ALABAMA STRATIGRAPHY

GEOLOGICAL SURVEY OF ALABAMA CIRCULAR 140

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CIRCULAR 140

ALABAMA STRATIGRAPHY

By

Dorothy E. Raymond, W. Edward Osborne,
Charles W. Copeland and Thornton L. Neathery

Tuscaloosa, Alabama
1988

GEOLOGICAL SURVEY OF ALABAMA

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July 26, 1988

Honorable Guy Hunt
Governor of Alabama
Montgomery, Alabama

Dear Governor Hunt:

I have the honor to transmit herewith a report entitled "Alabama Stratigraphy," by Dorothy E. Raymond, W. Edward Osborne, Charles W. Copeland and Thornton L. Neathery, which has been published as Circular 140 of the Geological Survey of Alabama.

This report on the general geology of Alabama has been prepared to accompany and introduce a compilation of the stratigraphic names presently formally recognized by the Geological Survey of Alabama. Descriptions include information on the distribution, thickness, lithologic characteristics, and age of each of the described formations. Also included with the text is a chart showing the stratigraphic relations of each of the described formations.

Publication of this report fulfills public need for easily available general information on the state's geology and will be of great benefit to scientists, industry, and educational institutions.

Respectfully,

Ernest A. Mancini
State Geologist

CONTENTS

ILLUSTRATIONS

ALABAMA STRATIGRAPHY

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INTRODUCTION

This report briefly describes the general geology of Alabama and includes a compilation of the formal stratigraphic names presently accepted for use in maps and reports of the Geological Survey of Alabama. The nomenclature for the lithostratigraphic and lithodemic units generally conforms to the recommendations of the North American Stratigraphic Code (1983, American Association of Petroleum Geologists Bulletin, v. 67, no. 5, p. 841-875) implemented by the Geological Survey of Alabama with the present report. Where formal names for rock units have not been proposed or accepted, informal names in use by the Survey are included herein.

Stratigraphic columns showing the age and stratigraphic relations for each of the formations exposed at the surface and occurring in the subsurface in Alabama are included in plate 1. The relative ages have been determined or interpreted from published literature. The final section of this report lists all the lithostratigraphic and lithodemic units in alphabetical order. A description is presented for each unit along with the type locality, the first reference, and a few selected significant references. The principal differences in the names of the rock units used herein and those used in previous reports that followed recommendations of the 1961 Code of Stratigraphic Nomenclature (1961, American Association of Petroleum Geologists Bulletin, v. 45, no. 5, p. 645-665) pertain to the highly metamorphosed and igneous rocks of the Piedmont physiographic province.

The five physiographic regions of Alabama are differentiated on the basis of topographic relief, rock types, and geologic structure. From north to south these are the Interior Low Plateaus, Appalachian Plateaus, Valley and Ridge, Piedmont and Coastal Plain provinces (fig. 1). Descriptions of each of the regions are presented in the pages to follow. The Interior Low Plateaus and Appalachian Plateaus section has been written by Dorothy E. Raymond, the Valley and Ridge section was written by W. Edward Osborne, the Piedmont has been described by Thornton L. Neathery, and the Gulf Coastal Plain was described by Charles W. Copeland.

APPALACHIAN AND INTERIOR LOW PLATEAUS PROVINCES

Most of north Alabama is divided on the basis of physiography into two provinces, the Appalachian and Interior Low Plateaus (fig. 1) (Sapp and Emplaincourt, 1975). The Interior Low Plateaus to the north is primarily a limestone plateau of moderate relief. To the south and east is the Appalachian Plateaus, which is comprised of submaturely to maturely dissected sandstone and shale synclinal plateaus with moderate relief. In the eastern part of the Appalachian Plateaus are three linear anticlinal limestone valleys (Murphrees Valley, Wills Valley, and Sequatchie Valley) characterized by the presence of resistant sandstone ridges and moderate relief.

STRATIGRAPHY AND STRUCTURE

The Appalachian and Interior Low Plateaus are underlain by Paleozoic sedimentary rocks ranging from Cambrian to Pennsylvanian in age. Rocks exposed in the Interior Low Plateaus lie on the south flank of the Nashville Dome and dip gently to the south at about 30 feet per mile. To the east in the Appalachian Plateaus northeast-trending anticlines (Sequatchie, Murphrees Valley, and Wills Valley anticlines) expose older rocks in narrow linear outcrops (fig. 2). Whereas the Sequatchie and Wills Valley anticlines are asymmetric to the northwest and include southeast-dipping thrust faults along parts of the northwest limbs, the Murphrees Valley anticline is asymmetric to the southeast and is bounded on the southeast side by the northwest-dipping Straight Mountain fault. These anticlines

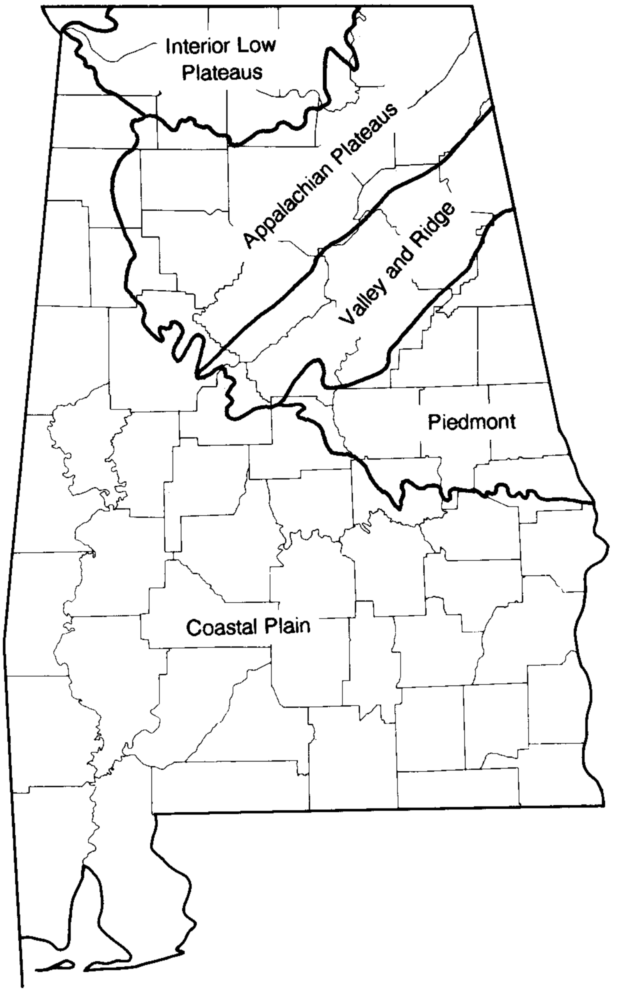

Figure 1.--Physiographic provinces of Alabama.

are separated by broad synclinal mountains (Sand, Lookout, and Blount Mountains). To the south Paleozoic rocks dip southwestward into the Black Warrior basin beneath the Coastal Plain overlap.

Paleozoic sedimentary rocks in the Plateaus are underlain by crystalline basement rocks of probable Precambrian age (Kidd, 1975). These basement rocks have metavolcanic affinities. K-Ar radiometric age data indicate that metamorphism of these basement rocks occurred at least 750 to 1,000 million years (m.y.) ago (Neathery and Copeland, 1983).

In the subsurface the basement complex is overlain by a basal Cambrian clastic sequence comprised of the Rome and Conasauga Formations. The Rome Formation of Early Cambrian age consists of fine-grained clastic rocks and lesser amounts of carbonates and evaporites (Kidd, 1975; Neathery and Copeland, 1983; Raymond, D. E., 1985b). The Rome represents the initial marine transgression over an irregular basement surface and includes sediments deposited primarily in supratidal to shallow-water environments. The overlying Conasauga Formation of Middle Cambrian age consists of a thick sequence of marine shale and limestone.

Overlying the Conasauga is a thick sequence of shelf carbonates of Late Cambrian to Late Ordovician age (Drahovzal and Neathery, 1971; Kidd, 1975; Benson and Mink, 1983). The upper part of this carbonate sequence crops out in the Interior Low Plateaus and in the Sequatchie, Murphrees Valley, and Wills Valley anticlines. In the subsurface at the base of this carbonate sequence is the Upper Cambrian-Lower Ordovician Knox Group, composed of cherty dolomite and limestone deposited on a shallow marine shelf. The top of the Knox is a karstic unconformity and is placed at the base of the red and green shales and limestones of the Pond Spring Formation of the overlying Stones River Group (Kidd, 1975; Benson and Mink, 1983).

The Stones River Group and the overlying Nashville Group comprise a transgressive-regressive sequence of light-colored peritidal to subtidal shallow-shelf limestones (Benson and Mink, 1983) equivalent to the Chickamauga Limestone in the Valley and Ridge province to the east. Thin beds of bentonite near the top of the Stones River Group have been used for regional correlation (Kidd, 1975).

The Inman and Leipers Limestones overlie the Nashville Group in the northeast part of the Plateaus. The Inman is comprised of shallow subtidal calcareous shales and carbonate mudstones. The overlying Leipers is composed primarily of peritidal fossiliferous limestone. Both formations pinch out to the south and west. Where the Inman is absent and the Leipers directly overlies the Nashville Group, the Leipers and the upper part of the Nashville Group are combined into the Elkmont Formation because of similar lithologies (Neathery and Drahovzal, 1985). Where the Elkmont is recognized (primarily in the subsurface), the lowermost unit of the Nashville Group, the Hermitage Formation, is also distinguished. Further to the southwest in the subsurface, the Maysville (Leipers Limestone), Eden (Inman Formation), and Nashville Groups are combined into one undifferentiated unit. At the top of the Ordovician sequence is the Sequatchie Formation of Late Ordovician age, predominantly a silty carbonate locally containing interbeds of fossiliferous crystalline limestone and shale (Neathery and Drahovzal, 1985).

Unconformably overlying Ordovician strata are rocks of Silurian age. Throughout most of the Plateaus, the Silurian is comprised of a thin carbonate sequence (Brassfield Limestone and Wayne Group) that thickens to the southwest (Silurian undifferentiated) reaching a maximum beneath the Coastal Plain overlap in Tuscaloosa and Pickens Counties (Jewell, 1969; Kidd, 1975). In the northeastern part of the Plateaus from Blount to Jackson County, the Silurian is represented by a clastic sequence of interbedded sandstone, shale and hematite (Red Mountain Formation and its equivalents). In the Plateaus, the Silurian rocks are overlain by the Chattanooga Shale of Devonian age. To the southwest in the Black Warrior basin an unnamed and undifferentiated Devonian cherty carbonate unit underlies the Chattanooga Shale and thickens rapidly to the southwest (Kidd, 1975).

Mississippian rocks are exposed in the Interior Low Plateaus and extend into the subsurface of the Appalachian Plateaus and the Black Warrior basin (fig. 2). The lower part of the Mississippian System consists of a basal shale (Maury Formation) and chert and cherty carbonates (Fort Payne Chert and Tuscumbia Limestone). The carbonates reflect deposition on a stable marine shelf which received little clastic sediment. The Fort Payne is uniform in distribution; however, the Tuscumbia is thickest in the northern part of the Black Warrior basin (the East Warrior platform), thinning off the platform into areas of presumably lower energy (Thomas, 1972).

The upper part of the Mississippian is comprised of three lithofacies: (1) a northeastward-thickening clastic facies (Pennington Formation) in northeastern Alabama; (2) a southwestward-thickening clastic facies (Floyd Shale and Parkwood Formation) in the Black Warrior basin; and (3) a carbonate facies (Bangor and Monteagle Limestones) in north-central Alabama (East Warrior platform) (Thomas, 1972, 1979).

The carbonate facies in north-central Alabama consists primarily of shallow-water, high-energy marine limestones. At the base of the carbonate facies is the Monteagle Limestone, which consists primarily of massive cross-bedded oolitic and bioclastic limestone that interfingers southwestward with the Pride Mountain Formation and the overlying Hartselle Sandstone. In the northeasternmost part of the Plateaus, the Monteagle is overlain by the Bangor Limestone, primarily a bioclastic and oolitic limestone locally containing interbeds of mudstone and shale. Oolitic limestones of the Bangor are thickest in a linear trend generally parallel to and near the edge of the East Warrior platform (Thomas, 1972). The Bangor grades northeastward and southwestward into clastic facies.

The two separate clastic facies reflect sediment sources to the northeast and southwest of the East Warrior platform. The clastic facies on the southwest is composed of a progradational succession of prodelta shales (Floyd Shale) and overlying delta-front sandstones and shales (Parkwood Formation) (Thomas, 1979). A tongue of shale and sandstone (Pride Mountain Formation and Hartselle Sandstone) extends from the lower part of the clastic facies northeastward into the carbonate facies. The Hartselle Sandstone and less extensive sandstones within the Pride Mountain are aligned with the southwestern edge of the East Warrior platform and probably represent offshore bar and/or barrier island sands (Thomas, 1979).

The progradational clastic facies on the northeast (Pennington Formation) consists of a lower supratidal dolostone subsequently overlain by fine-grained shallow-marine clastics (Thomas, 1979).

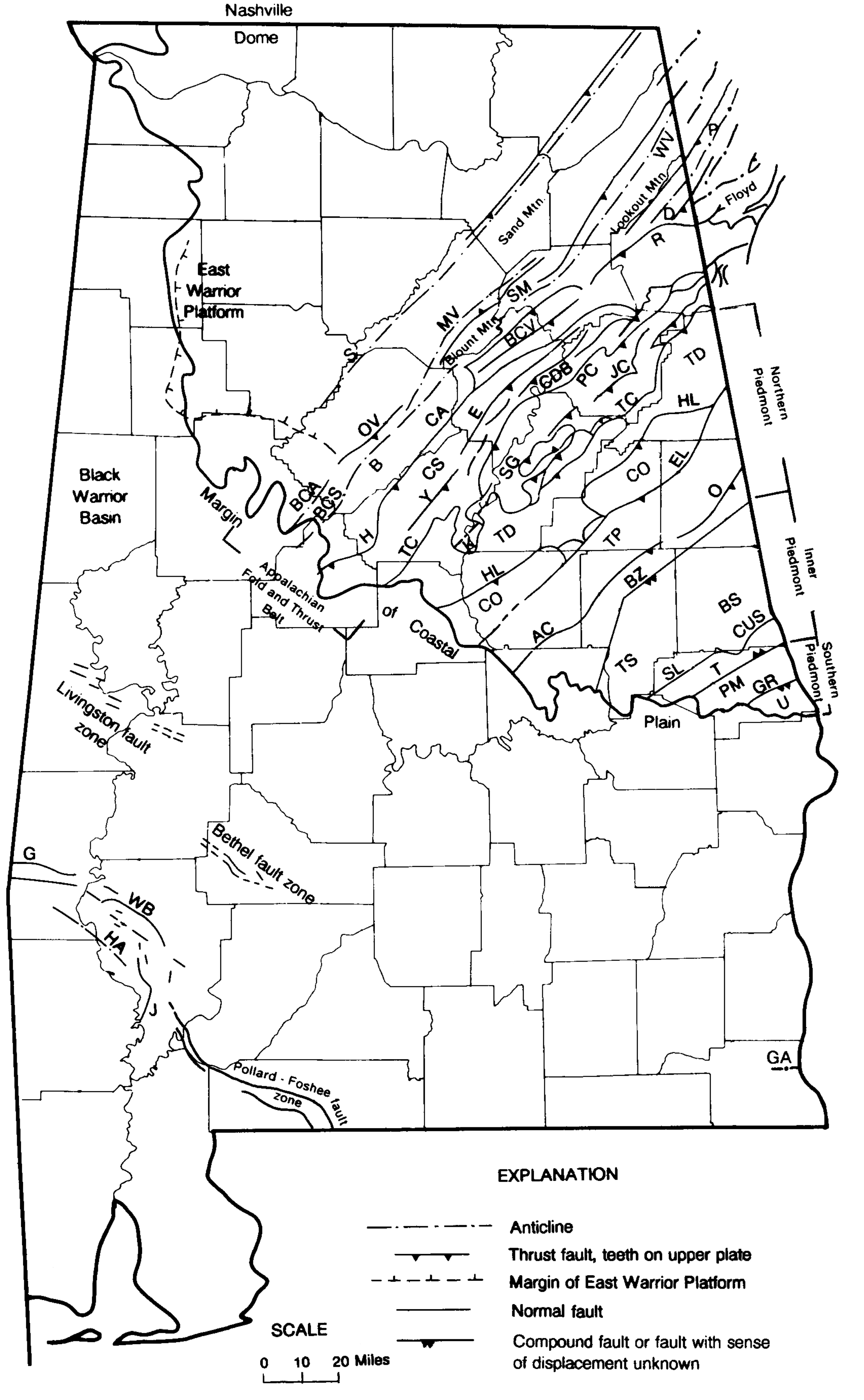

Figure 2.--Generalized structural geology map of Alabama (modified from Szabo and others, 1988; Thomas and Neathery, 1982; and Wilson and Tew, 1985). Explanation of symbols is given on facing page.

EXPLANATION

AC	Alexander City fault
B	Birmingham anticlinorium
BCA	Blue Creek anticline
BCS	Blue Creek syncline
BCV	Big Canoe Valley fault
BS	Boyds Creek synform
BZ	Brevard fault zone (includes Abanda and Katy Creek faults)
CA	Cahaba synclinorium
CDB	Coosa deformed belt
CO	Coosa block
CS	Coosa synclinorium
CUS	Cusseta synform
D	Dirtseller Mountain syncline
E	Eden fault
EL	Enitachopco line fault system
G	Gilbertown fault zone
GA	Gordon anticline
GR	Goat Rock fault zone
H	Helena fault
HA	Hatchetigbee anticline
HL	Hollins Line fault
J	Jackson fault
JC	Jacksonville fault complex
K	Kelley Mountain anticline
MV	Murphrees Valley anticline
O	Omaha fault
OV	Opossum Valley fault
P	Peavine anticline
PC	Pell City fault
PM	Pine Mountain block
R	Rome fault
S	Sequatchie anticline
SG	Sleeping Giants klippe
SL	Stonewall line
SM	Straight Mountain fault
T	Towaliga fault zone
TD	Talladega block
TF	Talladega-Cartersville fault
TP	Tallapoosa block
TS	Tallassee synform
U	Uchee block
WB	West Bend fault zone
WV	Wills Valley anticline
Y	Yellowleaf fault

These sediments grade eastward into sandstone, shale and carbonaceous beds indicative of marine bays, small bars, and coastal lagoons and marshes (Thomas, 1979). Both clastic facies grade upward into massive sandstones of the Pottsville Formation. In north-central Alabama where the clastic facies are absent, the Pottsville extends over the Bangor Limestone.

Pennsylvanian rocks crop out in the Appalachian Plateaus and dip to the southwest, thickening rapidly in that direction to more than 5,000 feet in the subsurface of the Black Warrior basin (Metzger, 1965). In the subsurface, Pennsylvanian rocks have been identified as far south as Marengo County beneath Coastal Plain sediments, where they appear to be terminated by thrust-faulted older sedimentary rocks or by metamorphic rocks (Kidd, 1976; Smith, 1979).

Pennsylvanian strata crop out in the Appalachian Plateaus province and include the Pottsville Formation and part of the Parkwood Formation. The Parkwood is a southwestward thickening clastic sequence of clay and silt shale containing interbeds of sandstone and limestone. Paleontologic data indicate that all or most of the Parkwood in Franklin County in the western part of the Plateaus is of Pennsylvanian age. However, in Jefferson County in the southeastern Plateaus, the Parkwood is partly Late Mississippian and partly Early Pennsylvanian. These data indicate that the base of the Parkwood may be strongly diachronous northwestward across the Appalachian Plateaus (Henry and others, 1981, 1985).

The Pottsville consists primarily of sandstone and shale and contains lesser amounts of coal, underclay, and limestone. The lower Pottsville was deposited in a prodelta/barrier/back-barrier system dominated by orthoquartzitic sandstone. The upper coal-bearing strata of the Pottsville were deposited in fluvial-dominated deltaic systems (Smith, 1979; Horsey, 1981; Rheams and Benson, 1982).

MINERAL RESOURCES

Coal mining is the largest mining industry in Alabama, and two of Alabama's four coal fields underlie the Appalachian Plateaus province (Ward and Evans, 1977). The Warrior coal field to the south is the most productive of the four fields and contains 90 percent of the state's coal reserves in more than 20 coal beds (Tolson, 1984). Both surface and subsurface mining are used to recover the coal. The Plateau coal field to the north contains more than 25 coal beds; however, utilization of reserves has been limited.

Oil and gas are currently being produced from several sandstone and limestone units in Ordovician, Devonian, Mississippian, and Pennsylvanian rocks of the Black Warrior basin (Raymond, R. N., 1985). Most production is centered in Fayette and Lamar Counties. Gas is also being produced from coal beds in the Pottsville in Tuscaloosa and Jefferson Counties.

Asphalt impregnated sand occurs in the Mississippian Hartselle Sandstone and Pride Mountain Formation in northwest Alabama. Reserves in the Hartselle have been estimated at about 3 billion barrels of oil in place (Wilson, 1983). To date, commercial development has been limited; however, improvement in extraction technology may lead to future development of this resource. Oil shale of the Chattanooga Shale also holds promise as a future source of energy for Alabama (Rheams and Neathery, 1988). Limestone is presently being quarried for aggregate and dimension stone from the Bangor, Monteagle, and Tuscumbia Limestones in the Plateaus. Other mineral resources in the Plateaus include asphaltic limestone, bauxite, tripoli, iron ore, and sand and gravel (Smith, 1983).

VALLEY AND RIDGE PROVINCE

The Valley and Ridge physiographic province in central and northeastern Alabama consists of a series of subparallel ridges and valleys trending generally northeast-southwest (fig. 1) (Fenneman, 1938; Sapp and Emplaincourt, 1975). This characteristic topography is developed on folded and thrust-faulted sedimentary rocks. The ridges are formed by sandstone and chert beds that are resistant to erosion; valleys are underlain by less resistant shale and carbonate rocks. The northwestern half of the province shows well-developed Valley and Ridge topography. The southeastern part of the province is characterized by a wide plain of varied relief containing irregularly spaced parallel ridges and valleys. In the extreme northeastern part of the province, mountainous terrain is developed on faulted and folded sandstone and quartzite.

STRATIGRAPHY

Paleozoic sedimentary rocks ranging in age from Cambrian to Pennsylvanian are exposed in the Valley and Ridge province. Precambrian crystalline basement rocks have not been penetrated by deep drilling; however, preserved thicknesses of Paleozoic rocks in synclines define a minimum depth to crystalline basement of approximately 23,000 feet in the central and southeastern Valley and Ridge (Thomas, 1982; Neathery and Thomas, 1983).

The Paleozoic stratigraphy of the Valley and Ridge province is grossly similar to that in the Appalachian and Interior Low Plateaus. The succession may be divided into four major components: a basal Cambrian clastic sequence, a Cambrian-Ordovician carbonate bank facies, a thin and laterally variable Middle Ordovician to Lower Mississippian sequence of shallow-marine shelf clastic and carbonate rocks, and Mississippian-Pennsylvanian clastic wedge facies (Thomas, 1982). The four stratigraphic components reflect different phases in the tectonic history of the southern continental margin of North America.

The basal Cambrian clastic sequence reflects predominantly clastic deposition on a rifted continental margin and records the initial transgression onto the craton (Thomas and Neathery, 1980; Thomas, 1982). Rifting was initiated during the late Precambrian (Rankin, 1975). The lowest part of the sequence consists of the Chilhowee Group, which includes fluvial to shallow-marine clastic sediments (Cochran, Nichols, and Wilson Ridge Formations) capped by a transgressive sandstone facies (Weisner Formation) (Mack, 1980) (plate 1). The Chilhowee is overlain by carbonate rocks of the Shady Dolomite, the lowest part of a regionally extensive carbonate bank facies (Rodgers, 1968). Fine-grained clastic and subordinate carbonate rocks of the overlying Rome and Conasauga Formations reflect deposition in marine-shelf environments (Rodgers, 1953; Palmer, 1971). The Conasauga locally grades laterally to extensive carbonate facies.

Upper Cambrian-Lower Ordovician rocks in the Valley and Ridge constitute a carbonate-bank facies that indicates establishment of an extensive passive continental margin (Thomas, 1982). The carbonate bank facies includes the carbonate facies equivalents of the Conasauga (Brierfield, Ketona, and Bibb Dolomites), as well as the regionally extensive carbonate rocks of the Knox Group. The Knox Group includes chert-bearing formations (Copper Ridge and Chepultepec Dolomites and Longview Limestone) as well as chert-free carbonate rocks (Newala Limestone). The top of the Knox is truncated by a regional unconformity that marks a major regression.

The Middle Ordovician to Lower Mississippian sequence is characterized by laterally variable shallow-marine shelf clastic and carbonate rocks (Thomas, 1982). The sequence is broken by numerous unconformities that are variable in magnitude. Middle and Upper Ordovician rocks in the Valley and Ridge province include three main facies. Exposures in the northwest part of the province are of light-colored shallow-marine limestone assigned to the Chickamauga Limestone. To the southeast these rocks change facies to deeper water dark-colored argillaceous limestone (Lenoir and Little Oak Limestones) and black shale (Athens Shale) (Benson and Mink, 1983). Clastic shelf and tidal-flat facies of the Greensport Formation, Colvin Mountain Sandstone, and Sequatchie Formation overlap the shallow-marine limestone facies in the northeastern part of the province and are interpreted as the distal part of a regional Ordovician clastic wedge that is thickest in eastern Tennessee (Drahovzal and Neathery, 1971; Thomas, 1977, 1982). The clastic rocks reflect orogenic uplift along the Appalachian orogen northeast of Alabama (Thomas, 1977; Chowns and McKinney, 1980; Thomas and Neathery, 1980; Thomas, 1982).

The Lower and Middle Silurian Red Mountain Formation unconformably overlies Middle and Upper Ordovician rocks in the western part of the province. The Red Mountain is a unique shallow-marine clastic sequence that contains significant quantities of iron-rich (hematite and chamosite) fine- to coarse-grained clastic rocks interpreted to represent back-barrier and lagoonal facies (Sheldon, 1970). The formation thickens to the northeast, suggesting dispersal from the same orogenic uplift that supplied Ordovician clastic facies (Chowns and McKinney, 1980; Thomas and Neathery, 1980).

The Early and Middle Devonian Frog Mountain Sandstone unconformably overlies Silurian and Ordovician rocks in parts of the Alabama Valley and Ridge province. The Frog Mountain is a complex stratigraphic unit that is bounded by unconformities and contains several internal unconformities (Ferrill, 1984). The source of Frog Mountain sediments has not been definitely identified, but the distribution of Early and Middle Devonian rocks in Alabama suggests a possible source area to the southeast of present Frog Mountain outcrops (Thomas and Neathery, 1980; Thomas, 1982; Tull, 1982b; Ferrill, 1984). Above the post-Middle Devonian unconformity in the northwestern part of the province is the thin, but regionally persistent, Upper Devonian Chattanooga Shale.

The Lower Mississippian Maury Formation unconformably overlies Devonian and older rocks in much of the Alabama Valley and Ridge. The thin, persistent shale is unconformably overlain by a regionally extensive shallow-marine shelf chert and cherty limestone (Lower Mississippian Fort Payne Chert and Tuscumbia Limestone) (Thomas, 1982).

Upper Mississippian and Pennsylvanian rocks exposed in the Valley and Ridge are similar to equivalent lithofacies in the Appalachian and Interior Low Plateaus and the Black Warrior foreland basin (plate 1). Three regional Upper Mississippian lithofacies are recognized: (1) a southwest-thickening clastic facies (Pride Mountain Formation, Hartselle Sandstone, Floyd Shale, and Parkwood Formation); (2) a shallow-marine carbonate facies (Bangor Limestone); and (3) a northeastward-thickening clastic facies (Pennington Formation) in northeastern Alabama (Thomas, 1972, 1979, 1982). Bangor and Pennington facies are dominantly restricted to the Appalachian Plateaus; the southwest-thickening clastic facies is the dominant Upper Mississippian stratigraphic element in the Valley and Ridge province. The southwest-thickening clastic facies is interpreted as a northeastward prograding succession of delta front, prodelta, and marine or barrier-bar sediments (Thomas, 1972, 1979, 1982). Both the southwest-thickening clastic sequence and the northeast-thickening clastic sequence represent the distal ends of regional clastic wedges dispersed from separate orogenic uplifts (Thomas, 1974). The two clastic sequences completely overlap the Bangor Limestone and grade upward to extensive clastic facies of the Pennsylvanian Pottsville Formation. The Pottsville Formation includes a sequence of quartz-arenite sandstone interpreted to be barrier-island facies (Hobday, 1974) overlain by coal-bearing delta plain facies in the upper part (Ferm and Ehrlich, 1967).

STRUCTURAL SETTING

The Valley and Ridge physiographic province in Alabama corresponds in part to the fold and thrust structural belt of the southern Appalachian orogen. The fold and thrust belt is defined as the belt of folded and thrust-faulted Paleozoic sedimentary rocks bounded by Paleozoic and Precambrian metamorphic rocks on the southeast (Piedmont) and by relatively undeformed Paleozoic sedimentary rocks of the Black Warrior foreland basin on the northwest (fig. 2). Major deformation in the fold and thrust belt apparently is restricted to the Paleozoic cover sequence above the basement (Rich, 1934; Rodgers, 1950; Harris, 1976; Thomas and Neathery, 1980; Thomas, 1982; Neathery and Thomas, 1983). However, important along-strike changes in Appalachian structures define northwest-trending cross-strike structural discontinuities (Wheeler, 1978) that may reflect irregular deformation of the cover sequence above reactivated basement faults (Drahovzal and others, 1974; Thomas and Neathery, 1980; Thomas, 1982). Furthermore, stratigraphic and structural data suggest that low-relief synsedimentary structures formed in the cover sequence over basement structures throughout the Paleozoic and that basement faults subsequently influenced the locations and geometry of thrust fault ramps during later large-scale Alleghanian thrusting (Thomas, 1982, 1983; Osborne and Guthrie, 1986).

The fold and thrust belt in Alabama has been subdivided into three domains: a northwestern domain of broad, flat-bottomed synclines and narrow, asymmetric anticlines; a central domain of higher relief folds and major thrust ramps; and a southeastern domain of large-scale thrust sheets at multiple levels above a basal decollement (Thomas and Neathery, 1980; Thomas, 1982; Neathery and Thomas, 1983). Because of an en echelon arrangement of folds and faults, the domain boundaries change from one structure to another along structural strike.

NORTHWESTERN DOMAIN

The northwestern domain corresponds to the major synclinal ridges and anticlinal valleys of the Appalachian Plateaus province and to the Blue Creek anticline and Blue Creek syncline near the Coastal Plain overlap (fig. 2). Thus, only the central and southeastern domains of the Appalachian fold and thrust belt correspond to the Valley and Ridge physiographic province in Alabama (Thomas and Neathery, 1980).

CENTRAL DOMAIN

The central domain of the fold and thrust belt (northwestern part of the Valley and Ridge province) is characterized by thrust faults and high-relief folds having as much as 20,000 feet of structural relief (fig. 2) (Thomas, 1982; Neathery and Thomas, 1983). The Birmingham anticlinorium in the southwest part of the central domain has a faulted northwest limb (Opossum Valley fault) and shares a common limb with the Cahaba synclinorium on the southeast. The Cahaba synclinorium is separated from the Coosa synclinorium by the regionally extensive Helena fault. In north-central Alabama the Helena apparently intersects the Big Canoe Valley fault, which truncates the up-plunge end of the Cahaba synclinorium. An unnamed fault between the Helena and Big Canoe Valley faults, previously mapped as the Helena (Butts, 1926), truncates a series of synclinal structures northeast of the Cahaba synclinorium. The Big Canoe Valley fault and the Rome fault mark the northwestern boundary of the domain in most of northern Alabama, but in extreme northeastern Alabama and northwestern Georgia the central domain includes the Dirtseller Mountain syncline, Peavine anticline, and Floyd synclinorium. The Eden and Yellowleaf faults define the southeastern boundary of the domain across most of the Valley and Ridge.

SOUTHEASTERN DOMAIN

The southeastern domain is characterized by large-scale, low-angle thrust sheets in multiple structural levels above the basal decollement (fig. 2) (Thomas, 1982; Neathery and Thomas, 1983). The Coosa deformed belt on the northwest side of the domain consists of numerous imbricate thrust slices, apparently juxtaposed from originally distant places (Thomas and Drahovzal, 1974). The Coosa deformed belt is bordered on the southeast by the Pell City fault that bounds an areally extensive low-angle thrust sheet. The Pell City thrust sheet is overridden on the southeast by structurally higher, large-scale thrust sheets. Some of these higher level thrust sheets are apparently rooted (Jacksonville fault complex; Osborne and Szabo, 1984), whereas others are preserved as klippen (Sleeping Giants; Bearce, 1978). The southeastern domain is bordered on the southeast by a major thrust fault (Talladega Front fault of Thomas and Neathery, 1982; Talladega-Cartersville fault of Tull, 1982b) that juxtaposes rocks of low metamorphic grade (Piedmont) and sedimentary rocks of the foreland fold and thrust belt. Just north of the Coastal Plain overlap the Kelley Mountain anticline is exposed in a half window through the Talladega-Cartersville thrust sheet.

MINERAL RESOURCES

The Valley and Ridge province contains two of Alabama's four coal fields: the Cahaba coal field (Cahaba synclinorium) and the Coosa coal field (Coosa synclinorium). The coal beds are primarily in the Pennsylvanian Pottsville Formation, although the Parkwood Formation contains a few, thin coals. The coal is generally of good quality and locally coal of coking quality is present in the Coosa field (Ward and Evans, 1977). Because of structural complexity the fields have not been extensively mined. The coal fields offer some potential for coal-bed methane production.

Very few wells have been drilled for oil and gas in the Valley and Ridge province in Alabama. Since 1979 several deep holes have been drilled in the Valley and Ridge and its extension beneath the Gulf Coastal Plain; all are dry and abandoned (Raymond, 1984). Potential source and reservoir rocks have been identified in the Middle and Upper Ordovician of the Valley and Ridge, but additional evaluation is needed to define the petroleum potential of this area (Benson and Mink, 1983).

The Valley and Ridge province contains a number of other mineral commodities. The largest non-energy mineral industry in the state is the quarrying of limestone (Wade and Smith, 1985). Limestone is presently mined from the Conasauga Formation, Longview Limestone, Newala Limestone, Lenoir Limestone, and Little Oak Limestone in the Valley and Ridge province. Other construction minerals produced from the Valley and Ridge during 1984 include dolomite, shale, kaolin, chert, and sand and gravel. Other mineral resources that are not presently commercially produced in the province include barite, red iron ore (hematite), brown iron ore (limonite), tripoli, manganese, lead, zinc, and bauxite.

PIEDMONT PROVINCE

The crystalline rocks of the Alabama Piedmont are subdivided into three lithotectonic provinces: Northern Piedmont, Inner Piedmont, and Southern Piedmont (Neathery and others, 1974, 1976) (fig. 2). Each province is bounded by a major regional fault, and each includes distinct lithostratigraphic and/or lithodemic units (plate 1). Metamorphic grade generally increases across the Piedmont from low-grade greenschist facies on the northwest to high-grade migmatite facies on the southeast.

The crystalline rocks occur in the Piedmont Upland section of the Piedmont physiographic province of Alabama (fig. 1) which is divided into two districts: the Northern Piedmont Upland district and the Southern Piedmont Upland district (Sapp and Emplaincourt, 1975). Elevations in the Northern Piedmont range from approximately 1,000 feet on the northwest to 500 feet in the south. Several sets of prominent ridges subdivide the district's topography. The highest are the Rebecca and Talladega Mountains, including Cheaha Mountain (elevation 2,407 feet), which form a prominent system of mountains along the northwest side of the district. Elevations in the Southern Piedmont district are much more subdued, ranging from approximately 800 feet on the north to approximately 500 feet in the south. The major drainage system has incised the topography about 200 feet. The boundary between the two districts coincides with the approximate location of the Brevard fault zone (fig. 2).

