STATE OF ARKANSAS

Arkansas Geological Commission
William V. Bush, State Geologist

INFORMATION CIRCULAR 36

STRATIGRAPHIC SUMMARY OF ARKANSAS

Compiled by

John David McFarland

Little Rock, Arkansas
Revised 2004

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STRATIGRAPHIC SUMMARY OF ARKANSAS

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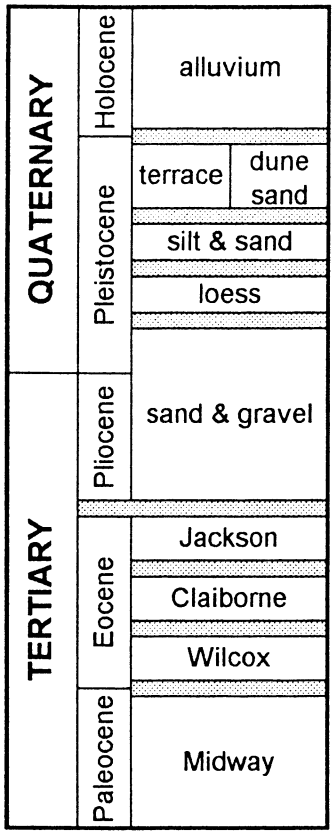
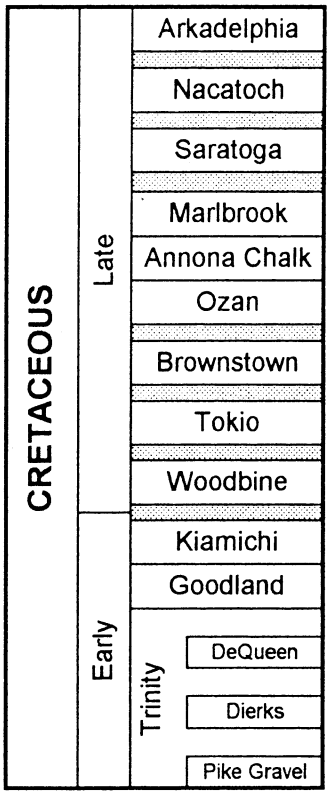
This summary of the stratigraphic section of Arkansas is intended to be a companion document for the Geologic Map of Arkansas (1976, 1993). It offers a brief description of each of the units depicted on the state geologic map. Some stratigraphic units combined on the Geologic Map of Arkansas are treated independently herein. A few units that are not specifically listed on the legend of the state geologic map are treated separately because of their outcrop prominence or importance for stratigraphic understanding. Some units depicted on the Geologic Map of Arkansas are not formal stratigraphic formations, but rather are descriptive references: nevertheless, a brief description is herein provided.. Most of these latter units are Quaternary subdivisions that have not yet been studied in detail. Some information contained in this document is at variance with the data presented on the Geologic Map of Arkansas due to more recent observations and interpretations.

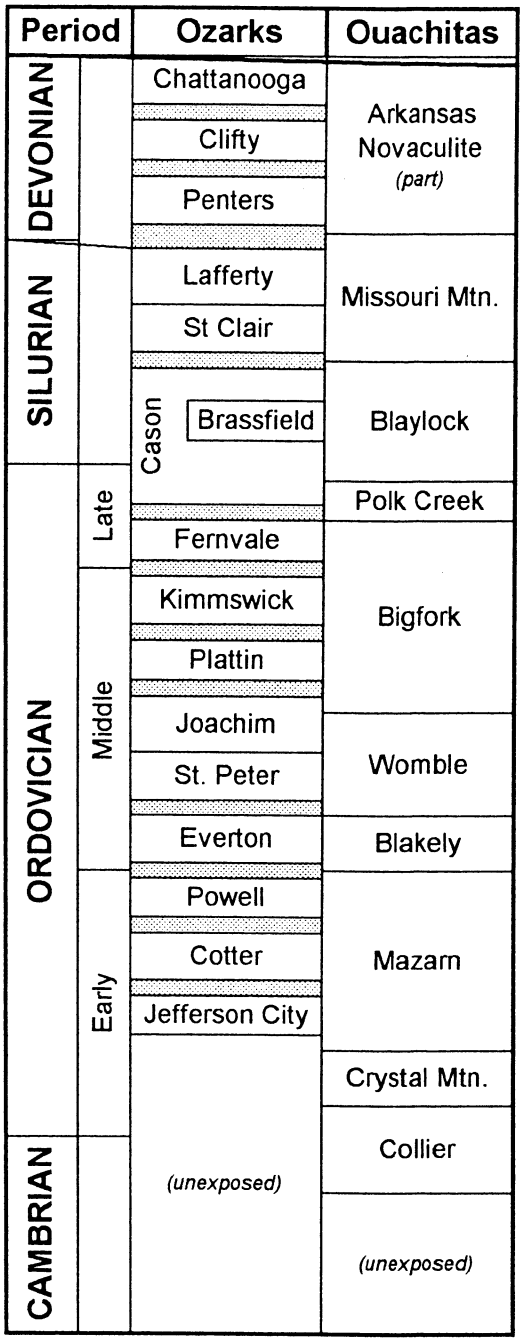
Each listing relates the general geology of each unit along with auxiliary information relating to the unit's age, distribution, original reference, and type locality. The information provided for each formation under the **Geology** heading consists of a brief statement relating to the dominate lithologies and characteristics of the unit, its fossil fauna, conformity of the lower contact, and thickness on the outcrop. If a unit has well known subdivisions they are usually treated within this section. The **Age** of each formation is listed by geologic Period often with some indication of conventional subdivision such as Early, Middle, and Late, or an Epoch name. The **Distribution** of each formation is presented with reference to the general area in Arkansas where the unit outcrops. If the unit is known outside of Arkansas, the other states are listed following the information about Arkansas. The **Original reference** is the citation for the original publication defining the unit. The **Type locality** information is usually the type area of the formation rather than a specific type locality. Many of these formations were defined before the practice of designating a type locality became a part of proper stratigraphic description.

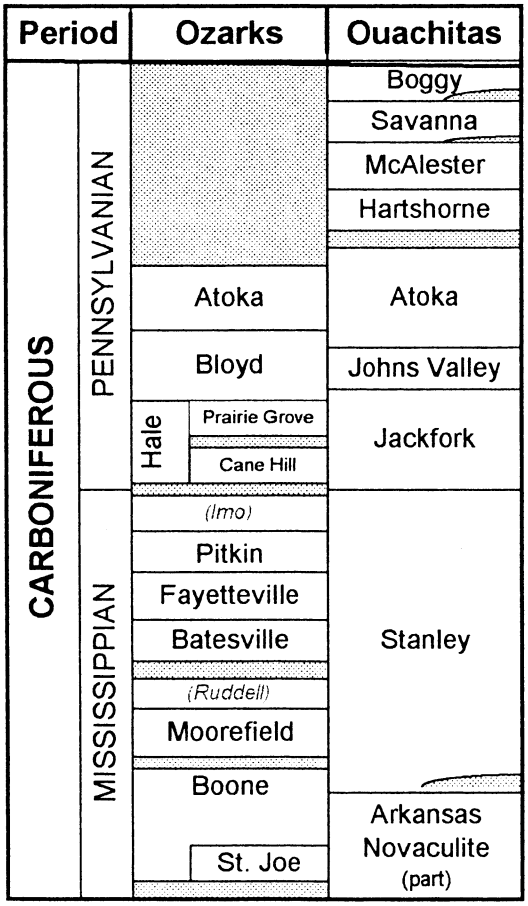
This document is broken into four sections: the Ozark Plateaus Region, the Ouachita Region including the Arkansas Valley, the Mississippi Embayment and Gulf Coastal Plain, and Igneous. Some units are recognized in more than one section of the state and are listed in all sections that apply. The order of the descriptions is the same as the stratigraphic sequence, oldest to youngest. The stratigraphic units listed herein that are printed in italics are in some way in dispute.

The information compiled in this document was derived from many sources, both personal and published. Along with the references listed below Arkansas Geological Commission staff members Doug Hanson, Boyd Haley, Mike Howard, Bill Prior, Charles Stone, and the author provided data from their personal researches into the various regions and strata.









Correlation charts of Arkansas formations. Recognized unconformities separating formations are indicated by a stipple pattern. No relative thickness or significance is implied by these charts.

OZARK PLATEAUS REGION

The Ozark Plateaus region of Arkansas is made up of generally flat-lying Paleozoic age strata divided into three plateau surfaces. The lowest and northern-most plateau is called the Salem and is generally underlain by dolostones, sandstones, and limestones of Ordovician age. The Springfield Plateau stands above the Salem a few hundred feet and is generally capped by lower Mississippian age limestones and cherts. The southern-most and highest plateau of the Ozarks is the Boston Mountains. It is dominated by Pennsylvanian age shales, siltstones, and sandstones. All of these plateaus are deeply dissected by numerous streams throughout the area. The faulting observed in the Ozarks is generally normal with most faults displaying a displacement down on the southern side; however, some observations suggest that a few strike-slip faults may be expressed. Gentle folds are noted but are generally of very low amplitude. The depositional environment of the rocks found in the Arkansas Ozarks is one of a relatively shallow continental shelf, sloping toward deeper water generally toward the south. This shelf emerged many times during the Paleozoic resulting in numerous unconformities throughout the sequence.

