, Geology of the Reliz Canyon, Thompson Canyon, and San Lucas quadrangles, Monterey County, California: U.S. Geol. Survey Bull. 1141–Q, p. Q1–Q41.

——— 1974, Geology of the southern Salinas Valley area, California: U.S. Geol. Survey Prof. Paper 819, 111 p.

Durham, J. W., 1944, Megafaunal zones of the Oligocene of northwestern Washington: California Univ. Dept. Geol. Sci. Bull., v. 27, no. 5, p. 101–211, pls. 13–18.

Durrell, Cordell, 1959, Tertiary stratigraphy of the Blairsden quadrangle, Plumas County, California: California Univ. Pubs. Geol. Sci., v. 34, no. 3, p. 161–192.

Eardley, A. J., and Hatch, R. A., 1940, Pre-Cambrian crystalline rocks of north-central Utah: Jour. Geology, v. 48, no. 1, p. 58–72.

[Eberlein, G. D., and Churkin, Michael, Jr.], 1973, New evidence bearing on age of Wales Group *in* U.S. Geol. Survey, Geological Survey Research 1973; U.S. Geol. Survey Prof. Paper 850, p. 72.

Ekren, E. B., Hinrichs, E. N., Quinlivan, W. D., and Hoover, D. L., 1973, Geologic map of the Moores Station quadrangle, Nye County, Nevada: U.S. Geol. Survey Misc. Geol. Inv. Map I–756.

Epis, R. C., and Chapin, C. E., 1974, Stratigraphic nomenclature of the Thirtynine Mile volcanic field, central Colorado: U.S. Geol. Survey Bull. 1395–C, C1–C23.

Etherington, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: California Univ. Dept. Geol. Sci. Bull., v. 20, no. 5, p. 31–142, 14 pls.

Foerste, A. F., 1906, The Silurian, Devonian, and Irvine formations of east-central Kentucky, with an account of their clays and limestones: Kentucky Geol. Survey, ser. 3, Bull. 7, 369 p.

Frye, J. C., and Leonard, A. B., 1952, Pleistocene geology of Kansas: Kansas State Geol. Survey Bull. 99, 230 p.

Green, M. W., 1974, The Iyanbito Member (a new stratigraphic unit) of the Jurassic Entrada Sandstone, Gallup-Grants area, New Mexico: U.S. Geol. Survey Bull. 1395–D, p. D1–D12.

Hackman, R. J., and Wyant, D. G., 1973, Geology, structure, and uranium deposits of the Escalante quadrangle, Utah and Arizona: U.S. Geol. Survey Misc. Inv. Map I–744, 2 sheets.

Hall, C. A., Jr., 1973a, Geologic map of the Morro Bay South and Port San Luis quadrangles, San Luis Obispo County, California: U.S. Geol. Survey Misc. Field Studies Map MF–511.

——— 1973b, Geology of the Arroyo Grande quadrangle, San Luis Obispo County, California: California Div. Mines and Geology Map Sheet 24.

[Hall, W. E., and Sandburg, C. E.], 1973, Mississippian age of rocks called Milligen in the Bayhorse area, Idaho, *in* U.S. Geol. Survey, Geological Survey Research 1973: U.S. Geol. Survey Prof. Paper 850, p. 45.

Hall, W. E., Batchelder, John, and Douglass, R. C., 1974, Stratigraphic section of the Wood River Formation, Blaine County, Idaho: U.S. Geol. Survey Jour. Research, v. 2, no. 1, p. 89–95.

Harrison, J. E., Griggs, A. B., and Wells, J. D., 1974, Tectonic features of the Precambrian Belt basin and their influence on post-Belt structures: U.S. Geol. Survey Prof. Paper 866, 15 p.

Hietanen, Anna, 1973, Geology of the Pulga and Bucks Lake quadrangles, Butte and Plumas Counties, California: U.S. Geol. Survey Prof. Paper 731, 66 p.