NORTHERN PIEDMONT

The Northern Piedmont is faulted against the Appalachian fold and thrust belt on the northwest along the Talladega-Cartersville fault system (fig. 2) (Thomas and Neathery, 1980). Internally, the Northern Piedmont includes three regional structural blocks. The Talladega block on the northwest contains low-grade metasedimentary and metavolcanic rocks. The central Coosa block contains higher grade metamorphic rocks, local areas of retrograded mineral assemblages, and some plutonic rocks. The Tallapoosa block on the southeast contains high-grade metasedimentary rocks, which locally have been strongly retrograded, and large areas of plutonic rocks. On the southeast, the Brevard fault zone separates the Northern Piedmont from the Inner Piedmont to the southeast.

TALLADEGA BLOCK

The northwest limit of the Talladega block is the Talladega-Cartersville fault system which separates low-grade metasedimentary rocks and incipiently metamorphosed and unmetamorphosed sedimentary rocks of the fold and thrust belt. The fault apparently occurs at different stratigraphic levels along strike. Rocks of the Talladega block dip homoclinally southeast at a moderate angle Internal facing criteria indicate that the sequence is right side up but recumbent northwesterly verging folds are present locally.

The rocks of the Talladega block are metamorphosed up to greenschist facies and are divided into the Kahatchee Mountain Group, Sylacauga Marble Group, Heflin Phyllite, Talladega Group, and Hillabee Greenstone (plate 1). Stratigraphically, the lowest exposed rocks of the Talladega block are rocks of the Kahatchee Mountain Group, which in ascending order includes the Waxahatchee Slate, Brewer Phyllite, Stumps Creek Formation, and Wash Creek Slate (Butts, 1926, 1940; Warren, 1969; Tull, 1982a; Guthrie, 1985). The rocks of the Kahatchee Mountain Group are considered to be late

Precambrian to Cambrian in age (Tull, 1982a). Overlying the Kahatchee Mountain Group is the Sylacauga Marble Group consisting primarily of carbonate rocks with some metasandstone, slate and phyllite (Tull, 1985). The lower part of the group is dolomitic and cherty. The upper part is an essentially chert-free, high-calcium marble. The upper contact of the marble unit is an unconformity tentatively correlated with the Lower-Middle Ordovician unconformity of the Valley and Ridge. This unconformity locally cuts out all of the carbonate section (Shaw, 1970; Tull, 1982a). Fossil data from some of the carbonate units thought to be equivalent to the Sylacauga Marble Group indicate an Early Ordovician age for part of the sequence (Harris and others, 1984).

The Talladega Group, the thickest, most areally extensive unit of the Talladega block, unconformably overlies the Sylacauga Marble Group or the Kahatchee Mountain Group (Shaw, 1970; Tull, 1982a). The Talladega Group consists of the Lay Dam Formation, Butting Ram Sandstone, Jemison Chert and Chulafinnee Schist. The Lay Dam consists of metamorphosed arkosic calcareous litharenites and sublitharenites, chloritic and carbonaceous pelites, and thin carbonate units. Near the Coastal Plain overlap are extensive sublitharenite units that are mapped as the Miller Mill Quartzite Member. Southwest of Sylacauga near the Coosa River, much of the Lay Dam is a diamictite that locally rests unconformably on the Jumbo Dolomite (Carrington, 1973; Tull, 1982a). Granitic clasts in the diamictite are of Grenville age (Telle and others, 1979). The Lay Dam grades upward into a medium- to coarse-grained fossiliferous quartzite known as the Butting Ram Sandstone. To the northeast the lower Lay Dam overlies the Heflin Phyllite, a calcareous chlorite sericite phyllite and thin bedded carbonate sequence. In the northeast, the Lay Dam Formation consists of metamorphosed thinly bedded sublitharenite, litharenite, and carbonaceous pelite. The lower part of the Lay Dam includes massive conglomeratic arenite, the Cheaha Quartzite Member (Neathery, 1973; Bearce 1973a, 1973b). At the top of the Lay Dam in the northeast, the carbonaceous pelite becomes the dominant lithology and is termed the Erin Slate Member (Butts, 1926; Neathery, 1973). Stratigraphically and locally structurally overlying the Lay Dam Formation and the Butting Ram Sandstone are the Jemison Chert (quartz schist) and the Chulafinnee Schist (chlorite-sericite-quartz schist) which appear to be laterally equivalent units. Overlying the Jemison Chert and Chulafinnee Schist is the Hillabee Greenstone (a layered volcanic sequence of massive greenstone, metadacite, and chlorite schist). The Jemison Chert and the underlying Butting Ram Sandstone contain fossils of Early (Middle?) Devonian age (Carrington, 1973; Butts, 1926; Sutley, 1977).

COOSA BLOCK

The Coosa block is bounded on the northwest by the Hollins line fault (Neathery and Reynolds, 1975; Thomas and Neathery, 1980), a regional line of structural discontinuity that extends in a sinuous trace across the Alabama Piedmont (fig. 2). The southeast boundary of the Coosa block is the relatively straight Enitachopco line fault, a major zone of structural discontinuity across the Northern Piedmont that truncates the Hollins line fault at several places and divides the Coosa block into two subregional salients. Each salient contains similar lithologic units and exhibits comparable structural and metamorphic styles. The northeast salient is divided into the Poe Bridge Mountain Group to the northwest and the Mad Indian Group to the southeast (Neathery, 1975). The southwest salient is divided into three units: the Wedowee Group, the Higgins Ferry Group, and the Hatchet Creek Group (Neathery, 1975; Tull, 1978; Thomas and Neathery, 1980). The Wedowee occurs along part of the northwest side of the southwest salient, becoming a prominent lithologic unit in Chilton County. Southeast of the Wedowee is the Higgins Ferry which is the major rock unit of the southwestern salient. Southeast of the Higgins Ferry is the Hatchet Creek Group.

Rocks of the Wedowee Group are principally ± quartz-graphite-sericite phyllite to fine-grained schist and ± chlorite-sericite phyllite to fine-grained schist. The Poe Bridge Mountain and Higgins Ferry Groups contain distinctive sequences of interlayered coarse-grained, commonly retrograded, graphitic feldspathic mica schist; graphitic and garnetiferous quartzite; garnet mica schist; fine-grained biotite gneiss (metagraywacke); and quartzite. Two major amphibolite sequences also occur associated with these groups: the Ketchepedrakee Amphibolite with the Poe Bridge Mountain Group and the Mitchell Dam Amphibolite with the Higgins Ferry Group. Chemically, these amphibolites resemble low-potassium tholeiitic basalts (Stow and others, 1984) suggesting deposition in a spreading back-arc basin (Neathery and Hollister, 1984). Associated with the amphibolites are highly manganiferous rocks (quartzites, schist, and gneiss) which are products of volcanogenic hydrothermal alterations (Neathery and Hollister, 1984; Schafer and Coolen, 1985). The Mad Indian and Hatchet Creek Groups are much more homogeneous in composition and consist of feldspathic garnet-quartz-muscovite schist, minor amounts of biotite (garnet) schist and gneiss, micaceous quartzite, migmatitic gneiss, and rare amphibolite. These two sequences typically contain abundant pegmatite and small granitoid bodies. Structural details indicate a complex fold history of at least four periods of deformation for the rocks of the Coosa block (Tull, 1978). Metamorphic grade of the Coosa block rocks ranges from kyanite to sillimanite. Local areas have upper greenschist facies retrograde mineral assemblages (Neathery, 1975). Hornblende from the Mitchell Dam Amphibolite near the Coosa River yields a K-Ar date of 348 m.y. and may reflect the time of regional uplift (Wampler and others, 1970).

TALLAPOOSA BLOCK

The Tallapoosa block is bounded on the northwest by the Enitachopco line fault and on the southeast by the Brevard fault zone (fig. 2). Throughout its length, the Enitachopco line fault is defined by a distinct zone 0.5 to 2 miles wide of small imbricate thrust slices and phyllonite (schuppen structure) (Tull, 1975).

The Tallapoosa block contains two distinctly different metasedimentary sequences: the Wedowee Group and the Emuckfaw Group (Neathery, 1975). The Wedowee Group forms the most areally extensive unit in the Northern Piedmont. The internal metamorphic stratigraphy of the Wedowee is complex as a result of a diverse original sedimentary rock assemblage and the different metamorphic and tectonic facies superimposed on them (Neathery and Reynolds, 1973). The Wedowee can be subdivided into two major metasedimentary sequences: the structurally lower Cragford Phyllite (graphite-sericite phyllite, sericite phyllite, feldspathic quartz-sericite phyllite, and garnet-sericite phyllite) and the overlying Cutnose Gneiss (feldspathic biotite-quartz gneiss and graphite-chlorite-sericite schist and phyllite) (Neathery and Reynolds, 1973). Metagraywacke and quartzite are common to rare, especially in the Cutnose Gneiss. Amphibolite is very rare, although chlorite-rich chlorite-sericite phyllite is locally present in the lower part of the sequence (Neathery, 1975). Along the northwest side of the Tallapoosa block is a zone 0.5 to 2 miles wide of schist and gneiss (Hackneyville Schist) that contains distinctive large prophyroblasts of muscovite and andalusite and has a multiply foliated texture.

In the southeastern part of the Tallapoosa block there are several areas of polydeformed and multiply foliated rock consisting predominantly of a mylonitic garnetiferous muscovite-biotite-quartz-plagioclase schist that Neathery and Reynolds (1975) named the Cornhouse Schist. Associated with the Cornhouse Schist is a series of elongate masses of sheared and retrograded amphibolite named the Beaverdam Amphibolite. Bentley and Neathery (1970) interpreted the relationship and areal distribution of these rocks to define the apparent cores of a series of tightly folded northwest-verging synform structures related to movement associated with the Omaha, Alexander City and Brevard faults in this area.

The Emuckfaw Group on the southeast side of the Tallapoosa block is an interlayered sequence of muscovite-biotite schist, metagraywacke, and locally quartzite and amphibolite. In the eastern part of the outcrop belt, there is a zone of graphitic aluminous schist (Glenloch Schist) that forms the core of a southwest-plunging antiform (Crawford and Medlin, 1973). Scattered throughout the Coosa and Tallapoosa blocks are small bodies of metamorphosed ultramafic and mafic rock (pyroxenite and gabbro). Typically, the mineral assemblages of the Wedowee, Cornhouse and Emuckfaw rocks are in the middle to upper amphibolite facies of regional metamorphism; scattered areas contain retrograded rock in which the mineral assemblages are in the upper greenschist and lower amphibolite facies.

The Tallapoosa block contains many granitoid plutons that range in composition from granite to quartz diorite (Deininger, 1975). Most plutons are exposed in the southwestern part of the block. The largest pluton is the Elkahatchee Quartz Diorite Gneiss, which includes minor masses of a strongly foliated granite (Hissop Granite) and trondhjemite (Rockford Granite). The Elkahatchee and another granitic mass, the Kowaliga Gneiss, comprise almost 40 percent of the exposed rock in the Tallapoosa block. Smaller granitic plutons (Almond Trondhjemite and Bluff Springs Granite) are scattered in the northeast part of the block. Intruded within the Emuckfaw Group are a series of narrow elongate sills(?) of granitic rock (Zana Granite) (520 m.y., Russell, 1978). The relationship of these sills to the Kowaliga Gneiss or the Emuckfaw is uncertain. In general, contacts between granitoid rocks and the metasedimentary rock sequences are obscure. Field relationships suggest that most bodies have an intrusive contact relationship, but Deininger (1975) has suggested that a number of the granite masses may be paragneisses and some contacts may be unconformities. Radiometric age determinations by Russell (1978) provide a U-Pb zircon age of 516 m.y. and a Rb-Sr whole rock age of 490 ± 26 m.y. for the Elkahatchee Quartz Diorite Gneiss, a U-Pb age of 520 m.y. for the Kowaliga Gneiss, and a Rb-Sr age of 366 ± 18 m.y. for the Bluff Springs Granite pluton in the northeast part of the block. The Elkahatchee, Kowaliga, Zana and Bluff Springs are premetamorphic granitoid intrusions.

The Tallapoosa block contains three major internal faults: the Alexander City fault, Omaha fault, and a series of microbreccia zones which splay off the Abanda fault of the Brevard fault zone (fig. 2). Both the Alexander City and the Omaha faults are characterized by intense shearing of schist units adjacent to the faults, and the faults separate similar lithologic units. The Alexander City and Omaha faults also coincide with a prominent aeromagnetic high (Neathery and others, 1976) and may represent segments of a single fault (Bentley and Neathery, 1970). The microbreccia zones appear to be extensions of late lateral shear along the Brevard fault. Along each fault, cleavage dips southeast at steep to moderate angles. Mineral lineations and axes of rare small folds plunge steeply east or southeast.

BREVARD FAULT ZONE

The Brevard fault zone in Alabama is best described as a narrow zone of moderately sheared rock locally containing more intensely sheared rock. Throughout most of its length in Alabama, the zone is bounded on the northwest by the Abanda fault and on the southeast by the Katy Creek fault. Between the two faults is a distinctive metasedimentary unit, the Jacksons Gap Group, which consists of sericite-quartz phyllonite, sericite phyllonite, graphite-quartz schist, quartzite, chlorite-sericite phyllite, metaconglomerate, porphyroclastic gneiss, and mylonite. Locally, mafic units are included in the sequence.

The internal stratigraphy of the Brevard fault zone changes along strike southwest from the Alabama-Georgia boundary. Near the convergence of the Omaha, Alexander City, and Abanda faults, cataclasis is intense and most of the recognizable units to the northeast become obscure. Farther southwest along strike, the intensity of cataclasis decreases and an internal lithology is definable. About halfway across the Alabama Piedmont the rocks of the Jacksons Gap Group abruptly trend southward, cataclasis further decreases, and the metasedimentary nature of the rock units in the Jacksons Gap becomes recognizable. Truncation of rock type along strike suggests that the Brevard crosscuts the regional strike of rock units at a low angle.

INNER PIEDMONT

The Inner Piedmont is bounded on the northwest by the southern boundary fault of the Brevard fault zone and on the southeast by the northwest edge of the Towaliga fault zone (fig. 2). Rocks of the Inner Piedmont are subdivided into the Dadeville Complex and the Opelika Complex on the basis of distinctive stratigraphy and tectonic style (Bentley and Neathery, 1970).

The Dadeville Complex comprises the northwestern two-thirds of the Inner Piedmont southeast of the Brevard fault zone and is interpreted to be a major synformal structure (Bentley and Neathery, 1970). The Dadeville consists of two lithodemic sequences: (1) a mafic volcaniclastic sequence composed of chlorite-actinolite schist and chlorite quartzite (Waresville Schist), an amphibolite (Ropes Creek Amphibolite), and a felsic volcaniclastic sequence composed of hornblende gneiss, muscovite schist, and quartzite (Waverly Gneiss) that forms the major rock assemblage of the synform and (2) a sequence of interlayered biotite-garnet-muscovite schist, biotite-muscovite schist, biotite gneiss, and thin amphibolite units (Agricola Schist) that define the core of the synform. Pegmatites are common in the Agricola Schist. Large ultramafic pyroxenite lenses, mafic igneous rocks, and a sequence of leucocratic granitic gneisses (Rock Mills and Camp Hill Granite Gneisses) complete the rock assemblages of the Dadeville Complex. The relationship of the Rock Mills Granite Gneiss to the Camp Hill Granite Gneiss is unclear. Both appear continuous over wide areas and have distinctly different compositions and bulk chemistry. The Rock Mills is almost a true granite, whereas the Camp Hill appears to be a quartz monzonite to quartz diorite (Bentley and Neathery, 1970).

The Opelika Complex on the southeast is separated from the Dadeville Complex by the Stonewall Line (Bentley and Neathery, 1970), a major lithodemic discontinuity (fig. 2). The Opelika Complex consists of three major units: (1) an interlayered fine-grained biotite-oligoclase gneiss and a very coarse-grained muscovite-biotite schist (Auburn Gneiss); (2) a kyanite-sillimanite-muscovite schist and quartzite sequence with a few thin amphibolite units (Loachapoka Schist); and (3) a series of deformed granitic plutons (Bottle Granite).

The general distribution of foliations in the Inner Piedmont defines a system of northeast-plunging folds. Mesoscopic and megascopic structures indicate highly ductile deformation with a major transport from the southeast. The largest fold is the Tallassee synform which occupies the western part of the outcrop area of the Dadeville Complex (fig. 2). Two smaller, but similar synforms, the Boyds Creek synform (Bentley and Neathery, 1970) and the Cusseta synform (Sears and others, 1981) are present along the southeast side of the Inner Piedmont. These structures, together with a number of tight megascopic isoclines, which have predominantly south- and southeast-dipping recumbent axial surfaces and easterly plunges, led Bentley and Neathery (1970) to postulate that the Inner Piedmont is an allochthonous block, a nappe or large thrust sheet, rooted south of the Pine Mountain block in the Southern Piedmont. Subsequent work by Sears and others (1981) has shown that the structural style is more complex and involves the transposition, detachment, folding, and refolding of a series of nappes.

SOUTHERN PIEDMONT

The Southern Piedmont lithotectonic province is divided into two structural blocks: the Pine Mountain block and Uchee block (fig. 2). The Southern Piedmont includes two major regional fault zones: the Towaliga fault zone, which separates the Pine Mountain block from the Inner Piedmont block, and the Goat Rock fault zone, which separates the Pine Mountain block from the Uchee block (Bentley and Neathery, 1970).

PINE MOUNTAIN BLOCK

The Pine Mountain block is bounded on the north by the northwest edge of the Towaliga fault zone and on the south by the Bartletts Ferry fault of the Goat Rock fault zone (fig. 2). The block includes the cataclastic rocks of the Towaliga fault zone on the northwest, an older basement schist and gneiss complex (Wacoochee Complex), and a younger metasedimentary sequence of quartzite, marble, and aluminous schist (Pine Mountain Group).

The Towaliga fault zone is a 4.5- to 6.0-mile-wide zone of cataclastic rock along the northwest side of the Pine Mountain block (plate 2) and represents, in part, the sheared limbs of overturned nappes (Sears and others, 1981). Rocks within the fault zone include mylonite, blastomylonite, mylonite gneiss, mylonite schist, mylonite quartzite, microbreccia, and scattered tectonic slices of the quartzite-marble-schist sequence of the Pine Mountain Group. The main movement zone of the Towaliga fault appears to cut obliquely across regional strike. A splay off the north side of the Towaliga fault bounds a large slice of Pine Mountain rock (Manchester Schist) whereas within the Towaliga fault zone are thin, isolated fragments of nappe limbs composed of Pine Mountain rock. Units within the fault zone generally dip steeply northwest but locally the dip is vertical or steep to the southeast. Minor folds within the fault zone suggest a late folding episode subsequent to major tectonic movement.

Southeast of the Towaliga fault zone is the Pine Mountain block proper. Basement rocks of the Pine Mountain block consist of three poorly exposed highly deformed units of feldspathic schist and gneiss of the Wacoochee Complex: the Halawaka Schist, the Whatley Mill Gneiss, and the Phelps Creek Gneiss (Bentley and others, 1971). The Halawaka Schist and the Whatley Mill Gneiss are highly deformed and appear to represent original basement rock. The Phelps Creek Gneiss appears to have intruded the Halawaka contemporaneously with latter stages of deformation but prior to deposition of the overlying Pine Mountain metasedimentary sequence. Much of the gneiss has feldspar augen as much as 10 inches in diameter. Pegmatites and granitic dikes are common. Radiometric age dates of gneiss in the Pine Mountain block in Georgia indicate a 1.1 billion year old basement (Odom and others, 1973).

The overlying younger metasedimentary sequence, the Pine Mountain Group, consists of: the Hollis Quartzite, Chewacla Marble, and Manchester Schist (Clarke, 1952; Bentley and Neathery, 1970). The Hollis Quartzite is composed mostly of well-sorted quartz and contains minor amounts of muscovite, microcline, and sulfide minerals. The Chewacla Marble is fine- to coarse-grained light-gray dolomitic marble typically containing flow folds. Overlying the marble is the Manchester Schist, which is composed of a lower graphitic aluminous schist and biotite schist unit, a middle quartzite unit similar to the Hollis Quartzite, and an upper unit of biotite-muscovite-quartz schist and feldspathic schist. Locally, the entire sequence has been injected with granite dikes and pegmatites.

UCHEE BLOCK

The southeasternmost structural block in the Alabama Piedmont is the Uchee block. It is bounded on the northwest by the Bartletts Ferry fault, the northwest edge of the Goat Rock fault zone, and on the south it is covered by Upper Cretaceous sediments of the Gulf Coastal Plain (fig. 2).

In western Georgia and eastern Alabama, the cataclastic zone of the Goat Rock fault zone is nearly 5 miles wide. Within the zone foliations strike N. 45 E. and dip moderately to the southeast. Mineral lineations and fold axes are subhorizontal. Locally, small steeply plunging late folds suggest a movement subsequent to major mylonitization and recrystallization. The Goat Rock fault zone includes a wide assortment of cataclastic rocks apparently derived from rocks of the Uchee Group to the southeast. The zone includes blastomylonite, porphyroclastic-blastomylonite, mylonite, ultramylonite, mylonite gneiss, and minor units of mylonite amphibolite. The Goat Rock fault zone includes two extensive ultramylonite zones: one along the northwest boundary (Bartletts Ferry fault) and another, the principal zone of movement, near the middle of the zone (Goat Rock fault).

Migmatitic gneiss and schist comprise most of the Uchee block in Alabama (Motts Gneiss, Moffits Mill Schist, Uchee Complex). Intruded into the Motts Gneiss and the southern edge of the Goat Rock fault zone are a number of small, nonfoliated epidote-muscovite-quartz diorite to granodiorite plutons (Hospilika Granite). The southern edge of the Goat Rock fault zone dies out southeastward through an 18-mile-wide zone of leucocratic, quartz diorite pencil gneiss and sheared amphibolite (Motts Gneiss). South of the Motts Gneiss, in the western part of the Uchee block, a migmatitic metasedimentary sequence (Moffits Mill Schist) consists of interlayered fine- to medium-grained metagraywacke and biotite-epidote-muscovite-quartz schist. This unit appears to grade eastward into the Phenix City Gneiss of the Uchee Complex, a coarsely crystalline, highly contorted migmatitic gneiss complex composed of biotite-epidote-quartz diorite gneiss, biotite-hornblende gneiss, and epidote-biotite amphibolite. Along the Chattahoochee River are highly sheared and contorted amphibolite units.

A 600 m.y. isotopic age for the Phenix City Gneiss is indicated by U-Pb zircon techniques (Russell, 1978). Rb-Sr whole rock age determinations from phyllonites in the Bartletts Ferry fault indicate a 375 m.y. age for the major deformational or metamorphic event (Russell, 1978). K-Ar age determinations from the Phenix City Gneiss and from a pluton (Hospilika Granite) that cuts the southern margin of the Goat Rock fault zone range from 274 to 303 m.y (Wampler and others, 1970; Russell, 1978). These data appear to place a time constraint on the last movement of the Goat Rock fault.

A number of diabase dikes cross the regional strike of the Inner and Southern Piedmont. Most are narrow and have limited extent; however, six dikes are of sufficient length and width to be mappable. The longest (40 miles) and thickest (50 feet) is the Auburn Dike. Other dikes include the Oak Bowery Dike, Marcoot Dike, Snapper Dike, Danway Dike, and the Salem Dike. Chemically, most of the dikes resemble tholeiitic basalts except the Snapper and Danway which are olivine basalts. Age of the dikes ranges from Late Triassic to Early Jurassic (Deininger and others, 1975).

MINERAL RESOURCES

A variety of metallic and nonmetallic minerals occur associated with the rocks of the Alabama Piedmont. Historically, only a few of these minerals have been successfully exploited. Most of the known mineralization occurs in the Coosa and Tallapoosa structural blocks of the Northern Piedmont although some rocks and minerals of economic use occur in other parts of the Piedmont.

Metallic mineralization in the Alabama Piedmont is concentrated in the northern Piedmont. Gold and copper-pyrite have been produced in limited quantities from small scattered deposits since about 1830. The principal gold-bearing areas are found in southern Cleburne, Clay and Tallapoosa Counties, although isolated occurrences of gold have been found in all counties. Tin was produced from a pegmatite-rich area of central Coosa County between 1940 and 1942. Lead, zinc, arsenic, columbium-tantalum, tungsten, molybdenum, vanadium and manganese also occur in the Northern Piedmont, but in lesser quantities than copper-pyrite, and are often associated with each other. Metallic mineralization in the Inner Piedmont and Southern Piedmont parts of the Alabama Piedmont is poorly known. Pyrite, magnetite and chromite have been recognized in several small deposits associated with ultramafic rock but no production is known.

Nonmetallic or industrial minerals produced from rocks of the Alabama Piedmont include mica, feldspar, talc, anthophyllite asbestos, fine-ground calcite and beryl. Other nonmetallic minerals found in the Piedmont include uranium, kyanite, silica, kaolin and barite. Graphite production was one of the largest mineral industries in the Northern Piedmont for more than 40 years. Mica production spanned more than 100 years, and the principal mining activities were centered in Clay and Randolph Counties of the Northern Piedmont and Tallapoosa and Lee Counties of the Inner Piedmont. Feldspar and beryl were obtained as by-products from mica production. Calcium products are produced from stone quarried from the Sylacauga Marble Group. Talc has been mined from metamorphosed dolomite in Talladega County, and talc and asbestos have been mined from ultramafic rocks in Tallapoosa County.

Construction materials represent the major mineral extraction activity in the Alabama Piedmont. Marble, crushed stone and sand and gravel are produced from a variety of sources. Dimension stone was produced from the Sylacauga Marble Group in Talladega County and crushed dolomitic and calcitic marble is produced from marble bodies in Talladega and Lee Counties. Crushed stone, principally granite and granitic gneiss, has been produced from a variety of different granitic bodies scattered throughout the Piedmont. Most production is intermittent, depending on local demand. Sand and gravel are produced principally from the flood plain of the Tallapoosa River in Cleburne County. Smaller deposits on secondary streams supply local markets.

COASTAL PLAIN PROVINCE

The East Gulf Coastal Plain physiographic section of the Coastal Plain province in Alabama is an area of Mesozoic and Cenozoic sediments occupying the southern part of the state and parts of the western tier of counties where mostly unconsolidated sediments of the Coastal Plain overlap consolidated rocks of the Plateaus, Valley and Ridge, and Piedmont provinces. In Alabama, the strike belts of the Coastal Plain sediments trend east-west in eastern and central parts of the state, trend northwest in western Alabama, and trend northward from Lamar County as part of the regional trend of stratigraphic units along the eastern flank of the Mississippi embayment (fig. 1).

In northwestern Alabama, Coastal Plain sediments cap hills and plateau remnants of Paleozoic rock and are usually from 50 to 1,000 feet thick. The sediments thicken rapidly to the south and near the coast are probably more than 24,000 feet thick where they overlie metamorphic or igneous rocks. In southeastern Alabama, Coastal Plain sediments are about 8,000 feet thick and overlie Mesozoic volcaniclastic rocks, metamorphic rocks, and a small area of unmetamorphosed Paleozoic rocks (King, 1961; Neathery and Thomas, 1975; Horton and others, 1984).

Most of the Coastal Plain is an area of low to moderate relief, and the topography is considerably more gentle than that of the bordering regions. However, stream valleys commonly have 200 to 400 feet of relief. Resistant beds in some of the Cretaceous formations form broadly arcuate cuestas that rise from 50 to 200 feet above the surrounding prairie floors in parts of central Alabama. Further south, in parts of Choctaw, Clarke, and Monroe Counties are hills underlain by resistant parts of Eocene formations that interrupt the otherwise gentle slope of the land surface to the Gulf. Gently rolling landscapes and broad flat areas are common near the southeastern corner of Alabama where the formations are composed mainly of easily eroded sediments.

STRATIGRAPHY

The record of Coastal Plain sedimentation in Alabama begins with the deposition of several thousand feet of sediments ranging in age from Late Triassic to Early Cretaceous that are deeply buried and not exposed at the surface (plate 1). The earliest known Coastal Plain sediments were deposited as fine and coarse siliciclastic red beds (Eagle Mills Formation, Late Triassic) in grabens on the rifted margin of the developing Gulf of Mexico basin as described by Rainwater (1967) and Woods and Addington (1973). The Eagle Mills red beds are mainly silty to sandy calcareous mudstone, red cross-bedded sandstone and thin zones of conglomerate deposited in continental oxidizing environments (Tolson and others, 1983). Assumed Triassic sediments in southeast Alabama are mostly red beds of arkosic sandstone and mudstone and are associated with mafic igneous rocks of basaltic or diabasic composition (Neathery and Thomas, 1975). In southwestern Alabama Coastal Plain sedimentation began with the deposition of the Werner Formation which includes a lower conglomeratic red-bed sequence and overlying beds of massive anhydrite and thin beds of sandstone and salt. Early patterns of sedimentation in the Triassic and Jurassic were strongly controlled by topographic prominences in the area.

Arid conditions persisted in part throughout most of Jurassic time and evaporite minerals are common in Middle Jurassic rocks and parts of the Upper Jurassic rocks. The deposition of formations known to be of Jurassic age was confined to embayments in southwestern Alabama. Red beds in eastern Alabama that overlie the probable Triassic beds may be of Jurassic age but lithologic units suitable for paleontologic determinations have not been located. Massive beds of salt (Louann Salt) of undetermined thickness were deposited above the Werner. In the Late Jurassic as overlying sediments began to accumulate, flowage of the salt affected the deposition of Upper Jurassic and later sediments. Above the Louann is a sandstone (Norphlet Formation) that in updip areas of Choctaw, Clarke and Monroe Counties is mainly fluvial in character and includes beds of shale and conglomerate. Downdip the Norphlet sandstones are quartz rich (Denkman Sandstone Member) and consist of gray and brown very fine- to medium-grained subarkose deposited mainly as dune and interdune sediments with wadi and playa lake sediments in interdune areas. In Mobile Bay and areas near the coast the upper part of the formation includes shoreface sands probably reworked from the underlying sediments (Mancini and others, 1985).

Following the deposition of the Norphlet, the Gulf basin deepened and widened and more open marine conditions prevailed (Tolson and others, 1983). Carbonate rocks were deposited in central parts of the embayments and mixed carbonates and evaporites were deposited in restricted shallow water areas and along the margins of the embayments (Smackover and Haynesville Formations).

In the later stages of the Jurassic, land masses to the north of the Gulf basin apparently were uplifted and large volumes of mostly red clastics (Cotton Valley Group) were spread southward by an extensive prograding delta (Tolson and others, 1983). Cotton Valley sediments are widespread in southwest Alabama and extend further to the north than the underlying Smackover and Norphlet. The mostly red Cotton Valley fine and coarse clastics were deposited in paralic environments that reflect terrestrial, marginal marine, and shallow sea conditions. Deposition of the fine and coarse clastics continued into the Early Cretaceous. The updip limit of the Cotton Valley is indistinct; however, approximately 100 feet is identifiable in Sumter County. The group thickens rapidly to the south and is from 2,000 to 3,000 feet thick in the coastal counties.

Sediments of the Lower Cretaceous are mainly terrigenous clastics consisting mostly of interbedded sandstone and shale and conglomeratic sandstone deposited as part of a large fluvial-deltaic complex that extended from the Atlantic Coastal Plain into Mexico. A series of shallow marine beds of anhydrite and limestone occur near the middle of the Lower Cretaceous sequence in parts of southwestern Alabama (Ferry Lake Anhydrite and Mooringsport Formation). The Lower Cretaceous is subdivided into numerous formations in Mobile and Baldwin Counties, but elsewhere in south Alabama, the Lower Cretaceous succession is not differentiated (plate 1). The entire sequence ranges in thickness from less than 50 feet in updip areas of southern Pickens and Perry Counties to more than 7,000 feet in southern Alabama.

Upper Cretaceous formations of the Tuscaloosa Group unconformably overlie the Lower Cretaceous strata and in the subsurface of coastal counties are partly fossiliferous, nearshore, marine clastics (Mancini and Payton, 1981). The shelf and marine bar sands of the subsurface grade updip into lower delta plain fine and coarse clastics and estuarine deposits that are exposed at the surface as the member formations of the Tuscaloosa Group. The Eutaw Formation overlies the Tuscaloosa Group and indistinct contacts in the subsurface indicate that the Eutaw and Tuscaloosa are all part of a genetically related sedimentary cycle. In outcrop, basal beds of the Tuscaloosa are mainly fluvial and grade upward into estuarine, inner-shelf marine and open bay sands and fine clastics of the Eutaw Formation (Reinhardt, 1980).

Following the deposition of the Eutaw Formation, a broad epicontinental sea formed over the present Gulf Coastal Plain. Accumulations of micro-organisms in the epicontinental sea formed thick deposits of chalk (Selma Group). Streams in western Mississippi and eastern Alabama introduced fine and coarse clastics into the margins of the epicontinental sea. Interfingering of the chalk formations of western Alabama and clastic equivalents in eastern Alabama (Blufftown and Ripley Formations and Providence Sand) occurs in central Alabama and eastward (plate 1) (Monroe, 1941). A tongue of the Mooreville Chalk at the base of the Selma Group extends eastward into Russell County. A tongue of the Providence Sand extends as far west as western Lowndes County.

The Selma Group is mainly chalk, but it also includes a formation composed mainly of sand with some clay that extends across the entire state (Ripley Formation). Resistant beds of sandstone in the Ripley form cuestas that are prominent features in the inner Coastal Plain. The Ripley and the eastern Alabama clastic equivalents of the Selma are restricted to the areas of outcrop and the shallow subsurface. Downdip the clastic units merge with mostly undifferentiated chalk deposits of the Selma Group. The Ripley in central and western Alabama is overlain by chalk and calcareous clay of the Prairie Bluff Chalk. The Prairie Bluff in western Alabama is sandy fossiliferous chalk. In Lowndes and Montgomery Counties the formation includes large amounts of fine terrigenous clastic sediments where it begins to intertongue with the Providence Sand. In Wilcox, Dallas and Marengo Counties, the Prairie Bluff is thin and discontinuous, and apparently was eroded in places prior to the deposition of the overlying Paleocene Clayton Formation. The Prairie Bluff in Sumter County is mostly sandy chalk.

Following the deposition of the Prairie Bluff, the seas regressed and the area was eroded removing part of the rock record (Pessagno, 1967). The erosional unconformity separating the Cretaceous and Tertiary sediments represents a significant gap in the sedimentary record (plate 1). Initial deposition in the Tertiary Period began with the Paleocene Clayton Formation of the Midway Group which extends across the entire Coastal Plain. In eastern Alabama the formation is up to 380 feet thick; it thins westward to 150 feet in Wilcox County and in extreme western Alabama is 20 feet thick or less. The formation in eastern Alabama is mainly a fossiliferous limestone, in central Alabama it is a silty clay with thin interbeds of limestone overlain by massive limestone, and in western Alabama, although not well preserved, it is mostly limestone. The Clayton Formation is overlain unconformably in eastern Alabama by the Nanafalia Formation of the Wilcox Group and its nonmarine equivalent beds and elsewhere by the Porters Creek Formation of the Midway Group.