JEFFERSON CITY DOLOMITE/FORMATION

Age: Early Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; Missouri

Geology: The Jefferson City consists of light to dark tan, fine grained, crystalline dolostone and considerable chert with some rare thin beds of sandstone, shale, and oolite. Few fossils are known from the "Jeff City". The Jefferson City Dolomite unconformably overlies Roubidoux Formation. This lower contact is not exposed in Arkansas. The Jefferson City Formation has not been successfully differentiated from the Cotter Formation in Arkansas.

Original reference: A. Winslow, 1894, Missouri Geol. Survey, v. 6, p. 331, 373, 375.

Type locality: Named for exposures at Jefferson City, Cole County, MO.

COTTER DOLOMITE/FORMATION

Age: Early Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; southern Missouri, and Oklahoma.

Geology: The Cotter is composed of dolostone of predominantly two types: a fine-grained, argillaceous, earthy textured, relatively soft, white to buff or gray dolostone called "cotton rock", and a more massive, medium-grained, gray dolostone that weathers somewhat hackly and becomes dark on exposure. The formation contains chert, some minor beds of greenish shale, and occasional thin interbedded sandstone. The chert nodules associated with the Cotter frequently have concentric light and dark bands. The fossils known from the Cotter are rare but include gastropods, cephalopods, and reef-building algae. To date, there has been no success in differentiating the Cotter Formation from the Jefferson City

Formation in Arkansas although the contact is considered disconformable. The thickness is thought to be 340 feet in vicinity of Cotter but the interval may reach as much as 500 feet thick in places.

Original reference: A. H. Purdue and H. D. Miser, 1916, U.S. Geol. Survey Geol. Atlas, Folio 202.

Type locality: Starting at valley bottom just upstream from west end of the old White River bridge at Cotter and extending to top of hill westward along the old U.S. Highway 62, Baxter County, Ark.

POWELL DOLOMITE/FORMATION

Age: Early Ordovician Period

Distribution: Northern Arkansas, Ozark Plateaus; southeastern Missouri.

Geology: The Powell is generally a fine-grained, light gray to greenish gray, limy, argillaceous dolostone with thin beds of shale, sandstone, sandy dolostone, and occasionally chert. In the lower half of the formation a dark massive ledge with abundant drusy quartz has been located in many areas. A conglomerate has been noted at the base of the formation in most places. The Powell is not known to contain many fossils, although gastropods, cephalopods, and trilobites have been reported. The lower contact with the Cotter is disconformable. The formation's thickness is as much as 215 feet but may be much thinner.

Original reference: A. H. Purdue and H. D. Miser, 1916, U. S. Geol. Survey Geol. Atlas, Folio 202.

Type locality: Name derived from Powell Station, now abandoned, on Missouri-Pacific Railroad about 2 miles down stream on Crooked Creek from present village of Pyatt, Marion County, Ark.

EVERTON FORMATION

Age: Middle Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; southern Missouri.

Geology: The Everton shows considerable differences in lithologic character from one place to another. It is composed of various mixtures of dolostone, sandstone, and limestone. The formation also has traces of conglomerate, shale, and chert in limited areas. The limestones are light-gray to brownish gray and are generally more or less dolomitic and sandy. The dolostones are light to dark gray and generally more or less limy and sandy. The Everton has thick members of friable, sandstone dominating local sections in the different regions. These sands tend to be made up of white, well rounded, frosted, medium sized grains and are almost indistinguishable from the overlying St. Peter Sandstone when observed out of context. It is not unusual for one lithology to grade into another along the bedding. Bedding throughout this unit is thin to massive. Named members include the Newton Sandstone, the Calico Rock Sandstone, and the Kings River

Sandstone. Fossils are not common in the Everton. Ostracodes are the fossils most often found with cephalopods, gastropods, bivalves, trilobites, and bryozoans also noted. The lower contact is unconformable and other disconformities occur within the formation. The thickness of the Everton varies from about 300 feet to as much as 650 feet.

Original reference: A. H. Purdue, 1907, Geol. Soc. America Bull., v. 18, p. 251-256.

Type locality: Named from Everton, Boone County, Ark.

ST. PETER SANDSTONE/FORMATION

Age: Middle Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, Oklahoma, and Wisconsin.

Geology: The St. Peter is generally expressed as a massive bedded, medium to fine grained, well rounded, friable, white sandstone. A few minor beds of shale, limestone, and/or dolostones have been noted in some sections. The cement is commonly calcite often with single crystals incorporating hundreds to thousands of sand grains. The unit is a frequent bluff-former. Crossbedding and ripple marks are not common but are noted. No body fossils are known from the St. Peter in Arkansas, but a few trace fossils have been reported. The base of the St. Peter is unconformable often with several feet of relief. The formation ranges from a feather edge to as much as 175 feet thick.

Original reference: D. D. Owen, 1847, Preliminary Report. of the Geological Survey of Wisconsin and Iowa: U. S. Gen. Land Office Report 1847 (U. S. 30th Cong., 1st Session. S. Ex. Doc. 2), p. 169, 170.

Type locality: At Fort Snelling, Hennepin County, Minnesota. Named for exposures on St. Peter River, now called Minnesota River, southern Minnesota.

JOACHIM DOLOMITE/FORMATION

Age: Middle Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; eastern Missouri and southwestern Illinois.

Geology: The Joachim is chiefly a fine grained dolostone and dolomitic limestone with thin beds of shale. Some thin sandstones have been noted near its base and some of the carbonates are sandy in places. Supratidal deposits are frequent and display mud-cracks, calcite pseudomorphic after halite hopper crystals, and laminated horizons. A few bivalves have been collected from the lower Joachim. The Joachim seems to rest conformably upon the St. Peter Sandstone. The Joachim is absent in the west but may attain thicknesses of over 100 feet.

Original reference: A. Winslow, 1894, Missouri Geol. Survey, v. 6, p. 331, 352.

Type locality: Named for exposures along Joachim Creek, Jefferson County, MO.

PLATTIN LIMESTONE/FORMATION

Age: Middle Ordovician Period

Distribution: central northern Arkansas, Ozark Plateaus; eastern Missouri and western Illinois.

Geology: The Plattin is a very fine grained, light to dark gray, micritic limestone in mostly thin beds. Medium and coarse grained limestone beds are rarely noted. Traces of rounded and frosted quartz sand is found in some beds. The limestone often has small blebs of calcite. The Plattin commonly breaks with conchoidal fracture and is noted for not supporting lichens to any great extent. Fossils are common to some upper beds, most notably *Tetradium* coral fragments and colonies. The lower contact of the Plattin is disconformable. The Plattin may reach as much as 250 feet thick but is usually much thinner.

Original reference: E. O. Ulrich, 1904, Missouri Bur. Geology and Mines, v. 2, 2d ser., p. 111.

Type locality: Named for exposures near mouth of Plattin Creek, Jefferson County, MO.

KIMMSWICK LIMESTONE/FORMATION

Age: Middle Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; eastern Missouri and southwestern Illinois.

Geology: The formation is chiefly an even-bedded, thin to massive, light- to pinkish gray, fine- to coarse-grained, bioclastic limestone with a characteristic surgary texture. Some beds of dolostone and sandstone have been noted. The grains of the rock are normally a well mixed accumulation of fossil fragments including corals, bryozoans, brachiopods, trilobites, crinoids, and mollusks. The lower boundary displays a "welded," disconformable contact with the Plattin and displays an angular relationship with it in at least one place. The Kimmswick ranges from 0 to 55 feet in thickness.

Original reference: E. O. Ulrich, 1904, Missouri Bur. Geology and Mines, V. 2, 2d ser., p. 111.

Type locality: Named for exposures at Kimmswick, Jefferson County, MO.

FERNVALE LIMESTONE/FORMATION

Age: Late Ordovician Period

Distribution: northern Arkansas, Ozark Plateaus; western Tennessee, northwestern Alabama, southwestern Illinois, southeastern Missouri, and central, eastern, and northeastern Oklahoma.

Geology: The Fernvale is generally a massive, sometimes cross-bedded, coarsely crystalline, light gray to pink, crinoidal limestone. This unit may appear quite similar to the underlying Kimmswick in some sections. Barrel-shaped crinoid columnals are found in many sections of Fernvale. The Fernvale is sometimes

vuggy and often contains traces of bluish to olive gray clays. Fossils are found throughout the unit but an interval at the top of the formation is often found that contains orthoconic nautiloids. Other fossils noted include brachiopods, bryozoans, and crinoids. The basal contact is a "welded" discomformity. The Fernvale ranges in thickness from 0 to over 100 feet.

Original reference: C. W. Hayes and E. O. Ulrich, 1903, U. S. Geol. Survey Geol. Atlas, Folio 95, p. 2.

Type locality: Named for Fernvale, Williamson County, Tenn.

CASON SHALE/FORMATION

Age: Late Ordovician Period, (and Early/Middle Silurian Period)

Distribution: northern Arkansas, Ozark Plateaus

Geology: The Cason consists of several rock types. The rock types are: phosphatic sandstone and shale, oolitic limestone, pelmatozoan limestone (Brassfield), and sandy, calcareous shale containing flattened algal "buttons" (oncolites). The sequence is usually blue-green to dark gray colored. (Some modern workers place the Brassfield Limestone as a member of the Cason below the "button" shale and above the phosphatic sandstone and shale.) Phosphatic brachiopods are found in some beds and other fossil fragments are common. Agglutinated foraminifera and conodonts have been identified from acid residues. The Cason is disconformable on the underlying beds and may contain at least two other unconformities. At no place does the entire Cason sequence seem to be preserved. The Cason is not known to be much more than 23 feet thick in any one place and usually much thinner.