Hobbs, W. E., 1899, Some new fossils from eastern Massachusetts: Am. Geologist, v. 23, p. 109–115.

Howard, K. A., and Shervais, J. W., 1973, Geologic map of Smith Prairie, Elmore County, Idaho: U.S. Geol. Survey Misc. Geol. Inv. Map I–818.

Iddings, J. P., 1892, Microscopical petrography of the eruptive rocks of the Eureka district, Nevada, *in* Hague, Arnold, Geology of the Eureka district, Nevada: U.S. Geol. Survey Mon. 20, p. 335–396.

Irwin, W. P., Wolfe, E. W., Blake, M. C., Jr., and Cunningham, C. G., Jr., 1974, Geologic map of the Pickett Peak quadrangle, Trinity County, California: U.S. Geol. Survey Geol. Quad. Map GQ–1111.

Kleinpell, R. M., 1938, Miocene stratigraphy of California: Tulsa, Okla., Am. Assoc. Petroleum Geologists, 450 p.

Krieger, M. H., 1974, Geologic map of the Putnam Wash quadrangle, Pinal County, Arizona: U.S. Geol. Survey Geol. Quad. Map GQ–1109.

Kümmel, H. B., and Knapp, G. N., 1904, The stratigraphy of the New Jersey clays: New Jersey Geol. Survey, Final Rept., v. 6, p. 117–209.

Lewis, R. Q., Sr., and Taylor, A. R., 1971, Geologic map of the Hustonville quadrangle, Casey and Lincoln Counties, Kentucky: U.S. Geol. Survey, Geol. Quad. Map GQ–916.

Lewis, R. Q., Sr., and Thaden, R. E., 1962, Geology of the Wolf Creek Dam quadrangle, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ–177.

——— 1966, Geologic map of the Albany quadrangle, Kentucky-Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ–550.

MacKevett, E. M., Jr., and Plafker, George, 1974, The Border Ranges fault in south-central Alaska: U.S. Geol. Survey Jour. Research, v. 2, no. 3, p. 323–329.

McAllister, J. F., 1973, Geologic map and sections of the Amargosa Valley borate area—southeast continuation of the Furnace Creek area—Inyo County, California: U.S. Geol. Survey Misc. Geol. Inv. Map I–782.

McIntyre, D. H., 1974, Concepcíon and Palma Escrita Formations, western Puerto Rico: U.S. Geol. Survey Bull. 1394–D, p. D1–D9.

McKee, E. H., 1973, Preliminary geologic map of the Austin quadrangle, Lander County, Nevada: U.S. Geol. Survey Misc. Field Studies Map MF–485.

McKnight, E. T., 1974, Geology and ore deposits of the Rico district, Colorado: U.S. Geol. Survey Prof. Paper 723, 100 p.

Merriam, C. W., 1973, Middle Devonian rugose corals of the central Great Basin: U.S. Geol. Survey Prof. Paper 799, 53 p.

Miller, R. L., and Roen, J. B., 1973, Geologic map of the Pennington Gap quadrangle, Lee County, Virginia, and Harlan County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ–1098.

Moore, E. J., 1963, Miocene marine mollusks from the Astoria Formation in Oregon: U.S. Geol. Survey Prof. Paper 419, 109 p., 33 pls. [1964].

Moore, R. C., Frye, J. C., Jewett, J. M., Lee, Wallace, and O'Connor, H. G., 1951, The Kansas rock column: Kansas State Geol. Survey Bull. 89, 132 p.

Mullens, T. E., and Laraway, W. H., 1973, Geologic map of the Morgan 7½-minute quadrangle, Morgan County, Utah: U.S. Geol. Survey Misc. Field Studies Map MF–318.

Naeser, C. W., 1969, Etching fission tracks in zircons: Science, v. 165, p. 388.