The Porters Creek Formation is a massive, marine, dark-brown to black clay with thin interbeds of limestone locally and includes a thin bed of shell marl at the top. In the subsurface, equivalent strata comprise the shale of the Midway Group which is 1,000 feet thick or more. An extensive network of estuaries and marshes developed along the margins of the coastline following the deposition of the Porters Creek, and deposits formed include thinly laminated beds of sand, silt, clay and lignite (Naheola Formation of southwestern Alabama) (Toulmin, 1977). Equivalent beds in southeastern Alabama were eroded away or not deposited, but lignite and sand are preserved in depressions and karst features in the top of the Clayton Formation. The succeeding formations of the Wilcox Group (Nanafalia Formation, Tuscahoma Sand and Hatchetigbee Formation) were all deposited in marginal marine and estuarine environments. Intermittent marine transgressions or minor basin subsidence events resulted in the deposition of thin shell marl beds. The prominent marl beds in surface exposures are the "*Ostrea thirsae* beds" in the Nanafalia, the Bells Landing and Greggs Landing Marls in the Tuscahoma, and the Bashi Marl at the base of the Hatchetigbee. The formations of the Wilcox Group are 1,750 feet thick in southwestern Alabama and 650 feet thick in southeastern Alabama. In outcrop the formations of the Wilcox Group are uniform in composition and are mainly thinly laminated interbedded carbonaceous clay, silt, and fine sand; thin beds of lignite and sand; and persistent beds of shell marl which increase in number in the subsurface.

Shallow marine sediments comprise the middle Eocene formations (Tallahatta and Lisbon Formations and Gosport Sand). Minerals indicative of altered volcanic materials and clay are mixed with the fossiliferous sand beds of the Tallahatta (Reynolds, 1970). The Lisbon is a variety of nearshore marine sand and estuarine sand and clay deposits in southwestern Alabama and in southeastern Alabama includes beds of limestone. The Gosport Sand at the top of the middle Eocene is a highly fossiliferous unit composed mainly of shells that is exposed locally in southwestern Alabama. In the subsurface, the Tallahatta and Lisbon become entirely marine and more calcareous.

Formations of the upper Eocene (Jackson Stage) in western Alabama are mostly nearshore and open marine sand and fossiliferous clay with thin interbeds of fossiliferous limestone (Moodys Branch Formation and Yazoo Clay). In central and eastern Alabama equivalent formations are composed mainly of calcareous sand and fossiliferous limestone (Moodys Branch and Crystal River Formations). In eastern Alabama the upper Eocene units are exposed in the valleys of the principal streams but elsewhere are deeply weathered to sandy and clayey residuum containing chert boulders. Downdip formations of the Jackson Stage consist mostly of fossiliferous limestone. As the Jackson Stage came to an end the epicontinental sea covering the southern parts of the Alabama Coastal Plain became shallower.

Shallow marine limestones are typical of the Oligocene in most of south-central and southwestern Alabama. Any limestone that may have been present at the surface in southeastern Alabama is now deeply weathered and is included in Tertiary residuum on geologic maps. Near the Alabama-Mississippi boundary fine clastic materials were spread into the sea forming the Red Bluff Clay and the associated Forest Hill Sand while limestone of the Bumpnose Limestone was being deposited from central Clarke County eastward into Covington County. The overlying Marianna Limestone is a distinctive, shallow, warm-water limestone containing large foraminifers. The formation can be traced into the shallow subsurface but apparently does not occur downdip. The lower-half of the Byram Formation, which overlies the Marianna, is mainly limestone (Glendon Limestone Member and an unnamed member) and the upper part is mostly dark carbonaceous clay with thin lenses of glauconitic sand. This upper Bucatunna Clay Member of the Byram is a distinctive subsurface marker reported to contain bentonite (Toulmin and others, 1951) and includes a thin bed of lignite in Monroe County (Ivey, 1957).

The Chickasawhay Limestone and Paynes Hammock Sand occur at the top of the Oligocene Series. The Chickasawhay is mostly fossiliferous soft limestone at the surface that is traceable in the subsurface and to offshore areas. The Paynes Hammock is mostly fossiliferous nearshore marine sand and estuarine sand and clay that is poorly exposed and not readily traced into the subsurface. The Paynes Hammock is partly a facies equivalent of the Chickasawhay. In the subsurface the Chickasawhay and Bucatunna near the top of the Oligocene overlie limestone of late Eocene Jackson age.

Following the close of the Oligocene, the epicontinental sea receded from all but the southern part of the state and fluvial siliciclastics of clay, sand and gravel were spread over the southern part of the Coastal Plain. Undifferentiated sediments of the Miocene have been mapped as far north as southern Choctaw County and eastward but in southeastern Alabama are not differentiable and have been mapped as a part of the Tertiary residuum. In the southern parts of Mobile and Baldwin Counties Miocene coarse clastic sediments grade into or interfinger with nearshore marine clay and sand of the Pensacola Clay. The sand and clay units in the Pensacola overlie the Tampa Limestone and contain open marine foraminiferal faunas of middle Miocene age (Raymond, D. E., 1985a). The

Miocene sediments thicken downdip to about 2,600 feet at the mouth of Mobile Bay. The Miocene Series also includes clay beds of early Pliocene age as determined from a vertebrate fossil locality in the area (Whitmore, 1983).

The Citronelle Formation of Pliocene-Pleistocene age consists of deeply weathered red sands, fine quartz and chert pebble gravels, and beds of varicolored clays deposited by fluvial processes. The Citronelle is best exposed in Mobile, Baldwin and Escambia Counties and is widely distributed as outliers or as a veneer over older formations beyond those limits, especially in Conecuh, Monroe and Washington Counties.

Terrace remnants unconformably overlie older geologic units throughout southern and western Alabama and generally occur in areas adjacent to major streams and their larger tributaries. The terraces, which probably range in age from late Pliocene to Holocene, represent ancient flood plains of major streams that were abandoned when the streams entrenched to lower elevations. The deposits consist chiefly of lenses of poorly sorted gravel, cross-bedded sand, silt and clay.

Alluvial deposits of Holocene age underlie the floodplains of all the major streams in south Alabama and unconformably overlie units of older geologic age. The alluvial deposits are very similar lithologically to terrace deposits but generally contain greater quantities of organic material.

The alluvial deposits and the sediments composing the beaches along the coast are the youngest deposits occurring in the East Gulf Coastal Plain section (Carlston, 1950). The beach sand is mostly fine to medium grained, subangular to subrounded and quartzose and may contain shells, shell debris, assorted plant and animal fragments, and traces of heavy minerals such as ilmenite and rutile.

STRUCTURAL FEATURES

The principal structural features of the Alabama Coastal Plain, with surface expression, are mainly in the southwestern part and include the Livingston fault zone, the Bethel fault zone, the Gilbertown-West Bend-Pollard fault zones, the Hatchetigbee anticline, the Jackson fault and numerous minor faults (fig. 2). Structures in southeastern Alabama are mostly deeply buried and poorly known. The Gordon anticline in the vicinity of the Chattahoochee River in Houston County is described by Hager (1918) and folds exposed along the Chattahoochee River are shown in Toulmin and others (1964). Minor faults also occur in southeastern Alabama but the traces are not nearly as long or displacements as great as those in southwestern Alabama.

The Livingston fault zone extends for about 40 miles as a long narrow belt from northwestern Sumter County southeastward into north-central Marengo County (Monroe and Hunt, 1958). The zone is nearly continuous (fig. 2) but is covered by flood-plain deposits of the Tombigbee River near the Sumter-Marengo County boundary. In Sumter County the Demopolis Chalk, Ripley Formation and Prairie Bluff Chalk are within the zone of faulting where the strata are broken into a series of parallel horsts and grabens that strike generally N.70°W. and are bounded by high-angle reverse faults. Displacements along the faults may exceed 90 feet but usually average about 40 feet (Self, 1976). The faults in Marengo County are separated at the surface by a series of narrow parallel blocks of Demopolis Chalk that project upward into sands of the Ripley Formation. The maximum vertical displacement is about 75 feet (Newton and others, 1961).

The Gilbertown-West Bend and Pollard-Foshee fault zones in Alabama are part of a peripheral fault system described by Murray (1961) that occurs near the updip limits of thick Jurassic carbonates and near the margins of Jurassic salt basins. The peripheral faults dip both basinward and landward forming regional partly en echelon grabens about 4 miles wide. The Gilbertown-West Bend fault zone can be traced at the surface across Choctaw and Clarke Counties, but the Pollard-Foshee fault zone is concealed by Miocene and Citronelle sediments in Escambia County. The displacements of the faults range from 75 to 300 feet at the surface but increase with depth.

The Bethel fault zone in Wilcox County has been mapped for about 20 miles in southwestern Wilcox County by LaMoreaux and Toulmin (1959) and a northwestern extension has been mapped in southeastern Marengo County (Newton and others, 1961). The Bethel and associated faults deform beds of the Wilcox Group at the surface and have vertical displacements of up to 100 feet. Faults of the Bethel zone in southwestern Wilcox County are possibly related to the peripheral faults to the southwest and overlie a salt-bearing Jurassic embayment.

The Hatchetigbee anticline is a broad elongate asymmetric structure which extends 30 miles southeast from the Mississippi State boundary across the southern part of Choctaw County and northeast corner of Washington County into west-central Clarke County. The Hatchetigbee Formation of the Wilcox Group is the oldest formation exposed at the surface in the breached crest of the anticline. Oligocene sediments surround the structure and beds dip more steeply on the southwest flank.

The southeast end of the Hatchetigbee anticline merges in unknown relationships with the Jackson fault. The Jackson fault at the surface is about 18 miles long and has a general northerly trend from its known southern extent to a point northwest of Jackson, Alabama (fig. 2). The fault is downthrown to the west and as reported by Toulmin (1940) has a minimum throw of 1,350 feet at the surface.

MINERAL RESOURCES

The Coastal Plain is a source of a wide variety of raw-material products and fossil fuels. All the materials necessary for construction are abundant in the area. Sand and gravel are mined in almost every county in south Alabama. Much of this sand and gravel is used in road construction and as aggregate within Alabama and is also transported to adjoining states. Calcareous rocks suitable for the manufacture of cement are present in the chalks of the Selma Group and the limestone formations of Eocene and Oligocene age in southwest Alabama. Limestone of the region has also been used widely for soil conditioning. Clay minerals such as bentonite, zeolite, high-alumina clay, and kaolin also occur in the Coastal Plain. Clays suitable for bricks and tiles occur in western Alabama and high-alumina clays, including kaolin, used for refractories occur in the southeastern part of the state. Bentonite used as bond for foundry sand and for absorbents occurs in Lowndes and Crenshaw Counties. Expansive clay for aggregate and pet supplies occurs in the Porters Creek Formation in Choctaw, Marengo, Sumter and Wilcox Counties. Zeolite minerals are common constituents of the Clayton, Nanafalia and Tallahatta Formations (Reynolds, 1970). Brine for industrial chemicals is solution-mined from a shallow salt dome near McIntosh in Washington County.

Fossil fuels produced in south Alabama include oil, gas, and gas condensate. Crude oil is produced from formations of the Jurassic in Baldwin, Choctaw, Clarke, Escambia, Mobile, Monroe and Washington Counties; from Lower Cretaceous formations in Baldwin and Mobile Counties; and from the Upper Cretaceous formations in Baldwin, Choctaw, Clarke, and Escambia Counties. Natural gas is produced from formations of Jurassic age in Baldwin, Choctaw, Clarke, Escambia, Mobile, Monroe, and Washington Counties. In addition, large quantities of natural gas are being discovered in the Norphlet Formation in Mobile Bay and adjoining areas offshore. Deep wells in the Smackover and Norphlet Formations in Escambia, Mobile and Washington Counties yield large quantities of gas condensate. Sulfur, propane, butane, and natural gasoline are by-products of the cleansing and extraction plants which process the oil, gas, and condensate from the fields producing from Jurassic formations. Sulfur is important in the production of many chemicals and the sulfur produced at the extraction plants adds considerably to the raw material wealth of the state. More than 4,125,000 long tons of sulfur had been produced through 1985.

A nearly continuous belt of lignite in formations of Paleocene age occurs between Sumter and Henry Counties. Demonstrated resources of lignite in beds from 30 to 60 inches thick occur at relatively shallow depths in the area (Tolson, 1985). A preliminary study by Barnett and Clarke (1983) indicates that considerable quantities of commercial grade peat occur near the coast in Baldwin and Mobile Counties and in the delta of the Mobile River.

DESCRIPTIONS OF LITHOSTRATIGRAPHIC AND LITHODEMIC UNITS

Agricola Schist (Dadeville Complex)

Biotite ±garnet ±sillimanite-feldspar-quartz schist, interlayered with thin-bedded dark-brown hornblende amphibolite and gneiss; contains pegmatite pods and veins. Inner Piedmont.

Type locality: Exposures near Agricola south of Dadeville, Tallapoosa County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 27-28.

Alluvial, coastal, and terrace deposits

Sand, silt, clay, and gravel, varicolored; locally may contain organic matter, peat, shells and shell debris. Coastal deposits present in south Alabama. Thickness ranges from 0 to 150 feet. Pleistocene and Holocene.

Copeland, C. W., 1976, Faults in Tertiary rocks of southwestern Alabama, *in* Copeland, C. W., Newton, J. G., and Self, D. M., Cretaceous and Tertiary faults in southwestern Alabama: Alabama Geological Society Guidebook, 14th Annual Field Trip, p. 26-27.

Almond Trondhjemite

Light-gray to locally white leucocratic trondhjemite, containing abundant muscovite and locally biotite and epidote; typically fine- to medium-grained, locally foliated. Accessory minerals include apatite, sphene, garnet, zircon and a little pyrite. Occurs as scattered phacoliths, sills, dikes and plutons. Northern Piedmont.

Type locality: Exposures in the community of Almond, Randolph County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 13-14.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, 32-43.

Tull, J. F., 1987, Structural setting of granitic plutonism in the Northern Piedmont, Alabama Appalachians, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 23-28.

Size, W. B., and Dean, L. S., 1987, Structural petrology and petrogenesis of trondhjemite, Northern Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 73-95.

Defant, M. J., Drummond, M. S., Arthur, J. D., and Ragland, P. C., 1987, The petrogenesis of the Blakes Ferry pluton, Randolph County, Alabama, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 97-116.

Amphibolite in Uchee Complex

Migmatitic actinolite and orthopyroxene-rich amphibolite. Southern Piedmont.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 57-58.

Schamel, Steven, Hanley, T. B., and Sears, J. W., 1980, Geology of the Pine Mountain window and adjacent terranes in the Piedmont province of Alabama and Georgia: Geological Society of America Guidebook, Southeastern Section, 29th Annual Meeting, p. 7-12.

Arcola Limestone Member of Mooreville Chalk

See Mooreville Chalk.

Type locality: In bluff at old Arcola Landing on Black Warrior River, NE¼ sec. 4, T. 18 N., R. 3 E., Hale County, Alabama, about 5 miles northeast of Demopolis, Alabama.

Stephenson, L. W., and Monroe, W. H., 1938, Stratigraphy of Upper Cretaceous Series in Mississippi and Alabama: American Association of Petroleum Geologists Bulletin, v. 22, p. 1655-1657.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, 150 p.

Belt, R. H., and others, compilers, 1945, Geologic map of Mississippi (1:500,000): Mississippi Geological Society.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Athens Shale

Black graptolitic fissile shale, which in its lower part contains interbeds of argillaceous dark-gray to black limestone. Present in the eastern Valley and Ridge, primarily in the southern part. Thickness ranges from 0 to 300 feet in outcrop. Middle Ordovician, Chazyan-Porterfieldian.

Type locality: Named for exposures at Athens, McMinn County, Tennessee.

Hayes, C. W., 1894, Kingston folio, Tennessee: U.S. Geological Survey Geologic Atlas, Folio 4, 4 p.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 107-112.

Butts, Charles, 1940, Description of the Montevallo and Columbiana Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 226.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 32-42.

Benson, D. J., 1986, Depositional setting and history of the Middle Ordovician of the Alabama Appalachians, *in* Benson, D. J., and Stock, C. W., Depositional history of the Middle Ordovician of the Alabama Appalachians: Alabama Geological Society Guidebook, 23rd Annual Field Trip, p. 22-23.

Attalla Chert Conglomerate Member of the Chickamauga Limestone

Conglomerate of subangular to rounded pebbles, cobbles and boulders of chert and rare dolomite and quartzite in a matrix of sand-sized chert and quartz. Clay is commonly mixed with the clastics. A thin greenish-gray shale and more rarely dark-red to dusky-red shale lenses or beds commonly occur near the base of the Attalla. Locally, the conglomerate grades into a medium- or coarse-grained sandstone. The Attalla Chert Conglomerate Member occurs locally at the base of the Chickamauga Limestone in Jefferson, Blount, Etowah, St. Clair, and Cherokee Counties. Thickness ranges from 0 to 110 feet. Middle Ordovician, Chazyan.

Type locality: Exposures at Attalla, Etowah County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, 24 p.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 120-121.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 10-12.

Auburn Dike

Tholeiitic diabase with a subophitic to intergranular texture. The dike is composed of three segments which average 50 feet in width and extend for approximately 40 miles. Southern Piedmont. Triassic?-Jurassic?

Type locality: Exposures 2½ miles east of Auburn, Lee County, Alabama.

Adams, G. I., 1933, General geology of the crystallines of Alabama: Journal of Geology, v. 41, p. 172-173.

Deininger, R. W., 1966, The petrology of the Auburn dike: Alabama Academy of Science Journal, v. 37, p. 259.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 41.

Deininger, R. W., Dallmeyer, R. D., and Neathery, T. L., 1975, Chemical variations and K-Ar ages of diabase dikes in east-central Alabama: Geological Society of America Southeastern Section Abstracts with Programs, v. 7, no. 4, p. 482.

Auburn Gneiss (Opelika Complex)

Fine-grained biotite-oligoclase gneiss (quartz-diorite), intermixed with very coarse-grained muscovite-biotite schist. Locally, contains a few small muscovite-rich pegmatite veins. Partially weathered exposures are characterized by blocky layers of fine-grained biotite gneiss in a coarse muscovite-rich saprolite. Fresh exposures are found on U.S. Highway 280, 1 mile north of Pepperell and below Opelika Dam, 2 miles northeast of Opelika. Inner Piedmont.

Type locality: Named for exposures in and north of Auburn, Lee County, Alabama. Fresh exposures occur on U.S. Highway 280, 1 mile north of Pepperell, and below Opelika Dam, 2 miles northeast of Opelika, Lee County (Bentley and others, 1971).

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 32.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 13-14.

Sears, J. W., Cook, R. B., Jr., and Brown, D. E., 1981, Tectonic evolution of the western part of the Pine Mountain window and adjacent Inner Piedmont province, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 2-4.

Bangor Limestone

Medium- to medium-light-gray, medium-bedded, primarily bioclastic and oolitic limestone, locally including micrite, shaly argillaceous limestone, calcareous clay shale, and earthy dolostone. Interbeds of dusky-red and olive-green blocky mudstone occur in the upper part of the formation. Present in the Plateaus and the western Valley and Ridge. Thickness ranges from 0 to 700 feet. Upper Mississippian, Chesterian.

Type locality: Exposures at Bangor, Blount County, Alabama.

Smith, E. A., 1890, Appendix on the geology of the valley regions adjacent to the Cahaba field, *in* Squire, Joseph, Report on the Cahaba coal field: Alabama Geological Survey Special Report 2, part 2, p. 155-157, map.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 195-199.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 44-57

Bashi Marl Member of Hatchetigbee Formation

See Hatchetigbee Formation.

Type locality: Exposures on Bashi Creek, Clarke County, Alabama, especially at Wood's Bluff, Tombigbee River, just below mouth of Bashi Creek.

Heilprin, Angelo, 1882, Notes on the Tertiary geology of the southern United States: Philadelphia Academy of Natural Science Proceedings, v. 33, p. 158-159.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 106-107.

Beaverdam Amphibolite

Dark-green to dark-gray very fine- to coarse-grained hornblende amphibolite, with delicate bands of white quartzose, feldspathic material, extensively sheared and folded; locally retrograded to actinolite-tremolite-chlorite schist with minor amounts of albite, magnetite, and epidote. Includes all amphibolite associated with the Wedowee Group. Northern Piedmont.

Type locality: Exposures along Beaverdam Creek in the southern part of the Wadley North Quadrangle, southwest Randolph County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 20-21.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 17-23.

Stow, S. H., Neilson, M. J., and Neathery, T. L., 1984, Petrography, geochemistry and tectonic significance of the amphibolites of the Alabama Piedmont: American Journal of Science, v. 284, nos. 4 and 5, p. 417-418.

Bells Landing Marl Member of Tuscahoma Sand

See Tuscahoma Sand.

Type locality: Exposures at Bells Landing on the Alabama River in Monroe County, Alabama.

Smith, E. A., 1883, Report of the years 1881 and 1882: Alabama Geological Survey Report of Progress 7, p. 256, 321.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 105-106.

Bibb Dolomite

Dark-gray coarsely crystalline, thick-bedded, highly siliceous dolomite, characterized by locally abundant chert with irregular cavities. Crops out in the southern part of the eastern Valley and Ridge. Thickness ranges from 250 to 500 feet. Upper Cambrian, Franconian.

Type locality: Exposures at Bibb Furnace about 2 miles west of Brierfield, Bibb County, Alabama.

Ulrich, E. O., 1915, Bibliographic index of American Ordovician and Silurian fossils: U.S. National Museum Bulletin 92, v. 2, pl. 2, p. 1512.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 83-84.

Bluffport Marl Member of Demopolis Chalk

See Demopolis Chalk.

Type locality: On Bluffport road in the NW¼ sec. 27, T. 19 N., R. 1 W., Sumter County, Alabama, about 6½ miles due east of Livingston. Named for Bluffport Bluff along Tombigbee River, Alabama.

Monroe, W. H., 1956, Bluffport Marl Member of Demopolis Chalk, Alabama: American Association of Petroleum Geologists Bulletin, v. 40, no. 11, p. 2740-2742.

Bluff Springs Granite

Medium-grained, locally foliated leucocratic quartz diorite to quartz monzonite and tonalite. Northern Piedmont.

Type locality: Bluff Springs, Clay County, Alabama.

Prouty, W. F., 1923, Geology and mineral resources of Clay County, with special reference to the graphite industry: Alabama Geological Survey Special Report 12, p. 51.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 36-43.

Deininger, R. W., 1975, Granitic rocks in the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 56-57.

Size, W. B., and Dean, L. S., 1987, Structural petrology and petrogenesis of trondhjemite, northern Alabama Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 73-95.

Blufftown Formation (Selma Group)

The Blufftown extends from the Chattahoochee River Valley westward into central Russell County where it is divided into two westward-extending tongues by an eastward-extending tongue of the Mooreville Chalk. In the Chattahoochee River Valley the Blufftown is mainly glauconitic calcareous fine sand, micaceous clay and marl, fossiliferous clay, gray calcareous fossiliferous sandstone, and carbonaceous clay and silt. To the west the lower tongue of the Blufftown is gravelly sand, glauconitic sand, calcareous clay, and sandy clay and merges with the lower part of the Mooreville Chalk in southwestern Macon County. The upper tongue is mainly calcareous sandy clay and micaceous silty fine sand with thin layers of limestone and sandstone. The upper tongue merges with the Mooreville Chalk and the lower part of the Demopolis Chalk in western Bullock County. Thickness ranges from 30 feet in Macon County where the Blufftown merges into the Mooreville Chalk to 600 feet at the Alabama-Georgia State line. Upper Cretaceous, Santonian?-Campanian.

Type locality: Named for exposures at Blufftown, Stewart County, Georgia.

Veatch, J. O., 1909, Second report on the clay deposits of Georgia: Georgia Geological Survey Bulletin 18, p. 86, 88-89.

Stephenson, L. W., and Monroe, W. H., 1938, Stratigraphy of Upper Cretaceous Series in Mississippi and Alabama: American Association of Petroleum Geologists Bulletin, v. 22, no. 12, p. 1648-1649.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, p. 73-88.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Sohl, N. F., and Smith, C. C., 1980, Notes on Cretaceous biostratigraphy: American Geological Institute, Excursions in Southeastern Geology, v. II, p. 400-401.

Reinhardt, Juergen, 1980, Upper Cretaceous stratigraphy and depositional environments: American Geological Institute, Excursions in Southeastern Geology, V. II, p. 388.

Bottle Granite (Opelika Complex)

A series of fine- to medium-grained foliated granite to quartz monzonite plutons with similar chemical and mineralogical components. Usually strong gneissic banding along margins. Locally porphyritic textures at margins. Fresh exposures occur in the vicinity of Mt. Jefferson; about 2 miles north of Loachopoka at Sougahatchee Creek at the Carroll Quarry, NW¼ sec. 34, T. 19 N., R. 24 E.; and in the vicinity of Ridgelove, Lee County. Inner Piedmont.

Type locality: Three plutons in the vicinity of the community of The Bottle, sec. 31, T. 20 N., R. 26 E., Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 32.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 14-15.

Sears, J. W., Cook, R. B., Jr., and Brown, D. E., 1981, Tectonic evolution of the western part of the Pine Mountain window and adjacent Inner Piedmont province, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 8.

Goldberg, S. A., and Burnell, J. R., 1987, Rubidium-strontium geochronology of the Farmville [Bottle] granite, Alabama Inner Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 251-257.

Boyles Sandstone Member of Pottsville Formation

The basal resistant conglomeratic orthoquartzite unit of the Pottsville in the Warrior coal field. The Boyles consists of one or more persistent orthoquartzite sandstone beds interbedded with varying amounts of gray shale, thin-bedded micaceous sandstone, and locally one or more thin coal beds. The lower part is generally conglomeratic; the upper part may contain a few thin conglomeratic lenses locally. Thickness of the Boyles ranges from 200 to 700 feet. The Boyles is thinnest along the southeast margin of the Warrior coal field near Birmingham and thickens westward and southwestward in the subsurface. The Boyles can generally be separated into two sandstone units separated by a predominantly shaly unit. Appalachian Plateaus. Pennsylvanian.

Type locality: Exposure at Boyles Gap, north of Birmingham, Jefferson County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175.

Culbertson, W. C., 1963, Correlation of the Parkwood Formation and the lower member of the Pottsville Formation in Alabama: U.S. Geological Survey Professional Paper 450-E, p. E47-E50.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B16-B17, pls. 2 and 3.

Raymond, D. E., Rheams, L. J., Osborne, W. E., Gillespie, W. H., and Henry, T. W., 1988, Surface and subsurface mapping for the establishment of a stratigraphic and biostratigraphic framework for the Pennsylvanian section in the Jasper Quadrangle of the Black Warrior basin of Alabama: Alabama Geological Survey open-file report, p. 8-11, 22-34.

Brassfield Limestone

Greenish-gray to medium-gray to light-brownish-gray cherty, argillaceous, dolomitic, glauconitic, sandy limestone. A thin, very fine-grained greenish-gray argillaceous sandstone occurs locally. Recognizable in the Interior Low Plateaus. Thickness ranges from 0 to 36 feet. Lower Silurian, Alexandrian-Ontarian?

Type locality: Exposures along the Louisville and Atlantic Railroad between Brassfield and Panola, Madison County, Kentucky.

Foerste, A. F., 1905, II. Clays of Silurian, Devonian, Wavery and Irvine Formations, *in* Clays in several parts of Kentucky with some account of sands, marls, and limestones: Kentucky Geological Survey Bulletin 6, p. 145.

Jewell, J. W., 1969, An oil and gas evaluation of north Alabama: Alabama Geological Survey Bulletin 93, p. 18 and 37.

Bremen Sandstone Member of Pottsville Formation

A coarse-grained, thick-bedded sandstone just above the Black Creek coal in the Warrior coal field. The sandstone averages 80 feet in thickness. Appalachian Plateaus. Pennsylvanian.

Type locality: Exposures in Bremen northwest corner of Birmingham Quadrangle, Cullman County.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 9.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B18.

Brewer Phyllite (Kahatchee Mountain Group)

Alternating layers of grayish-yellow-green to grayish-green and very dark-red clayey and silty phyllite or slate, interbedded with metasiltstone, quartzite (locally conglomeratic) and metalimestone and metadolomite near the base (Sawyer Limestone Member). Beds range from a fraction of an inch to as much as 10 feet thick and are commonly graded. The upper contact with the Wash Creek Slate is gradational. Northern Piedmont. Upper Precambrian?-Cambrian?

Type locality: Exposures at Brewer School, Columbiana Quadrangle; Chilton County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 52-53.

Butts, Charles, 1940, Description of the Montevallo and Columbiana Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 226.

Carrington, T. J., 1964, Talladega Slate, *in* Deininger, R. W., and others, Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 15.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 6-9.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian western margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 13-15.

Brierfield Dolomite

Medium-bluish-gray coarsely crystalline, thick-bedded, in part highly siliceous dolomite. Crops out in the Cahaba Valley in Shelby County. The Brierfield is 1,500 feet thick along Sixmile Creek in Shelby County. Upper Cambrian, Dresbachian.

Type locality: Exposures on Mahan Creek in vicinity of Brierfield, Bibb County, Alabama.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geological Society of America Bulletin, v. 22, p. 628, 633, 634, pl. 27.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 81.

Bucatunna Clay Member of Byram Formation

See Byram Formation.

Type locality: Exposures along Bucatunna Creek, north of Denham post office (abandoned), in sec. 19, T. 8 N., R. 5 W., Wayne County, Mississippi.

Blanpied, B. W., and others, 1934, Stratigraphy and paleontological notes on the Eocene (Jackson Group), Oligocene, and lower Miocene of Clarke and Wayne Counties, Mississippi: Shreveport Geological Society Guidebook, 11th Annual Field Trip, p. 3, 4, 12-16, charts.

MacNeil, F. S., 1944, Oligocene stratigraphy of Southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1315-1316 and 1332-1341.

May, J. H., 1974, Wayne County geology, *in* Wayne County geology and mineral resources: Mississippi Geological, Economic and Topographic Survey Bulletin 117, p. 87-93.

Buckner Anhydrite Member of Haynesville Formation

Massive anhydrite with laminated finely crystalline dolomite and intercalated thin dolomitic, anhydritic shale, fine-grained anhydritic sandstone beds and bedded salt. Thickness ranges from 0 to 660 feet. Occurs in the subsurface in southwest Alabama. Upper Jurassic, Kimmeridgian.

Type locality: Named after Buckner field, Columbia County, Arkansas.

Shearer, H. K., 1938, Developments in south Arkansas and north Louisiana in 1937: American Association of Petroleum Geologists Bulletin, v. 22, no. 6, p. 724.

Philpott, T. H., and Hazzard, R. T., 1949, Cretaceous of Austin, Texas, area: Shreveport Geological Society Guidebook, 17th Annual Field Trip, fig. 5 (correlation chart).

Oxley, M. L., Minihan, E. D., and Ridgway, J. M., 1967, A study of the Jurassic sediments in portions of Mississippi and Alabama: Gulf Coast Association of Geological Societies Transactions, v. 17, p. 32-37.

Tolson, J. S., Copeland, C. W., and Bearden, B. L., 1983, Stratigraphic profiles of Jurassic strata in the western part of the Alabama Coastal Plain: Alabama Geological Survey Bulletin 122, p. 16-17.

Bumpnose Limestone (Vicksburg Group)

White to grayish-orange chalky, soft to brittle, subcoquinoid, glauconitic, argillaceous, very fossiliferous limestone. The lower 5 feet is more glauconitic and argillaceous. Present in southeast Alabama, east of the Sepulga River. Thickness ranges from 13 to 17 feet. Grades westward into Red Bluff Clay. Oligocene, Vicksburg (Rupelian).

Type locality: Quarry near center of W½ sec. 23, T. 5 N., R. 11 W., Jackson County, Florida. Named for exposures along and near Bumpnose Road north and west of Marianna, Florida.

Moore, W. E., 1955, Geology of Jackson County, Florida: Florida Geological Survey Bulletin 37, p. 19 (fig. 4), 21 (table 1), 30, 36-42.

Huddlestun, P. F., and Toulmin, L. D., 1965, Upper Eocene-lower Oligocene stratigraphy and paleontology in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 15, p. 155-159.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 124.

Butting Ram Sandstone (Talladega Group)

White to light-bluish-gray medium- to coarse-grained, locally conglomeratic, thick-bedded quartzitic sandstone; commonly conglomeratic in the basal part. Contacts of the Butting Ram with the underlying Lay Dam Formation and the overlying Jemison Chert are gradational. Possible Devonian fossils from upper metasiltstone. Northern Piedmont. Silurian?-Devonian?

Type locality: Butting Ram Shoals on the Coosa River, on the border between Chilton and Coosa Counties, abut 10 miles northeast of Clanton, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 54-56.

Carrington, T. J., 1964, Talladega slate, *in* Deininger, R. W., Bentley, R. D., Carrington, T. J., Clarke, O. M., Jr., Power, W. R., and Simpson, T. A., Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 1.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians: Geological Society of America Special Paper 191, p. 11.

Byram Formation (Vicksburg Group)

The Byram Formation includes, from the bottom up, yellow to white irregularly indurated, coquinoid and crystalline limestone (Glendon Limestone Member); gray to grayish-orange, sandy, glauconitic, fossiliferous marl (unnamed marl member); and yellow sand and dark bentonitic, carbonaceous clay (Bucatunna Clay Member). Present in south Alabama. Thickness ranges from 39 to 89 feet. Oligocene, Vicksburg (Rupelian).

Type locality: On right bank of the Pearl River in S½ NW¼NW¼ sec. 19, T. 4 N., R. 1 E., Hinds County, Mississippi. Named for Byram, Mississippi.

Casey, T. L., 1902, On the probable age of the Alabama white limestone: Philadelphia Academy of Natural Science Proceedings, v. 53, p. 517-518.

MacNeil, F. S., 1944, Oligocene stratigraphy of Southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1315-1316 and 1329-1341.

Camp Branch Sandstone Member of Pottsville Formation

Medium-grained well-indurated thick-bedded sandstone about 40 feet thick. This most persistent of the sandstone members of the Pottsville is present beneath the Cobb coal group in the Warrior coal field (Appalachian Plateaus) in Jefferson, Walker, Tuscaloosa and Fayette Counties. Appalachian Plateaus. Pennsylvanian.

Type locality: Exposures along the south bluff of Camp Branch, Birmingham district, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 9.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. 18.

Camp Hill Granite Gneiss (Dadeville Complex)

Granite to quartz diorite (tonalite), coarse- to medium-grained, foliated, locally biotite-rich; may contain thin amphibolite pods and lenses. Petrographically, the Camp Hill consists of biotite, microcline, oligoclase and quartz with apatite, zircon, and rutile as accessory minerals.

Type locality: Exposures at Rock Mills, Randolph County, Alabama.

Bentley, R. D., and Deininger, R. W., 1969, Granitic plutons in the Alabama Piedmont (abs.): Geological Society of America Abstracts with Programs, Southeastern Section, pt. 4, p. 4-5.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 28-29.

Neilson, M. J., 1987, The felsic gneisses of the Inner Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 9-15.

Cataclastic and mylonitic rock (Goat Rock fault zone)

Blastomylonite, porphyroclastic blastomylonite, mylonite, ultramylonite, mylonite gneiss, pencil gneiss, and minor units of mylonite amphibolite. The Goat Rock fault zone is comprised of two faults, the Goat Rock fault and the Bartletts Ferry fault. Southern Piedmont.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 36-37.

Higgins, M. W., 1971, Cataclastic rocks: U.S. Geological Survey Professional Paper 687, p. 46-48.

Cataclastic rock (Towaliga fault zone)

Mylonite, blastomylonite, porphyroclastic blastomylonite, mylonite gneiss, mylonite schist, mylonite quartzite, microbreccia, and scattered tectonic slices of the Pine Mountain metasedimentary sequence. Southern Piedmont.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 32-33.

Higgins, M. W., 1971, Cataclastic rocks: U.S. Geological Survey Professional Paper 687, p. 46-48.