Original reference: H. S. Williams, 1894, Am. Jour. Sci., 3d, v. 48, p. 325-331.

Type locality: Named for Cason tract, near Batesville, Independence County.

BRASSFIELD LIMESTONE/(MEMBER) FORMATION

Age: Early Silurian Period

Distribution: central northern Arkansas, Ozark Plateaus; central Kentucky, southern Indiana, southwestern Ohio, and southern Tennessee.

Geology: This unit is a light gray to deep red, fossiliferous limestone with traces of glauconite in its lower beds. The Brassfield limestones range from poorly washed and sorted biosparites (dominate), to biomicrite and mud free biosparite. Out of context the Brassfield lithologies can be indistinguishable from the Fernvale and St. Clair limestones. (The Brassfield is considered a member of the Cason by some modern workers.) The chief constituent of Brassfield limestones is fragmented crinozoans, but bryozoa, brachiopods, gastropods, and trilobites as well as other common Paleozoic fossil groups have been noted. The unit is disconformable on the underlying strata. The Brassfield's distribution in Arkansas is somewhat limited. Its thickness ranges from 0 to 38 feet.

Original references: A. F. Foerste, 1905, Kentucky Geol. Survey Bull. 6, p. 156; 1906, Kentucky Geol. Survey Bull. 7, p. 10, 27.

Type locality: Named for exposures along Louisville and Atlantic Railroad between Brassfield and Panola, Madison County, KY.

ST. CLAIR LIMESTONE/FORMATION

Age: Early/Middle Silurian Period

Distribution: northern Arkansas, Ozark Plateaus; southern Illinois, and central eastern Oklahoma.

Geology: The St. Clair is coarse-grained, highly fossiliferous, generally light gray to pinkish-gray limestone. The lower few feet of the unit are usually pyritic and contain spherical algal "buttons" similar to the flattened oncolites of the Cason. The upper and lower portions of the sequence are less well washed than the middle beds and therefore contain more mud matrix. Bedding is normally thick to massive. The formation contains well preserved whole shells of brachiopods, ostracods, and trilobite pygidia and cephala. Fragmentary remains of crinoids, corals, bryozoa, bivalves, gastropods, and cephalopods are also found. Exposures are somewhat limited to small areas in Independence, Izard, and Stone counties. The St. Clair is unconformable at it base and may rest on the Brassfield, Cason, or Fernvale. The formation is thicker in the eastern part of its outcrop area. Overall its thickness ranges from 0 to 100 feet.

Original reference: R. A. F. Penrose, Jr., 1891, Arkansas Geol. Survey Ann. Rept. 1890, v. 1, p. 102-103, 112-114, 124-128, 166-174.

Type locality: Named for St. Clair Springs, 8 miles northeast of Batesville, Independence County, Ark.

LAFFERTY LIMESTONE/FORMATION

Age: Middle/Late Silurian Period

Distribution: central northern Arkansas

Geology: The Lafferty is generally an earthy, gray-green to red micrite or sparsely fossiliferous biomicrite. Clay increases upward in the section so that the upper beds approach a calcareous claystone. Fossils are few in the Lafferty but agglutinated foraminifers are noted. The Lafferty seems to rest conformably on the St. Clair. This lower boundary is marked at the top of the last abundant coarse-grained bioclastic crinozoan limestone of the St. Clair. The Lafferty has a maximum thickness of 97.5 feet in its type area, but it typically averages 5 to 20 feet. The unit is of limited extent.

Original reference: H. D. Miser, 1920, U. S. Geol. Survey Bull. 715-G.

Type locality: Well exposed at Tate Spring, 1 1/4 miles north of Penters Bluff Station, Izard County. Named for West Lafferty Creek which is half a mile east of exposure.

PENTERS CHERT/FORMATION

Age: Early (to Middle?) Devonian Period

Distribution: central northern Arkansas

Geology: The Penters is a fine-grained, fossiliferous, dolomitic, limestone with some chert and siliceous replacement overlain by a massive, dense, mottled gray chert with some patches of fine-grained limestone. A thick bed of chert breccia occurs at the top of the Penters in some sections. The Penters is unfossiliferous at its type locality, but a small brachiopod fauna has been recovered from the base of the formation in another area. The Penters is of sporadic exposure in its outcrop area. The lower contact appears to be disconformable. The thickest outcrop exposure ascribed to this unit displays about 25 feet; however, at least one report suggests a maximum thickness of about 90 feet.

Original reference: H. D. Miser, 1920, U. S. Geol. Survey Bull. 715-G.

Type locality: Named for exposures at Penters Bluff Station, Izard County.

CLIFTY (LIMESTONE)/FORMATION

Age: Middle Devonian Period

Distribution: northwestern Arkansas

Geology: At its type locality the Clifty is a thin, very sandy limestone with a few fossils. Outside the type area units ascribed to the Clifty are mostly sandstones. This unit is often confused with or inadvertently combined with the Sylamore Sandstone Member of the Chattanooga Shale. Brachiopods have been collected from the Clifty. The unit is disconformable with the underlying beds. The maximum thickness of the Clifty is only 4 feet, but it is usually thinner, averaging 2 feet or less.

Original reference: A. H. Purdue and H. D. Miser, 1916, U. S. Geol. Survey Geol. Atlas, Folio 202.

Type locality: Named for East Fork of Little Clifty Creek, Eureka Springs quadrangle, Carroll County.

CHATTANOOGA SHALE/FORMATION

Age: Late Devonian Period (and Early Mississippian Period?)

Distribution: northern Arkansas, Ozark Plateaus; Tennessee, Alabama, Kentucky, Mississippi, and Oklahoma.

Geology: Typically a black, fissile clay shale that weathers into thin flakes. The beds are usually cut by prominent joints creating polygonal blocks upon weathering. The upper part of the formation may be slightly sandy and usually contains abundant pyrite. The Chattanooga appears to be all Devonian in Arkansas. A lower sandstone Member is called the Sylamore Sandstone may dominate or fill the Chattanooga interval in some areas. The Sylamore is a white to dark gray phosphatic quartz sandstone. Its texture is fine-grained to sandy conglomerate.

The Chattanooga contains few fossils but conodonts and some brachiopods have been recovered. The basal contact is unconformable. The thickness of the Chattanooga (including the Sylamore) ranges from 0 to about 85 feet, but normally averages about 30 feet.

Original reference: C. W. Haynes, 1891, Geol. Soc. America Bull., v. 2, p. 143.

Type locality: Hillside exposure at north end of Cameron Hill, Chattanooga, Hamilton County, Tenn. Standard section: Cut on Tennessee Highway 26, at east approach to Silgo Bridge over Caney Fork, 7.1 miles east of courthouse at Smithville, DeKalb County, Tenn.

ST. JOE LIMESTONE/MEMBER (FORMATION)

Age: Early Misssissippian Period

Distribution:; northern Arkansas, Ozark Plateaus; Oklahoma, southern Missouri.

Geology: The St. Joe is a fine-grained crinoidal limestone that may contain some smooth bedded chert in limited places. Some beds may display a coarse bioclastic texture. The limestones (and cherts) are frequently gray but may also be red, pink, purple, brown, or amber. The fossil clasts are generally white in contrast to the matrix. Some thin calcareous shales are found in the sequence (top, lower middle, and base). The base of the St. Joe is generally marked by a phosphatic, greenish shale or conglomerate. The St. Joe is a frequent bluff former. The St. Joe interval is considered a member of the Boone Formation but several workers have suggested a formational rank for the unit. Crinoids, brachiopods, bryozoa, conodonts, blastoids, ostracods, and rugose coral have been noted in the St. Joe. The basal contact is considered disconformable in most places, but some workers suggest a conformable lower contact with the Chattanooga Shale. The St. Joe ranges from a feather edge to over 110 feet in thickness.

Original Reference: T. C. Hopkins, 1893, Annual Report of the Geological Survey of Arkansas for 1890, v. 4.

Type locality: Named for exposures near St. Joe, AR. Principal reference section in a quarry two miles northwest of St. Joe (NE, NW, Sec.18, T16N, R17W).

BOONE FORMATION/(LIMESTONE/CHERT)

Age: Early and Middle Mississippian Period

Distribution: northern Arkansas, Ozark Plateaus; southwestern Missouri and eastern Oklahoma.

Geology: The Boone consists of gray, fine to coarse grained fossiliferous limestone interbedded with chert. Some sections may be predominantly limestone or chert. The cherts tend to be dark in color in the lower part of the sequence and light in color in the upper part of the section. The quantity of chert varies considerably both vertically and horizontally. The sequence includes an oolite member (Short Creek) near the top of the Boone in western exposures and the generally chert-free

St. Joe Member at its base. The Boone is well known for dissolutional features such as sinkholes, caves, and enlarged fissures. Criniods are the most common fossil found in the Boone but brachiopods, bryozoa, mollusks, corals, shark material, trilobites, conodonts, and others are known. The lower contact of the Boone is considered disconformable in most places, but some workers suggest a conformable lower contact with the Chattanooga Shale; the contact with the St. Joe is conformable. The thickness of the Boone is 300 to 350 feet in most of northern Arkansas but as much as 390 feet has been reported.

Original reference: J. C. Branner and F. W. Simonds, 1891, Arkansas Geol. Survey Ann. Rept. 1888, v. 4, p. xiii, 27-37.

Type locality: Named for extensive development in Boone County, Ark.

MOOREFIELD FORMATION/SHALE

Age: Late Mississippian Period

Distribution: central northern Arkansas, Ozark Plateaus; central eastern Oklahoma.