Nelson, A. E., 1974, Changes in nomenclature of upper Precambrian to lower Paleozoic(?) formations in the Natick quadrangle, eastern Massachusetts, and their tentative correlations with rocks in Rhode Island and Connecticut: U.S. Geol. Survey Bull. 1395–E, p. E1–E15.

Noble, D. C., Slemmons, D. B., Korringa, M. K., Dickinson, W. R., Al-Rawi, Yehya, and McKee, E. H., 1974, Eureka Valley Tuff, east-central California and adjacent Nevada: Geology, v. 2, no. 3, p. 139–142.

Nolan, T. B., Merriam, C. W., and Blake, M. C., Jr., 1974, Geologic map of the Pinto Summit quadrangle, Eureka and White Pine Counties, Nevada: U.S. Geol. Survey Misc. Geol. Inv. Map I–793, 2 sheets, text, 14 p.

Olmsted, F. H., Loeltz, O. J., and Irelan, Burdge, 1973, Geohydrology of the Yuma area, Arizona and California: U.S. Geol. Survey Prof. Paper 486–H, p. H1–H227.

Pavlides, Louis, Sylvester, K. A., Daniels, D. L., and Bates, R. G., 1974, Correlation between geophysical data and rock types in the Piedmont and Coastal Plain of northeast Virginia and related areas: U.S. Geol. Survey Jour. Research, v. 2, no. 5, p. 569–580.

Pierce, W. G., Nelson, W. H., and Prostka, H. J., 1973, Geologic map of the Pilot Peak quadrangle, Park County, Wyoming: U.S. Geol. Survey Misc. Geol. Inv. Map I–816.

Puffett, W. P., 1974, Geology of the Negaunee quadrangle, Marquette County, Michigan: U.S. Geol. Survey Prof. Paper 788, 53 p.

Quinlivan, W. D., Rogers, C. L., and Dodge, H. W., Jr., 1974, Geologic map of the Portuguese Mountain quadrangle, Nye County, Nevada: U.S. Geol. Survey Misc. Geol. Inv. Map I–804.

Rankin, D. W., Espenshade, G. H., and Shaw, K. W., 1973, Stratigraphy and structure of the metamorphic belt in northwestern North Carolina and southwestern Virginia: a study from the Blue Ridge across the Brevard fault zone to the Sauratown Mountains anticlinorium: Am. Jour. Sci., v. 273–A (Byron N. Cooper Volume), p. 1–40.

Rau, W. W., 1964, Foraminifera from the northern Olympic Peninsula, Washington: U.S. Geol. Survey Prof. Paper 374–G, p. G1–G33, 2 figs., 7 pls.

Reed, E. C., and Dreeszen, V. H., 1965, Revision of the classification of the Pleistocene deposits of Nebraska: Nebraska Geol. Survey Bull. 23, 65 p.

Rodgers, John, 1937, Stratigraphy and structure in the upper Champlain Valley: Geol. Soc. America Bull., v. 48, no. 11, p. 1573–1588.

Rubey, W. W., 1973, New Cretaceous formations in the western Wyoming thrust belt: U.S. Geol. Survey Bull. 1372–I, p. I1–I35.

Schlocker, Julius, 1974, Geology of the San Francisco North quadrangle, California: U.S. Geol. Survey Prof. Paper 782, 109 p.

Secor, D. T., and Wagener, H. S., 1968, Stratigraphy, structure, and petrology of the Piedmont in central South Carolina—Carolina Geol. Soc. Field Trip, Oct. 18–20, 1968: South Carolina Div. Geology Geol. Notes, v. 12, no. 4, p. 67–84.

Simons, F. S., 1974, Geologic map and sections of the Nogales and Lochiel quadrangles, Santa Cruz County, Arizona: U.S. Geol. Survey Misc. Geol. Inv. Map I–762, text, 9 p.

Sims, P. K., and Morey, G. B., 1974, Minnesota's mineral resources: a brief overview: Skillings Mining Rev., v. 63, no. 13, p. 1–7, and v. 63, no. 14, p. 1–9.