Chattanooga Shale

Brownish-black to grayish-black silty, organic shale, and lesser amounts of light- to dark-gray, fine-grained sandstone that may contain pyrite and phosphatic inclusions. Outcrops occur in the northern and eastern parts of the Plateaus and in the Valley and Ridge. Thickness ranges from 0 to 82 feet. Upper Devonian, Chautauquan.

Type locality: Hillside exposure at north end of Cameron Hill, Chattanooga, Hamilton County, Tennessee.

Standard section: Cut on Tennessee Highway 26, at east approach to Sligo Bridge over Caney Fork, 7.1 miles east of courthouse at Smithville, De Kalb County, Tennessee.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geological Society of America Bulletin, v. 2, p. 143.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 158-161.

Hass, W. H., 1956, Age and correlation of the Chattanooga Shale and the Maury Formation: U.S. Geological Survey Professional Paper 286, p. 23-26, pl. 5.

Conant, L. C., and Swanson, V. E., 1961, Chattanooga Shale and related rocks of central Tennessee and nearby areas: U.S. Geological Survey Professional Paper 357, 91 p.

Rheams, K. F., and Neathery, T. L., 1988, Characterization and geochemistry of Devonian oil shale: North Alabama, northwest Georgia, and south-central Tennessee (a resource evaluation): Alabama Geological Survey Bulletin 128, p. 7-17.

Cheaha Quartzite Member of Lay Dam Formation

White to light-gray coarse-grained, conglomeratic, thick-bedded quartzite; grades into adjacent units. Northern Piedmont. Devonian?

Type locality: Cheaha Mountain, Clay County.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 54.

Carrington, T. J., 1964, Talladega slate, *in* Deininger, R. W., Bentley, R. D., Carrington, T. J., Clarke, O. M., Jr., Power, W. R., and Simpson, T. A., Alabama Piedmont geology: Alabama Geological Society Guidebook, 2d Annual Field Trip, p. 16 and 18.

Bearce, D. N., 1973, Character of the Talladega belt in eastern Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 14.

Cook, T. A., 1982, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 47-59.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 7, 10-11.

Chepultepec Dolomite (Knox Group)

The lower part of the formation is mostly light-gray compact, thick-bedded limestone, some layers of which contain fossil gastropods and interbedded dolomite. The upper part is dark-bluish-gray medium to coarsely crystalline, both thick- and thin-bedded dolomite that yields abundant cavernous and fossiliferous chert. The Chepultepec is distinguished by its soft, mealy, cavernous chert. Generally mappable in the Valley and Ridge; however, identification is uncertain in the subsurface of the Plateaus where equivalent strata are included in the Knox Group undifferentiated. Thickness ranges from 0 to 1,250 feet. Lower Ordovician, Canadian.

Type locality: Named for exposures near Chepultepec (now Allgood), Blount County, Alabama, 30 miles northeast of Birmingham.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geological Society of America Bulletin, v. 22, p. 549, 638-640, pl. 27.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 90-91.

Chestnut Sandstone Member of Pottsville Formation

A quartzose sandstone that makes a prominent ridge along the entire Cahaba coal field. The member is about 100 feet thick at the northern end and thickens to about 200 feet in the southern part of the coal field, where it contains a thick shale parting. The Chestnut Sandstone lies 500 to 800 feet above the Pine Sandstone Member and is above the Gould coal group. Valley and Ridge. Pennsylvanian.

Type locality: Chestnut Ridge, just northwest of the Cahaba River, Birmingham Quadrangle, Jefferson County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 10.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B36, pl. 3.

Chewacla Marble (Pine Mountain Group)

Light-gray to yellowish-gray locally siliceous medium to coarsely crystalline dolomitic marble; locally rich in phlogopite along shear planes near the contact with the Hollis Quartzite. Primary bedding is suggested by alternating light and dark banding that is as much as 20 feet thick. The Chewacla is exposed in Lee County in the vicinity of Chewacla Creek, in the vicinity of the Kiln and Spring Villa, and south of Union Grove Church. The best exposure is in a stone quarry south of Chewacla State Park in SE$\frac{1}{4}$ sec. 18, T. 18 N., R. 26 E. Southern Piedmont.

Type locality: Exposures on Chewacla Creek, Lee County, Alabama.

Prouty, W. F., 1918, Preliminary report on the crystalline and other marbles of Alabama: Alabama Geological Survey Bulletin 18, p. 94-95.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 35-36.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 26-28.

Chickamauga Limestone

Medium- to dark-gray thick- to thin-bedded partly argillaceous and silty, micritic to medium-grained limestone with locally abundant fossil horizons and thin dolomite beds in the upper and lower parts. Several prominent bentonites occur in the upper part of the Chickamauga. The Attalla Chert Conglomerate Member occurs locally at the base of the Chickamauga. The Chickamauga crops out in the western Valley and Ridge and in Wills and Murphrees Valleys. Thickness ranges from 260 to 1,100 feet. Middle Ordovician, Chazyan-Shermanian.

Type locality: Exposures along Chickamauga Creek east of Chattanooga, Tennessee, and branches of that creek in Ringgold Quadrangle, Georgia.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geological Society of America Bulletin, v. 2, p. 143, 148.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 119-133.

Milici, R. C., and Smith, T. W., 1969, Stratigraphy of the Chickamauga Supergroup in its type area: Tennessee Department of Conservation, Division of Geology Report of Investigations, no. 24, 35 p.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 5-18.

Benson, D. J., and Stock, C. W., 1986, Depositional history of the Middle Ordovician of the Alabama Appalachians: Alabama Geological Society Guidebook, 23rd Annual Field Trip, 119 p.

Chickasawhay Limestone

Bluish-gray glauconitic, fossiliferous soft marl, and harder beds of white fossiliferous, silty, partly glauconitic limestone. Present in south Alabama. Thickness ranges from 10 to 26 feet in outcrop. Oligocene, Chattian.

Type locality: On U.S. Highway 45, 3 miles north of Waynesboro, Wayne County, Mississippi. Named for exposures on the Chickasawhay River.

Blanpied, B. W., and others, 1934, Stratigraphy and paleontological notes on the Eocene, Oligocene, and lower Miocene of Clarke and Wayne Counties, Mississippi: Shreveport Geological Society Guidebook, 11th Annual Field Trip, p. 3, 4, 12, 16-19, charts.

MacNeil, F. S., 1944, Oligocene stratigraphy of Southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1313-1354.

Poag, C. W., 1972, Planktonic foraminifers of the Chickasawhay Formation, United States Gulf Coast: Micropaleontology, v. 18, no. 3, p. 257-277.

Chilhowee Group

At the base is an arkosic conglomerate, arkose, and discontinuous mudstone. Overlying this basal unit is a thick sequence of greenish-gray mudstone with minor siltstone and very fine-grained sandstone. This sequence grades upward into white to moderate-reddish-orange orthoquartzitic, fine- to very coarse-grained, friable sandstone and conglomerate containing interbedded gray silty mudstone. The Chilhowee is divisible, in ascending order, into the Cochran, Nichols, Wilson Ridge, and Weisner Formations. The Chilhowee crops out in the eastern Valley and Ridge. Maximum thickness preserved in outcrops is 1,738 feet (the lower contact is faulted at all localities). Lower Cambrian, Taconian?

Type locality: Named for Chilhowee Mountain, Sevier and Blount Counties, Tennessee.

Safford, J. M., 1856, A geological reconnaissance of the State of Tennessee: Tennessee State Geologist 1st Biennial Report, p. 149, 152-153.

Mack, G. H., 1980, Stratigraphy and depositional environments of the Chilhowee Group (Cambrian) in Georgia and Alabama: American Journal of Science, v. 280, p. 497-517.

Osborne, W. E., and Szabo, M. W., 1984, Stratigraphy and structure of the Jacksonville fault, Calhoun County, Alabama: Alabama Geological Survey Circular 117, p. 4-7.

Chulafinnee Schist (Talladega Group)

Fine- to medium-grained, light- to dark-greenish-gray, fissile quartz-sericite-chlorite schist, which may include thin chlorite phyllite and quartzose phyllite beds and is locally calcareous and intensively sheared. Upper contact with the Hillabee Greenstone is gradational. Northern Piedmont. Early to Middle Devonian?

Type locality: Exposures near Chulafinnee on Alabama Highway 431, Cleburne County, Alabama.

Bearce, D. N., 1973, Character of the Talladega belt in eastern Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 14.

Bearce, D. N., 1973, Geology of the Talladega metamorphic belt in Cleburne and Calhoun Counties, Alabama, *in* Symposium, Geology of the Blue Ridge-Ashland-Wedowee belt in the Piedmont: American Journal of Science, v. 273, no. 8, p. 742-754.

Neathery, T. L., 1973, Observations on the lithologic relationships within the Talladega Group, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 53.

Bearce, D. N., 1979, Geology of the Talladega belt in the Hightower reentrant, Cleburne County, Alabama, *in* Tull, J. F., and Stow, S. H., eds., The Hillabee metavolcanic complex and associated rock sequences: Alabama Geological Society Guidebook, 17th Annual Field Trip, p. 37-40.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 3-18.

Citronelle Formation

Moderate-reddish-brown deeply weathered sand containing quartz and chert pebbles and lenticular beds of red, purple, yellow, and gray clays that are typically mottled. Present in southwest Alabama. Thickness ranges from 0 to 200 feet. Pliocene and Pleistocene, Piacenzian-Calabrian?

Type locality: Exposures around Citronelle, Mobile County, Alabama, especially along Mobile and Ohio Railroad for a distance of 3 or 4 miles.

Matson, G. C., and Berry, E. W., 1916, The Pliocene Citronelle Formation of the Gulf Coastal Plain and its flora: U.S. Geological Survey Professional Paper 98-L, p. 167-208.

Reed, P. C., 1971, Geologic map of Mobile County, Alabama: Alabama Geological Survey Special Map 93, p. 5-7.

Claiborne Group

The Claiborne Group is comprised of the Tallahatta Formation, Lisbon Formation, and Gosport Sand, in ascending order. Eocene, Claiborne (upper Ypresian-Bartonian).

Type locality: Exposures at Claiborne Bluff and Claiborne Landing on the Alabama River, Monroe County, Alabama.

Conrad, T. A., 1848, Observations on the Eocene formation and descriptions of one hundred and five new fossils of that period, from the vicinity of Vicksburg, Mississippi: Philadelphia Academy of Natural Science Proceedings, 1847, v. 3, p. 280-282.

Toulmin, L. D., 1944, General features of the Tertiary formations in Alabama: Southeastern Geological Society Guidebook, 1st Field Trip, p. 10-11.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 107-116.

Clayton Formation (Midway Group)

In westernmost Alabama, the undivided Clayton is composed of 5 to 20 feet of marl and limestone. In Wilcox, Lowndes and Butler Counties, the Clayton is subdivided into two members. The lower Pine Barren Member contains 150 feet of medium-gray fossiliferous calcareous silt, glauconitic sand, and thin beds of gray sandy limestone. The upper McBryde Limestone Member consists of gray to white marl and clayey chalk 20 to 50 feet thick. The undivided Clayton in eastern Alabama consists of 5 to 10 feet of basal gravelly sand overlain by 10 to 380 feet of sandy fossiliferous limestone. Crops out in the Coastal Plain of south Alabama. Paleocene, Midway (Danian).

Type locality: Cut on the Central of Georgia Railroad about 1 mile east of Clayton, Barbour County, Alabama.

Langdon, D. W., 1891, Variations in the Cretaceous and Tertiary strata of Alabama: Geological Society of America Bulletin, v. 2, p. 587-606, pl. 23.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 93-97.

Coal Bluff Marl Member of Naheola Formation

See Naheola Formation.

Type locality: Named from Coal Bluff on the west side of the Alabama River in SE¼ sec. 7, T. 11 N., R. 7 E., Wilcox County, Alabama.

Smith, E. A., 1886, Summary of the lithological and stratigraphical features and subdivisions of the Tertiary of Alabama, *in* Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geological Survey Bulletin 1, p. 12.

Langdon, D. W., Jr., 1894, Section II, The Tertiary and Cretaceous formations east of the Alabama River, *in* Smith, E. A., Johnson, L. C., and Langdon, D. W., Jr., Report on the geology of the Coastal Plain of Alabama: Alabama Geological Survey Special Report 6, p. 421.

Cushman, J. A., 1944, A Paleocene foraminiferal fauna from the Coal Bluff Marl Member of the Naheola Formation of Alabama: Cushman Laboratory for Foraminiferal Research Contributions, v. 20, pt. 2, p. 29-52.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, p. 79-95, 202.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 99.

Cochran Formation

Poorly sorted arkosic sandstone and conglomerate containing laterally discontinuous greenish-gray silty mudstone interbeds. Maximum thickness preserved in outcrops is 233 feet. The lower contact is faulted at all known exposures. Crops out in the eastern Valley and Ridge. Lower Cambrian.

Type locality: Cochran Creek on south side of Chilhowee Mountain, Blount County, Tennessee. Makes crest of mountain northwest of lower course of creek.

Keith, A., 1875, Description of the Knoxville sheet: U.S. Geological Survey Geologic Atlas, Folio 16.

Rodgers, John, 1953, Geologic map of East Tennessee with explanatory text: Tennessee Division of Geology Bulletin 58, pt. 2, v. i, p. 35-38.

Mack, G. H., 1980, Stratigraphy and depositional environments of the Chilhowee Group (Cambrian) in Georgia and Alabama: American Journal of Science, v. 280, p. 497-517.

Cocoa Sand Member of Yazoo Clay

Dusky-yellow calcareous, fossiliferous fine- to medium-grained, firm, massive sand. Lithologies may vary over short distances to include sandy limestone, calcareous sand or greenish-gray, micaceous, calcareous, very clayey sand. Present in southwest Alabama. Thickness ranges from 5 feet on the Conecuh River to 50 feet in Choctaw County. Eocene, Jackson (Priabonian).

Type locality: Named for abandoned county post office called Cocoa, which stood in SW$\frac{1}{4}$ sec. 13, T. 11 N., R. 5 W., Choctaw County, Alabama, about 2$\frac{1}{2}$ miles east of Melvin, on road to Gilbertown.

Cushman, J. A., 1925, Eocene foraminifera from the Cocoa sand of Alabama: Cushman Laboratory for Foraminiferal Research Contributions, v. 1, pt. 3, p. 65-69.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 126-129.

Coker Formation (Tuscaloosa Group)

Light-colored very fine to medium micaceous sand, cross-bedded sand, varicolored micaceous clay, and a few thin gravel beds containing chert and quartz pebbles. Quartz and chert gravels at the base of the formation are comprised of very fine pebbles to large cobbles. Near the base in western Alabama is a unit of thinly laminated finely glauconitic very fine- to medium-grained sand, silt, and dark-gray carbonaceous and lignitic clay referred to as the "Eoline Member." In southwestern Elmore County, the formation includes marine sediments consisting of glauconitic, fossiliferous fine- to medium-grained quartz sand and medium-gray carbonaceous silty clay. Thickness ranges from 230 to over 500 feet. Present in west-central Alabama. Upper Cretaceous, upper Cenomanian-lower Turonian.

Type locality: Section on road from Spring Hill School in secs. 21 and 22, T. 21 S., R. 11 W., 3 miles south of Coker, Tuscaloosa County, Alabama.

Conant, L. C., and Monroe, W. H., 1945, Stratigraphy of the Tuscaloosa Group in the Tuscaloosa and Cottondale Quadrangles, Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 37.

Monroe, W. H., Conant, L. C., and Eargle, D. H., 1946, Pre-Selma Upper Cretaceous stratigraphy of western Alabama: American Association of Petroleum Geologists Bulletin, v. 30, no. 2, p. 197-200.

Drennen, C. W., 1953, Reclassification of outcropping Tuscaloosa Group in Alabama: American Association of Petroleum Geologists Bulletin, v. 37, p. 522-538.

Colvin Mountain Sandstone

Light- to very light-gray orthoquartzitic, slightly iron-stained, thick- and thin-bedded, often massive, medium- to coarse-grained, well-sorted sandstone containing local concentrations of small pebbles. Near the top of the sandstone are two layers of light-gray to greenish-gray very sandy bentonite. Present in the northern part of the eastern Valley and Ridge, in Calhoun, St. Clair, southeastern Etowah, and southeastern Cherokee Counties. Thickness ranges from 15 to 75 feet, averaging 70 feet. Middle Ordovician, Rocklandian-Kirkfieldian.

Type locality: Exposures at Alexander Gap through Colvin Mountain, Calhoun County, Alabama.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 48-50 and 226-227.

Conasauga Formation

Limestone, dolomite, and shale of varying proportions in different areas. Limestone in western belts is medium-bluish-gray, fine grained, mostly thin bedded, and highly argillaceous in part. Shales and mudstones in the lower part of the formation to the east are dark greenish gray, dusky yellow, and pale olive, and locally contain interbeds of limestone (sometimes cherty) and rare siltstone. Limestone interbeds are medium to dark gray, thin to medium bedded, micritic, argillaceous, and locally oolitic or oncolitic. In the eastern belts the upper part is light to dark gray, medium to thick bedded dolostone. In places the Conasauga is highly fossiliferous. Small amounts of light-bluish-gray to light-brownish-gray to white cryptocrystalline to oolitic chert occur in the upper part of the Conasauga. Present in the subsurface of the Plateaus and crops out in the Valley and Ridge. Reported thicknesses range from about 500 feet (Talladega County) to about 2,600 feet in the Valley and Ridge. Middle and Upper Cambrian.

Type locality: Named for exposures in Conasauga Valley, Dalton Quadrangle, northwestern Georgia.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geological Society of America Bulletin, v. 2, p. 143, 144-148.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 67-78.

Cloud, P. E., Jr., 1967, Geology and bauxite deposits of the Rock Run and Goshen Valley areas, northeast Alabama: U.S. Geological Survey Bulletin 1199-N, p. 7-8, pl. 2.

Neathery, T. L., Smith, W. E., Clark, O. M., Jr., and Szabo, M. W., 1968, Geology and mineral resources of Etowah County, Alabama: Alabama Geological Survey open-file report, p. 16-18.

Copper Ridge Dolomite (Knox Group)

Light-gray thick-bedded, medium to coarsely crystalline, siliceous dolomite. Characteristic chert is dense, tough, hard, generally white or yellowish-gray, stromatolitic, and usually jagged, and is comprised in part of megaquartz. Generally mappable in the Valley and Ridge; however, identification is uncertain in the subsurface of the Plateaus, where equivalent strata are included in the Knox Group undifferentiated. Thickness ranges from 1,250 to 1,800 feet. Upper Cambrian, Franconian-Trempealeauan.

Type locality (Ulrich, 1911): Named for Copper Ridge, a long, narrow, monoclinal ridge at the northwest base of Clinch Mountain, northeastern Tennessee. Type locality is along the road from Bean Station to Evans Ferry on Clinch River (Ulrich, 1911, p. 636), now U.S. Highway 25-E.

Reference section (Bridge, 1956): Original type locality now submerged by Cherokee Lake; Bean Station is designated as new reference section, more than 1 mile to the west.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geological Society of America Bulletin, v. 22, p. 548, 635-636, pl. 27.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 84-87.

Bridge, Josiah, 1956, Stratigraphy of the Mascot-Jefferson City zinc district, Tennessee: U.S. Geological Survey Professional Paper 227, p. 25-29.

Cornhouse Schist (Wedowee Group)

Medium- to coarse-grained multiply foliated ± plagioclase ± garnet-biotite-muscovite-quartz schist interlayered with chlorite-biotite-garnet schist; locally contains feldspathic quartzites, muscovite schists, and thin layered amphibolites. (See Beaverdam Amphibolite.) Typically mylonitic in texture and commonly contains "spindles," "buttons" or small lenticular disks of graphite-sericite phyllite. Northern Piedmont.

Type locality: Exposures along Cornhouse Creek near Swan Hill, secs. 6, 7, 8, and 9, T. 21 S., R. 11 E.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 30-31.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 26.

Cotton Valley Group

Moderate- to pale-red, light-gray, and white, fine- to very coarse-grained to conglomeratic, angular to subrounded, quartzose, friable sandstone, locally containing chert and abundant metamorphic rock fragments (schist and talc notably). Interbedded shale units are mostly dark- to dusky-red updip and gray downdip. Shales are sandy, silty, micaceous and calcareous in part. Occasional thin sandy, dolomitic limestone beds occur in downdip and offshore areas. Thickness ranges from 100 feet in Sumter County to 2,900 feet near the coast. Occurs in the subsurface in southwest Alabama. Upper Jurassic-Lower Cretaceous, Kimmeridgian-Hauterivian?

Type locality: Cotton Valley field, Webster Parish, Louisiana.

Shearer, H. K., 1938, Developments in south Arkansas and north Louisiana in 1937: American Association of Petroleum Geologists Bulletin, v. 22, no. 6, p. 722, 723, 724-725.

Oxley, M. L., Minihan, E. D., and Ridgway, J. M., 1967, A study of the Jurassic sediments in portions of Mississippi and Alabama: Gulf Coast Association of Geological Societies Transactions, v. 17, p. 37-38.

Tolson, J. S., Copeland, C. W., and Bearden, B. L., 1983, Stratigraphic profiles of Jurassic strata in the western part of the Alabama Coastal Plain: Alabama Geological Survey Bulletin 22, p. 18-21, plates, appendix.

Moore, Tim, 1983, Cotton Valley depositional systems of Mississippi: Gulf Coast Association of Geological Societies Transactions, v. 33, p. 163-167.

Forgotson, J. M., Jr., 1954, Regional stratigraphic analysis of Cotton Valley Group of upper Gulf Coastal Plain: American Association of Petroleum Geologists Bulletin, v. 38, no. 1, p. 2476-2499.

Cragford Phyllite (Wedowee Group)

Interbedded fine-grained graphite-chlorite-sericite schist and phyllite, garnet-sericite schist and phyllite, graphite-quartz-sericite phyllite, occasional thin beds of fine-grained feldspathic biotite gneiss, and locally thin interbeds of calc-silicate rock and quartzite. Northern Piedmont.

Type locality: Exposures near the town of Cragford, Clay County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 9.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 25-28.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 15-16.

Crystal River Formation (Jackson Group)

White to cream medium-textured to coquinoid limestone that is soft and chalky to compact and brittle, and rather pure. Thickness is 120 feet in Covington County. Present in south-central and southeast Alabama. Grades westward into the Yazoo Clay. Eocene, Jackson (Priabonian).

Type locality: Crystal River Rock Company quarry, NE¼SW¼ sec. 6, T. 19 S., R. 18 E., Citrus County, Florida.

Puri, H. S., 1953, Zonation of the Ocala Group in Peninsular Florida (abs.): Journal of Sedimentary Petrology, v. 23, no. 2, p. 130.

Puri, H. S., 1957, Stratigraphy and zonation of the Ocala Group: Florida Geological Survey Bulletin 38, p. 31-38.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 123-126.

Cusseta Sand Member of Ripley Formation

Calcareous sandstone, sandy chalk and coarse cross-bedded sand with occasional thin layers of limestone and fine gravel. In Barbour and Russell Counties, the lower part consists of 10 to 20 feet of medium- to coarse-grained sand that locally contains clay pebbles and is glauconitic, gravelly and fossiliferous. This basal sand grades upward into clayey fine-grained micaceous sand and dark-gray silty, micaceous, carbonaceous, fossiliferous clay. Thickness is variable, but typically less than 200 feet. The Cusseta crops out from Montgomery County eastward into Georgia. It grades westward into the Demopolis Chalk in Montgomery County. Upper Cretaceous, Campanian-Maastrichtian.

Type locality: Named for exposures in the vicinity of Cusseta, Chattahoochee County, Georgia.

Veatch, J. O., 1909, Second report on the clay deposits of Georgia: Georgia Geological Survey Bulletin 18, p. 86-89.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, p. 73-88.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Cutnose Gneiss (Wedowee Group)

Cyclically interbedded fine-grained quartz-biotite-feldspar gneiss, fine-grained graphite-chlorite-sericite schist, and locally graphite-quartz-sericite phyllite and quartzite. Northern Piedmont.

Type locality: Exposures along Cutnose Creek, northeast Randolph County, Alabama.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 28-29.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 16-17.

Dadeville Complex

A sequence of volcaniclastic rock including amphibolite, hornblende gneiss, pyroxenite lenses, mafic igneous rocks, and leucocratic granitic rocks, interlayered with a sequence of biotite-garnet-muscovite schist, biotite-muscovite schist, biotite gneiss, and thin amphibolite units. Pegmatites are common in the northwestern part of the Dadeville Complex. The complex is comprised of the Agricola Schist, Ropes Creek Amphibolite, Waresville Schist, Waverly Gneiss, ultramafic and mafic intrusive rocks, Camp Hill Granite Gneiss, and the Rock Mills Granite Gneiss. Inner Piedmont.

Type locality: Named for the town of Dadeville, Tallapoosa County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 26-31.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 6-10.

Brown, D. E., and Cook, R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek areas, Chambers and Lee Counties, Alabama, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 15-33.

Danway Dike

Olivine diabase. The Danway Dike ranges from 10 to 20 feet in thickness and extends for a distance of about 8 miles. Southern Piedmont. Triassic?-Jurassic?

Type locality: Exposures just east of Danway siding (formerly Tuckersburg) on the Roanoke branch of the Central of Georgia Railway between Opelika and LaFayette, Chambers County, Alabama.

Adams, G. I., 1933, General geology of the crystallines of Alabama: Journal of Geology, v. 41, p. 173.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 41.

Brown, D. E., and Cook R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek area, Chambers and Lee Counties, Alabama, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 31-32.

Demopolis Chalk (Selma Group)

Light-gray to medium-light-gray fossiliferous chalk. The lower part of the formation consists of thin beds of marly chalk. The upper Bluffport Marl Member consists of 50 to 65 feet of massive chalky very dark-gray marl, very clayey chalk, and calcareous clay. The Demopolis Chalk is present from the Mississippi State line in southern Pickens County to western Bullock County where it grades into the Ripley and Blufftown Formations. Thickness ranges from 495 feet in Sumter County to about 420 feet in western Montgomery County. Upper Cretaceous, Campanian-Maastrichtian.

Type locality: Bluff of chalk on the Tombigbee River at Webb and Sons cotton warehouse in Demopolis, Marengo County, Alabama.

Smith, E. A., 1903, 58th Congress, 1st Session, S. Ex. Doc. 19, p. 12-20, map.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, p. 64-73.

Eargle, D. H., 1950, Geologic map of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations, Preliminary Map 105.

Monroe, W. H., 1956, Bluffport Marl Member of Demopolis Chalk, Alabama: American Association of Petroleum Geologists Bulletin, v. 40, no. 11, p. 2740-2742.

Monroe, W. H., and Hunt, J. L., 1958, Geology of the Epes Quadrangle, Alabama: U. S. Geological Survey Quadrangle Map GQ-113.

Denkman Sandstone Member of the Norphlet Formation

Gray and brown fine- to medium-grained, well-sorted subarkosic sandstone; comprises the upper part of the Norphlet. Typically, the Denkman consists of an upper massive to indistinctly horizontal, discontinuous, wavy, laminated sandstone and a lower high-angle, planar, cross-bedded sandstone. Thickness locally exceeds 700 feet. Present in the subsurface of southwest Alabama. Upper Jurassic, Oxfordian.

Type section: Lion Oil Company's No. 2 Denkman well, NW¼NE¼ sec. 22, T. 7 N., R. 4 E., Rankin County, Mississippi; section between 15,997 or 15,998 and 16,276 feet (T.D.).

Murray, G. E., 1961, Geology of the Atlantic and Gulf Coastal province of North America: New York, Harper and Brothers, Publishers, p. 290-291.

Tyrrell, W. W., Jr., 1972, Denkman Sandstone Member - An important Jurassic reservoir in Mississippi, Alabama, and Florida: Gulf Coast Association of Geological Societies Transactions, v. 22, p. 32.

Wilkerson, R. P., 1981, Depositional environments and regional stratigraphy of Jurassic Norphlet Formation in south Alabama: Gulf Coast Association of Geological Societies Transactions, v. 31, p. 471-419.

Eagle Mills Formation

Dark-reddish-brown partly silty to sandy, calcareous mudstone and occasional light-olive-gray mudstone. Contains occasional calcite veins and nodules and occasional nodular anhydrite and/or limestone. Interbeds of grayish-red very fine- to coarse-grained, partly conglomeratic, partly cross-bedded sandstone and thin zones of conglomerate. Locally present in the subsurface of southwest Alabama. Thickness is greater than 1,349 feet in southern Choctaw County. Upper Triassic, Norian-Rhaetian.

Type locality: Amerada Petroleum Co. et al. No. 1 Eagle Mills Lumber Company well in sec. 11, T. 12 S., R. 16 W., Ouachita County, Arkansas.

Shearer, H. K., 1938, Developments in south Arkansas and north Louisiana in 1937: American Association of Petroleum Geologists Bulletin, v. 22, no. 6, p. 724.

Weeks, W. B., 1938, South Arkansas stratigraphy with emphasis on the older Coastal Plain beds: American Association of Petroleum Geologists Bulletin, v. 22, no. 8, p. 958-959 (fig. 2), 960 (fig. 3), 962-964.

Scott, K. R., Hayes, W. E., and Fietz, R. P., 1961, Geology of the Eagle Mills Formation: Gulf Coast Association of Geological Societies Transactions, v. 11, p. 1-14.

Dinkins, J. H., Jr., 1968, Jurassic stratigraphy of central and southern Mississippi, *in* Jurassic stratigraphy of Mississippi: Mississippi Geological, Economic, and Topographic Survey Bulletin 109, p. 9-38.

Elkahatchee Quartz Diorite Gneiss

Fine- to coarse-grained, massive to strongly foliated, mesocratic to melanocratic, locally sheared granodiorite to diorite. Northern Piedmont.

Type locality: Exposures along Elkahatchee Creek in Tallapoosa County, Alabama.

Wampler, J. M., Neathery, T. L., and Bentley, R. D., 1970, Age relations in the Alabama Piedmont, *in* Bentley, R. D., and Neathery, T. L., Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 88.

Deininger, R. W., 1975, Granitic rocks in the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 53-55.

Moore, W. B., Tull, J. F., and Allison, D. T., 1987, Intrusive chronology, progressive deformation, and geochemistry of granitoid dikes, and strain analysis of xenoliths, Northern Piedmont, Tallapoosa County, Alabama, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 33-55.

Elkmont Formation

Gray phosphatic limestone with interbeds of gray and black shale. Used in the subsurface of the western Plateaus for the sequence of limestones between the Sequatchie Formation and Hermitage Formation of the Nashville Group where the Inman Formation is absent. Thickness averages between 200 and 300 feet. Middle-Upper Ordovician, Shermanian-Maysvillian.

Type locality: Elkmont Quarry, Limestone County, Alabama, in SE¼SE¼ sec. 31, T. 1 S., R. 4 W.

Neathery, T. L., and Drahovzal, J. A., 1985, Lithostratigraphy of Upper Ordovician strata in Alabama: Alabama Geological Survey Circular 124, p. 12-13.

Emuckfaw Group

Sequence of medium-grained muscovite-biotite-feldspar schist, fine-grained muscovite-biotite-quartz-feldspar gneiss, graphite-garnet-muscovite schist, and quartzite; occasional thin amphibolite and rare ultramafic pods. May include thin aluminous graphitic schists. Locally sheared to mylonite schist. Includes Glenloch Schist. Northern Piedmont.

Type locality: Exposures along Emuckfaw Creek, 2.4 km north of Horseshoe Bend, Tallapoosa County, Alabama.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 8, 16-17.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 30-32.

Osborne, W. E., Szabo, M. W., Neathery, T. L., and Copeland, C. W., Jr., compilers, 1988, Geologic map of Alabama, northeast sheet: Alabama Geological Survey Special Map 220 (in press).

Eoline Member of Coker Formation

See Coker Formation.

Type locality: Exposures in cuts along Alabama Highway 6, about 30 miles southeast of Tuscaloosa and 1.5 miles east of community of Eoline, Bibb County, Alabama.

Conant, L C., and Monroe, W. H., 1945, Stratigraphy of the Tuscaloosa Group in the Tuscaloosa and Cottondale Quadrangles, Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 37.

Drennen, C. W., 1953, Reclassification of outcropping Tuscaloosa Group in Alabama: American Association of Petroleum Geologists Bulletin, v. 37, no. 3, p. 528, 529.

Erin Slate Member of Lay Dam Formation

Locally highly graphitic, black sericitic phyllite and slate. Northern Piedmont. Devonian?

Type locality: Vicinity of Erin, Clay County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 57-58, 217-219.

Neathery, T. L., 1973, Observations on the lithologic relationships within the Talladega Group, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 52.

Gastaldo, R. A., and Cook, R. B., 1982, A reinvestigation of the paleobotanical evidence for the age of the Erin Shale, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 69-77.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 11.

Cook, T. A., 1982, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., Black, W. W., Kish, S. A., and Tull, J. F., eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 47-54.

Escambia Sand Member of Pensacola Clay

See Pensacola Clay.

Type locality: Three oil test wells in Baldwin County, Alabama. They are the Baldwin-Garrett No. 1, in NE¼NW¼ sec. 9, T. 9 S., R. 5 E.; the Temple-Ehle No. 1, in the center of NE¼SE¼ sec. 15, T. 18 S., R. 4 E.; and the Temple-Sherrill et al. No. 1, in SE¼NE¼ sec. 15, T. 7 S., R. 4 E. Named for the Escambia River in Florida.

Marsh, O. T., 1966, Geology of Escambia and Santa Rosa Counties, western Florida panhandle: Florida Geological Survey Bulletin, no. 46, p. 54-68.

Raymond, D. E., 1985, Depositional sequences in the Pensacola Clay (Miocene) of southwest Alabama: Alabama Geological Survey Bulletin 114, 87 p.

Eutaw Formation

Light-greenish-gray fine- to medium-grained well-sorted micaceous cross-bedded sand that is fossiliferous and glauconitic in part and contains beds of greenish-gray micaceous, silty clay and medium-dark-gray carbonaceous clay. Thickness is 350 to 400 feet in outcrop in western and central Alabama; the formation thins eastward to 100 to 150 feet in easternmost Alabama. Downdip in southwestern Alabama, the Eutaw thins to about 200 feet. The Tombigbee Sand Member is present locally in west-central Alabama in the upper part of the formation. Upper Cretaceous, Santonian-Campanian.

Type locality: Named for Eutaw, Greene County, Alabama.

Hilgard, E. W., 1860, Report on the geology and agriculture of the State of Mississippi: Mississippi Geologic and Agricultural Report, p. 3, 61-68.

Stephenson, L. W., 1926, The Mesozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 234-237.

Stephenson, L. W., and Monroe, W. H., 1938, Stratigraphy of Upper Cretaceous Series in Mississippi and Alabama: American Association of Petroleum Geologists Bulletin, v. 22, no. 12, p. 1642 (fig. 2), 1648-1649.

Copeland, C. W., ed., 1968, The geology of non-Appalachia Alabama: Appendix G to Report for development of water resources in non-Appalachia Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 18-19.

Sohl, N. F., and Smith, C. C., 1980, Notes on Cretaceous biostratigraphy: American Geological Institute, Excursions in Southeastern Geology, v. II, p. 392-402.

Fayetteville Phyllite (Sylacauga Marble Group)

Medium-gray and dusky-red phyllite and slate interlayered with light-brown to light-gray feldspathic metasiltstone, fine-grained metasandstone, and dolomite marble. Northern Piedmont. Cambrian?-Ordovician?

Type locality: Exposures near the village of Fayetteville, Talladega County, Alabama.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-26.

Ferry Lake Anhydrite

White and very light- to pinkish-gray finely crystalline anhydrite, with olive- to medium-gray banding, and very light- to medium-gray finely crystalline, partly oolitic limestone. Interbedded with occasional grayish-red shale. Thickness reaches 250 feet. Present in the subsurface of southwest Alabama. Lower Cretaceous, Albian.