Geology: The Moorefield in the Batesville district consists of a lower member of black calcareous shale and siliceous limestone and upper member of dark fissile clay shale. The unit listed as the Ruddell Shale on the state geologic map is usually considered part of the Moorefield and is equivalent to the upper member listed here. The Moorefield is sparsely fossiliferous in much of the sequence but locally may contain an abundant fauna dominated by cephalopods and brachiopods. The lower boundary is sharp and considered unconformable by most workers. The thickness ranges from a thin edge to 300 feet

Original reference: G. I. Adams, 1904, U. S. Geol. Survey Prof. Paper 24, p. 26.

Type locality: Named for Moorefield, Independence County, Ark.

RUDDELL FORMATION/SHALE

Age: *Late Mississippian Period*

Distribution: *central northern Arkansas, Ozark Plateaus.*

Geology: *The Ruddell is described as being made up of dark gray to greenish-gray fissle clay shales with some dark-gray to black limestone concretions. The Ruddell as indicated on the state geologic map is usually considered part of the Moorefield by most geologists and is equivalent to its upper member. See the listing for the Moorefield Formation.*

Original reference: *Mackenzie Gordon Jr., 1944, AAPG Bull., v. 28, n. 11, p. 1631-1634.*

Type locality: *West end of Ruddell Hill (NE, NE, S 13, T7N, R13W), Independence Co., AR.*

BATESVILLE SANDSTONE/FORMATION

Age: Late Mississippian Period

Distribution: northern Arkansas, Ozark Plateaus; southern Missouri and northeastern Oklahoma.

Geology: The Batesville is an often flaggy, fine- to coarse-grained, cream-colored to brown sandstone with thin shales. A limestone member, the Hindsville, found mostly in western outcrops is a crystalline, fossiliferous limestone that, when present, usually occurs at the base of the formation. In western Arkansas the Hindsville may be the only representative of this unit. Fossils are somewhat common in the Hindsville Member but generally sparse in the sand facies. The basal contact is unconformable and often marked by a chert (Boone) conglomerate. The thickness of the Batesville is quite variable, ranging from a feather edge to over 200 feet. The thickest sections are in Independence County.

Original reference: J. C. Branner and F. W. Simonds, 1891, Arkansas Geol. Survey Ann. Rept. 1888, v. 4, p. xiii, 26, 49-53.

Type locality: Named for Batesville, Independence County, Ark.

FAYETTEVILLE SHALE/FORMATION

Age: Late Mississippian Period

Distribution: northern Arkansas, Ozark Plateaus; southern Missouri, eastern Oklahoma.

Geology: The Fayetteville is a black, fissile, concretionary, clay shale. Dark gray, fine-grained limestones commonly interbed with the shales in north central Arkansas. The Wedington Sandstone Member, known from west Arkansas outcrops, is composed of gray to brown, fine-grained, sometimes calcareous sandstone. Septarian concretions are common in lower beds of the Fayetteville but may be found throughout the formation. Fossils are abundant in some intervals and in local areas. Most of the fauna recovered is pyritic, but some silicified material is found. The Fayetteville is considered to rest conformably on the Batesville (& Hindsville). The Fayetteville ranges in thickness from 10 to 400 feet.

Original reference: F. W. Simonds, 1891, Arkansas Geol. Survey Ann. Rept. 1888, v. 4, p. 26, 42-49.

Type locality: Named for Fayetteville, in valley of West Fork of White River, Washington County, Ark.

PITKIN LIMESTONE/FORMATION

Age: Late Mississippian Period

Distribution: northern Arkansas, Ozark Plateaus; eastern Oklahoma

Geology: The Pitkin is usually represented by a fine to coarse grained, oolitic, bioclastic limestone. Sequences of black shale interbedded with the limestone are noted in the eastern outcrop area; minor chert is sometimes found near either the top or bottom of the interval; and minor sandstone has been reported near the top of the

unit in the northwest. The unit becomes more shaly to the south. Fossils are common and include crinoids, brachiopods, bryozoa, corals, bivalves, gastropods, cephalopods, trilobites, conodonts, and shark teeth. The bryozoan *Archimedes* is a good marker fossil for this unit but does occur in other subjacent formations. The basal contact of the Pitkin is conformable. The thickness of the Pitkin ranges from a thin edge to over 400 feet. The average thickness is about 50 feet in the west and about 200 feet in the east.

Original reference: G. I. Adams and E. O. Ulrich, 1904, U. S. Geol. Survey Prof. Paper 24, p. 27, 109.

Type locality: Named for exposures near Pitkin post office in Washington County, Ark.

HALE FORMATION

Age: Early Pennsylvanian Period, Morrowan Series

Distribution: northern Arkansas, Ozark Plateaus; southern Missouri and northeastern Oklahoma.

Geology: The Hale Formation is made up of two members: a lower Cane Hill Member and an upper Prairie Grove Member. The Cane Hill Member is typically composed of dark gray silty shale interbedded with siltstone and thin bedded fine-grained sandstone. Some lithologies are locally calcareous. Isolated thick to massively bedded sandstones sometimes occur in the section. Fossils are principally found associated with the calcareous units and include various mollusks, brachiopods and other groups. The lower contact of the Cane Hill marks the Mississippian-Pennsylvanian boundary in north Arkansas.

> *An upper Mississippian age sequence mapped on the Geologic Map of Arkansas as the lower part of the Cane Hill Member of the Hale Formation in north central Arkansas has been offered as a separate unit called the Imo Formation (Original reference: M. Gordon, Jr., 1964, U. S. Geol. Survey Prof. Paper 460, p. 34; Type locality: Sulphur Springs Hollow, SE, SE, Sec. 3 & NW, NW, Sec. 11, T13N, R17W; Searcy County, AR.). This sequence is a fossiliferous gray to black shale with some fine to coarse-grained phosphatic sandstone and conglomeratic limestone. Upper-most Mississippian age fossils are common in some intervals and include bivalves, gastropods, cephalopods, brachiopods, crinoids, trilobites, palynomorphs, plant material, and others. The upper boundary is poorly defined and may be a shale on shale contact while the base appears to be conformable with the Pitkin. The maximum thickness of the "Imo" cannot be determined without a clear definition of its contacts, but descriptions have indicated a range from 200 to 340 feet.*

The Prairie Grove Member is composed of thin to massive, often crossbedded, frequently pitted ("honeycomb weathering"),light gray to dark brown, limy sandstone or variously sandy limestone with lenses of relatively pure, crinoidal, highly fossiliferous limestone and oolitic limestone. Prairie Grove outcrops frequently have a mottled appearance when fresh. Fossils are common but generally fragmental. The fossil fauna includes: crinoids, bryozoans, brachiopods, algae, corals, trilobites, mollusks, and microfossils. The lower contact of the Prairie Grove is considered unconformable. The Hale (Cane Hill) rests with

pronounced unconformity upon older strata. The reported thickness of the Hale ranges from a few feet to more than 300 feet.

Original reference: G. I. Adams and E. O. Ulrich, 1905, U. S. Geol. Survey. Geol. Atlas, Folio 119. L. G. Henbest, 1953, Am. Assoc. Petroleum Geologists Bull., v. 37, no. 8.

Type locality: Named for Hale Mountain, vicinity of Cane Hill, Washington County, Ark. Well exposed beside Arkansas State Highway 59 for 3 miles along the road south of Evansville in SE, Sec. 35, T13N, R33W.

BLOYD FORMATION/SHALE

Age: Early Pennsylvanian Period, Morrowan Series

Distribution: northern Arkansas, Ozark Plateaus; eastern Oklahoma.

Geology: The Bloyd Formation consists of (in ascending order): the Brentwood Limestone Member, the Woolsey Member, Dye Shale Member, Kessler Limestone Member, and the Trace Creek Shale Member (considered a part of the Atoka Formation by many modern workers). The Brentwood is a sequence of limestones separated by thick intervals of dark shale. The normal sequence usually has 2 to 4 limestones intervals; however, east of the type region the unit becomes more sandy. The Woolsey is composed of terrestrial sediments comprised of dark-gray, fissile shale often interbedded with thin siltstones. A thin coal bed, called the Baldwin Coal, occurs at or near the top of the Woolsey. To the east of Washington County the Woolsey is replaced by a thick, fine- to medium-grained, cross bedded sandstone facies commonly referred to as the Middle Bloyd Sandstone. This unit frequently contains quartz granules and is a common bluff-former. The Middle Bloyd Sandstone is normally mapped as part of the Dye Shale. The marine deposited Dye Shale Member is predominantly a dark-gray shale with scattered calcareous concretions. Where underlain by the Woolsey, the Dye frequently has a bed of calcareous sandstone with scattered clay pebbles and quartz granules, called the caprock, at its base. The Kessler Limestone Member is either a single unit of limestone or a sequence of limestone and shale interbedded. The limestones are bioclastic and oolitic and contain abundant oncoliths, traces of clay-pebble conglomerate, and minor amounts of calcareous sandstone. The Kessler seems to be absent east of central Madison County. The Trace Creek Shale Member is composed of dark-gray shales with some thin beds of sandstone. The sandstone beds become thicker and more common toward the top of the unit. Fossils of most common invertebrate phyla are known mostly from the limestones and calcareous sandstones of the Bloyd. The base of the Bloyd is considered conformable, but unconformities are recognized at the base of the Dye and at the base of the Trace Creek. Typical thicknesses reported for the Bloyd range between 175 and 200 feet.

Original reference: A. H. Purdue, 1907, U. S. Geol. Survey Geol. Atlas, Folio 154.