Sirkin, L. A., 1974, Palynology and stratigraphy of Cretaceous strata in Long Island, New York, and Block Island, Rhode Island: U.S. Geol. Survey Jour. Research, v. 2, no. 4, p. 431–440.

Slemmons, D. B., 1966, Cenozoic volcanism of the central Sierra Nevada, California, *in* Bailey, E. H., ed., Geology of northern California: California Div. Mines and Geology Bull. 190, p. 199–208.

Smith, J. H., 1965, A summary of stratigraphy and paleontology, upper Colarado and Montana Groups, south-central Wyoming, northeastern Utah, and northwestern Colorado, *in* Sedimentation of Late Cretaceous and Tertiary outcrops, Rock Springs uplift—Wyoming Geol. Assoc., 19th Field Conf., 1965, Guidebook: Casper, Wyo., Petroleum Inf., p. 13–26.

Snavely, P. D., Jr., and MacLeod, N. S., 1974, Yachats Basalt—an upper Eocene differentiated volcanic sequence in the Oregon Coast Range: U.S. Geol. Survey Jour. Research, v. 2, no. 4, p. 395–403.

Staatz, M. H., 1973, Geologic map of the Goat Mountain quadrangle, Lemhi County, Idaho, and Beaverhead County, Montana: U.S. Geol. Survey Geol. Quad. Map GQ–1097.

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

Steven, T. A., Lipman, P. W., Hail, W. J., Jr., Barker, Fred, and Lueldke, R. G., 1974, Geologic map of the Durango quadrangle, southwestern Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I–764.

Stewart, J. H., 1974, Correlation of uppermost Precambrian and Lower Cambrian strata from southern to east-central Nevada: U.S. Geol. Survey Jour. Research, v. 2, no. 5, p. 609–618.

Taylor, A. R., Luft, S. J., and Lewis, R. Q., Sr., 1968, Geologic map of the Greensburg quadrangle, Green and Taylor Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ–739.

Taylor, M. E., and Halley, R. B., 1974, Systematics, environment, and biogeography of some Late Cambrian and Early Ordovician trilobites from eastern New York State: U. S. Geol. Survey Prof. Paper 834, 38 p.

Thomasson, M. R., 1959a, Late Paleozoic stratigraphy and paleotectonics of central and eastern Idaho [abs.]: Dissert Abs., v. 20, no. 3, p. 999.

——— 1959b, Late Paleozoic stratigraphy and paleotectonics of central and eastern Idaho: Madison, Univ. Wisconsin, Ph.D. thesis, 244 p.

Thorup, R. R., 1941, Vaqueros Formation (Tertiary) at its type locality, Junipero Serra quadrangle, Monterey County, California [abs.]: Geol. Soc. America Bull., v. 52, no. 12, pt. 2, p. 1957–1958.

Ward, J. R., 1973, Geohydrology of Atchison County, northeastern Kansas: U.S. Geol. Survey Hydrol. Inv. Atlas HA–467.

Weir, G. W., 1972, Geologic map of the Halls Gap quadrangle, Lincoln County, Kentucky: U.S. Geol. Survey, Geol. Quad. Map GQ–1009.

Weller, J. M., 1931, Mississippian fauna: Kentucky Geol. Survey, ser. 6, v. 36, pp. 249–290.

Wrucke, C. T., 1974, The Whitehorn Granodiorite of the Arkansas Valley in central Colorado: U.S. Geol. Survey Bull. 1394–H, p. H1–H8.

Yochelson, E. L., and Kriz, Jiri, 1974, Platyceratid gastropods from the Oriskany Sandstone (Lower Devonian) near Cumberland, Maryland: Synonymies, preservation and color markings: Jour. Paleontology, v. 48, no. 3, p. 474–483.

☆U.S. GOVERNMENT PRINTING OFFICE: 1975 O–211-317/6