Type locality: Gulf Refining Company's Caddo Levee Board "O" Gas Unit Well No. 1, Jeems-Bayou field, sec. 10, T. 20 N., R. 16 W., Caddo Parrish, Louisiana. Top of unit placed at 3,823 and base at 4,072 feet.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 4, 35-36.

Nunnally, J. D., and Fowler, H. F., 1954, Lower Cretaceous stratigraphy of Mississippi: Mississippi Geological Survey Bulletin 79, 45 p.

Forgotson, J. M., Jr., 1957, Stratigraphy of Comanchean Cretaceous Trinity Group [Gulf Coastal Plain]: American Association of Petroleum Geologists Bulletin, v. 41, no. 10, p. 2354-2355.

McGlamery, Winifred, 1950-1961, Alabama Geological Survey unpublished sample descriptions of oil test wells.

Pittman, J. G., 1985, Correlation of beds within the Ferry Lake Anhydrite of the Gulf Coastal Plain: Gulf Coast Association of Geological Societies Transactions, v. 35, p. 251-260.

Floyd Shale

Dark-gray clay shale containing siderite nodules, especially in the upper part of the formation. Gray claystone interbeds are common. Thin beds of sandstone, limestone, and chert are locally present. Present in the subsurface of the southwestern part of the Plateaus and in the Valley and Ridge. Thickness ranges from 0 to about 2,000 feet. Upper Mississippian, Meramecian-Chesterian.

Type locality: Exposures east of White Oak Mountain and Taylor Ridge, Floyd County, Georgia, where it occupies several large and more or less detached areas.

Hayes, C. W., 1891, The overthrust faults of the southern Appalachians: Geological Society of America Bulletin, v. 2, p. 141-154.

Hayes, C. W., 1892, Report on the geology of northeastern Alabama and adjacent portions of Georgia and Tennessee: Alabama Geological Survey Bulletin 4, 85 p.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 201-204.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 57-67.

Forest Hill Sand (Vicksburg Group)

Dark-greenish-gray carbonaceous, pyritic, calcareous, sparingly glauconitic and fossiliferous clay with lenses of glauconitic, fossiliferous sand. Present in southwest Alabama. Thickness ranges from 7 to 26 feet. Oligocene, Vicksburg (Rupelian).

Type locality: On Jackson-Raymond Road, 0.5 mile northeast of Forest Hill School in NE¼ sec. 22 and NW¼ sec. 23, T. 5 N., R. 1 W., Hinds County, Mississippi.

Cooke, C. W., 1918, Correlation of the deposits of Jackson and Vicksburg ages in Mississippi and Alabama: Washington Academy of Science Journal, v. 8, p. 187, 191-193.

Toulmin, L. D., LaMoreaux, P. E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Alabama Geological Survey County Report 2, p. 127 and 128.

Fort Payne Chert

Dark-gray to light-gray finely crystalline to microcrystalline siliceous limestone and smoky chert in irregular beds and nodules. Locally includes dark shale or light-gray coarse bioclastic limestone in lenses. Weathers to a grayish-orange to light-gray bedded fossiliferous chert. Present in the Plateaus and the Valley and Ridge. Thickness ranges from 0 to 207 feet. Lower Mississippian, Osagian.

Type locality: Named for exposures at Fort Payne, De Kalb County, Alabama.

Smith, E. A., 1890, An appendix on the geology of the valley regions adjacent to the Cahaba field, *in* Squire, Joseph, Report on the Cahaba coal field: Alabama Geological Survey Special Report 2, p. 155-156, section opposite p. 152, map.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 162-167.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 9-13.

Frog Mountain Sandstone

Light-gray to black to brown very fine- to coarse-grained, locally pebbly sandstone that is partly silty, partly calcareous, and poorly to well sorted, containing interbeds of dark-gray shale and black to brown mudstone. Lower part of formation consists of light-gray to black partly silty dolomudstone or light- to dark-gray fossiliferous, glauconitic limestone interbedded with light- to dark-gray and brown fossiliferous chert. Present in the Valley and Ridge. Thickness ranges from 0 to 213 feet. Lower and Middle Devonian.

Type locality: Frog Mountain, Cherokee County, Alabama.

Hayes, C. W., 1894, Geology of a portion of the Coosa Valley in Georgia and Alabama: Geological Society of America Bulletin, v. 5, p. 470.

Drahovzal, J. A., and Thomas, W. A., 1977, Pre-Mississipppian sandstones in the interior structures of the Appalachian fold and thrust belt of eastern Alabama, *in* Bearce, D. N., ed., Cambrian and Devonian stratigraphic problems of eastern Alabama: Alabama Geological Society Guidebook, 15th Annual Field Trip, p. 29-36.

Kidd, J. T., and Shannon, S. W., 1977, Preliminary areal geologic maps of the Valley and Ridge province, Jefferson County, Alabama: Alabama Geological Survey Atlas Series, no. 10, 41 p.

Gantts Quarry Formation (Sylacauga Marble Group)

White and pale-blue to light-gray calcite marble locally containing interlayered dolomite marble and thin phyllite layers. Northern Piedmont. Ordovician?

Type locality: Gantts Quarry, west-southwest of Sylacauga, Alabama.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline: Upper Precambian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-26.

Glendon Limestone Member of Byram Formation

See Byram Formation.

Type locality: Glendon, a flag station on Southern Railway between Jackson and Walker Springs in the southern part of sec. 31, T. 7 N., R. 3 E., Clarke County, Alabama. Reference section: St. Stephens Quarry, St. Stephens, Alabama.

Hopkins, O. B., 1917, Oil and gas possibilities of the Hatchetigbee anticline, Alabama: U.S. Geological Survey Bulletin 661-H, p. 298, 300.

MacNeil, F. S., 1944, Oligocene stratigraphy of Southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1315-1316 and 1329-1332.

Glenloch Schist (Emuckfaw Group)

Thick sequence of interlayered muscovite-garnet-quartz-feldspar schist and muscovite-graphite-garnet-quartz schist. Scattered layers of metagraywacke, kyanite-muscovite-quartz-biotite schist, biotite-muscovite-garnet-quartz schist and minor zones of staurolite-biotite-muscovite-quartz schist are present. The kyanite- and staurolite-bearing schist is more common near the middle of the Glenloch. Extends from Heard County, Georgia, to western Randolph County, Alabama. Northern Piedmont.

Type locality: Community of Glenloch, Heard County, Georgia.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 15-16.

Gooch Branch Chert (Sylacauga Marble Group)

Light-gray to light-brown dolomite marble associated with abundant light-gray to white massive to moderately foliated metachert. Northern Piedmont. Cambrian?-Ordovician?

Type locality: Not stated. Exposed in series of low discontinuous hills in the city of Sylacauga, Alabama.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-26.

Gordo Formation (Tuscaloosa Group)

Cross-bedded sand in massive beds that locally contain gravel and gray, moderate-red and pale-red-purple partly mottled clay in beds that generally are lenticular and locally carbonaceous; lower part is predominantly a gravelly sand consisting chiefly of chert and quartz pebbles. Thickness ranges from 115 to 300 feet. Present in west-central Alabama. Upper Cretaceous, Turonian-Coniacian?

Type locality: South-facing slope of Little Bear Valley, sec. 20, T. 20 S., R. 13 W., 2 miles southwest of Gordo, Pickens County, Alabama.

Conant, L. C., and Monroe, W. H., 1945, Stratigraphy of the Tuscaloosa Group in the Tuscaloosa and Cottondale Quadrangles, Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 37.

Monroe, W. H., Conant, L. C., and Eargle, D. H., 1946, Pre-Selma Upper Cretaceous stratigraphy of western Alabama: American Association of Petroleum Geologists Bulletin, v. 30, no. 2, p. 200-204.

Gosport Sand (Claiborne Group)

Quartzose, calcareous, fine- to coarse-grained, glauconitic, very fossiliferous sand containing lenses of greenish-gray shale. Present in southwest Alabama. Thickness ranges from 17 to 30 feet. Eocene, Claiborne (Bartonian).

Type locality: Named for Gosport, a landing on the Alabama River, a few miles below Claiborne Bluff in Clarke County, Alabama.

Smith, E. A., 1907, Underground water resources of Alabama: Alabama Geological Survey Monograph 6, p. 5, 18-19.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 115-116.

Grampian Hills Member of Nanafalia Formation

See Nanafalia Formation.

Type locality: In continuous roadcut along Alabama Highway 41 on south side of Gravel Creek valley, 7.1 miles south of Camden on road to Monroeville, Wilcox County, Alabama. Named for exposures in Grampian Hills, southern part of Wilcox County.

Blanpied, B. W., and Hazzard, R. T., 1939, Tentative correlation charts of the Gulf Coast Mesozoic and Cenozoic Systems: Shreveport Geological Society Guidebook, 14th Annual Field Trip, p. 128.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, p. 96 (fig. 32), 100, 101, 102, 108 (fig. 38), 109-110, 112, 116, 117, pls. 2, 3.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 100-105.

Gravel Creek Sand Member of Nanafalia Formation

See Nanafalia Formation.

Type locality: South wall of Gravel Creek, 7.1 miles south of Camden, Wilcox County, on Alabama Highway 41 to Monroeville. Present in outliers far north of normal outcrop area.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, p. 96-121, pls. 2, 3.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 100-105.

Greensport Formation

Variegated dusky-red and yellowish-brown siltstone, micritic limestone, and shale, containing irregular lenses of fine-grained sandstone. Bedding is even and regular, ranging from 6 inches to 2 feet. Present in the eastern Valley and Ridge, in St. Clair, Etowah, Calhoun and Cherokee Counties. Thickness ranges from 200 to 250 feet. Middle Ordovician, Porterfieldian-Rocklandian.

Type locality: Exposure at Greensport Gap on the Coosa River and nearby exposures on Alabama Highway 77, Etowah County, Alabama.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 45-48.

Greggs Landing Marl Member of Tuscahoma Sand

See Tuscahoma Sand.

Type locality: Named for exposures at Greggs Landing on the Alabama River in northwestern part of Monroe County, Alabama. Exposure is now covered by Claiborne Lake.

Smith, E. A., 1886, Summary of the lithological and stratigraphical features and subdivisions of the Tertiary of Alabama: Alabama Geological Survey Bulletin 1, p. 12.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 105-106.

Hackneyville Schist (Wedowee Group)

Medium- to coarse-grained quartz-albite-muscovite-biotite schist, graphite-muscovite-quartz schist, quartz-plagioclase-almandine-kyanite-muscovite schist, and biotitic quartzite. Commonly contains muscovite, andalusite and/or chiastolite porphyroblasts in south-central Clay County. Pods of massive sillimanite occur in the higher grade metamorphic rocks. Northern Piedmont.

Type locality: Not stated. Named for town of Hackneyville, Tallapoosa County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 9.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 29-30.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 24-25.

Halawaka Schist (Wacoochee Complex)

Intermixed sequence of feldspathic muscovite-biotite schist and quartz-diorite gneiss and augen gneiss with lenses of muscovite-graphite schist and thin irregular amphibolite units. Cut by numerous granitic or feldspathic veins. Locally, numerous small muscovite-rich pegmatites. In addition to exposures at the type locality, typical exposures can also be seen along the backwaters of the Chattahoochee River, along Little Uchee and Wacoochee Creeks, and in the immediate area south of Halawaka. Southern Piedmont.

Type locality: Exposures along the Salem-Halawaka road through secs. 13, 24, and 26, T. 19 N., R. 28 E., Lee County, Alabama.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 22.

Hanover Schist (Hatchet Creek Group)

Interbedded sequence of coarse- to fine-grained (±staurolite)-albite-biotite-sericite-quartz-muscovite schist and (±staurolite)-biotite-feldspar gneiss, with garnet, chlorite, and sillimanite as common accessory minerals. Less abundant units include graphitic feldspathic schist, hornblende quartzite, and thin amphibolite. Sericite commonly occurs as fibrous elliptical prophyroblastic aggregates. Locally, the schist is saturated with leucocratic granitoid rock. Northern Piedmont.

Type locality: Exposed along U.S. Highway 231 south of Hanover, along Mount Olive to Goodwater Road at Hatchet Creek, Coosa County, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 27.

Hartselle Sandstone

Light-colored fine-grained, well-sorted, quartzose sandstone that is locally cross-bedded, is partly calcareous, is generally thick-bedded to massive, and contains interbeds of clay shale. Present in the Plateaus and the western Valley and Ridge. Thickness ranges from 0 to 150 feet. Upper Mississippian, Chesterian.

Type locality: Named for exposures at Hartselle, Morgan County, Alabama.

Smith, E. A., 1894, Geological map of Alabama with explanatory chart: Alabama Geological Survey Special Map 1.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 36-44.

Hatchet Creek Group

Sequence of dense fine- to coarse-textured schist and gneiss divided into the Hanover Schist and the Pinchoulee Gneiss. Locally, the complex is highly feldspathized and intruded by leucocratic granitoid plutons. Northern Piedmont.

Type area: Coosa and Elmore Counties. Named for Hatchet Creek near Goodwater, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 27-28.

Hatchetigbee Formation (Wilcox Group)

Gray, brown and olive-green locally cross-bedded, very fine- to fine-grained sand and interlaminated carbonaceous, sparsely micaceous, silty clay, silt, and sandy clay. The lower 6 to 35 feet is the Bashi Marl Member, a pale-olive to greenish-gray fine-grained, abundantly glauconitic fossiliferous sand and marl containing boulder-size calcareous sandstone concretions. Thickness ranges from 250 feet in the western Coastal Plain to 35 feet in southeastern Alabama where fossiliferous, glauconitic, marly sand beds make up most of the formation. Eocene, Sabine (lower Ypresian).

Type locality: Exposures at Hatchetigbee Bluff on the Tombigbee River in sec. 16, T. 18 N., R. 1 W., Washington County, Alabama.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 39-43.

MacNeil, F. S., 1944, The Tertiary formations [Georgia]: Southeastern Geological Society Guidebook, 2nd Field Trip, p. 27-28.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 106-107.

Haynesville Formation

A variable lithologic sequence of evaporites and associated sediments including moderate-red, dusky-red to grayish-red silty, micaceous, locally anhydritic shale; light-red to light-gray fine- to coarse-grained, quartzose, partly calcareous, partly conglomeratic sandstone; anhydrite and salt either as distinct beds or as accessory minerals in the clastics; light-gray to olive-gray to brownish-gray microcrystalline, argillaceous to oolitic limestone; and dusky-brown dolomite. A massive anhydrite, the Buckner Anhydrite Member, locally occurs at the base of the formation. Thickness ranges from 0 to 2,600 feet. Present in the subsurface of southwest Alabama. Upper Jurassic, Kimmeridgian.

Type locality: Wells in Haynesville oil field, northern Louisiana.

Philpott, T. H., and Hazzard, R. T., 1949, Cretaceous of Austin, Texas, area: Shreveport Geological Society Guidebook, 17th Annual Field Trip, fig. 5.

Goebel, L. A., 1950, Cairo field, Union County, Arkansas: American Association of Petroleum Geologists Bulletin, v. 34, no. 10, p. 1978-1979.

Oxley, M. L., Minihan, E. D., and Ridgway, J. M., 1967, A study of the Jurassic sediments in portions of Mississippi and Alabama: Gulf Coast Association of Geological Societies Transactions, v. 17, p. 32-37.

Moore, C. H., 1984, The upper Smackover of the Gulf Rim: Depositional systems, diagenesis, porosity evolution and hydrocarbon production, *in* The Jurassic of the Gulf Rim: Gulf Coast Section Society of Economic Paleontologists and Mineralogists Foundation Proceedings, Third Annual Research Conference, p. 292-293.

Heflin Phyllite

Calcareous sandy metasiltstone, which is grayish green, medium gray, and medium bluish gray, thinly laminated, and interbedded with and gradational into poorly sorted, silty, fine- to coarse-grained metasandstone. Weathers to pale-brown, pale-gray, or reddish-gray. Occasional lenses of calcite and dolomite marble up to 1 foot thick. Locally, near the base is an interval of greenish-gray to dark-gray granular phyllitic metasandstone or quartz-pebble metaconglomerate which is 20 to 50 feet thick where well developed. Northern Piedmont. Cambrian?-Devonian?

Type locality: Along U.S. Highway 78 from the northwestern margin of the Talladega belt eastward up the frontal scarp to the Skyway Road (State Highway 49), and from the northwestern margin of the belt southeastward along U.S. Highway 431. Named for the town of Heflin, Cleburne County, Alabama.

Bearce, D. N., 1973, Character of the Talladega belt in eastern Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 10-12.

Neathery, T. L., 1973, Observations on the lithologic relationships within the Talladega Group, Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 51-52.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 10-11.

Cook, T. A., 1982, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians: Geological Society of America Special Paper 191, p. 47-50.

Bearce, D. N., 1985, Early Cambrian nappes bordering Talladega belt in eastern Alabama, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 47.

Osborne, W. E., Szabo, M. W., Neathery, T. L., and Copeland, C. W., Jr., compilers, 1988, Geologic map of Alabama, northeast sheet: Alabama Geological Survey Special Map 220 (in press).

Hermitage Formation (Nashville Group)

Medium- to dark-gray argillaceous, fossiliferous, poorly or wavy-bedded, phosphatic limestone and gray shale. Present in the Plateaus. The characteristic lithologies of the Hermitage serve to distinguish the base of the Nashville Group. Thickness ranges from 35 to 200 feet. Middle Ordovician, Kirkfieldian-Shermanian.

Type locality: Exposures near and at Hermitage Station on hill between Stoner Creek and Lebanon-Nashville and Central Pikes, Davidson County, Tennessee.

Hayes, C. W., and Ulrich, E. O., 1903, Description of the Columbia Quadrangle [Tennessee]: U.S. Geological Survey Geological Atlas, Folio 95, p. 1

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians, *in* The Middle and Upper Ordovician of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 17.

Higgins Ferry Group

Interbedded sequence of at least three major lithologic units: coarse- to fine-grained biotite-feldspar-quartz gneiss, sericite-feldspar-muscovite schist (±biotite)-(±garnet)-muscovite schist, biotite-garnet-feldspar gneiss; (±roscoelite)-graphite-quartz schist, graphitic quartzite; and garnet quartzite and garnetiferous altered mafic rocks. Locally, a few thin actinolite-chlorite-hornblende amphibolite and pyroxenite bodies. (See Mitchell Dam Amphibolite.) Kyanite, sillimanite and sericite porphyroblasts common in more aluminous units. Scattered pegmatites. Northern Piedmont.

Type locality: Wilderness region of western Coosa and eastern Chilton Counties and along Higgins Ferry road in Chilton County, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 17-22.

Hillabee Greenstone

Massive fine-grained pale-green to light-olive-brown greenstone, weathering to a dark-red or brownish-yellow; and well-foliated, slaty mafic phyllites. Locally, relict igneous textures can be identified. Felsic metavolcanic rocks (quartz dacites) are interlayered with the greenstones and mafic phyllites in areas where the thickness of the Hillabee exceeds 600 feet. Northern Piedmont. Paleozoic.

Type locality: Exposures at Hillabee, on Hillabee Creek, Clay County, Alabama.

Brewer, W. M., 1896, Upper gold belt of Alabama: Alabama Geological Survey Bulletin 5, p. 84-97.

Griffin, R. H., 1951, Structure and petrography of the Hillabee sill and associated metamorphics of Alabama: Alabama Geological Survey Bulletin 63, 74 p.

Clarke, O. M., Jr., and Carrington, T. J., 1964, Hillabee Chlorite Schist, *in* Deininger, R. W., Bentley, R. D., Carrington, T. J., Clarke, O. M., Jr., Power, W. R., and Simpson, T. A., Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 19-22.

Carrington, T. J., and Wigley, Perry, 1967, Redefinition of the Hillabee schist, Alabama: Southeastern Geology, v. 8, no. 1, p. 19-31.

Neathery, T. L., and others, 1975, Geologic profiles in the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 1-3.

Tull, J. F., Stow, S. H., Long, Lamar, and Hayes-Davis, Bertram, 1978, The Hillabee Greenstone--Stratigraphy, geochemistry, structure, mineralization, and theories of origin: University of Alabama Mineral Resources Institute Research Report Series, no. 1, 100 p.

Tull, J. F., and Stow, S. H., eds., 1979, The Hillabee metavolcanic complex and associated rock sequences: Alabama Geological Society Guidebook, 17th Annual Field Trip, 64 p.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians: Geological Society of America Special Paper 191, p. 7, 12-14.

Stow, S. H., 1982, Igneous petrology of the Hillabee Greenstone, northern Alabama Piedmont, *in* Bearce, D. N., Black, W. W., Kish, S. A., and Tull, J. F., eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 79-92.

Tull, J. F., and Stow, S. H., 1982, Geologic setting of the Hillabee metavolcanic complex and associated strata-bound sulfide deposits in the Appalachian Piedmont of Alabama: Economic Geology, v. 77, p. 312-321.

Russell, G. S., Russell, C. W., and Golden, B. K., 1984, The Taconic history of the northern Alabama Piedmont: Geological Society of America, Southeastern Section, Abstracts with Programs, v. 16, no. 3, p. 191.

Hissop Granite

Granite to granodiorite, mesocratic to leucocratic, strongly lineated. Northern Piedmont.

Type locality: Exposures near the community of Hissop, Coosa County, Alabama.

Deininger, R. W., 1975, Granitic rocks in the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 53-55.

Green, N. L., and Cook, R. B., 1987, Fluorine geochemistry of northern Alabama Piedmont granitoids, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 184-186.

Hollis Quartzite (Pine Mountain Group)

Quartzite with minor amounts of muscovite, microcline, and sulfide minerals; locally arkosic and commonly sheared. May be massive or have numerous interbedded schist laminae. Southern Piedmont.

Type locality: Exposures at or near Hollis, 5 miles southeast of Opelika, Lee County, Alabama.

Adams, G. I., 1926, The crystalline rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 33-34.

Adams, G. I., 1930, The significance of quartzites of Pine Mountain in the crystallines of west-central Georgia: Journal of Geology, v. 38, p. 271-279.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 35.

McDaniel, C. R., 1981, Mylonitic rocks along a transect of the Pine Window and adjacent Uchee belt, the west side of the Chattahoochee River, Lee County, Alabama, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 42.

Hospilika Granite (Uchee Complex)

Plutons of leucocratic epidote-muscovite quartz diorite to granodiorite; weak flow banding. Intrusive into the Phenix City Gneiss and the Motts Gneiss of the Goat Rock fault zone. These plutons are post-tectonic because they crosscut the lineation of the Goat Rock fault zone near Stroud Cemetery ($SW\frac{1}{4}SE\frac{1}{4}$ sec. 17, T. 18 N., R. 29 E.). Southern Piedmont.

Type locality: Exposures along Hospilika Creek in the $NE\frac{1}{4}$ sec. 27, T. 18 N., R. 29 E., Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 40.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 40.

Deininger, R. W., Bentley, R. D., and Neathery, T. L., 1971, Chemical variations among granitic plutons in Alabama Piedmont; a progress report (abs.): Geological Society of America Abstracts with Programs, v. 3, no. 5, p. 307-308.

Hosston Formation

Sandstone, shale, and mudstone, interbedded. Sandstones are varicolored, ranging from white to dark red to greenish gray, very fine to coarse grained, in part calcareous, micaceous, sparingly lignitic, and argillaceous. Shales and mudstones are varicolored reds and grays; are silty, sandy, hard, micaceous, calcareous and sparingly fossiliferous; and locally contain nodules of lime. Range in thickness and extent are unknown; however, thickness is known to reach 1,663 feet. The formation is recognized principally in Mobile and Baldwin Counties but equivalent beds are probably present elsewhere in the subsurface of southwest Alabama. Lower Cretaceous, Hauterivian-Barremian.

Type locality: Dixie Oil Co. Robert Shaw No. 92 (Dillon No. 92) in sec. 13, T. 21 N., R. 15 W., Caddo Parish, Louisiana. Named after town of Hosston located about 7 miles north of top of Pine Island anticline.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 28-30.

Nunnally, J. D., and Fowler, H. F., 1954, Lower Cretaceous stratigraphy of Mississippi: Mississippi Geological Survey Bulletin 79, 45 p.

McGlamery, Winifred, 1950-1961, Alabama Geological Survey unpublished sample descriptions of oil test wells.

Inman Formation

Greenish-gray to green calcareous laminated shale and argillaceous limestone interbedded with red or dusky-red shale and thin-bedded light-gray peloidal fine-grained limestone. Small amounts of grayish-green dolomite are also present. Present in the northeastern part of the Plateaus. Thickness ranges from 0 to 50 feet. Upper Ordovician, Edenian.

Type locality: Named for exposures at Inman, Marion County, Tennessee.

Wilson, C. W., Jr., 1949, Pre-Chattanooga stratigraphy in central Tennessee: Tennessee Division of Geology Bulletin 56, p. 2 (fig. 1), p. 175-179.

Neathery, T. L., and Drahovzal, J. A., 1985, Lithostratigraphy of Upper Ordovician strata in Alabama: Alabama Geological Survey Circular 124, p. 8-10.

Jackson Group

The Jackson Group is composed of the Moodys Branch Formation and Yazoo Clay in the west and the Moodys Branch and Crystal River Formations to the east. The group crops out across south Alabama, being predominantly clastic in the west and carbonate in the east. Thickness is 170 feet in western Alabama, 120 feet in central Alabama and 150 feet in the southeastern corner of the state. Downdip the group is 150 to 250 feet thick. Eocene, Jackson (Priabonian).

Type locality: Named for exposures at Jackson, Mississippi, along Pearl River and Moodys Branch.

Conrad, T. A., 1856, Observations on the Eocene deposits of Jackson, Mississippi, with description of thirty-four new species of shells and corals: Philadelphia Academy Natural Science Proceedings, v. 7, p. 257-258.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 116-129.

Jacksons Gap Group

Graphitic sericite (muscovite)-quartz schist, quartzite, metaconglomerate, sericite-quartz phyllonite, sericite phyllonite, and chlorite-sericite phyllonite. Blastomylonite, porphyroclastic blastomylonite schist, and mylonite quartzite occur along margins of the complex and comprise most of the unit northeast of Jacksons Gap. Brevard fault zone. Piedmont.

Type locality: Along lake front road 2 miles southwest of Jacksons Gap, Tallapoosa County, Alabama, from S$\frac{1}{2}$ NE$\frac{1}{4}$ sec. 27 to Manoy [not Maroy] Creek, SW$\frac{1}{4}$SW$\frac{1}{4}$ sec. 25, T. 22 N., R. 22 E.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 22-23, 108-116.

Jemison Chert (Talladega Group)

Massive, thick-bedded, fine-grained grayish-white to yellowish-orange locally argillaceous metachert, containing marine invertebrate fossils of Early to Middle Devonian age. To the east, the Jemison appears to grade laterally into the Chulafinnee Schist. Northern Piedmont. Early to Middle Devonian.

Type locality: Named for exposures at and near Jemison, Chilton County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 145-147.

Neathery, T. L., 1973, Observations on the lithologic relationships within the Talladega Group, Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 51-55.

Carrington, T. J., 1973, Metamorphosed Paleozoic sedimentary rocks in Chilton, Shelby, and Talladega Counties, Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 31.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 3-18.

Jumbo Dolomite (Sylacauga Marble Group)

Medium- to light-gray medium to coarsely crystalline, locally silty and laminated, generally highly fractured dolostone; basal contact gradational; near the base contains intraclasts and recrystallized fragments up to 6 cm in length; locally sandy in lower part. Northern Piedmont. Cambrian?

Type locality: Exposures extending from the NE$\frac{1}{4}$ sec. 4, T. 23 N., R. 16 E., to a locality half a mile west of old Jumbo Post Office, in W$\frac{1}{2}$ sec. 19, T. 23 N., R. 15 E., Chilton County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 53-54.

Pendexter, W. S., 1982, Stratigraphic relationships of the carbonate sequence in the Talladega slate belt, Chilton and Coosa Counties, Alabama, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 61-68.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 9.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-24.

Kahatchee Mountain Group

A dominantly clastic sequence which consists of metamorphosed siltstones and other pelites, coarse-grained feldspathic metamorphosed sandstone, and a minor marble unit. Includes in ascending order the Waxahatchee Slate, the Brewer Phyllite, the Stumps Creek Formation, and the Wash Creek Slate. Northern Piedmont. Upper Precambrian?-Cambrian?

Type locality: Named for Kahatchee Mountain northwest of Sylacauga, Alabama.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 3-18.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian western margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 11-19.

Kalona Quartzite Member of Wash Creek Slate

Light-brown to light-gray fine- to coarse-grained feldspathic quartzite. Northern Piedmont. Upper Precambrian-Cambrian?

Type locality: Exposures east of U.S. Highway I65, Chilton County, Alabama.

Carrington, T. J., 1972, Meta-Paleozoic rocks, Chilton County, Alabama, *in* Tolson, J. S., ed., Guide to Alabama geology: Geological Society of America, Southeastern Section, Guidebook, 21st Annual Meeting, p. 14.

Carrington, T. J., 1973, Metamorphosed Paleozoic sedimentary rocks in Chilton, Shelby, and Talladega Counties, Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 30.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 8.

Ketchepedrakee Amphibolite

Dark-green to black fine- to coarse-grained, layered to massive hornblende actinolite-amphibolite with zones or pods of coarse hornblendite and enstatite-hypersthene pyroxenite; may also include a few felsic dikes, widely scattered pegmatites, and screens of schist and gneiss. Magnetite, ilmenite, zoisite, and quartz are common accessory minerals. Includes all thin amphibolites associated with the Poe Bridge Mountain Group. Northern Piedmont.

Type locality: Exposures along Ketchepedrakee Creek in northern Clay County, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 41-42.

Ketona Dolomite

Light-gray coarsely crystalline thick-bedded, mostly chert-free, remarkably pure dolomite. Present in the Valley and Ridge and the subsurface of the Appalachian Plateaus. Thickness ranges from 250 to 760 feet. Upper Cambrian, Dresbachian-Franconian.

Type locality: Exposures at Ketona, Jefferson County, Alabama.

Burchard, E. F., Butts, Charles, and Eckel, E. C., 1910, Iron ores, fuels and fluxes of the Birmingham district, Alabama: U.S. Geological Survey Bulletin 400, p. 14.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 3.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 81-83.

Knox Group

Light-gray to light-brownish-gray limestone, dolomitic limestone and dolomite, containing fine to medium, rounded, frosted quartz sand and white to light-gray to brownish-gray chert. Minor amounts of gray and green shale are known in the lower Knox and several thin sandstone zones are useful markers. Crops out in the Valley and Ridge and is present in the subsurface of the Appalachian and Interior Low Plateaus. In the Valley and Ridge, the Knox, in ascending order, is locally divisible into the Copper Ridge Dolomite, Chepultepec Dolomite, and Longview and Newala Limestones. Thickness ranges from 1,476 to 4,225 feet. Upper Cambrian-Lower Ordovician, Franconian-Canadian.

Type locality: Named for development in Knox County, Tennessee.

Safford, J. M., 1869, Geology of Tennessee: Nashville, p. 151, 158-159, 203-226.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 78-100, accompanying map.

Butts, Charles, and Gildersleeve, Benjamin, 1948, Geology and mineral resources of the Paleozoic area in northwest Georgia: Georgia Geological Survey Bulletin 54, p. 16-18.

Kidd, J. T., 1976, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 24-27.

Kowaliga Gneiss

Gray coarse-grained granodiorite to quartz and plagioclase-biotite gneiss, monzonite, with plagioclase or microcline augen up to 4 inches in diameter. Generally sheared along margins. Age of the gneiss is reported to be 460 ± 19 Ma. Northern Piedmont.

Type locality: Named for exposures along Kowaliga Creek, Elmore County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 19-20.

Deininger, R. W., 1975, Granitic rocks in the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 49-52.

Russell, G. S., 1975, Geochronologic investigations in the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip. p. 87-98.

Bieler, D. B., and Deininger, R. W., 1987, Geologic setting of the Kowaliga augen gneiss and the Zana Granite, northern Alabama Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 57-72.

Russell, G. S., Odom, A. L., and Russell, C. W., 1987, Uranium-lead and rubidium-strontium isotopic evidence for the age and origin of granitic rocks in the northern Alabama Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 239-249.

Lay Dam Formation (Talladega Group)

Polymictic greenish-gray thick and irregularly bedded metaclastics (graywacke, siltstone, sandstone and arkose); may include thin zones of chlorite schist, graphite slate and bluish-gray to grayish-orange silty limestone; contains quartzite beds; and a conglomeratic facies of bouldery metagraywacke with clasts up to 3 feet in diameter occurs in Coosa and Chilton Counties. In Cleburne and Calhoun Counties, the Lay Dam includes rocks previously assigned to the Abel Gap Formation of Bearce (1973), which consist of interbedded greenish-gray metasiltstone and quartzite, black phyllitic metasiltstone, medium-gray to greenish-gray arkosic quartzite, and dark-gray pyritic quartzite. The Lay Dam includes three members, the Miller Mill Quartzite Member, the Erin Slate Member, and the Cheaha Quartzite Member. A significant regional angular unconformity is present at the base of the Lay Dam. Northern Piedmont. Silurian?-Devonian?

Type locality: Exposures on both sides of U.S. Highway l65, Chilton County, Alabama.

Bearce, D. N., 1973, Character of the Talladega belt in eastern Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 11-14.

Carrington, T. J., 1973, Metamorphosed Paleozoic sedimentary rocks in Chilton, Shelby and Talladega Counties, Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 29-30.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 10-11.

Leipers Limestone

Medium-dark-gray finely crystalline thin- to medium-bedded fossiliferous limestone interbedded with thin argillaceous limestones that form partings between the thicker, less argillaceous beds. Present in the northeastern part of the Plateaus. Generally referred to as the Maysville Group in the subsurface. Thickness ranges from 0 to 60 feet. Upper Ordovician, Maysvillian.

Type locality: Along Leipers Creek 2 miles north of Water Valley, Maury County, Tennessee.

Hayes, C. W., and Ulrich, E. O., 1903, Description of the Columbia Quadrangle, Tennessee: U.S. Geological Survey Geologic Atlas, Folio 95.

Jewell, J. W., 1969, An oil and gas evaluation of North Alabama: Alabama Geological Survey Bulletin 93, p. 10.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 20-22.

Kidd, J. T., 1975, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies, v. 25, p. 29.

Neathery, T. L., and Drahovzal, J. A., 1985, Lithostratigraphy of Upper Ordovician strata in Alabama: Alabama Geological Survey Circular 124, p. 10-11.

Lenoir Limestone

Dark-gray highly argillaceous, finely crystalline, fossiliferous, medium- to thick-bedded and evenly bedded limestone. Contains thin, irregular partings of clay and other fine-grained impurities that are revealed on weathering as raised anastomosing bands. Locally, at the base are thin conglomeratic zones of chert, quartz, or quartzite pebbles. A basal fenestral mudstone is called the Mosheim Limestone Member. Present in the eastern Valley and Ridge. Thickness ranges from 150 to 800 feet. Middle Ordovician, Whiterockian-Chazyan.

Type locality: Exposures at Lenoir City, Loudon County, Tennessee.

Safford, J. M., and Killebrew, J. M., 1876, Elements of geology of Tennessee: Nashville, p. 108, 123, 130-131, 137.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 29-32.

Lick Creek Sandstone Member of Pottsville Formation

A fine- to coarse-grained well-indurated sandstone, conglomeratic in part, that averages about 50 feet in thickness. The sandstone contains rounded pebbles, as much as an inch in diameter, of quartz or quartzite; black, gray, green, brown, and red chert pebbles; and occasional metamorphic rock fragments. The Lick Creek is in the Warrior coal field and occurs beneath the Mary Lee coal group. Appalachian Plateaus. Pennsylvanian.