Type locality: Named from Bloyd Mountain, 9 miles southwest of Fayetteville, Washington County, Ark.

ATOKA FORMATION

Age: Pennsylvanian Period, Atokan Series

Distribution: in Arkansas the Boston Mountains, Arkansas River Valley, and Ouachita Mountains; eastern Oklahoma, eastern New Mexico, and central and western Texas.

Geology: The Atoka is a sequence of marine, mostly tan to gray silty sandstones and grayish-black shales. Some rare calcareous beds and siliceous shales are known. This unit has the largest areal extent of any of the Paleozoic formations in the state. It is the surface rock of the Boston Mountains and dominates the exposures in the Arkansas River Valley and the frontal Ouachita Mountains. It is also present in the southern part of the Ouachita Mountains. In the Arkansas River Valley and the frontal Ouachita Mountains the Atoka has been subdivided into upper, middle, and lower lithic members based on regionally mappable shale or sandstone intervals. The unit locally contains discontinuous streaks of coal and coaly shale in the Boston Mountains and Arkansas River Valley. Fossil plants are common throughout the section but are generally poorly preserved. Poorly preserved invertebrate fossils are much less common and are found at several horizons. Trace fossils are relatively common in the Atoka. The Atoka is conformable with the Bloyd Shale in the Boston Mountains and the Johns Valley Shale in the Ouachita Mountains. The unit may reach up to 25,000 feet thick in the Ouachita Mountains although only large incomplete sections are known.

Original reference: J. A. Taff and G. I. Adams, 1900, U. S. Geol. Survey 21st Ann. Rept., pt. 2, p. 273.

Type locality: Named for Atoka, Atoka County, Oklahoma.

CRETACEOUS ROCKS

Age: Late Cretaceous Period, Gulfian Series

Distribution: Eastern margin of Ozark Plateaus in northern Arkansas

Geology: Local deposits of black shaley clay and gravel atop Paleozoic age rocks. Fossils found associated with this sequence suggest a possible Ozan Formation correlation. This sequence has not been assigned to a specific stratigraphic unit or studied in detail.

SAND and CLAY

Age: Cretaceous Period?

Distribution: Eastern margin of Ozark Plateaus in northern Arkansas

Geology: Scattered deposits of sands and clay of uncertain affinities lying atop Paleozoic age rocks. This sequence has not been assigned to a specific stratigraphic unit or studied in detail.

GRAVEL

Age: Tertiary Period

Distribution: Eastern margin of Ozark Plateaus in northern Arkansas

Geology: Scattered deposits of gravel found on isolated hills lying atop Paleozoic and Cretaceous(?) age rocks. This sequence has not been assigned to a specific stratigraphic unit or studied in detail.

ALLUVIUM and TERRACE DEPOSITS

Age: Quaternary Period

Distribution: In the major stream valleys along the eastern margin of Ozark Plateaus in northern Arkansas

Geology: The deposits indicated by this notation are alluvial deposits of present streams and one or more terrace levels. Sediments will include gravels, sands, silts, clays and mixtures of any and all of these. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ARKANSAS VALLEY AND OUACHITA MOUNTAINS REGION

The Arkansas Valley is dominated by Pennsylvanian age clastic sediments deposited on the margin of a continental shelf primarily by deltas and reorganized in part by marginal marine processes. Structurally the area is made up of broad synclines with relatively narrow intervening anticlines. The axes of these folds generally trend east-west. Most of the faulting observed is normal but some thrusts faults are noted associated with the anticlines in the southern part of the province. The synclines are often the most conspicuous present positive topographic features as a result of more rapid erosion of underlying shales once capping sandstones were breached on the crests and flanks of the surrounding anticlines.

The Ouachita Mountains are made up of complexly folded and faulted Paleozoic age sedimentary rocks that were originally deposited in mostly deep marine environments. The continental collision during the late Paleozoic that pushed up this region produced a structural fabric that trends more or less east-west. The folding was intricate at all scale levels and several local sequences, both complete and partial, are overturned. Compressional faulting is commonly expressed in the sequence throughout the area. The Ouachita province, in a general sense, can be considered an anticlinorum with late Cambrian and early Ordovician age deposits being exposed in the center and Mississippian and Pennsylvanian age sediments exposed around the margins. The area is cut off to the east by the Gulf Coastal Plain and Mississippi Embayment.

COLLIER SHALE/FORMATION

Age: Late Cambrian Period and Early Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains (principally Montgomery and Garland Counties); southeastern Oklahoma.

Geology: The sequence is composed of gray to black, lustrous shale containing occasional thin beds of dense, black, and intensely fractured chert and with an interval of bluish gray, dense to spary, thin-bedded limestone. The limestone is conglomeratic and pelletoidal, in part, near the top, with pebbles and cobbles of limestone, chert, metaarkose, and quartz. The entire unit displays intensive deformation and frequent small quartz veins. Fossils are rare but include trilobites, and conodonts. The base of the formation is not exposed but the total thickness of the exposed portion exceeds 1000 feet.

Original reference: A. H. Purdue, 1909, Geological Society of America Bulletin v. 19, p. 557; A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 31.

Type locality: Named for Collier Creek, Montgomery County, Arkansas.

CRYSTAL MOUNTAIN SANDSTONE/FORMATION

Age: Early Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains (principally Montgomery and Garland Counties); southeastern Oklahoma.

Geology: The formation is typically composed of massive, coarse-grained, well rounded, light gray sandstone. Lesser amounts of interbedded light gray to gray shale, black chert, bluish gray limestone, and gray calcareous conglomeratic sandstone (often containing clasts of metaarkose) are usually present. Some large boulders of metaarkose and other exotics occur in some slurried conglomerate intervals. The unit is often set with a network of quartz veins up to several inches thick. In some places the quartz veins are open (up to several feet wide) allowing clusters of quartz crystals to form. Conodont fossils are known from this unit. The contact with the underlying Collier Shale is considered conformable. Typical thicknesses of the unit range from 500 to 850 feet but some sites may have less than 50 feet.

Original reference: A. H. Purdue, 1909, Geological Society of America Bulletin v. 19, p. 557; A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 32.

Type locality: Named for Crystal Mountains, Montgomery County, Arkansas.

MAZARN SHALE/FORMATION

Age: Early Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma.

Geology: The formation is predominantly shale with small amounts of siltstone, silty to conglomeratic sandstone, limestone, and glossy black chert. The shale is mostly gray black but thin layers of olive gray silty shale or siltstone interbed the darker shales in some sequences. When the dark and greenish shales are cleaved at an angle to bedding they yield a ribboned surface. In many places quartzose siltstone or very fine-grained sandstone is present. The dense, bluish gray, thin bedded limestones are found (when present) throughout the interval. Thin to thick beds of gray sandstone are occasionally found at random horizons notably in the upper and lower portions of the sequence. The cherts are usually found in the upper part of the unit. Milky quartz veins are common in some areas. Only conodonts and a few graptolites fossils have been noted. The unit is conformable with the underlying Crystal Mountain Sandstone. The thickness of the unit is thought to range from 1000 feet to over 2500 feet.

Original reference: H. D. Miser, 1917, U. S. Geological Survey Bulletin, V. 660, p. 68.

Type locality: Named for Mazarn Creek (headwaters), eastern Montgomery County, northeastern Caddo Gap Quadrangle, Arkansas.

BLAKELY SANDSTONE/FORMATION

Age: Middle Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma

Geology: The formation consists of black and green shale in alternating layers with hard gray sandstone and some bluish gray limestone. Although the shale may locally make up 50% - 75% of the sequence it is the sandstones that stand out. The sandstones are light gray to blue, medium-grained, well cemented and in thin to thick beds. Both silica and calcite have been noted as cement. Where the cement is silca the sandstone is quartzite and is quite resistant to weathering. Erratic metaarkose boulders and pebbles occur in the some conglomeratic sandstones. The shales of the Blakely are sometimes ribboned much like the Mazarn shales. Graptolites and conodonts are the fossils reported from the formation. The lower contact is considered unconformable by some workers. The thickness ranges from a few feet to about 700 feet.

Original reference: E. O. Ulrich, 1911, Geological Society of America Bulletin, V. 22, p. 676.

Type locality: Named for Blakely Mountain, Garland County, Arkansas.

WOMBLE SHALE/ FORMATION

Age: Middle Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains; southern Oklahoma.

Geology: The Womble is mostly black shale with thin layers of limestone, silty sandstone, and some chert. Some green shales are interbedded with the black shales but less so than with the Mazarn. Cleavage at an angle to bedding frequently displays a ribboned cleavage surfaces. The sandstones are dark gray, compact, fine-grained though occasionally conglomeratic, and may be phosphatic. These sandstones are generally found in the lower part of the formation. The dense, blue-gray limestones usually occur near the top of the formation in thin to medium beds. Black chert is also present as thin layers also at the top of the formation. Large milky quartz veins often fill fractures in the formation. Graptolite and conodont fossils have been noted from the Womble. The Womble rests conformably on the underlying Blakely. The Womble ranges from 500 to 1200 feet thick.

Original reference: H. D. Miser, 1917, U. S. Geological Survey Bulletin 600, p. 67

Type locality: Named for the town of Womble (now called Norman), Crystal Mountain area.

BIGFORK CHERT/FORMATION

Age: Middle and Late Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma.

Geology: The Bigfork consists of thin bedded, dark gray, cryptocrystalline chert interbedded with varying amounts of black siliceous shale, calcareous siltstone, and

dense, bluish gray limestone. The cherts normally occur in thin to medium beds and are usually highly fractured. The interbedded siliceous shales occur in thin to thick sequences and are often pyritic. The limestones occur mostly as interbeds in the chert and typically weather to a soft brown layer. The limestones are more common in the northwestern exposures. Fossils are rare but fragments of brachiopods, crinoids, sponges, conodonts, and graptolites have been reported. The contact between the Bigfork and the underlying Womble is conformable. The Bigfork in Arkansas ranges from about 450 feet thick in the northern Ouachitas to about 750 feet thick in the southern Ouachitas.

Original reference: A. H. Purdue, 1909, Geological Society of America Bulletin v. 19, p. 557; A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 35.

Type locality: Named for exposures near the Bigfork Post Office, Montgomery County, Arkansas.

POLK CREEK SHALE/FORMATION

Age: Late Ordovician Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma

Geology: The Polk Creek rocks are black, sooty, fissile shale with minor black chert and traces of gray quartzite and limestone. Graptolites are common in most of the shales in the formation. The Polk Creek rests conformably on the Bigfork Chert. Its thickness ranges from about 50 to about 225 feet.

Original reference: A. H. Purdue, 1909, Geological Society of America Bulletin v. 19, p. 557; A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 36.

Type locality: Named for Polk Creek, Caddo Gap Quadrangle, Montgomery County, Arkansas.

BLAYLOCK SANDSTONE/FORMATION

Age: Silurian Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma.

Geology: The Blaylock consists of fine-to medium-grained sandstone of tan, dark gray, or greenish color, interbedded with dark-colored to black fissile shale in the southern Ouachita Mountains. The sandstones are usually thin bedded but some intervals consists of fairly thick beds. The sandstones tend toward wackestones with small amounts of plagioclase, zircon, tourmaline, garnet, leucoxene, and mica. The shales, which may dominate thick sequences, are usually dark gray and micaceous. Fossils are rare: only graptolites and a few trace fossils have been reported. The unit rests conformably on the Polk Creek. The formation ranges from as much as 1200 feet thick along the southwestern part of its outcrop area in

Arkansas, but thins dramatically to the north where it is frequently represented by only 5 to 20 feet of olive gray shale.

Original reference: A. H. Purdue, 1909, Geological Society of America Bulletin v. 19, p. 557; A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 37.

Type locality: Named for Blaylock Mountain, Montgomery County, Arkansas.

MISSOURI MOUNTAIN SHALE/FORMATION

Age: Silurian Period

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma.

Geology: The Missouri Mountain Formation is a shale interbedded with various amounts of conglomerate, novaculite, and sandstone. The shales are usually gray, green, black, or red but weather to buff, green, yellow, or reddish brown. The conglomerate is normally found at or near the base of the unit and may be up to 4 feet thick. Thin beds of novaculite are present in the upper parts of the unit. The thin quartzitic sandstones occur throughout the unit but are more common in the upper and lower parts. Few identifiable fossils have been found in the Missouri Mountain. The Missouri Mountain rest conformably on the Blaylock to the south and the Polk Creek in the northern part of its outcrop range. It reaches a maximum of about 300 feet in thickness.

Original reference: A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 37.

Type locality: Named for exposures in the Missouri Mountain, Polk and Montgomery Counties, Arkansas.

ARKANSAS NOVACULITE FORMATION

Age: Devonian and Early Mississippian Periods

Distribution: west central Arkansas, Ouachita Mountains; southeastern Oklahoma.

Geology: Three Divisions of the Arkansas Novaculite are recognized (except in the northern exposures). The Lower Division is white massive-bedded novaculite with some interbedded gray shales near its base. The Middle Division is greenish to dark gray shales interbedded with many thin beds of dark novaculite. The Upper Division is white, thick bedded, often calcareous novaculite. Conodonts and other microfossils are sometimes common in the Arkansas Novaculite. The formation rests conformably on the Missouri Mountain Formation at most places but the presence of conglomerates in a few places suggests a possible minor incipient submarine disconformity. The formation may attain a thickness of up to 900 feet in its southern outcrops, but it thins rapidly to as little as 60 feet to the north.

Original reference: A. H. Purdue, 1909, Slates of Arkansas: Arkansas Geological Survey, p. 30, 39-40; (L. S. Griswold, 1892, Arkansas Geological Survey Annual Report 1890, V. 3, p. 57-61, 69, 85, 87-113).

Type locality: Named for quarries in Arkansas (especially near Hot Springs in Garland County) that produced this rock under the trade name of "Arkansas Novaculite".

STANLEY SHALE/FORMATION (GROUP)

Age: Mississippian Period

Distribution: west central Arkansas, Ouachita Mountains; Central southern and southeastern Oklahoma.

Geology: The Stanley is composed of dark gray shale interbedded with fine-grained sandstone. A thick sandstone member, the Hot Springs Sandstone, is found near the base of the sequence and an equivalent thin conglomerate/breccia occurs at the base of the unit in many other places. Minor amounts of tuff, chert, and conglomerate have also been noted in various parts of the sequence. The silty sandstones outside the Hot Springs Member are normally found in thin to massive beds separated by thick intervals of shale. The tuffs (Hatton Tuff Lentil and others) seem to be restricted to the lower part of the Stanley, cherts are sometimes found in the middle and upper parts of the formation. Both plant and invertebrate fossils are known from the Stanley, but the preservation is usually poor. The Hot Springs Sandstone and conglomerate/breccia at the base of the formation possibly indicates a submarine disconformably between the Stanley and the Arkansas Novaculite in Arkansas. The total thickness of the Stanley varies from 3500 to over 10,000 feet. The Hot Springs Sandstone may be as much as 200 feet thick in the Hot Springs district, but is thinner elsewhere.

Original reference: J. A. Taff, 1902, U. S. Geological Survey Geological Atlas, Folio 79

Type locality: Named for Stanley, Pushmataha County, Oklahoma.

JACKFORK SANDSTONE/FORMATION (GROUP)

Age: Pennsylvanian Period, Morrowan Series

Distribution: west central Arkansas, Ouachita Mountains; southeastern and central southern Oklahoma.

Geology: The Jackfork is thin to massive bedded, fine- to coarse-grained, brown, tan, or bluish gray quartzitic sandstones with subordinate brown silty sandstones and gray-black shales. Toward the north of its outcrop area the shale units of the lower and middle Jackfork take up more of the section and the sandstones are more lenticular, often occurring as chaotic masses in the shale. Minor conglomerates composed of quartz, chert, and metaquartzite occur notably in the southern exposures of the formation. A few poorly preserved invertebrate and plant fossils have been recovered from the Jackfork. The Jackfork rests conformably on the Stanley. The formation is generally found to be between 3500 to 6000 feet thick.

Original reference: J. A. Taff, 1902, U. S. Geological Survey Geological Atlas, Folio 79

Type locality: Named for Jackfork Mountain, Pittsburg and Pushmataha Counties, Oklahoma.

JOHNS VALLEY SHALE/FORMATION

Age: Pennsylvanian Period, Morrowan Series

Distribution: west central Arkansas, Ouachita Mountains, southern Arkansas River Valley; southeastern Oklahoma.

Geology: The Johns Valley is generally gray black clay shale with numerous intervals of silty, thin to massive, brownish gray sandstone. Small amounts of gray-black siliceous shale and chert have also been noted. In the frontal Ouachita Mountains the unit contains large quantities of erratic rocks (limestones, dolostones, cherts, etc.) formed by submarine slumping of older stratigraphic units to the north. The Johns Valley is conformable with the underlying Jackfork. Due to the high degree of structural deformation the total thickness of the unit is difficult to estimate, but it likely exceeds 1500 feet.

Original reference: E. O. Ulrich, 1927, Oklahoma Geological Survey Bulletin 45, p. 6, 21-23, 30, 36-37.

Type locality: Named for Johns Valley, Pushmataha County, Oklahoma. Typically exposed in the center of the Tuskahoma syncline (N 1/2, T1S, R16E).

ATOKA FORMATION

Age: Pennsylvanian Period, Atokan Series

Distribution: in Arkansas the Boston Mountains, Arkansas River Valley, and Ouachita Mountains; eastern Oklahoma, eastern New Mexico, and central and western Texas.

Geology: The Atoka is a sequence of marine, mostly tan to gray silty sandstones and grayish-black shales. Some rare calcareous beds and siliceous shales are known. This unit has the largest areal extent of any of the Paleozoic formations in the state. It is the surface rock of the Boston Mountains and dominates the exposures in the Arkansas River Valley and the frontal Ouachita Mountains. It is also present in the southern part of the Ouachita Mountains. In the Arkansas River Valley and the frontal Ouachita Mountains the Atoka has been subdivided into upper, middle, and lower lithic members based on regionally mappable shale or sandstone intervals. The unit locally contains discontinuous streaks of coal and coaly shale in the Boston Mountains and Arkansas River Valley. Fossil plants are common throughout the section but are generally poorly preserved. Poorly preserved invertebrate fossils are much less common and are found at several horizons. Trace fossils are relatively common in the Atoka. The Atoka is conformable with the Bloyd Shale in the Boston Mountains and the Johns Valley Shale in the Ouachita Mountains. The unit may reach up to 25,000 feet thick in the Ouachita Mountains although only large incomplete sections are known.

Original reference: J. A. Taff and G. I. Adams, 1900, U. S. Geol. Survey 21st Ann. Rept., pt. 2, p. 273.
Type locality: Named for Atoka, Atoka County, Oklahoma.