Type locality: Exposures along Lick Creek in the vicinity of Kimberly, Jefferson County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 9.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. 18.

Lisbon Formation (Claiborne Group)

Glauconitic, calcareous, fossiliferous sand and sandy clay. The Lisbon is divisible into three units. The "lower" Lisbon is a coarse-grained glauconitic, highly fossiliferous sand. The "middle" Lisbon is mostly carbonaceous sand and carbonaceous silty clay. The "upper" Lisbon is the thickest (75 feet) unit consisting of glauconitic, calcareous, clayey sand, sandy clay and calcareous sand, all containing fossils. Present in the Coastal Plain of south Alabama. The thickness of the formation from west to east ranges from 165 to 75 feet. Eocene, Claiborne (Lutetian-Bartonian).

Type locality: Named for exposures on Lisbon Bluff on the Alabama River in Clarke County, Alabama.

Aldrich, T. H., 1886, Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geological Survey Bulletin 1, p. 44-60.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 111-115.

Little Oak Limestone

Dark-gray argillaceous, fossiliferous limestone containing chert nodules and stringers and thin interbeds of silty shale. The upper part is very argillaceous. In St. Clair County, two bentonites are present in the upper part of the formation. Present in the eastern Valley and Ridge, predominantly in Shelby, St. Clair, and Calhoun Counties. Thickness ranges from 0 to 500 feet. Middle Ordovician, Chazyan-Porterfieldian.

Type locality: Exposures on west front of Little Oak Ridge, south of Leeds, Jefferson County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 112, map.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 42-45.

Loachapoka Schist (Opelika Complex)

Muscovite-quartz schist, biotite-garnet-muscovite schist and minor quartzite. Quartzite beds occur in the middle of the unit. Locally contains coarse-grained kyanite-sillimanite-muscovite schist. Minor interlayered amphibolite occurs locally. Inner Piedmont.

Type locality: Exposures in the vicinity of Loachapoka, Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 31-32.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 11-13.

Sears, J. W., Cook, R. B., Jr., and Brown, D. E., 1981, Tectonic evolution of the western part of the Pine Mountain window and adjacent Inner Piedmont province, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 2-5.

Longview Limestone (Knox Group)

Light-gray cherty, locally sandy thick-bedded, finely to medium crystalline limestone and dolomite. Chert is brittle, compact and fragile and weathers to small fragments. Scattered fossils include characteristic *Lecanospira*. Mappable locally in the Valley and Ridge. Thickness averages 500 feet. Lower Ordovician, Canadian.

Type locality: Named for the town of Longview, Shelby County, Alabama, which is located on a wide area of the formation.

Ulrich, E. O., 1924, Marble deposits of east Tennessee: Tennessee Division of Geology Bulletin 28, p. 34.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 92-95.

Louann Salt

Massive silty, sandy white halite with some interlayered anhydrite. Reported thicknesses range from 0 to 600 feet. Present in the subsurface of southwest Alabama. Middle and Upper Jurassic, Callovian and Oxfordian.

Type locality: Gulf Refining Co.'s No. 49, Louis Werner Saw Mill Company well, sec. 5, T. 16 S., R. 16 W., Union County, Arkansas.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 4 (table 2), 8.

Hazzard, R. T., Blanpied, B. W., and Spooner, W. C., 1947, Notes on correlations of the Cretaceous of east Texas, south Arkansas, north Louisiana, Mississippi, and Alabama: Shreveport Geological Society 1945 Reference Report, v. 2, p. 483, 484, 487-489, cross sections.

Andrews, D. I., 1960, The Louann Salt and its relationship to Gulf Coast salt domes: Gulf Coast Association of Geological Societies Transactions, v. 10, p. 215-240.

Tolson, J. S., Copeland, C. W., and Bearden, B. L., 1982, Stratigraphic profiles of Jurassic strata in the western part of the Alabama Coastal Plain: Alabama Geological Survey Bulletin 122, p. 10-11.

Lower Cretaceous undifferentiated

Pink and yellow coarse-grained sand and gravel with gray shale and red and ochre clay. Present in the subsurface in southwest Alabama; however, extent and range in thickness are unknown. Total thickness of Lower Cretaceous sediments is known to reach approximately 7,375 feet in Mobile Bay. Lower and Upper Cretaceous, Hauterivian-Cenomanian.

Maher, J. C., and Applin, E. R., 1968, Correlation of subsurface Mesozoic and Cenozoic rocks along the Eastern Gulf Coast: American Association of Petroleum Geologists Cross Section Publication 6, p. 11 and 12.

"Lower Tuscaloosa" (Tuscaloosa Group)

Greenish-gray to very light-gray micaceous very fine- to medium-grained, quartzose sandstone that locally may be fossiliferous and glauconitic; interbedded with dark-gray silty claystone in the upper part of the sequence. Thickness ranges from 21 feet in Houston County to 758 feet in Washington County. Informal term used in the subsurface of south Alabama. Upper Cretaceous, Cenomanian.

Mancini, E. A., and Payton, J. W., 1981, Petroleum geology of South Carlton field, Lower Tuscaloosa "Pilot sand," Clarke and Baldwin Counties, Alabama: Gulf Coast Association of Geological Societies Transactions, v. 31, p. 139-147.

McBryde Limestone Member of Clayton Formation

See Clayton Formation.

Type locality: Exposures in roadcuts along State Highway 100 in secs. 28 and 33, T. 12 N., R. 10 E., Wilcox County about 3 miles west of McBryde Station, Alabama.

MacNeil, F. S., 1946, Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U.S. Geological Survey Strategic Minerals Investigations Preliminary Report 3-195, p. 7-8.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, 280 p.

Mad Indian Group

Fine-grained feldspathic biotite gneiss and medium- to coarse-grained muscovite-biotite-garnet schist. Accessory minerals include kyanite, sillimanite, sphene, apatite, and opaque minerals. Many of the schists have been retrograded to chlorite-garnet-quartz sericite schist. Locally, there are thin units of kyanite and biotite quartzite. Irregular zones of finely disseminated graphite in locally garnetiferous sericite-quartz schist, with scattered thin, massive to layered amphibolite bodies. Extensively cut by feldspathic dikes, pegmatites, and small granitic bodies. Northern Piedmont.

Type locality: Exposures along Mad Indian Creek, North Lineville East Quadrangle, Clay County, Alabama.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 13-15.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 28-29.

Manchester Schist (Pine Mountain Group)

Interlayered schist and quartzite. Comprised of three members: a lower graphitic, aluminous schist and biotite schist unit; a middle quartzite unit; and an upper unit of biotite-muscovite-quartz schist and feldspathic schist. Locally, the entire sequence has been injected with granite dikes and pegmatites. Southern Piedmont.

Type locality: Named for Manchester, Meriwether County, Georgia. Exposed in two belts that extend generally northeast, one is north of Pine Mountain and the other south of Oak Mountain.

Crickmay, G. W., 1935, Kyanite in Talbot and Upson Counties [Georgia]: Georgia Geological Survey Bulletin 46, p. 32-36.

Clarke, J. W., 1952, Geology and mineral resources of the Thomaston Quadrangle, Georgia: Geological Geological Survey Bulletin 59, p. 14-23.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 36.

Sears, J. W., Cook, R. B., Jr., and Brown, D. E., 1981, Tectonic evolution of the western part of the Pine Mountain window and adjacent Inner Piedmont province, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 9.

Steltenpohl, M. G., 1988, Geology of the Pine Mountain imbricate zone, Lee County, Alabama: Alabama Geological Survey Circular 136, p. 7-8.

Marcoot Dike

Tholeiitic olivine diabase. The dike is approximately 20 miles long and averages about 20 feet in thickness. Southern Piedmont. Triassic?-Jurassic?

Type locality: Just east of old post office site of Marcoot in Chambers County, 6 miles northwest of LaFayette Alabama.

Adams, G. I., 1933, General geology of the crystallines of Alabama: Journal of Geology, v. 41, p. 172.

Deininger, R. W., 1967, Some petrographic variations among diabase dikes in Lee and Chambers Counties, Alabama: Alabama Academy of Science Journal, v. 38, p. 341.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 41.

Brown, D. E., and Cook, R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek area, Chambers and Lee Counties, Alabama, *in* Sears, J. W., Contrasts in tectonic style

between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 31-32.

Marianna Limestone (Vicksburg Group)

White to cream-colored soft, porous, chalky limestone. Includes glauconitic limestone and calcareous sand in the basal part in western Alabama. Recognizable in southwest Alabama. Thickness estimated between 40 and 75 feet in west Alabama. Oligocene, Vicksburg (Rupelian).

Type locality: Exposures at Marianna, Jackson County, Florida.

Johnson, L. C., 1892, The Chattahoochee embayment [Florida]: Geological Society of America Bulletin, v. 3, p. 128-132.

MacNeil, F. S., 1944, Oligocene stratigraphy of Southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1315, 1324-1329.

"Marine Tuscaloosa" (Tuscaloosa Group)

Dark-gray silty, micaceous, fossiliferous, laminated shale. Thickness ranges from 80 feet in Barbour County to 535 feet in Baldwin County. Informal term used in the subsurface of south Alabama. Upper Cretaceous, Cenomanian.

Mancini, E. A., Smith, C. C., and Payton, J. W., 1980, Geologic age and depositional environment of the "Pilot sand" and "marine shale," Tuscaloosa Group, South Carlton field, south Alabama, *in* Geology of the Woodbine and Tuscaloosa Formations: Gulf Coast Section, Society of Economic Paleontologists and Mineralogists, 1st Annual Research Conference, p. 24-25.

Mancini, E. A., and Payton, J. W., 1981, Petroleum geology of South Carlton field, lower Tuscaloosa "Pilot sand," Clarke and Baldwin Counties, Alabama: Gulf Coast Association of Geological Societies Transactions, v. 31, p. 139-147.

Matthews Landing Marl Member of Porters Creek Formation

See Porters Creek Formation.

Type locality: Named for old Matthews Landing on the Alabama River in the northern part of sec. 12, T. 12 N., R. 6 E., Wilcox County, Alabama.

Smith, E. A., 1886, Summary of the lithological and stratigraphic features and subdivisions of the Tertiary of Alabama, *in* Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geological Survey Bulletin 1, p. 13.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 57-60.

MacNeil, F. S., 1946, Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U.S. Geological Survey Strategic Minerals Investigations Preliminary Report 3-195, p. 5, 11-12.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 97-98.

Maury Formation

Greenish-gray to grayish-red thinly laminated shale, commonly containing phosphate nodules. Present in the subsurface in the Appalachian Plateaus and in outcrop in the Valley and Ridge and the Plateaus. Thickness ranges from 0 to 7 feet. Lower Mississippian, Kinderhookian.

Standard section: Along south side of road near top of west slope of Pull Tight Hill, 13.5 miles southeast of Franklin and 1.2 miles east of Cross Key, Williamston County, Tennessee. Named for Maury County, Tennessee, where the formation is well developed.

Safford, J. M., and Killebrew, J. B., 1900, The elementary geology of Tennessee: Nashville, p. 104, 141, 143.

Hass, W. H., 1956, Age and correlation of the Chattanooga Shale and the Maury Formation: U.S. Geological Survey Professional Paper 286, p. 23-26, pl. 5.

Conant, L. C., and Swanson, V. E., 1961, Chattanooga Shale and related rocks of central Tennessee and nearby areas: U.S. Geological Survey Professional Paper 357, p. 62-69.

Maysville Group

See Leipers Limestone.

Meridian Sand Member of Tallahatta Formation

See Tallahatta Formation.

Type locality: Named for exposures at and near Meridian, Lauderdale County, Mississippi.

Lowe, E. N., 1933, The Eocene formations below the Jackson: Mississippi Geological Survey Bulletin 25.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 107-111.

Midway Group

The Midway Group is composed of the Clayton, Porters Creek, and Naheola Formations, in ascending order. Paleocene, Midway (Danian-Thanetian).

Type locality: Named for exposures at Midway Landing and plantation on west side of Alabama River about 5 miles below Prairie Bluff in Wilcox County, Alabama.

Harris, G. D., 1894, On the geological position of the Eocene deposits of Maryland and Virginia: American Journal of Science, 3rd, v. 47, p. 303-304 [1896].

Harris, G. D., 1894, Claiborne fossils: Bulletins of American Paleontology, v. 1, no. 4, p. 10-38.

Cooke, C. W., 1925, Correlation of the Eocene formations in Mississippi and Alabama: U.S. Geological Survey Professional Paper 140-E, p. 133-134.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 93-99.

Miller Mill Quartzite Member of Lay Dam Formation

White to medium-gray medium- to coarse-grained, quartzose to feldspathic quartzite, with local conglomeratic zones. Northern Piedmont. Silurian? to Devonian?

Type locality: At site of mill operated by Miller family, State Highway 145, east of U.S. Highway I65, Chilton County, Alabama.

Carrington, T. J., 1972, Meta-Paleozoic rocks, Chilton County, Alabama, *in* Tolson, J. S., ed., Guide to Alabama geology: Geological Society of America, Southeastern Section Guidebook, 21st Annual Meeting, p. 14.

Carrington, T. J., 1973, Metamorphosed Paleozoic sedimentary rocks in Chilton, Shelby and Talladega Counties, Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 29-30.

Miocene undifferentiated

Red and orange quartz sand, thin gravel beds and massive mottled varicolored clay. Present in southwest Alabama. Thickness ranges from 0 to 2,000 feet. Miocene and Pliocene?

Reed, P. C., 1971, Geologic map of Mobile County, Alabama: Alabama Geological Survey Special Map 93, p. 2-5.

Raymond, D. E., 1985, Depositional sequences in the Pensacola Clay (Miocene) of southwest Alabama: Alabama Geological Survey Bulletin 114, p. 14-15.

Mitchell Dam Amphibolite

Dark-green to black fine- to coarse-grained, thin-layered to massive hornblende-actinolite amphibolite; locally chlorite and biotite are abundant. Plagioclase, quartz, and clinozoisite are common accessory minerals. Includes all thin amphibolites associated with the Higgins Ferry Group. Northern Piedmont.

Type locality: Exposures near Mitchell Dam on the Coosa River, east of the Coosa River Bridge, SW¼ sec. 13, T. 21 N., R. 16 E., Chilton County, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society, 13th Annual Field Trip, p. 34-40.

Rheams, K. F., Allison, David, and Tull, J. F., 1986, Mitchell Dam Amphibolite along Alabama Highway 22, east-central Chilton and west-central Coosa Counties, Alabama, *in* Neathery, T. L., ed., Southeastern section of the Geological Society of America Centennial Field Guide, v. 6, p. 301-304.

Moffits Mill Schist

Biotite-epidote-muscovite-quartz schist and interlayered fine- to medium-grained metagraywacke and quartzite. Migmatitic in part. Individual beds of schist range from 0.25 inch to 5 inches in thickness. Layers of metagraywacke are generally 2 to 3 feet thick, although a few layers form beds 20 to 50 feet thick. Southern Piedmont.

Type locality: Exposures at the site of the old Moffits Mill on Little Uchee Creek in sec. 36, T. 18 N., R. 28 E., Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 38-39.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 35.

Monteagle Limestone

Light-gray cross-bedded oolitic limestone, with massive beds more than 10 feet thick that are interbedded with beds of micrite, bioclastic limestone, dolostone, and dolomitic limestone; argillaceous limestone; and greenish-gray and medium-gray clay shale. Present in northeastern Alabama. Thickness ranges from 200 to 300 feet. Upper Mississippian, Meramecian-Chesterian.

Type locality: Section at Monteagle, Tennessee.

Peterson, M. N. A., 1962, The mineralogy and petrology of Upper Mississippian carbonate rocks of the Cumberland Plateau in Tennessee: Journal of Geology, v. 70, p. 1-31.

Stearns, R. G., 1963, Monteagle Limestone, Hartselle Formation, and Bangor Limestone--A new Mississippian nomenclature for use in middle Tennessee, with a history of its development: Tennessee Division of Geology Information Circular 11, 18 p.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 18-24.

Moodys Branch Formation (Jackson Group)

Greenish-gray to pale-yellowish-orange glauconitic, calcareous, fossiliferous sand and sandy marl. The upper part is generally less glauconitic and more calcareous than the lower part. Contains the guide fossil *Periarchus lyelli* (Conrad). Present in south Alabama. Thickness ranges from 10 to 48 feet. Eocene, Jackson (lower Priabonian).

Type locality: At intersection of Peachtree Street and Poplar Boulevard in city of Jackson, Hinds County, Mississippi.

Reference section: In Riverside Park in Jackson, Mississippi. Named for exposures along Moodys Branch of Pearl River in Jackson, Mississippi.

Meyer, Otto, 1885, The genealogy and the age of the species of the southern Old Tertiary, part III: American Journal of Science, 3d, v. 30, p. 435.

Lowe, E. N., 1915, Mississippi: Its geology, geography, soils, and mineral resources: Mississippi Geological Survey Bulletin 12, Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists, 1960, Unit I, Type localities project: Baton Rouge, Society of Economic Paleontologists and Mineralogists.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 116-122.

Mooreville Chalk (Selma Group)

Yellowish-gray to dark-bluish-gray clayey compact fossiliferous chalk and chalky marl; near base may include thin glauconitic and clayey marl beds; weathers to white or cream. The lower few feet of the formation is a compact calcareous sand containing scattered quartz pebbles, phosphatic pellets, and phosphatic internal molds of fossil shells. The upper Arcola Limestone Member includes two to four beds of light-gray impure dense, brittle fossiliferous limestone with softer marl interbeds. The member is about 10 feet thick. Thickness of the Mooreville ranges from 270 feet in west Alabama to 600 feet in Montgomery County. The formation thins to 100 feet in southern Macon County where it grades into the Blufftown Formation. Present in the Coastal Plain from Sumter County to eastern Russell County. Upper Cretaceous, Campanian.

Type locality: Named for exposures at Mooreville, Lee County, Mississippi.

Stephenson, L. W., 1917, Tongue, a new stratigraphic term, with illustrations from the Mississippi Cretaceous: Washington Academy of Science Journal, v. 7, p. 243-250.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, 150 p.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Mooringsport Formation

Grayish-red finely micaceous shale; medium-dark-gray to very light-gray very finely crystalline, oolitic, partly arenaceous limestone; olive-gray to white finely crystalline anhydrite; very light-gray to pinkish-gray and pale-red fine-grained, partly silty sandstone. Thickness reaches 220 feet. The formation is recognized principally in Mobile and Baldwin Counties but equivalent beds are probably present elsewhere in the subsurface in southwest Alabama. Lower Cretaceous, Albian.

Type locality: Union Producing Co.'s Noel Estate well No. 1-A, Mooringsport field, sec. 11, T. 19 N., R. 16 W., Caddo Parish, Louisiana. Top is 825 feet below top of Trinity Group.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 36-37, cross sections.

Nunnally, J. D., and Fowler, H. F., 1954, Lower Cretaceous stratigraphy of Mississippi: Mississippi Geological Survey Bulletin 79, 45 p.

McGlamery, Winifred, 1950-1961, Alabama Geological Survey unpublished sample descriptions of oil test wells.

Mosheim Limestone Member (Lenoir Limestone)

Medium- to dark-gray thick-bedded to massive lime mudstone containing abundant fenestrae. Present locally at the base of the Lenoir Limestone in the eastern Valley and Ridge. Thickness ranges from 0 to more than 200 feet. Although originally given formation status (Butts, 1926), the limited geographic distribution and thickness of the Mosheim indicate that member stratigraphic rank is more appropriate. Middle Ordovician, Whiterockian.

Type locality: Named for exposures in a railroad cut at Mosheim Station, Greene County, Tennessee.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geological Society of America Bulletin, v. 22, p. 413, 414, 538, 543, 544, 557, 636, pl. 27.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 92-95.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians, *in* The Middle and Upper Ordovician of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 31-32.

Benson, D. J., and Mink, R. M., 1983, Depositional history and petroleum potential of the Middle and Upper Ordovician of the Alabama Appalachians: Gulf Coast Association of Geological Societies Transactions, v. 33, p. 13-21.

Motts Gneiss

Leucocratic quartz diorite pencil gneiss, with zones of sheared epidote-hornblende-oligoclase amphibolite. Uniform lineation results upon weathering in a characteristic saprolite with spindly fragments. Present along the southeast edge of the Goat Rock fault zone in a 2-mile-wide zone. Good exposures are at Dunken and Little Uchee Creeks; typical exposures occur along the Shotwell-Meadows Crossroads road. The amphibolite mylonite is best exposed below the dam on Little Uchee Creek at the site of the old Moffits Mill. Southern Piedmont.

Type locality: Exposures near the community of Motts in sec. 9, T. 18 N., R. 29 E., Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 38.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 33-35.

McDaniel, C. R., 1981, Mylonitic rocks along a transect of the Pine Mountain window and adjacent Uchee belt, the west side of the Chattahoochee River, Lee County, Alabama, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window in eastern Alabama and adjacent Georgia: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 43-44.

Osborne, W. E., Szabo, M. W., Neathery, T. L., and Copeland, C. W., Jr., compilers, 1988, Geologic map of Alabama, northeast sheet: Alabama Geological Survey Special Map 220 [in press].

Naheola Formation (Midway Group)

The Naheola Formation is divided into the Oak Hill Member below and the Coal Bluff Marl Member above. The Oak Hill Member consists of brownish-gray laminated sandy silt and silty clay and beds of greenish-gray fine-grained sand. Lignite, 1 to 7 feet thick, is present locally at the top of the member. The Coal Bluff Marl Member consists of glauconitic partly fossiliferous sand and fossiliferous sandy marl and contains thin-bedded silty clay in the upper part. The Oak Hill is generally 80 to 150 feet thick in the western Coastal Plain. The Oak Hill Member thins greatly east of Wilcox County and is absent east of Butler County. The Oak Hill thickens west of Wilcox County and becomes more sandy in Mississippi. The Coal Bluff is 15 to 60 feet thick, is absent in eastern Alabama, and is unfossiliferous and not distinguished as a separate member in Sumter County and to the west in Mississippi. Paleocene, Midway (lower Thanetian).

Type locality: Named for Naheola Bluff on the Tombigbee River in SE¼ sec. 30, T. 15 N., R. 1 E., Choctaw County, Alabama.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of Tuscaloosa, Tombigbee, and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 57-60.

Toulmin, L. D., LaMoreaux, P. E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Alabama Geological Survey Special Report 21, p. 41-44.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, p. 22, 79-95.

Nanafalia Formation (Wilcox Group)

The Nanafalia Formation is divisible into three members. The Gravel Creek Sand Member at the base consists of fine- to coarse-grained cross-bedded sand containing fine quartz gravel, clay pebbles and thinly laminated beds of carbonaceous clay and silt. The middle unnamed member, informally called the "*Ostrea thirsae* beds," consists of glauconitic quartz sand and glauconitic sandy marl containing *Odontogryphaea thirsae* (Gabb) (previously called "*Ostrea thirsae*"). The upper Grampian Hills Member consists of marine glauconitic sandy clay and dark-gray massive clay with glauconitic sand beds in places. The Nanafalia crops out across the Coastal Plain, ranging in thickness from 250 feet in south-central and southwestern Alabama to a minimum of 75 feet along the Alabama-Georgia State line. Paleocene, Sabine (lower and middle Thanetian).

Type locality: Named for exposures at Nanafalia Landing on the Tombigbee River in Marengo County, Alabama.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of Tuscaloosa, Tombigbee and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 51-57.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, p. 95-111, pls. 2, 3.

Copeland, C. W., ed., Geology of the Alabama Coastal Plain: Alabama Geological Survey Circular 47, p. 24.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, 100-105.

Nashville Group undifferentiated

Medium- to dark-gray micritic to medium-grained, partly crystalline fossiliferous limestone. In the subsurface of north Alabama, the Nashville is a gray phosphatic limestone that is argillaceous and silty in its lower part and which contains minor amounts of gray shale. Locally, it consists of gray to greenish-gray limestone, brown dolomitic limestone, green dolomite, gray silty and shaly limestone, gray bentonitic shale, and brown chert. Present in the subsurface of the Plateaus and in outcrop in the northern and northeastern parts of the Plateaus. Thickness ranges from 50 feet near Gadsden, Etowah County, to 250 feet in Jackson County. Middle Ordovician, Kirkfieldian-Shermanian.

Type area: Exposures in the Central Basin of Tennessee. Named for Nashville, Tennessee.

Safford, J. M., 1851, The Silurian basin of Middle Tennessee with notices of the strata surrounding it: American Journal of Science, 2nd Series, v. 12, p. 352-361.

Wilson, C. W., Jr., 1948, Pre-Chattanooga stratigraphy in Central Tennessee: Tennessee Division of Geology Bulletin 56, 407 p.

Milici, R. C., and Smith, J. W., 1969, Stratigraphy of the Chickamauga Supergroup in its type area: Tennessee Division of Geology Report of Investigations, no. 24, p. 23-24.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 16-18.

Kidd, J. T., 1976, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 29-32.

Newala Limestone (Knox Group)

Dark-gray, light-gray, and bluish-gray compact or noncrystalline or textureless, thick-bedded micritic or peloidal limestone and some dolomite. Dolomite occurs as beds as much as 20 feet thick or as mottling. Dolomite is finely to medium crystalline. Mappable locally in the Valley and Ridge. Thicknesses reported for the Newala range from about 200 to 1,000 feet. Lower Ordovician, Canadian.

Type locality: Newala post office, Shelby County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 95-99.

Nichols Formation

Massive to laminated greenish-gray and black micaceous mudstone with minor interbeds of siltstone and very fine-grained sandstone. Thickness is approximately 420 feet. Crops out in the eastern Valley and Ridge. Lower Cambrian.

Type locality: Named for Nichols Branch of Walden Creek at eastern end of Chilhowee Mountain, Sevier County, Tennessee.

Keith, A., 1895, Description of the Knoxville sheet: U.S. Geological Survey Geologic Atlas, Folio 16, p. 3.

Mack, G. H., 1980, Stratigraphy and depositional environments of the Chilhowee Group (Cambrian) in Georgia and Alabama: American Journal of Science, v. 280, p. 497-515.

Norphlet Formation

The Norphlet includes an updip conglomeratic sandstone, a discontinuous and localized basal shale, red beds and an upper quartzose sandstone (Denkman Sandstone Member) that comprises most of the formation. The conglomeratic sandstone is gray to red, fine to very coarse grained, poorly sorted, and quartzose; clasts range in size from granules to cobbles consisting of chert, shale, quartz and assorted metamorphic or igneous rock fragments. Mostly black with some brown and red shale is known to occur at the base of the formation in parts of Choctaw and Escambia Counties. Red beds in the formation are mostly sandstone, siltstone and shale. The sandstone generally is gray to red, very fine to coarse, poorly to moderately sorted, quartzose and feldspathic. The Denkman Sandstone Member comprises most of the formation in downdip and offshore areas and is mostly gray and brown very fine- to medium-grained, well-sorted, subarkosic sandstone. Thickness ranges from 0 to over 900 feet. Present in the subsurface of southwest Alabama, Upper Jurassic, Oxfordian.

Type locality: Gulf Refining Co.'s No. 49, L. Werner Saw Mill Co. well, Union County, Arkansas.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 4 (table 2), 8.

Hazzard, R. T., Blanpied, B. W., and Spooner, W. T., 1947, Notes on correlations of the Cretaceous of east Texas, south Arkansas, north Louisiana, Mississippi, and Alabama: Shreveport Geological Society 1945 Reference Report, v. 2, p. 483, 484, 488, 490 (table 5).

Wilkerson, R. P., 1981, Depositional environments and regional stratigraphy of Jurassic Norphlet Formation in south Alabama: Gulf Coast Association of Geological Societies Transactions, v. 31, p. 417-419.

Pepper, Fred, 1982, Depositional environments of the Norphlet Formation (Jurassic) for southwestern Alabama: Gulf Coast Association of Geological Societies Transactions, v. 32, p. 17-22.

Cagle, J. W., and Khan, M. A., 1983, Smackover-Norphlet stratigraphy, south Wiggins arch, Mississippi and Alabama: Gulf Coast Association of Geological Societies Transactions, v. 33, p. 23-29.

North Twistwood Creek Clay Member of Yazoo Clay

Greenish-gray slightly calcareous and plastic clay. Lithologically, this member may range from a pure montmorillonite clay to a lignitic, zeolitic, micaceous, calcareous, sandy clay to a micaceous, calcareous, argillaceous sand. Present in south Alabama. Thickness ranges from 32 feet on the Sepulga River to 60 feet in southwest Alabama. Eocene, Jackson (lower Priabonian).

Type locality: Exposures on the west side of North Twistwood Creek in SW$\frac{1}{4}$ sec. 1, T. 3 N., R. 12 E., Jasper County, Mississippi, 2 miles southwest of Rose Hill on State highway to Gridly and Turnerville.

Murray, G. E., 1947, Cenozoic deposits of central Gulf Coastal Plain: American Association of Petroleum Geologists Bulletin, v. 31, no. 10, p. 1838 (fig. 6), 1839 (footnote).

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 126-129.

Oak Bowery Dike

Tholeiitic olivine diabase. The dike is about 6 feet thick and 5 miles long. Southern Piedmont. Triassic?-Jurassic?

Type locality: Exposed from 1½ miles northwest of Opelika, Lee County, to 1 mile north of Oak Bowery, Chambers County, Alabama. Best exposed along stream in the NW¼SW¼ sec. 34, T. 21 N, R. 26 E.

Deininger, R. W., 1967, Some previously unreported details on locations of diabase dikes in Lee and Chambers Counties, Alabama (abs.): Alabama Academy Science Journal, v. 38, p. 229.

Brown, D. E., and Cook, R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek area, Chambers and Lee Counties, Alabama, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 31-32.

Oak Hill Member of Naheola Formation

See Naheola Formation.

Type locality: In roadcut on Alabama Highway 10, one-half mile west of Oak Hill post office, sec. 17, T. 11 N., R. 10 E., Wilcox County, Alabama.

Reference section: Outcrops near Mt. Zion Church, S½ sec. 9, T. 11 N., R. 10 E., along Alabama Highway 21, Wilcox County, Alabama.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 63.

Toulmin, L. D., Jr., 1944, The Midway-Wilcox contact in Alabama: Alabama Academy of Science Journal, v. 16, p. 42.

Toulmin, L. D., LaMoreaux, P. E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Alabama Geological Survey Special Report 21, p. 42-45, pl. 3, geologic map.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, 280 p.

Opelika Complex

A metasedimentary sequence consisting of fine-grained biotite-oligoclase gneiss, very coarse-grained muscovite-biotite schist, kyanite-sillimanite-muscovite schist and quartzite with a few thin amphibolite units, and several irregular semiconcordant granitic plutons. Includes the Loachapoka Schist to the northwest, Auburn Gneiss to the southeast, and the intrusive Bottle Granite. Inner Piedmont.

Type locality:
Named for town of Opelika, Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 31-32.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 11-15.

Sears, J. W., Cook, R. B., Jr., and Brown, D. E., 1981, Tectonic evolution of the western part of the Pine Mountain window and adjacent Inner Piedmont province, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 2-8.

"*Ostrea thirsae* beds"

See Nanafalia Formation.

Ordovician undifferentiated

Brownish-gray to medium-gray partly dolomitic, partly oolitic, partly silty and sandy limestone with minor amounts of chert and ostracods. Present in the subsurface of the southern Black Warrior basin. Middle and Upper Ordovician (Whiterockian-Richmondian?).

Kidd, J. T., 1975, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 27-32.

Raymond, D. E., and Copeland, C. W., 1987, Selected columnar sections for the Coastal Plain, Appalachian Plateaus, Interior Low Plateaus, and Valley and Ridge provinces in Alabama: Alabama Geological Survey Atlas Series 20, p. 9, 11.

Pachuta Marl Member of Yazoo Clay

Light-greenish-gray clayey, glauconitic, fossiliferous, calcareous sand or sandy marl to limestone that weathers to pale-yellowish-orange. Present in southwest Alabama. Thickness ranges from 6 to 15 feet. Eocene, Jackson (Priabonian).

Type locality: Exposures on the south side of Pachuta Creek, 1¼ miles south and southeast of Pachuta in SW¼ sec. 8, T. 2 N., R. 14 E., Clarke County, Mississippi.

Murray, G. E., 1947, Cenozoic deposits of central Gulf Coastal Plain: American Association of Petroleum Geologists Bulletin, v. 31, no. 10, p. 1830 (fig. 6), 1839 (footnote).

Toulmin, L. D., LaMoreaux, P. E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Alabama Geological Survey Special Report 21, p. 122, 126, pl. 3.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 126-129.

Paluxy Formation

Pale-red, very light-gray to pinkish-gray fine- to medium-grained, subangular to subrounded, quartzose, micaceous, argillaceous sandstone. Pale-red, grayish-red to medium-dark-gray very finely micaceous, partly arenaceous shale with occasional pale-red finely crystalline nodular limestone. Thickness reaches 1,246 feet. The Paluxy is recognized mainly in the subsurface of Mobile and Baldwin Counties, but equivalent beds are probably present elsewhere in the subsurface in southwest Alabama. Lower Cretaceous, Albian.

Type locality: Named for town and creek in Somervell County, Texas.

Hill, R. T., 1891, The Comanche series of the Texas-Arkansas region: Geological Society of America Bulletin, v. 2, p. 504.

Nunnally, J. D., and Fowler, H. F., 1954, Lower Cretaceous stratigraphy of Mississippi: Mississippi Geological Survey Bulletin 79, 45 p.

McGlamery, Winifred, 1950-1961, Alabama Geological Survey unpublished sample descriptions of oil test wells.

Parkwood Formation

Medium- to dark-gray silty clay shale and mudstone, interbedded with light- to medium-gray very fine- to fine-grained argillaceous, micaceous, and locally cross-bedded and ripple-marked sandstone. Nodules and thin nodular beds of siderite are common, especially in the lower part of the formation. Sandstone units generally range from 10 to 50 feet in thickness, but locally are as much as 150 feet thick. Locally contains beds of medium- to dark-gray argillaceous, bioclastic, and cherty limestone; interbeds of blocky dusky-red and grayish-green mudstone; and beds of clayey coal a few inches thick. Present in the southern part of the Black Warrior basin and the western Valley and Ridge. Thickness ranges from 0 to more than 2,500 feet. Upper Mississippian-Lower Pennsylvanian, Chesterian-Morrowan.

Type locality: Named for exposures at Parkwood, Jefferson County, Alabama.

Burchard, E. F., Butts, Charles, and Eckel, E. C., 1910, Iron ores, fuels and fluxes of the Birmingham district Alabama: U.S. Geological Survey Bulletin 400, p. 15, 20.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 8.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 67-83.

Paynes Hammock Sand

Blue-green calcareous, predominantly medium-grained to coarse-grained, argillaceous sand interspersed with infrequent beds of bluish-gray clay and thin-bedded sandy limestone. Present in southwest Alabama at widely scattered outcrops. Thickness is 13 feet at the type locality in Clarke County. Oligocene, Chattian.

Type locality: Along branch entering Tombigbee River at Paynes Hammock, Alabama, in NW¼SW¼ sec. 16, T. 5 N., R. 2 E., Clarke County, Alabama.

MacNeil, F. S., 1944, Oligocene stratigraphy of southeastern United States: American Association of Petroleum Geologists Bulletin, v. 28, no. 9, p. 1346-1354.

Poag, C. W., 1966, Paynes Hammock (Lower Miocene?) Foraminifera of Alabama and Mississippi: Micropaleontology, v. 12, no. 4, p. 393-440.

Poag, C. W., 1972, Planktonic foraminifers of the Chickasawhay Formation, United States Gulf Coast: Micropaleontology, v. 18, no. 3, p. 257-277.

Pennington Formation

Gray clay shale, containing interbeds of dusky-red and olive-gray mudstones; bioclastic, oolitic, and micritic limestones; microcrystalline dolostones; argillaceous sandstone; and carbonaceous claystone and shaly coal. Present in northeast Alabama. Thickness ranges from 150 to 550 feet. Upper Mississippian, Chesterian.