HARTSHORNE SANDSTONE/FORMATION

Age: Pennsylvanian Period, Desmoinesian Series
Distribution: west central Arkansas, Arkansas River Valley; eastern Oklahoma.
Geology: The Hartshorne is normally a brown to light gray, massive, frequently cross-bedded, medium-grained sandstone. It is the first continuous sandstone underlying the Lower Hartshorne Coal. The formation is a prominent ledge-former under favorable structural conditions. A few fragmental plant fossils have been noted in the formation. The Hartshorne rests with minor unconformity on the Atoka Formation. The unit's thickness ranges from about 10 to 300 feet
Original reference: J. A. Taff, 1899, U. S. Geol. Survey 19th Ann. Rept., pt. 3, p. 436
Type locality: Named for exposures near Hartshorne, Pittsburg County, Oklahoma.

MCALESTER FORMATION

Age: Pennsylvanian Period, Desmoinesian Series
Distribution: western Arkansas River Valley, Arkansas coal fields; eastern Oklahoma.
Geology: The McAlester consists of (in ascending order): several hundred feet of shale with thin sandstone and coal (the Lower Hartshorne Coal is just above the base), several hundred feet of shale with a few sandstone beds and coal (Upper Hartshorne Coal), and capped by several hundred feet of shale with a few coal beds. Plant and a few invertebrate fossils have been reported from several horizons with in the formation. The McAlester rest conformably on the Hartshorne. The unit ranges from about 500 feet to 2300 feet thick.
Original reference: J. A. Taff, 1899, U. S. Geol. Survey 19th Ann. Rept., pt. 3, p. 437
Type locality: Named for exposures around McAlester, Pittsburg County, Oklahoma.

SAVANNA FORMATION

Age: Pennsylvanian Period, Desmoinesian Series
Distribution: western Arkansas River Valley; eastern and southern Oklahoma.
Geology: In Arkansas the Savanna consists mostly of dark gray shale and silty shale. It contains minor amounts of light gray siltstone and medium gray, very fine- to fine-grained sandstone. On rare occasions the sandstones may contain rounded, coarse-grained, quartz sand. The beds at the base and top of the section are normally the thickest. At least six coal beds are found in the formation. The unit caps isolated synclinal mountains in the western Arkansas River Valley. Fossils are few but plant and marine invertebrate faunas have been found. The Savanna seems

to be conformable with the underlying strata. The complete Savanna section is about 1600 feet thick but the top several hundred feet of the sequence is generally missing in Arkansas.

Original reference: J. A. Taff, 1899, U. S. Geol. Survey 19th Ann. Rept., pt. 3, p. 437

Type locality: Named for Savanna, Pittsburg County, Oklahoma

BOGGY FORMATION

Age: Pennsylvanian Period, Desmoinesian Series

Distribution: Generally limited to isolated exposures in the Arkansas River Valley; fairly widespread in central southern and eastern Oklahoma.

Geology: Only basal portions of the Boggy are present in Arkansas. It is composed of light gray, fine to medium grained, silty, micaceous sandstone. Typically the sandstones are cross-bedded, ripple-marked, and contain thin beds of light gray siltstone and dark gray shale. Plant fossils have been found associated with some thin coal beds in the Boggy of Oklahoma. The basal sandstone sequence fills channels cut into the underlying Savanna Formation. About 225 feet of the lower Boggy are present in Arkansas, but the unit may reach 1100 feet thick in Oklahoma.

Original reference: J. A. Taff, 1899, U. S. Geol. Survey 19th Ann. Rept., pt. 3, p. 438

Type locality: Named for exposures along North Boggy Creek, Pittsburg and Atoka County, Oklahoma

TERRACE DEPOSITS

Age: Quaternary Period, Pleistocene Epoch

Distribution: Arkansas River valley and significant tributaries

Geology: The terrace deposits include a complex sequence of unconsolidated gravels, sandy gravels, sands, silty sands, silts, clayey silts, and clays. The individual deposits are often lenticular and discontinuous. At least three terrace levels are recognized with the lowest being the youngest. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ALLUVIUM

Age: Quaternary Period, Holocene Epoch

Distribution: flood plains of the Arkansas River and significant tributaries

Geology: The deposits indicated by this notation are alluvial deposits of present streams. Sediments will include gravels, sands, silts, clays and mixtures of any and all of these. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare and modern. The lower contact is unconformable. The thickness is variable.

MISSISSIPPI EMBAYMENT AND GULF COASTAL PLAIN

Eastern and southern Arkansas are underlain by Cretaceous age through recent sedimentary deposits with small areas of Cretaceous age igneous intrusions. The Cretaceous sedimentary deposits crop out in southwestern Arkansas and represent shallow, marginal, and often restricted marine environments. Southern Arkansas is dominated by Tertiary age marginal marine and coastal plain continental deposits with a veneer of Quaternary terrace and alluvial deposits. Eastern and northeastern Arkansas is dominated by Quaternary age terrace and alluvial deposits with minor exposures of Tertiary age materials. At least three terrace levels are recognized in the region. The Mississippi Embayment manifests a north-south linear erosional remnant called Crowley's Ridge which is generally capped by Quaternary age loess and preserves minor exposures of Tertiary age deposits along its margins. Topographically the entire area ranges from low hills to essentially flat.

TRINITY GROUP/FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Little River, Sevier, Howard, Hempstead, Pike, Clark, and Nevada counties; Texas, Louisiana, Oklahoma.

Geology: The Trinity Group is comprised of sand, gravel, clay, limestone, and evaporite deposits. Gypsum is mined commercially from this unit. Prominent members of the Trinity include the Pike Gravel, the Dierks Limestone, and the DeQueen Limestone. The Pike Gravel, the basal member of the Trinity Group, is a bedded, 0 to 100 foot thick, pale yellow to medium orange gravel deposit. The Dierks Limestone is a 0 to 70 foot thick, interbedded, greenish calcareous clay and gray fossiliferous limestone found in the lower part of the Trinity. The DeQueen Limestone is found in the middle part of the Trinity sequence and is composed of interbedded green and gray calcareous clay, limestone, gypsum and celestite 0 to 100 feet thick. The limestones are thin bedded and sandy for the most part, but crystalline and fossiliferous intervals are present. The DeQueen is also noted for a dinosaur track-way site found in a quarry near Nashville in Howard County. The upper part of the Trinity is mostly fine-grained, cross-bedded sand, usually weathered reddish. Marginal marine fossils are noted from the Trinity and carbonized logs are found between the Dierks and DeQueen. The base of the Trinity rests unconformably on a surface of upturned and eroded Paleozoic rocks. The Trinity Group may be as much as 1000 feet thick although it is usually much thinner.

Original Reference: R. T. Hill, 1888, Science, v. 11, p. 21

Type locality: Named for exposures on the Trinity River of Texas.

GOODLAND LIMESTONE/FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Limited exposure along Little River north of Cerrogordo, Little River County, Arkansas, Gulf Coastal Plain; Oklahoma and Texas

Geology: The Goodland Limestone is a medium to thick bedded, hard, sandy, light gray limestone with minor thin bedded calcareous sandstone. Poorly preserved fossils are common. The lower contact is not exposed in Arkansas. The maximum exposed thickness of the Goodland is 35 feet; however, the entire unit may reach 50 feet.

Original reference: R. T. Hill, 1891, Geological Society American Bulletin v. 2, p. 504-514.

Type locality: Named for Goodland, Choctaw County, Oklahoma. (Old Goodland is present site of Good Switch on railroad, 3 miles south of Hugo, OK.)

KIAMICHI FORMATION

Age: Early Cretaceous Period, Comanchian Series

Distribution: Very limited exposure in Little River County, Arkansas Gulf Coastal Plain; Oklahoma, Texas.

Geology: The Kiamichi Formation is composed of closely packed oyster shells in a matrix of dense, hard, gray-green marl interbedded with softer gray and green marls. Discontinuous beds and lenses of fossiliferous limestone are found in some outcrops. Almost all fossils associated with this unit are assigned to *Gryphaea navia*. The conformability of the lower contact has not been reported in Arkansas. A maximum of 20 feet of Kiamichi is reported.

Original reference: R. T. Hill, 1891, Geological Society of America Bulletin, v. 2, p. 504-515.

Type locality: Named for historic plains of Kiamichi River near Fort Towson, Choctaw County, Oklahoma.

WOODBINE FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Pike , Howard, and Sevier Counties; Texas, Oklahoma, Louisiana

Geology: The Woodbine is composed of bedded gravel, sand, bedded clay, and water-lain volcanic tuff and ash. The basal part of this unit is gravel of variable thickness and maybe cemented by iron oxides to form a conglomerate. The overlying water-lain volcanic tuffs are sandy and cross-bedded. These sediments are blue-green when fresh and deep red waxy clay when weathered. Rare leaf fossils are noted from some clays of the Woodbine. The formation was deposited upon an

unconformable surface separating the Early and Late Cretaceous. The Woodbine Formation is 0-350 feet thick.

Original reference: R. T. Hill, 1901, U. S. Geological Survey 21st Annual Report, pt. 7, p. 293.

Type locality: Named for exposures at Woodbine, Cooke County, Texas.