Type locality: Named for Pennington Gap, Lee County, Virginia, about 40 miles northeast along strike from Cumberland Gap.

Campbell, M. R., 1893, Geology of the Big Stone Gap coal field of Virginia and Kentucky: U.S. Geological Survey Bulletin 111, p. 28, 37.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 83-90.

Pensacola Clay

Greenish-gray to light-olive-gray slightly calcareous, slightly micaceous, in part fossiliferous, silty to sandy marine clay containing beds and lenses of sand. The formation consists of upper and lower clay members separated by the Escambia Sand Member, a gray fine- to very coarse-grained micaceous quartz sand locally containing small pebbles and granules of quartz, shells, and carbonaceous plant fragments. Present in the subsurface of Mobile and Baldwin Counties. Thickness ranges from 500 to more than 1,600 feet. Middle and upper Miocene, Langhian-Tortonian.

Type locality: Three oil test wells 22 to 24 miles west and southwest of Pensacola, Florida. They are the Baldwin-Garrett No. 1, in NE¼NW¼ sec. 9, T. 9 S., R. 5 E.; the Temple-Ehle No. 1, in the center of NE¼SE¼ sec. 15, T. 8 S., R. 4 E.; and the Temple-Sherrill et al No. 1, in SE¼NE¼ sec. 15, T. 7 S., R. 4 E, Baldwin County, Alabama. The formation is named for the city of Pensacola, Florida.

Marsh, O. T., 1966, Geology of Escambia and Santa Rosa Counties, western Florida panhandle: Florida Geological Survey Bulletin, no. 46, p. 54-68.

Raymond, D. E., 1985, Depositional sequences in the Pensacola Clay (Miocene) of southwest Alabama: Alabama Geological Survey Bulletin 114, 87 p.

Phelps Creek Gneiss (Wacoochee Complex)

Light- to medium-gray granite and quartz monzonite gneiss, often strongly foliated and in part cataclastic. Occurs in numerous small dikes and sheets. Poorly exposed because the high feldspar content facilitates weathering and decomposition. Southern Piedmont.

Type locality: Exposures along Phelps Creek just north of Salem, Lee County, Alabama.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 22-24.

Phenix City Gneiss (Uchee Complex)

Coarsely crystalline highly contorted migmatitic biotite-epidote quartz diorite gneiss, biotite-hornblende gneiss, and locally epidote-biotite amphibolite. Typically, intensely folded and migmatized. Locally, includes large exotic xenoliths of other rock units. In two abandoned quarries approximately 3 miles east of Smiths Station in the NE¼ sec. 21, T. 18 N., R. 30 E., Lee County, calcite crystals as much as 2 inches in diameter occur as widely disseminated phenocrysts in the more mafic phases of the gneiss Here also, the Phenix City Gneiss appears to be intruded by granodiorite and pegmatites. Southern Piedmont.

Type locality: Exposures at Rocky Shoals on the Chattahoochee River at Phenix City, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 39-40.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 36-38.

Pinchoulee Gneiss (Hatchet Creek Group)

Fine- to medium-grained feldspathic biotite gneiss, locally garnetiferous and commonly saturated with leucocratic granitoid dikes, sills, and plutons. Occasional zones of graphite-sericite-feldspar schist, hornblende quartzite, garnet quartzite, and thin amphibolite. Migmatitic along southeastern margin and along Coosa River. Northern Piedmont.

Type locality: Exposed along shores of Lake Jordan between Chestnut Creek and Welona fault, Chilton County.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 27-28.

Pine Barren Member of Clayton Formation

See Clayton Formation.

Type locality: In roadcuts and ditches on south side of Pine Barren Creek, along State Highway 100, from southern junction with State Highway 11 to bed of creek at McConnicos Mill in SE¼ sec. 21, T. 12 N., R. 10 E., Wilcox County, Alabama.

Smith, E. A., 1886, Summary of the lithological and stratigraphical features and subdivisions of the Tertiary of Alabama, *in* Aldrich, T. H., Preliminary report on the Tertiary fossils of Alabama and Mississippi: Alabama Geological Survey Bulletin 1, p. 14.

MacNeil, F. S., 1946, Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U.S. Geological Survey Strategic Minerals Investigation Preliminary Report 3-195, p. 8-9.

LaMoreaux, P. E., and Toulmin, L. D., 1959, Geology and ground-water resources of Wilcox County, Alabama: Alabama Geological Survey County Report 4, 280 p.

Pine Hill Anhydrite Member of Louann Salt

White finely crystalline anhydrite with random reddish inclusions and occasional interbeds of salt. Locally present at the top of the Louann Salt in the subsurface of southwest Alabama. Thickness reaches a maximum of 100 feet in Washington County; however, where present, thickness generally ranges from 7 to 40 feet. Upper Jurassic, Oxfordian?

Type well: Because no well designated in original reference, designated herein as the Brandon Company, W. J. Miller et al No. 1, from a depth of 8,764 to 8,772 feet near Pine Hill, Wilcox County, Alabama.

Oxley, M. L., and Minihan, E. D., 1968, Jurassic geology of Alabama and Florida panhandle: Gulf Coast Association of Geological Societies Transactions, v. 18, p. 51.

Oxley, M. L., and Minihan, E. D., 1969, Alabama exploration underway: Oil and Gas Journal, v. 67, no. 4, p. 207-212.

Oxley, M. L., and Minihan, E. D., 1969, Alabama discoveries spark interest in adjoining states: Oil and Gas Journal, v. 67, no. 5, p. 125-126.

Mink, R. M., Bearden, B. L., and Mancini, E. A., 1985, Regional Jurassic geologic framework of Alabama coastal waters area and adjacent Federal waters area: Alabama State Oil and Gas Board Oil and Gas Report 12, p. 6, 7, 22.

Pine Mountain Group

Sequence of fine-grained metasediments comprised of the Hollis Quartzite, Chewacla Marble, and Manchester Schist. Southern Piedmont.

Type locality: Outcrops on Pine Mountain, from western part of Harris County to eastern part of Pike County, Georgia.

Galpin, S. L., 1915, A preliminary report on the feldspar and mica deposits of Georgia: Georgia Geological Survey Bulletin 30, p. 74-76.

Crickmay, G. W., 1952, Geology of the crystalline rocks of Georgia: Georgia Geological Survey Bulletin 58, p. 22-23.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 34-36.

Sears, J. W., Cook, R. B., Gilbert, O. E., Carrington, T. J., and Schamel, Steven, 1981, Stratigraphy and structure of the Pine Mountain window in Georgia and Alabama: Georgia Geological Survey Information Circular 54-A, p. 41-53.

Steltenpohl, M. G., 1988, Geology of the Pine Mountain imbricate zone, Lee County, Alabama: Alabama Geological Survey Circular 136, p. 7-8.

Pine Sandstone Member of Pottsville Formation

A thick-bedded coarse-grained quartzose conglomeratic sandstone, which grades upward to a flaggy fine-grained sandstone. The Pine Sandstone occurs in the lower part of the Pottsville in the Coosa and Cahaba coal fields, lying 200 to 1,000 feet above the basal Shades Sandstone Member. The Pine Sandstone Member increases in thickness from 250 feet in the northern part of the Cahaba coal field to 400 feet in the southern part. Thickness in the Coosa coal field ranges from 200 to 500 feet. Southern Valley and Ridge. Pennsylvanian.

Type locality: Named for Pine Ridge [sic] or Pine Mountain, southeast of Shades Mountain, Jefferson and Shelby Counties, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 10.

Rothrock, H. E., 1949, Geology and coal resources of the northeast part of the Coosa coal field, St. Clair County, Alabama: Alabama Geological Survey Bulletin 61, p. 22, pl. 1, fig. 2.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B35-B36, pls. 2 and 3.

Poe Bridge Mountain Group

Interlayered sequence of coarse- to fine-grained feldspathic graphite schist, (± roscoelite)-graphite-quartz schist, graphitic quartzite, (± staurolite) ± (kyanite) ± (sillimanite)-muscovite-biotite schist, garnet-biotite-muscovite schist and gneiss, fine-grained biotite-feldspar gneiss, pyritic sericite-quartz schist, garnet quartzite, garnetiferous amphibole schist (garnetite) and isolated pods and small bodies of pyroxenite, metanorite, metagabbro and hornblendite. (See Ketchepedrakee Amphibolite). Occasional pegmatites. Northern Piedmont.

Type area: West-central Clay and south-central Cleburne Counties, Alabama.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 22-24.

Cook, R. B., Hicks, B. K., and Beg, M. A., 1982, Reconnaissance uranium exploration in Coosa and Clay Counties, Alabama: Alabama Geological Survey Circular 107, 44 p.

Pond Spring Formation (Stones River Group)

Mottled greenish-gray and gray partly argillaceous and silty limestone and/or dolomite, locally containing beds of green shale that may be locally conglomeratic at the base and containing occasional rounded quartz sand grains. Present at the base of the Stones River Group in the Plateaus, primarily in the northern part. Thickness ranges from 0 to 239 feet. Middle Ordovician, Whiterockian.

Type locality: Chickamauga Valley, Kensington Quadrangle, Walker County, Georgia. Named for the town of Pond Spring.

Milici, R. C., and Smith, J. W., 1969, Stratigraphy of the Chickamauga Supergroup in its type locality: Georgia Geological Survey Bulletin 80, p. 4.

Milici, R. C., and Smith, J. W., 1969, Stratigraphy of the Chickamauga Supergroup in its type area: Tennessee Division of Geology Report of Investigations, no. 24, p. 15-17, 33-35.

Kidd, J. T., 1976, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 24-27.

Porters Creek Formation (Midway Group)

Dark-brown to black massive marine clay that breaks with subconchoidal fracture. About 20 feet of brownish-gray calcareous, glauconitic, shelly, silty clay at the top is called the Matthews Landing Marl Member. The Porters Creek becomes increasingly calcareous eastward where a prominent limestone occurs in the middle of the formation and the upper part grades into calcareous, micaceous silt and fine-grained sand. East of Crenshaw County equivalent facies are included in the Clayton Formation. Thickness ranges from 450 feet in the western part of the Coastal Plain to 150 feet in Wilcox and Butler Counties. Paleocene, Midway. (Danian-Thanetian).

Type locality: Named for exposures on Porters Creek, Hardeman County, Tennessee, about 1½ miles west of railroad station at Middleton.

Safford, J. M., 1864, On the Cretaceous and superior formations of west Tennessee: American Journal of Science, 2nd Series, v. 37, p. 361, 368.

MacNeil, F. S., 1946, Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U.S. Geological Survey Strategic Mineral Investigations Preliminary Report 3-195, p. 10-12.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p. 97-98.

Pottsville Formation

Interbedded sandstone, siltstone, shale, conglomerate, and coal. The lower part is dominated by massive, conglomeratic, orthoquartzitic sandstones interbedded with varying amounts of shale, siltstone, and thin discontinuous coals. The upper part includes most of the coal beds. Intervals between major coal groups consist of cyclic, coarsening upward sequences that grade from shales containing abundant bioturbation and marine fossils into siltstones and fine-grained sandstones. Present in the Appalachian Plateaus, the subsurface of the southern Black Warrior basin, and the Valley and Ridge. Thickness ranges from 0 to more than 9,000 feet. Lower Pennsylvanian, Morrowan.

Type locality: South of city of Pottsville along Pennsylvania Railroad cut on east side of water gap through Sharp Mountain, Schuylkill County, Pennsylvania.

Reference section: About 150 feet east of type section, along east side of roadcut for U.S. Highway 122.

Lesley, J. P., 1876, The Boyd's Hill gas well at Pittsburgh [Pennsylvania]: Pennsylvania 2nd Geological Survey Report L, app. E, p. 221-227.

Smith, W. E., 1979, Pennsylvanian stratigraphy of Alabama, *in* The Mississippian and Pennsylvanian (Carboniferous) Systems in the United States: U.S. Geological Survey Professional Paper 1110-I, p. 123-136.

Prairie Bluff Chalk (Selma Group)

Bluish-gray firm sandy, fossiliferous, brittle chalk. The Prairie Bluff crops out from Sumter County to south-central Bullock County where it grades into the Providence Sand. Locally absent, the Prairie Bluff reaches a maximum thickness of about 110 feet in Lowndes County. Upper Cretaceous, Maastrichtian.

Type locality: Named for exposures in Prairie Bluff, on the right bank of the Alabama River in the SW¼ sec. 32, T. 14 N., R. 7 E., Wilcox County, Alabama.

Winchell, Alexander, 1857, Notes on the geology of middle and southern Alabama: American Association Advancement Science Proceedings, 2nd Ser., v. 10, p. 83, 84, 90.

Eargle, D. H., 1950, Geologic map of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Stephenson, L. W., and Monroe, W. H., 1937, Prairie Bluff Chalk and Owl Creek formation of eastern Gulf region: American Association of Petroleum Geologists Bulletin, v. 21, no. 6, p. 807.

Monroe, W. H., and Hunt, J. L., 1958, Geology of the Epes Quadrangle, Alabama: U.S. Geological Survey Geologic Quadrangle Map GQ-113.

Sohl, N. F., 1960, Archeogastropoda, Mesogastropoda and stratigraphy of the Ripley, Owl Creek, and Prairie Bluff Formations: U.S. Geological Survey Professional Paper 331-A, p. 25-27.

Pride Mountain Formation

Medium- to dark-gray fissile clay shale containing abundant siderite nodules and occasional pyrite, interbedded locally with blocky dusky-red and green mudstone, calcareous clay shale, shaly argillaceous limestone that contains abundant bryozoans and brachiopods, and one to three units of a variable combination of sandstone and limestone. Basal beds are commonly oolitic and/or shaly limestone. Present in the western part of the Appalachian Plateaus and the southern part of the western Valley and Ridge. Thickness ranges from 0 to over 480 feet. Upper Mississippian, Meramecian-Chesterian.

Type locality: About 2 miles east of Pride, Alabama, and ½ mile south of U.S. Highway 72 in SE¼ sec. 15, T. 4 S., R. 12 W. Named for exposures in roadcuts on northeastern slope of Pride Mountain in north-central Colbert County, Alabama.

Welch, S. W., 1958, Stratigraphy of Upper Mississippian rocks above the Tuscumbia Limestone in northern Alabama and northeastern Mississippi: U.S. Geological Survey Oil and Gas Investigations Chart OC-58.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 24-36.

Providence Sand (Selma Group)

The upper part consists of cross-bedded fine to coarse sand and white, dark-gray, and pale-red-purple mottled clay containing lignite, sand, and kaolin. This upper part ranges from 80 to 150 feet in thickness. The lower part ranges from 10 to 150 feet in thickness and consists of dark-gray laminated to thin-bedded silty clay and very fine- to fine-grained sand that is abundantly micaceous and carbonaceous. Crops out in the Coastal Plain from southeastern Lowndes County into Georgia. Upper Cretaceous, Maastrichtian.

Type locality: Exposures in deep gullies at Providence, 8 miles west of Lumpkin, Stewart County, Georgia.

Veatch, J. O., 1909, Second report on the clay deposits of Georgia: Georgia Geological Survey Bulletin 18, p. 86.

Cooke, C. W., and Munyan, A. C., 1938, Stratigraphy of Coastal Plain of Georgia: American Association of Petroleum Geologists Bulletin, v. 22, no. 7, p. 791.

Eargle, D. H., 1950, Geologic map of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Razburg Sandstone Member of Pottsville Formation

A fine- to coarse-grained, well-indurated sandstone below the Gwin coal group in the Warrior coal field. Thickness averages 20 feet. Appalachian Plateaus. Pennsylvanian.

Type locality: Razburg, Jefferson County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 9.

Red Bluff Clay (Vicksburg Group)

Greenish-gray glauconitic, calcareous clay; dark-gray to yellowish-gray glauconitic, fossiliferous, partially indurated limestone; and gray silty clay containing interbeds of sand. Present in southwest Alabama. Thickness ranges from 10 to 60 feet where present. Grades eastward into Bumpnose Limestone. Oligocene, Vicksburg (Rupelian).

Type locality: Exposures at Red Bluff on the Chickasawhay River just above railroad bridge 1½ miles south of Shubuta, Wayne County, Mississippi.

Hilgard, E. W., 1860, Report on the geology and agriculture of the state of Mississippi: Mississippi Geologic and Agricultural Report, p. 135.

Toulmin, L. D., LaMoreaux, P. E., and Lanphere, C. R., 1951, Geology and ground-water resources of Choctaw County, Alabama: Alabama Geological Survey County Report 2, p. 127-128.

Red Mountain Formation

Dark-reddish-brown to olive-gray siltstone, sandstone and shale, also containing hematite beds 5 to 30 feet thick. Thin beds of limestone may be present. Found in northeast Alabama in the Appalachian Plateaus and Valley and Ridge. Thickness ranges from 95 to 590 feet. Lower-Upper Silurian, Alexandrian-Lockportian.

Type locality: Named for development on Red Mountain (East Red Mountain) east of Birmingham, Alabama.

Smith, E. A., 1876, Report of progress for 1876: Alabama Geological Survey Report of Progress, no. 4, p. 11, 23, 25, 42, 207-208.

Burchard, E. F., and Andrews, T. G., 1947, Iron ore outcrops of the Red Mountain Formation in northeast Alabama: Alabama Geological Survey Special Report 19, 375 p.

Kidd, J. T., and Shannon, S. W., 1977, Preliminary areal geologic maps of the Valley and Ridge province, Jefferson County, Alabama: Alabama Geological Survey Atlas Series, no. 10, 41 p.

Residuum

White to moderately reddish-orange sandy clay and clay with scattered layers of gravelly medium to coarse sand, fossiliferous chert and limestone boulders, and limonitic sand masses. Derived predominantly from solution and collapse of limestone in the Jackson Group and Oligocene Series and the slumping of Miocene sediments in the Coastal Plain of southeast Alabama. Eocene to Miocene.

MacNeil, F. S., 1946, Geologic map of the Tertiary formations of Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 45.

Szabo, M. W., and Copeland, C. W., Jr., compilers, 1988, Geologic map of Alabama, southeast sheet: Alabama Geological Survey Special Map 220 (in press).

Ripley Formation (Selma Group)

The upper unnamed member consists of light-gray to pale-olive massive, bioturbated, micaceous, glauconitic fine sand, sandy calcareous clay and thin indurated beds of fossiliferous sandstone. The lower Cusseta Sand Member consists of calcareous sandstone, sandy chalk and coarse cross-bedded sand with occasional thin layers of limestone and fine gravel. Excluding the Cusseta Sand, the Ripley generally ranges from 150 to 250 feet in thickness, although it thins to 35 feet in Sumter County. The Cusseta Sand Member is typically less than 200 feet in thickness. Present across the Coastal Plain in south-central Alabama. Upper Cretaceous, Maastrichtian.

Type locality: Named for Ripley, Tippah County, Mississippi.

Hilgard, E. W., 1860, Report on the geology and agriculture of the state of Mississippi: Mississippi Geologic and Agricultural Report, p. 3, 62, 83-95.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, p. 73-88.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Rockford Granite

Strongly peraluminous granite, trondhjemite, and granodiorite, fine- to medium-grained, leucocratic, locally pegmatitic. Northern Piedmont.

Type locality: Exposures in T. 24 N., R. 20 E., near the town of Rockford, Coosa County, Alabama.

Wampler, J. M., Neathery, T. L., and Bentley, R. D., 1970, Age relations in the Alabama Piedmont, *in* Bentley, R. D., and Neathery, T. L., Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 88.

Deininger, R. W., 1975, Granitic rocks in the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 57-58.

Drummond, M. S., 1987, Rockford Granite, Coosa County, Alabama: I. Geologic setting, occurrence, petrography and mineral chemistry, *in* Drummond, M. S., and Green, Nathan, eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 117-130.

Drummond, M. S., 1987, Rockford Granite, Coosa County, Alabama. II. Alkali metasomatism and trondhjemite genesis, *in* Drummond, M. S., and Green, Nathan, eds., Granites of Alabama: Tuscaloosa, Alabama Geological Survey, p. 131-154.

Drummond, M. S., and Allison, D. T., 1987, Rockford Granite, Coosa County, Alabama: III. Igneous petrogenesis and tectonic setting, *in* Drummond, M. S., and Green, Nathan, eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 155-182.

Rock Mills Granite Gneiss (Dadeville Complex)

Slightly foliated medium- to coarse-grained leucocratic granite gneiss and a well-foliated biotite granite gneiss, composed of biotite, microcline, oligoclase, and quartz with rutile and zircon as accessory minerals. Locally, epidote-rich; may include thin, small amphibolite bodies. Inner Piedmont.

Type locality: Extensive pavement areas at Rock Mills, Randolph County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 28-29.

Wade, G. D., 1985, Mineral resources of Chambers County, Alabama: Alabama Geological Survey Special Map 165, p. 1-3.

Neilson, M. J., 1987, The felsic gneisses of the Inner Piedmont, *in* Drummond, M. S., and Green, N. L., eds., Granites of Alabama: Tuscaloosa, Alabama, Alabama Geological Survey, p. 11.

Rocky Ridge Sandstone Member of Pottsville Formation

A thick-bedded conglomeratic quartzose sandstone about 50 to 100 feet thick that lies about 2,400 feet above the Chestnut Sandstone Member and about 3,000 feet above the Pine Sandstone Member in the interval between the Buck and Pump coal beds of the Pottsville Formation in the Cahaba coal field. Southern Valley and Ridge. Pennsylvanian.

Type locality: Named for Rocky Ridge, which is underlain by the sandstone and which occurs east and northeast of Cahaba pumping station in northwestern part of Vandiver Quadrangle, in T. 18 S., R. 2 W., Jefferson County, Alabama.

Butts, Charles, 1927, Description of the Bessemer and Vandiver Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 221, p. 14.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B 36.

Rodessa Formation

Pale-yellowish-brown, light-red to light-gray very fine- to coarse-grained micaceous, partly calcareous sandstone; black, gray or red limy, silty, or micaceous shale; and finely crystalline to oolitic, argillaceous, silty, fossiliferous limestone which may contain lenses of light-gray, medium-gray, and brownish-gray anhydrite. Thickness is known to reach 380 feet. Occurs in the subsurface of southwest Alabama principally in Mobile and Baldwin Counties, but equivalent beds are probably present elsewhere in southwest Alabama. Lower Cretaceous, Aptian -Albian.

Type well: Union Producing Co.'s Caddo Levee Board No. B-1, sec. 26, T. 23 N., R. 16 W., Caddo Parish, Louisiana. Interval on electric log from 5,320 to 5,805 feet represents Rodessa.

Weeks, W. B., 1938, South Arkansas stratigraphy with emphasis on the older Coastal Plain beds: American Association of Petroleum Geologists Bulletin, v. 22, no. 8, p. 961 (fig. 4), 970.

Forgotson, J. M., Jr., 1957, Stratigraphy of Comanchean Cretaceous Trinity Group [Gulf Coastal Plain]: American Association of Petroleum Geologists Bulletin, v. 41, no. 10, p. 2350-2354.

Eaves, Everett, 1976, Citronelle oil field, Mobile County, Alabama: American Association of Petroleum Geologists Memoir 24, p. 259-275.

Rome Formation

Moderate-red to grayish-green varicolored shale, and moderate-red and yellow to moderate-brown siltstone and sandstone; light-gray calcareous sandstone; and local beds of fairly pure limestone and dolomite. Anhydrite and dolomite are both present in the lower part of the formation in the subsurface. Bedding is typically thin and regular, ranging from laminae to beds a few inches thick. Present in the Valley and Ridge and the eastern Appalachian Plateaus. Reported thicknesses range from 290 feet in the subsurface of Cullman County to as much as 4,000 feet in the Valley and Ridge, although the latter may be excessive. Lower Cambrian.

Type locality: Named for exposures at Rome, Georgia.

Smith, E. A., 1890, An appendix on the geology of the valley regions adjacent to the Cahaba field, *in* Squire, Joseph, Report on the Cahaba coal field: Alabama Geological Survey Special Report 2, p. 149.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 65-67.

Raymond, D. E., and Copeland, C. W., 1987, Selected columnar sections for the Coastal Plain, Appalachian Plateaus, Interior Low Plateaus, and Valley and Ridge provinces in Alabama: Alabama Geological Survey Atlas Series 20, p. 40-41.

Ropes Creek Amphibolite (Dadeville Complex)

Layered and massive amphibolite, layers consisting of varying amounts of hornblende and plagioclase with lesser amounts of augite, biotite, garnet, epidote, quartz, sphene, apatite, and opaques. Locally hornblende migmatite and ultramafic pods. Inner Piedmont.

Type locality: Exposures along Ropes Creek in northeast Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 29-30.

Brown, D. E., and Cook, R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek area, Chambers and Lee Counties, Alabama, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 15-33.

Salem Dike

Olivine diabase. The dike extends a distance of approximately 10 miles and is 10 to 30 feet wide. Southern Piedmont. Triassic?-Jurassic?

Type locality: Exposures near Salem, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 41.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 41-43.

Deininger, R. W., Dallmeyer, R. D., and Neathery, T. L., 1975, Chemical variations and K-Ar ages of diabase dikes in west-central Alabama: Geological Society of America Southeastern Section Abstracts with Programs, v. 7, no. 4, p. 482.

Salt Mountain Limestone (Wilcox Group)

White massive indurated fossiliferous limestone, with sand at the base. Thickness ranges from 90 feet in outcrop in Clarke County to 36 feet in the subsurface of Mobile County. The formation is only exposed in the vicinity of Salt Mountain, southeast of Jackson, Clarke County. Paleocene, Sabine (middle Thanetian).

Type locality: Exposures at Salt Mountain, Clarke County, Alabama.

Langdon, D. W., 1891, Variations in the Cretaceous and Tertiary strata of Alabama: Geological Society of America Bulletin, v. 2, p. 589-605.

Toulmin, L. D., 1940, The Salt Mountain Limestone of Alabama: Alabama Geological Survey Bulletin 46, 126 p.

Sawyer Limestone Member (Brewer Phyllite)

Light- to medium-gray argillaceous, silty to siliceous slightly metamorphosed limestone interlayered with lithographic to coarsely crystalline calcite and dolomite marble and interbedded locally with phyllite and meta-sandstone. Northern Piedmont. Upper Precambrian?-Cambrian?

Type locality: Exposures in Sawyer Cove, Shelby County, Alabama.

Butts, Charles, 1940, Description of the Montevallo and Columbiana Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 226.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 6-9.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 13-15.

Selma Group

Upper stratigraphic unit of Cretaceous. The Selma Group is comprised of the Mooreville Chalk, Demopolis Chalk, Ripley Formation and Prairie Bluff Chalk in western Alabama and the Blufftown Formation, Ripley Formation, and Providence Sand in eastern Alabama. The group consists primarily of chalk and sand. Thickness ranges from 800 feet in Sumter County to 1,600 feet in Montgomery County. Upper Cretaceous, Campanian-Maastrichtian.

Type locality: Named for Selma, Dallas County, Alabama.

Smith, E. A., Johnson, L. C., and Langdon, D. W., 1894, Report on the geology of the Coastal Plain of Alabama: Alabama Geological Survey Special Report 6, p. 15, 22, 27, 255, 276-286.

Monroe, W. H., 1941, Notes on deposits of Selma and Ripley age in Alabama: Alabama Geological Survey Bulletin 48, p. 73-88.

Eargle, D. H., 1950, Stratigraphy of the Selma Group in eastern Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 105.

Monroe, W. H., and Hunt, J. L., 1958, Geology of the Epes Quadrangle, Alabama: U.S. Geological Survey Quadrangle Map GQ 113.

Sequatchie Formation

Eastern facies: Siltstone, sandstone, and shale, dusky-red and olive-gray in lower part; upper part consists of gray to grayish-green calcareous siltstone and dolomite. Bedding is regular but uneven. Rests conformably on the Colvin Mountain Sandstone and is overlain unconformably by the Silurian Red Mountain Formation.

Western facies: Calcareous laminated mudstone, mottled reddish-gray to green and yellow and containing interbeds of medium to coarsely crystalline locally fossiliferous limestone. Individual beds may be locally glauconitic, arenaceous, and silty. A distinctive fossiliferous limestone ("Fernvale Limestone") occurs in the upper part of the sequence as thin interbeds and lenses. These limestone beds are gray to red and medium to coarsely crystalline, and contain varying amounts of red, pink, yellow and brown calcite grains and green phosphatic inclusions. Bedding is 1 inch to 2 feet thick. In the west, a light-yellowish-gray and greenish-brown thinly bedded calcareous shale interbedded with thin layers of argillaceous limestone occurs at the top of the Sequatchie. This shale is equivalent to the Mannie Shale of Tennessee. A 1- to 4-foot-thick bed of dark-brown fine-grained sandstone occurs above the shale.

The eastern facies occurs in the northern part of the eastern Valley and Ridge, in St. Clair, southeastern Etowah, northwestern Calhoun, and southwestern Cherokee Counties. The western facies is present in the Plateaus and the western Valley and Ridge. Thickness ranges from 0 to 200 feet. Middle-Upper Ordovician, Kirkfieldian-Richmondian. Western facies younger than eastern facies.

Type locality: Named for exposures in Sequatchie Valley, Tennessee.

Ulrich, E. O., 1911, Revision of the Paleozoic systems: Geological Society of America Bulletin, v. 22, p. 614, 646-651, 665.

Wilson, C. W., Jr., 1949, Pre-Chattanooga stratigraphy in central Tennessee: Tennessee Division of Geology Bulletin 56, p. 209, 211, 219-229.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 22-27.

Shades Sandstone Member of Pottsville Formation

A thick-bedded coarse-grained quartzose sandstone, somewhat conglomeratic at the base, which occurs at the base of the Pottsville in the Coosa and Cahaba coal fields. The Shades Sandstone maintains an average thickness of about 200 feet throughout the length of the Cahaba coal field and a thickness of 190 to 500 feet in the Coosa coal field. Southern Valley and Ridge. Pennsylvanian.

Type locality: Named for occurrence on Shades Mountain, Birmingham Quadrangle, Jefferson County, Alabama.

Butts, Charles, 1910, Description of the Birmingham Quadrangle [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 175, p. 10, 11.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B35, pls. 2 and 3.

Shady Dolomite

Limestone and dolomite, generally poorly exposed. Limestone is bluish gray or pale yellowish gray, thick bedded, and in part medium crystalline. Dolomite is light to dark gray, finely to coarsely crystalline, argillaceous to sandy, siliceous and massive to laminated. Exposures are composed of moderate-reddish-brown sandy clay containing limonite granules and pebbles, semi-porcelaneous chert that weathers to a spongy texture, dark-gray vitreous chert, and residual veins of finely crystalline quartz that display a lacy "boxwork" texture. The lower 150 feet in the Anniston area, Calhoun County, is moderate-red, yellow, and grayish-red-purple silty clay and clayey siltstone. Crops out in the eastern Valley and Ridge. Reported thicknesses range from 370 feet in Cherokee County to 1,000 feet in southern Calhoun County. Lower Cambrian.

Type locality: Typically exposed in Stoney Creek Valley, Carter County, Tennessee. Named for Shady, Johnson County, Tennessee.

Keith, Arthur, 1903, Description of the Cranberry Quadrangle [North Carolina-Tennessee]: U.S. Geological Survey Geologic Atlas, Folio 90, 9 p.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 64-65.

Bearce, D. N., 1977, Stratigraphic problems of the eastern Coosa Valley, *in* Cambrian and Devonian stratigraphic problems of eastern Alabama: Alabama Geological Society Guidebook, 15th Annual Field Conference, p. 42.

Osborne, W. E., and Szabo, M. W., 1984, Stratigraphy and structure of the Jacksonville fault, Calhoun County, Alabama: Alabama Geological Survey Circular 117, p. 7.

Shelvin Rock Church Formation (Sylacauga Marble Group)

Moderate-pink to light-gray calcite and locally dolomite marble. Northern Piedmont. Cambrian?-Ordovician?

Type locality: Exposures in the hilly region around Shelvin Rock Church in NW$\frac{1}{4}$ sec. 4, T. 22 S., R. 3 E., approximately 3.7 miles west of Sylacauga, Talladega County, Alabama.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-26.

Shubuta Member of Yazoo Clay

Light-greenish-gray to white fossiliferous, calcareous clay containing many small irregular white calcareous nodules; grades eastward from the Tombigbee River into grayish-yellow-green sandy, very glauconitic marl and white limestone of the Crystal River Formation. Present in southwest Alabama. Thickness ranges from 20 to 36 feet. Eocene, Jackson (Priabonian).

Type locality: East side of Chickasawhay River just north of U.S. Highway 45 bridge east of Shubuta, SW¼ sec. 3, T. 10 N., R. 16 E., Clarke County, Mississippi.

Murray, G. E., 1947, Cenozoic deposits of central Gulf Coastal Plain: American Association of Petroleum Geologists Bulletin, v. 31, no. 10, p. 1838 (fig. 6), 1839 (footnote).

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 126-129.

Silurian undifferentiated

In the subsurface of the northern and central part of the Black Warrior basin, the Silurian section is fossiliferous and consists of grayish-red shale, argillaceous limestone, and crystalline limestone overlain by a medium-gray to greenish-gray argillaceous limestone sequence. To the south, the Silurian consists of orange-pink and pale-green crystalline limestone or grayish-red, light-gray, and light-red argillaceous, silty, earthy limestones that may contain glauconite and hematite pellets and/or ooids. Greenish-gray to grayish-red shale is generally present. In Jefferson and central Tuscaloosa Counties, the Silurian consists of interbedded limestone, shale, and sandstone in the upper half and hematite and ferruginous sandstone in the lower half. Crops out in the Interior Low Plateaus. Thickness ranges from 0 to almost 700 feet in northeast Pickens County. Lower-Upper Silurian, Alexandrian-Lockportian.

Kidd, J. T., 1975, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 20-39.

Sligo Formation

Gray and red partly calcareous, silty, micaceous shale; light-red to light-gray micaceous very fine- to coarse-grained quartzose sandstone; some olive-gray to dark-yellowish-orange mottled, finely crystalline limestone. Thickness is known to reach 540 feet. The formation is recognized principally in Mobile and Baldwin Counties but equivalent beds are probably present elsewhere in the subsurface of southwest Alabama; however, the exact thicknesses and extent are unknown. Lower Cretaceous, Barremian.

Type locality: Sligo field, Bossier Parrish, northwestern Louisiana. Type well not designated but formation is described in Stanolind Oil and Gas Co.'s Dillon Heir's No. 131 well, located in sec. 14, T. 21 N., R. 15 W., Caddo Parrish, Louisiana, and in Amerada Petroleum Corporation's Halff and Oppenheimer No. 8 well, southwest of Pearsall, Frio County, Texas.

Imlay, R. W., 1940, Lower Cretaceous and Jurassic formations of southern Arkansas and their oil and gas possibilities: Arkansas Geological Survey Information Circular 12, p. 30-32.

Eaves, Everett, 1976, Citronelle oil field, Mobile County, Alabama: American Association of Petroleum Geologists Memoir 24, p. 259-275.

Smackover Formation

Olive-gray to brownish-gray to dark-gray partly dolomitic limestone and dolostone; in upper part generally an oolitic, oncolitic or peloidal grainstone to wackestone; in lower part generally dense laminated mudstone, wackestone, or dolostone. Thickness ranges from 0 to 750 feet near the coast. Present in the subsurface of southwest Alabama. Upper Jurassic, Oxfordian.

Type locality: First known from Lion Oil Refining Co.'s Hayes No. 9-A, sec. 9, T. 16 S., R. 15 W., Union County, Arkansas. Named for Smackover field.

Bingham, D. H., 1937, Developments in Arkansas-Louisiana-Texas area, 1936-37: American Association of Petroleum Geologists Bulletin, v. 21, no. 8, p. 1068, 1072.

Mancini, E. A., and Benson, D. J., 1980, Regional stratigraphy of Upper Jurassic Smackover carbonates of southwest Alabama: Gulf Coast Association of Geological Societies Transactions, v. 30, p. 151-163.

Baria, L. R., Stoudt, D. L., Harris, P. M., and Crevello, P. D., 1982, Upper Jurassic reefs of Smackover Formation, United States Gulf Coast: American Association of Petroleum Geologists Bulletin, v. 66, no. 10, p. 1449-1456, 1463-1475.

Bradford, C. A., 1984, Transgressive-regressive carbonate facies of the Smackover Formation, Escambia County, Alabama, *in* The Jurassic of the Gulf Rim: Gulf Coast Section Society of Economic Paleontologists and Mineralogists Foundation Proceedings, Third Annual Research Conference, p. 27-39.

Snapper Dike

Olivine diabase. The Snapper Dike ranges from 10 to 30 feet in thickness and is about 17 miles long. Southern Piedmont. Triassic?-Jurassic?

Type locality: Named for Snapper Creek which it crosses in Chambers County, Alabama.

Adams, G. I., 1933, General geology of the crystallines of Alabama: Journal of Geology, v. 41, p. 173.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 41.

Brown, D. E., and Cook, R. B., Jr., 1981, Petrography of major Dadeville Complex rock units in the Boyds Creek area, Chambers and Lee Counties, Alabama, *in* Sears, J. W., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 31-32.

Stones River Group

Predominantly medium- to dark-gray thick- to thin-bedded, partly argillaceous and silty, generally fine-grained limestone with locally abundant fossil horizons. Near the top occurs a zone of bentonite beds and bentonitic shales. In the subsurface of the Plateaus, the upper part of the Stones River is a brownish-gray to medium-gray sublithographic to crystalline, occasionally fossiliferous and argillaceous, sometimes oolitic limestone, containing minor chert and ostracods. Thin beds of bentonite occur at the top in north Alabama. The lower part is a dolomitic, sucrosic, light-gray to greenish-gray limestone containing lesser amounts of brownish-gray limestone. Minor amounts of sucrosic dolomite, cryptocrystalline chert, and sublithographic to crystalline and less commonly oolitic limestone also occur. Locally, sandy zones occur near the base and middle of the Stones River Group. The Stones River Group crops out in the northern and northeastern parts of the Plateaus. Thickness ranges from 500 feet in Lamar County to 1,150 feet in Jackson County. Middle Ordovician, Whiterockian-Kirkfieldian.

Type locality: Named for exposures on Stones River near Nashville, Tennessee.

Safford, J. M., 1851, The Silurian basin of Middle Tennessee with notices of the strata surrounding it: American Journal of Science, 2nd Series, v. 12, p. 353, 354-356.

Drahovzal, J. A., and Neathery, T. L., 1971, Middle and Upper Ordovician stratigraphy of the Alabama Appalachians: Alabama Geological Society Guidebook, 9th Annual Field Trip, p. 9-16.

Kidd, J. T., 1976, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 20-39.

Straight Ridge Sandstone Member of Pottsville Formation

A resistant ridge-forming sandstone about 800 feet above the Wolf Ridge Sandstone Member and 2,100 feet above the Pine Sandstone Member of the Pottsville Formation in the southwestern part of the Coosa coal field. Thickness ranges from 50 to 100 feet. Valley and Ridge. Pennsylvanian.

Type locality: Named for Straight Ridge which is underlain by the sandstone and which extends along west side and south end of Yellowleaf basin, Vandiver Quadrangle, in T. 19 S., R. 1 E., Shelby County, Alabama.

Butts, Charles, 1927, Description of the Bessemer and Vandiver Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 221, p. 14.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. 13.

Straven Conglomerate Member of Pottsville Formation

A conglomerate of subrounded to well-rounded pebbles and a few cobbles (as much as 8 inches in diameter) of quartzite; black, gray, green, brown, and red chert; metamorphic rocks; and other conglomerates, in a matrix of well-cemented, fine to coarse quartz and chert grains. The Straven occurs at the base of the upper Pottsville in the Cahaba coal field and is between the Upper and Lower Thompson coal beds. The member ranges in thickness from about 5 to 75 feet. Valley and Ridge. Pennsylvanian.

Type locality: Named for Straven in the Montevallo Quadrangle, Shelby County, Alabama.

Butts, Charles, 1927, Description of the Bessemer and Vandiver Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 221, p. 14.

Culbertson, W. C., 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B 37.

Stumps Creek Formation (Kahatchee Mountain Group)

Grayish-green parallel- and cross-laminated micaceous, feldspathic, arenaceous metamorphosed siltstone, fine-grained metamorphosed sandstone, and green phyllite; locally contains interbeds of dark-green fine- to medium-grained pyritic quartzite. A hematitic, feldspathic, locally cross-bedded metamorphosed sandstone occurs near the top of the Stumps Creek. The Stumps Creek was originally defined by Warren (1969) as a tongue of the Wash Creek Slate overlying the Brewer Phyllite. Carrington (1973) used the term "Stumps Creek formation" informally to designate a unit gradationally overlying the Brewer Phyllite. When the Kahatchee Mountain Group was originally defined (Tull, 1982), the Stumps Creek was not included as a constituent formation. Subsequent work by Guthrie (1985) indicates that the Stumps Creek has sufficient thickness and areal extent to require formal status as a formation within the Kahatchee Mountain Group overlying the Brewer Phyllite and underlying the Wash Creek Slate. Upper Precambrian?-Cambrian?

Type locality: Exposures along Stumps Creek in northern Chilton County, Alabama.

Warren, R. N., 1969, Geology of a portion of the Stump Hills in southern Shelby County and northern Chilton County, Alabama: Tulane University M.S. thesis, 120 p.

Carrington, T. J., 1973, Metamorphosed Paleozoic sedimentary rocks in Chilton, Shelby, and Talladega Counties, Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society, 11th Annual Field Trip Guidebook, p. 36-37.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 3-18.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian western margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 11-19.

Sylacauga Marble Group

Predominantly a carbonate sequence consisting of interlayered calcite and dolomite marble, metachert, and metapelitic rocks. Includes the Jumbo Dolomite, the Fayetteville Phyllite, the Shelvin Rock Church Formation, the Gooch Branch Chert, and the Gantts Quarry Formation. Northern Piedmont. Cambrian?-Ordovician?

Type locality: Named for exposures and quarries around Sylacauga, Talladega County, Alabama.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 51-52.

Power, W. R., 1964, The Sylacauga Marble, *in* Deininger, R. W., Bentley, R. D., Carrington, T. J., Clarke, O. M., Jr., Power, W. R., and Simpson, T. A., Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 12-13.

Cook, T. A., 1982, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 50 and 55.

Pendexter, W. S., 1982, Stratigraphic relationships of the carbonate sequence in the Talladega slate belt, Chilton and Coosa Counties, Alabama, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 61-68.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 8-9, 13.

Tull, J. F., 1985, Stratigraphy of the Sylacauga Marble Group, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., Early evolution of the Appalachian miogeocline; Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 21-26.

Talladega Group

Clastic sequence divided into an upper unit of graphitic slate and phyllite, coarse-grained arkose, and locally conglomeratic quartzite, and a lower unit of calcareous slate and chlorite phyllite, calcareous arkose and quartzite, and thin-bedded limestone. The Talladega Group includes the Lay Dam Formation, the Butting Ram Sandstone, the Jemison Chert, and the Chulafinnee Schist. Northern Piedmont. Probably Devonian, although lower part may be as old as Silurian in age.

Type locality: Named for exposures on Talladega Creek, Talladega County, Alabama.

Smith, E. A., 1888, Report of progress for 1884-88: Alabama Geological Survey Report of Progress, no. 8, on geologic map of Alabama, no description.

Smith, E. A., 1894, A general account of the character, distribution, and structure of the crystalline rocks of Alabama, and the mode of occurrence of the gold ores: Alabama Geological Survey Bulletin 5, explanatory chart accompanying geologic map.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 49-61.

Carrington, T. J., 1964, Talladega Slate, *in* Deininger, R. W., and others, Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 14-18.

Neathery, T. L., 1973, The Talladega front: Synopsis of previous work, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 1-9.

Bearce, D. N., 1973, Character of the Talladega belt in eastern Alabama, *in* Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 10-21.

Neathery, T. L., 1973, Observations on the lithologic relationships within the Talladega Group, Alabama, *in* Carrington, T. J., ed., Talladega metamorphic front: Alabama Geological Society Guidebook, 11th Annual Field Trip, p. 51-55.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 3-18.

Cook, T. A., 1982, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 47-59.

Tallahatta Formation (Claiborne Group)

White to very light-greenish-gray thin-bedded to massive siliceous claystone interbedded with thin layers of clay, sandy clay, and glauconitic sand and sandstone. The Tallahatta thins to the east where the siliceous claystone becomes less prominent and clayey sand, sandy clay and limestone dominate. In southwest Alabama, the lower 8 to 10 feet is the Meridian Sand Member, a white to light-greenish-gray fine to coarse sand and fine gravel. The thickness of the Tallahatta ranges from 125 feet in southwest Alabama to 57 feet in southeast Alabama. Eocene, Claiborne (upper Ypresian-lower Lutetian).

Type locality: Named for development in Tallahatta Hills, Choctaw County, Alabama.

Dall, W. H., 1898, A table of the North American Tertiary formations, correlated with one another and with those of western Europe with annotations: U.S. Geological Survey 18th Annual Report, pt. 2, p. 344, chart.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 107-111.

Bybell, L. M., and Gibson, T. G., 1985, The Eocene Tallahatta Formation of Alabama and Georgia: Its lithostratigraphy, biostratigraphy, and bearing on the age of the Claibornian Stage: U.S. Geological Survey Bulletin 1615, 20 p.

Tallassee Metaquartzite (Jacksons Gap Group)

Principally graphitic sericite(muscovite)-quartz schist; includes sericite-quartz phyllonite; sericite phyllonite, blastomylonite, porphyroclastic blastomylonite schist, and mylonite quartzite occur principally along margins in south and form most of unit northeast of Jacksons Gap. Includes masses of interbedded grayish-green sericite phyllite and sericite-quartz-chlorite phyllite.

Type locality: Exposures at base of Thurlow Dam across from Tallassee Mill, E½ sec. 19, T. 18 N., R. 22 E., Tallapoosa County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 115.

Tampa Formation and Chickasawhay Limestone undifferentiated

Very light-gray to pinkish-gray to light-brown partially recrystallized, partly dolomitic limestone containing molds and casts of poorly preserved microfossils, vuggy in part to dense. Present in southwest Alabama subsurface. About 450 feet thick beneath Mobile Bay. Oligocene and lower Miocene, Chattian-Burdigalian.

Type locality (Tampa): Named for exposures at Tampa, Florida.

Type locality (Chickasawhay): On Highway 43, 3 miles north of Waynesboro, Wayne County, Mississippi. Named for exposures on Chickasawhay River.

Johnson, L. C., 1888, The structure of Florida: American Journal of Science, 3rd Series, v. 36, p. 235 [Tampa].

Blanpied, B. W., and others, 1934, Stratigraphy and paleontological notes on the Eocene (Jackson Group), Oligocene, and lower Miocene of Clarke and Wayne Counties, Mississippi: Shreveport Geological Society Guidebook, 11th Annual Field Trip, p. 3, 4, 12, 16-19, charts [Chickasawhay].

Marsh, O. T., 1966, Geology of Escambia and Santa Rosa Counties, western Florida panhandle: Florida Geological Survey Bulletin 46, p. 48-54.

Poag, C. W., 1972, Planktonic foraminifers of the Chickasawhay Formation, United States Gulf Coast: Micropaleontology, v. 18, no. 3, p. 257-277.

Tombigbee Sand Member of Eutaw Formation

Light-gray massive to weakly bedded, highly glauconitic sand that is somewhat clayey, contains abundant burrows and mollusk shells, and locally may include layers of calcareous sandstone and sandy chalk. Thicknesses of the discontinuous outcrops generally range from 5 to 20 feet in western Alabama. Present at the top of the Eutaw Formation. Relationships of the Tombigbee Sand Member and the Eutaw Formation in eastern Alabama are unclear. Upper Cretaceous, Santonian-Campanian.

Type locality: Named for exposures on Tombigbee River near Aberdeen, Monroe County, and at Plymouth Bluff, Lowndes County, Mississippi.

Hilgard, E. W., 1860, Report on the geology and agriculture of the State of Mississippi: Mississippi Geologic and Agricultural Report, p. 3, 61, 68-75.

Monroe, W. H., and Eargle, D. H., 1946, Geologic map of the Aliceville, Mantua, and Eutaw Quadrangles, Alabama, showing pre-Selma Upper Cretaceous formations: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 50.

Sohl, N. F., and Smith, C. C., 1980, Notes on Cretaceous biostratigraphy: American Geological Institute, Excursions in Southeastern Geology, v. II, p. 342-402.

Tuscahoma Sand (Wilcox Group)

Light-gray to light-olive-gray fine-grained sand interlaminated with thin-bedded carbonaceous silt and clay. Thin lignite beds occur locally. Two richly fossiliferous beds in the lower part of the Tuscahoma are given member status. The lower Greggs Landing Marl Member is a 6-foot-thick calcareous, glauconitic, silty sand or clayey silt containing lignite, abundant fossils, and small spheroidal concretions. The upper Bells Landing Marl Member is 9 feet thick and is a very fine-grained glauconitic, fossiliferous sand, containing large pillow-shaped concretions. The Tuscahoma crops out in the Coastal Plain where thickness ranges from 350 feet in Choctaw County to 90 feet in Henry County. The thickness is 650 feet in the subsurface of Clarke County. Paleocene, Sabine (middle and upper Thanetian).

Type locality: Named for exposures at Tuscahoma on the Tombigbee River in Choctaw County, Alabama.

Smith, E. A., 1888, Report of progress for 1884-1888: Alabama Geological Survey Report of Progress, no. 8, map.

Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, p. 105-106.

Tuscaloosa Group

Varicolored clay, sand, and gravel. In easternmost Alabama, the Tuscaloosa Group undifferentiated is composed of poorly sorted kaolinitic, arkosic sand and gravel and interbedded yellowish-orange to reddish-green mottled kaolinitic clay. The Tuscaloosa is present in the subsurface of south Alabama and crops out along the northern limit of the Coastal Plain. Updip, the group is comprised of the Coker and Gordo Formations. Downdip the Tuscaloosa is informally divided into lower, middle (marine), and upper units. In outcrop, the Tuscaloosa Group is from 600 to 900 feet thick in western Alabama and thins to 300 feet or less in eastern Alabama. From east to west in the subsurface, thickness ranges from 600 to 1,210 feet. Upper Cretaceous, Cenomanian-Coniacian?

Type locality: Named for Tuscaloosa, Tuscaloosa County, Alabama, and Tuscaloosa (Black Warrior) River at Steele's Bluff and White's Bluff, Hale County, Alabama.

Smith, E. A., and Johnson, L. C., 1887, Tertiary and Cretaceous strata of the Tuscaloosa, Tombigbee, and Alabama Rivers: U.S. Geological Survey Bulletin 43, p. 18, 95-117, 136-138, pl. 11.

Conant, L. C., and Monroe, W. H., 1945, Stratigraphy of the Tuscaloosa Group in the Tuscaloosa and Cottondale Quadrangles, Alabama: U.S. Geological Survey Oil and Gas Investigations Preliminary Map 37.

Drennen, C. W., 1953, Reclassification of outcropping Tuscaloosa Group in Alabama: American Association of Petroleum Geologists Bulletin, v. 37, p. 522-538.

Winter, C. V., Jr., 1954, Pollard Field, Escambia County, Alabama: Gulf Coast Association of Geological Societies Transactions, v. 4, p. 121-142.

Braunstein, Jules, 1959, Subsurface stratigraphy of the Upper Cretaceous in Mississippi, *in* Upper Cretaceous outcrop, northeast Mississippi, west central Alabama: Mississippi Geological Society Guidebook, 14th Field Trip, May 1959, p. 5-10.

Mancini, E. A., Smith, C. C., and Payton, J. W., 1980, Geologic age and depositional environment of the "Pilot sand" and "marine shale," Tuscaloosa Group, South Carlton field, South Alabama, *in* Geology of the Woodbine and Tuscaloosa Formations: Gulf Coast Section, Society of Economic Paleontologists and Mineralogists, 1st Annual Research Conference, p. 24-25.

Mancini, E. A., and Payton, J. W., 1981, Petroleum geology of the South Carlton Field, lower Tuscaloosa "Pilot sand," Clarke and Baldwin Counties, Alabama: Gulf Coast Association of Geological Societies Transactions, v. 31, p. 139-147.

Tuscumbia Limestone

Light-gray bioclastic or micritic, partly oolitic limestone in beds that generally are more than one foot thick. Massive cross-bedded very coarse bioclastic, crinoidal limestone beds are locally as much as 10 feet thick. Light-gray and white chert nodules and concentrically banded "concretionary" chert are abundant locally. Present in the Plateaus and Valley and Ridge. Thickness ranges from 0 to 250 feet. Upper Mississippian, Meramecian.

Type locality: Named for exposures at Tuscumbia, Colbert County, Alabama.

Smith, E. A., 1894, Geological map of Alabama: Alabama Geological Survey Special Map 1.

LaMoreaux, P. E., Swindel, G. W., Jr., and Lanphere, C. R., 1950, Ground-water resources of the Huntsville area, Alabama: Alabama Geological Survey Bulletin 62, p. 24, 26-27.

Thomas, W. A., 1972, Mississippian stratigraphy of Alabama: Alabama Geological Survey Monograph 12, p. 13-24.

Uchee Complex

Coarsely crystalline, highly contorted migmatitic gneiss and schist. Includes the Phenix City Gneiss, an unnamed amphibolite, and the Hospilika Granite. Southern Piedmont.

Type area: Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 39-40.

Osborne, W. E., Szabo, M. W., Neathery, T. L., and Copeland, C. W., Jr., compilers, 1988, Geologic map of Alabama, northeast sheet: Alabama Geological Survey Special Map 220 [in press].

Ultramafic Rocks of the Northern Piedmont

Ultramafic pods and sheets, principally enstatite-hypersthene pyroxenite with hornblende and actinolite alteration assemblages. Northern Piedmont.

Neathery, T. L., 1975, Rock units in the high-rank belt of the Northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the Northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 42-47.

Ultramafic and mafic intrusive rocks (Dadeville Complex)

Principally pyroxenite consisting of enstatite, hypersthene and bronzite, with minor amounts of olivine, interlayered with actinolite-tremolite amphibolite, altered locally to serpentine, anthophyllite, and talc. Includes meta-norite, meta-gabbro, hornblendite, garnet-hornblendite and massive amphibolite. Inner Piedmont.

Neathery, T. L., 1968, Talc and anthophyllite deposits in Tallapoosa and Chambers Counties, Alabama: Alabama Geological Survey Bulletin 90, 98 p.

Unnamed carbonate and chert unit, Devonian

Cherty, glauconitic, yellowish-gray to brownish-gray to medium-gray limestone, locally having a sandy zone near the top of the unit. Chert is white to light-brownish-gray, opaque to translucent and in part contains glauconite, dolomite rhombs, and white, brownish-gray and black inclusions that may be chitinozoans. Present in the subsurface in the western and southwestern parts of the Black Warrior basin. Thickness ranges from 0 to more than 1,200 feet in Sumter County. Lower Devonian.

Kidd, J. T., 1975, Pre-Mississippian subsurface stratigraphy of the Warrior basin in Alabama: Gulf Coast Association of Geological Societies Transactions, v. 25, p. 36.

"Upper Tuscaloosa" (Tuscaloosa Group)

Interbedded sandstone and shale; sandstone is dense, fine to medium grained, quartzose, and downdip in central and eastern Alabama is locally glauconitic and fossiliferous in part. Shales are hard to soft, gray to green, and sideritic in part. Thickness ranges from 165 feet in Houston County to 774 feet in Dallas County. Informal term used in the subsurface of south Alabama. Upper Cretaceous, Turonian-Coniacian?

Winter, C. V., Jr., 1954, Pollard Field, Escambia County, Alabama: Gulf Coast Association of Geological Societies Transactions, v. 4, p. 123-127, 129, 140.

Braunstein, Jules, 1959, Subsurface stratigraphy of the Upper Cretaceous in Mississippi, *in* Upper Cretaceous outcrops, northeast Mississippi, west-central Alabama: Mississippi Geological Society Guidebook, 14th Field Trip, p. 5-10.

Vicksburg Group

The Vicksburg Group consists of the Red Bluff Clay, Forest Hill Sand, Bumpnose Limestone, Marianna Limestone, and Byram Formation. The group is comprised primarily of carbonates and crops out across south Alabama. Oligocene, Vicksburg (Rupelian).

Type locality: Named for exposures at Vicksburg, Mississippi.

Conrad, T. A., 1848, Observations on the Eocene formation, and descriptions of 105 new fossils of that period, from the vicinity of Vicksburg, Mississippi, with an appendix: Philadelphia Academy of Natural Science Proceedings [1946], v. 3, p. 280-299.

Hazel, J. E., Mumma, M. D., Huff, W. J., 1980, Ostracode biostratigraphy of the lower Oligocene (Vicksburgian) of Mississippi and Alabama: Gulf Coast Association of Geological Societies Transactions, v. 30, p. 361-380.

Dockery, D. T., III, 1982, Lower Oligocene bivalvia of the Vicksburg Group in Mississippi: Mississippi Bureau of Geology Bulletin 123, 261 p.

Wacoochee Complex

Highly deformed feldspathic schist and gneiss. Much of the gneiss has large (10-inch) feldspar augen. Pegmatites and granitic dikes are common. The Wacoochee Complex consists of three poorly exposed units, the Halawaka Schist, the Whatley Mill Gneiss, and the Phelps Creek Gneiss. Southern Piedmont.

Type area: Exposures in southeastern Lee County, Alabama.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 34.

Schamel, Steven, Hanley, T. B., and Sears, J. W., 1980, Geology of the Pine Mountain window and adjacent terranes in the Piedmont province of Alabama and Georgia: Geological Society of America, Southeastern Section Guidebook, 29th annual meeting, p. 4-7.

McDaniel, C. R., 1981, Mylonitic rocks along a transect of the Pine Mountain window and adjacent Uchee belt, the west side of the Chattahoochee River, Lee County, Alabama, *in* Sears, J. W., ed., Contrasts in tectonic style between the Inner Piedmont terrane and the Pine Mountain window: Alabama Geological Society Guidebook, 18th Annual Field Trip, p. 41-42.

Waresville Schist (Dadeville Complex)

Banded amphibolite, interlayered with chlorite schist, chlorite amphibolite, chlorite-actinolite schist, chlorite quartzite and actinolite quartzite; may include small ultramafic pods. Inner Piedmont.

Type locality: Named for Waresville, Heard County, Georgia.

Bentley, R. D., and Neathery, T. L., 1970, Geology of the Brevard fault zone and related rocks of the Inner Piedmont of Alabama: Alabama Geological Society Guidebook, 8th Annual Field Trip, p. 26-27.

Wash Creek Slate (Kahatchee Mountain Group)

Black to grayish-green partly graphitic slate and laminated siltstone interbedded with locally conglomeratic light-gray to light-brown arkosic metamorphosed sandstone and quartzite. Includes Kalona Quartzite Member. Northern Piedmont. Upper Precambrian?-Cambrian?.

Type locality: Exposures on Wash Creek, south of Sawyer Cove, Chilton County, Alabama.

Butts, Charles, 1940, Description of the Montevallo and Columbiana Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 226.

Carrington, T. J., 1964, Talladega Slate, *in* Deininger, R. W., and others, Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 15-16.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 7, 13.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian western margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 15.

Washita and Fredericksburg Groups undifferentiated

Very light- to pinkish-gray to greenish-gray very fine- to medium-grained, angular to rounded, quartzose sandstone containing occasional chlorite, in part calcareous; interbedded (especially in lower part) with dusky-red, grayish-red, medium-gray to dark-gray micaceous, partly silty or sandy shale; occasional light-gray to dark-gray mottled, sublithographic limestone; pink nodular lime is a diagnostic constituent noted in drill-cutting samples. Thickness reaches 2,100 feet. Present in the subsurface of southwest Alabama. Lower and Upper Cretaceous, Albian and Cenomanian.

Type locality (Fredericksburg): Named for Fredericksburg, Gillespie County, Texas.

Type locality (Washita): Named for old Fort Washita, T. 5 S., R. 7 E., about sec. 23, Bryan County, Oklahoma

Hill, R. T., 1887, The topography and geology of the cross timbers and surrounding regions in northern Texas: American Journal of Science, 3rd Series, v. 33, p. 296-299.

McGlamery, Winifred, 1950-1961, Alabama Geological Survey unpublished sample descriptions of oil test wells.

Nunnally, J. D., and Fowler, H. F., 1954, Lower Cretaceous stratigraphy of Mississippi: Mississippi Geological Survey Bulletin 79, 45 p.

Waverly Gneiss (Dadeville Complex)

Feldspathic biotite-hornblende gneiss containing thin interlayered amphibolite, calc-silicate rock, garnet quartzite and muscovite schist; locally rich in manganese. Deeply weathered and poorly exposed. Inner Piedmont.

Type locality: Exposures in the town of Waverly, Chambers County, Alabama.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 9-10.

Waxahatchee Slate (Kahatchee Mountain Group)

Black to grayish-green partly calcareous, fine-grained and thinly foliated slate and phyllite, weathering to grayish-orange, light-brown, or greenish-gray, with numerous thin (up to 8 feet thick) beds and lenses of metamorphosed very fine-grained micaceous, feldspathic sandstone, siltstone, and minor conglomerate. Northern Piedmont. Upper Precambrian?-Cambrian?.

Type locality: Exposures on Waxahatchee Creek, Shelby County, Alabama.

Butts, Charles, 1940, Description of the Montevallo and Columbiana Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 226.

Carrington, T. J., 1964, Talladega Slate, *in* Deininger, R. W., and others, Alabama Piedmont geology: Alabama Geological Society Guidebook, 2nd Annual Field Trip, p. 14-15.

Tull, J. F., 1982, Stratigraphic framework of the Talladega slate belt, Alabama Appalachians, *in* Bearce, D. N., and others, eds., Tectonic studies in the Talladega and Carolina slate belts, southern Appalachian orogen: Geological Society of America Special Paper 191, p. 7.

Guthrie, G. M., 1985, The Kahatchee Mountain Group and late Precambrian-Lower Cambrian western margin evolution, *in* Tull, J. F., Bearce, D. N., and Guthrie, G. M., eds., Early evolution of the Appalachian miogeocline: Upper Precambrian-lower Paleozoic stratigraphy of the Talladega slate belt: Alabama Geological Society Guidebook, 22nd Annual Field Trip, p. 12-13.

Wayne Group

Red, gray and green silty, argillaceous limestone; red and green shale; and grayish-green nonporous crystalline limestone containing a few scattered pink calcite crystals. Recognizable in the surface and subsurface in the Interior Low Plateaus. Thickness ranges from 0 to 144 feet. Lower-Upper Silurian, Ontarian-Lockportian.

Type locality: Named for Wayne County, Tennessee, where all units are well developed.

Drake, N. F., 1914, Economic geology of the Waynesboro Quadrangle (Tennessee), *in* Resources of Tennessee: Tennessee Geological Survey Resources of Tennessee, v. 4, no. 3, p. 103.

Wilson, C. W., Jr., 1949, Pre-Chattanooga stratigraphy in central Tennessee: Tennessee Division of Geology Bulletin 56, p. 244.

Jewell, J. W., 1969, An oil and gas evaluation of north Alabama: Alabama Geological Survey Bulletin 93, p. 37-38.

Wedowee Group

Graphitic schist, phyllite, and phyllonite. Metagraywacke and quartzite are common to rare. Includes Hackneyville Schist, Cutnose Gneiss, Cragford Phyllite, Beaverdam Amphibolite, and Cornhouse Schist. Northern Piedmont.

Type locality: Exposures at and around Wedowee, Randolph County, Alabama.

Adams, G. I., 1926, The crystalline rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 36.

Neathery, T. L., and Reynolds, J. W., 1973, Stratigraphy and metamorphism of the Wedowee Group, a reconnaissance: American Journal of Science, v. 273, p. 723-741.

Neathery, T. L., and Reynolds, J. W., 1975, Geology of the Lineville East, Ofelia, Wadley North and Mellow Valley Quadrangles, Alabama: Alabama Geological Survey Bulletin 109, p. 23-31.

Neathery, T. L., 1975, Rock units of the high-rank belt of the northern Alabama Piedmont, *in* Neathery, T. L., and Tull, J. F., eds., Geologic profiles of the northern Alabama Piedmont: Alabama Geological Society Guidebook, 13th Annual Field Trip, p. 10-26.

Weisner Formation

Interbedded quartzose sandstone and laterally continuous conglomerate, containing minor greenish-gray mudstone. Thickness ranges from 98 to 492 feet. Crops out in the eastern Valley and Ridge. Lower Cambrian.

Type locality: Named for the fact it forms Weisner Mountain, Cherokee County, Alabama.

Smith, E. A., 1890, An appendix on the geology of the valley regions adjacent to the Cahaba field, *in* Squire, Joseph, Report on the Cahaba coal field: Alabama Geological Survey Special Report 2, p. 149.

Butts, Charles, 1926, The Paleozoic rocks, *in* Geology of Alabama: Alabama Geological Survey Special Report 14, p. 64-65.

Mack, G. H., 1980, Stratigraphy and depositional environments of the Chilhowee Group (Cambrian) in Georgia and Alabama: American Journal of Science, v. 280, p. 497-517.

Werner Formation

Anhydrite locally underlain by conglomeratic redbeds. The upper anhydrite sequence locally intertongues with the overlying Louann Salt. The sequence is comprised of white to pinkish-gray anhydrite containing scattered frosted, rounded, medium quartz sand and locally beds of salt. The lower conglomeratic sequence where present consists of pebbles of varicolored chert, dolomite and metamorphic, volcanic, and igneous rock in a calcite-cemented matrix of grayish-red to dark-reddish-brown clay, silt and sand. Fragments of metamorphic and igneous rock (including rhyolite) increase with depth. The conglomerate contains interbeds of dark-reddish-brown shale and pale-red sandstone. Extent and thickness of the Werner in southwest Alabama is uncertain; however, a maximum thickness of 1,364 feet is known from Choctaw County, of which 862 feet is the lower conglomeratic sequence. Middle Jurassic, lower and middle Callovian.

Type well: Gulf Refining Co.'s No. 49, Louis Werner Saw Mill Co. well located in Louann district, sec. 5, T. 16 S., R. 16 W., Union County, Arkansas.

Hazzard, R. T., Spooner, W. C., and Blanpied, B. W., 1947, 1945 Reference report on certain oil and gas fields of north Louisiana, south Arkansas, Mississippi, and Alabama: Shreveport Geological Society 1945 Reference Report, v. 2, p. 483, 484, 486-487.

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Whatley Mill Gneiss (Wacoochee Complex)

Medium- to coarse-grained biotite-muscovite gneiss with large (2-inch) potassium feldspar augen. Particularly well exposed along a tributary to Chewacla Creek in SW$\frac{1}{4}$ sec. 18, T. 18 N., R. 25 E. Microcline and orthoclase occur as individual augen locally. Tapered crushed zones parallel with foliation generally occur at ends of augen. Accessory minerals include epidote, sphene, zoisite, apatite, zircon, pyrite and magnetite. Southern Piedmont.

Type locality: An abandoned quarry at Whatley Mill in the SE$\frac{1}{4}$ sec. 15, T. 18 N., R. 26 E., Lee County, Alabama.

Bentley, R. D., Neathery, T. L., and Scott, J. C., 1971, Geology and mineral resources of Lee County, Alabama: Alabama Geological Survey unpublished manuscript, p. 22.

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Sears, J. W., and Cook, R. B., Jr., 1984, An overview of the Grenville basement complex of the Pine Mountain window, Alabama and Georgia: Geological Society of America Special Paper 194, p. 286.

Steltenpohl, M. G., 1988, Geology of the Pine Mountain imbricate zone, Lee County, Alabama: Alabama Geological Survey Circular 136, p. 7.

Wilcox Group

The Wilcox Group is composed of the Nanafalia Formation, Salt Mountain Limestone, Tuscahoma Sand, and Hatchetigbee Formation, in ascending order. Paleocene-Eocene, Sabine (lower Thanetian-lower Ypresian).

Type locality: Named for extensive development in Wilcox County, Alabama.

Crider, A. F., and Johnson, L. C., 1906, Summary of the underground water resources of Mississippi: U.S. Geological Survey Water-Supply Paper 159, p. 5, 9.

MacNeil, F. S., 1946, Summary of the Midway and Wilcox stratigraphy of Alabama and Mississippi: U.S. Geological Survey Strategic Minerals Investigations Preliminary Report 3-195, p. 17-22, correlation chart.

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Toulmin, L. D., 1977, Stratigraphic distribution of Paleocene and Eocene fossils in the eastern Gulf Coast region: Alabama Geological Survey Monograph 13, v. 1, p.100-107.

Wilson Ridge Formation

Interbedded quartzose sandstone, feldspathic sandstone and silty mudstone. Thickness ranges from 604 to 1,394 feet. Crops out in eastern Valley and Ridge. Cambrian.

Type locality: Exposures at Wilson Ridge, Cleburne County, Alabama, on Highway 70, 6 miles east of Piedmont, Alabama.

Mack, G. H., 1980, Stratigraphy and depositional environments of the Chilhowee Group (Cambrian) in Georgia and Alabama: American Journal of Science, v. 280, p. 497-517.

Wolf Ridge Sandstone Member of Pottsville Formation

A persistent hard white quartzitic sandstone 50 to 100 feet thick. The member lies 1,200 feet above the Pine Sandstone Member in the southwestern part of the Coosa coal field. Valley and Ridge. Pennsylvanian.

Type locality: Named for Wolf Ridge which is underlain by the sandstone and which is especially well developed in T. 19 S., R. 1 E., Shelby County, Alabama.

Butts, Charles, 1927, Description of the Bessemer and Vandiver Quadrangles [Alabama]: U.S. Geological Survey Geologic Atlas, Folio 221, p. 14.

Culbertson, W. C. 1964, Geology and coal resources of the coal-bearing rocks of Alabama: U.S. Geological Survey Bulletin 1182-B, p. B50, pl. 3.

Yazoo Clay (Jackson Group)

In south-central Alabama, the Yazoo is divisible into four members. From oldest to youngest these are: the North Twistwood Creek Clay Member, the Cocoa Sand Member, the Pachuta Marl Member, and the Shubuta Member. The Yazoo is primarily clastic in Choctaw and western Clarke Counties, becoming primarily carbonate to the south and east. Thickness ranges from 150 feet in Choctaw County to 70 feet in south-central Alabama. Eocene, Jackson (Priabonian).

Type locality: Named for exposures in bluff of Yazoo River at Yazoo City, Yazoo County, Mississippi.

Lowe, E. N., 1915, Mississippi, its geology, geography, soils, and mineral resources: Mississippi Geological Survey Bulletin 12, p. 79.

Murray, G. E., 1947, Cenozoic deposits of central Gulf Coastal Plain: American Association of Petroleum Geologists Bulletin, v. 31, no. 10, p. 1838 (fig. 6), 1839.

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Zana Granite

Quartz monzonite to granite with gneissic texture, cut by small pegmatites and aplite dikes, generally elongate; semiconcordant to foliation of country rock. Dating of zircons yields an age of 460 Ma for the granite. Northern Piedmont.

Type locality: Exposures in the vicinity of Zana, Tallapoosa County, Alabama, in secs. 35 and 36, T. 24 N., R. 23 E.

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