TOKIO FORMATION

Age: Late Cretaceous, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Oklahoma

Geology: The Tokio Formation is composed of a basal gravel overlain by coarse sand interbedded with light to dark colored clays. Some beds of calcareous or ferruginous sandstone occur in the sequence. The basal unit of bedded gravel is variable in thickness, ranging from 1 to 25 feet. This gravel may be cemented by iron oxides in places to form a conglomerate. The sands tend to be brown to gray and are generally cross-bedded. The dark gray clay is pyritic and contains plant imprints. Kaolin beds are found in the Tokio in Pike County. Fossils from the Tokio include bivalves, gastropods, plant material, and a few vertebrate remains. The lower contact of the Tokio is unconformable: the Tokio rests on the Woodbine Formation in Little River County and successively older units eastward. The Tokio's thickness reaches 300 feet in Howard County, but it thins to the east.

Original reference: H. D. Miser and A. H. Purdue, 1918, U. S. Geological Survey Bulletin 690, p. 19-24.

Type locality: Named for exposure in the vicinity of Tokio, Hempstead County, Arkansas.

BROWNSTOWN MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Texas, Oklahoma, (Louisiana?).

Geology: The Brownstown Marl is composed of clay marls, thin sometimes sandy limestones, sandy marls, and some fine-grained sands. Glauconite and some phosphatic material may be found associated with the various lithologies. The color is quite variable depending on the degree of weathering, iron content, and other factors yielding tan, brown, blue, green, red, yellow, gray, or any combination and shade of these colors. Near the base of the unit beds of thin hard limestone exists which contains poorly preserved fossils. The marls in the formation are often highly fossiliferous. The most common fossils are oysters and other bivalves, some cephalopods, and occasional echinoderms, fish material, and annelids. The Brownstown rests unconformably on underlying formations. The

Brownstown is about 250 feet thick in Howard County but thins both east and west of there.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 72, 86-87, 188; 1894, Geological Society of America Bulletin, v. 5, p. 302.

Type locality: Named after Brownstown, Sevier County, Arkansas.

OZAN FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain, parts of Clark, Pike, Hempstead, Howard, Sevier and Little River Counties; Oklahoma.

Geology: The Ozan Formation consists of tan, sandy, micaceous marl with a basal lentil of sandy marl and marly sand. The basal lentil, known as the Buckrange Sand, is highly glauconitic and contains shark teeth and phosphatic nodules. Another glauconitic interval is sometimes found about fifty five feet above the base of the Ozan. Near the top of the formation, the marls tend to become more chalky. An occasional bed of hard limestone has been noted in some outcrops near the top of the unit. Some of the Ozan marls are highly fossiliferous, commonly containing bivalves (mostly oysters), cephalopods, gastropods, echinoderms, corals, crustaceans, fish material and annelids. The Ozan Formation lies unconformably upon the Brownstown Marl. The Ozan ranges from 150 to 250 feet thick.

Original reference: C. H. Dane, 1926, U. S. Geological Survey Press Bulletin 8823, September 10, 1926

Type locality: Named for exposures along the middle fork of Ozan Creek and for the town of Ozan, Hempstead County, Arkansas.

ANNONA CHALK/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Hempstead, Howard and Little River Counties; Texas, Louisiana, Oklahoma.

Geology: The Annona Chalk is a hard, thick bedded to massive, slightly fossiliferous chalk. It weathers white, but is blue-gray when freshly exposed. The unit is commercially mined for cement. Fossils in the Annona include coelenterates, echinoderms, annelids, bivalves, gastropods, cephalopods, and some vertebrate traces. The Annona rests conformably upon the Ozan Formation. The unit is 0 to 100 feet thick.

Original reference: R. T. Hill, 1894, Geological Society of America Bulletin, v. 5, p. 308.

Type locality: Named for outcrops about 2 miles northwest of Annona, Red River County, Texas.

MARLBROOK MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Hempstead, Howard, and Little River Counties; Texas, Louisiana.

Geology: The Marlbrook Marl is a uniform chalky marl that is blue-gray when freshly exposed, and white to light brown when weathered. This unit is moderately fossiliferous in its upper part in contrast to the lower part where fossils are few. Common fossils include *Exogyra*, *Gryphaea*, and *Ostrea* oyster species and reptile remains. The lower contact of the Marlbrook is thought to be conformable. The Marlbrook is 50 to 220 feet thick.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 72, 84-86, 188.

Type locality: Typically exposed about 1 mile north of Saratoga, on road to Mineral Springs, Howard County, AR. Also exposed along Marlbrook Creek in T. 10 S., R. 24 W., Hempstead County, AR.

SARATOGA CHALK/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas. Parts of Clark, Hempstead, and Howard Counties; Louisiana, Texas.

Geology: The Saratoga Chalk is fossiliferous, hard, sandy, somewhat glauconitic chalk with some beds of marly chalk and chalky sand. It weathers white, light gray and light brown, and is blue-gray when freshly exposed. The common fossils found in the unit include sponges, bryozoa, echinodermata, annelids, bivalves, gastropods, cephalopods, crustaceans, and fish teeth. This unit displays an unconformity at its base, which represents a distinct faunal and lithologic break. The Saratoga is 20 to 70 feet thick.

Original reference: J. C. Branner, 1898, American Institute of Mining Engineers Transactions, v. 27, p. 52-59.

Type locality: Named for typical exposures north and east of Saratoga, Hempstead & Howard Counties, AR.

NACATOCH SAND/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Clark, Nevada, and Hempstead Counties; Louisiana, Texas.

Geology: The Nacatoch Sand is composed of cross-bedded, yellowish and gray fine quartz sand; hard, fossiliferous sandy limestone; coarse, highly glauconitic sand; fine-grained, argillaceous blue-black sand; bedded light-gray clay and marl. The

sands in the Nacatoch are generally unconsolidated. At the base of the unit hard, fossiliferous limestones and marl are found. Near the middle of the unit a coarse, highly glauconitic lens can be observed. On outcrop, this lens appears almost black in places and maybe 60 feet thick but averages closer to 30 feet thick. Thin bedded gray clay is found interbedded with fine sands close to the top of the unit. Fossils found in the Nacatoch include corals, echinoderms, bryozoa, annelids, bivalves, gastropods, cephalopods, crab remains, and some shark teeth. The Nacatoch Sand appears to have an unconformity at its base. The unit is 150 to 400 feet thick.

Original reference: A. C. Veatch, 1905, Louisiana Geological Survey Bulletin 1, p. 84-88; *and* 1905, U. S. Geological Survey Water-Supply Paper 114, p. 180-183.

Type locality: Typically exposed at Nacatoch Bluff on the Little Missouri River, Clark County, AR.

ARKADELPHIA MARL/FORMATION

Age: Late Cretaceous Period, Gulfian Series

Distribution: Gulf Coastal Plain in southwest Arkansas, parts of Clark, Nevada, and Hempstead Counties; Louisiana, Texas.

Geology: The Arkadelphia Marl is mostly a dark gray to black marl or marly clay with some limy, gray sandstone, gray sandy clay, sandy limestone, concretionary limestone, and white to light brown impure chalk. The sandy marls and limestones are found at or near the base of the unit, while the impure chalks are found closer to the top. (The strata that Hill first applied the name "Arkadelphia" to are no longer considered a part of this unit.) The fossil fauna includes corals, bivalves, gastropods, cephalopods, shark teeth, and various microfossils. The Arkadelphia rest with slight unconformably upon the Nacatoch Sand. The unit is 120 to 160 feet thick.

Original reference: R. T. Hill, 1888, Arkansas Geological Survey Annual Report 1888, v. 2, p. 53-56, 188.

Type locality: Typical exposures of the Arkadelphia (in its modern sense) can be found 5 to 7 miles north and northwest of Hope, between Interstate 30 and Prescott along Arkansas Highway 19, and in the Oakhaven area.

MIDWAY GROUP

Age: Tertiary Period, Paleocene Epoch

Distribution: central to southwestern Arkansas, in a band of exposure from Cabot to Texarkana; Texas to Georgia, Illinois, Kentucky, Missouri, and Tennessee.

Geology: The Midway sequence exposed at the surface in Arkansas represents a marginal marine depositional environment. The lithologies noted include calcareous shale, arenaceous limestone, calcareous glauconitic sandstone, conglomerate, and light to very dark bluish-gray clay shale. The Midway interval is not normally divided into

formations in Arkansas; however, various workers have indicated that it is possible to divide the unit into two formations: the lower Clayton Formation and the upper Porters Creek Formation. The Clayton contains most of the calcareous and sandy lithologies whereas the Porters Creek is chiefly composed of shales and silty shales. The fossils of the Midway interval includes a rich fauna that includes bivalves, gastropods, foraminifera, and ostracods with bryozoa, brachiopods, echinoids, crabs, fish, and crocodile teeth fossils also found. The lower boundary of the Midway is unconformable. The thickness ranges from a feather edge to as much as 130 feet on the outcrop; in the subsurface the unit is usually much thicker.

Original reference: G. D. Harris, 1894, American Journal Science, 3d, v. 47, p. 303-304; and, 1896, American Paleontology Bulletin, v. 1, n. 4, p. 10-38.

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

WILCOX GROUP

Age: Tertiary Period, Eocene Epoch

Distribution: central to southwestern Arkansas, in a wide band of exposure from Cabot to Texarkana, along the west side of Crowley's Ridge north of Jonesboro; Texas to Georgia, Illinois, Kentucky, Missouri, and Tennessee.

Geology: The Wilcox is a thick series of non-marine sands, silty sands, clays, and gravels with some thick deposits of lignite. In central Arkansas bauxite is found at the base of the Wilcox near Cretaceous age syenite knobs that were positive topographic features during Wilcox time. The sands are generally fine to very-fine grained and light gray in color when fresh. The clays are light gray or brown in color and often sandy or silty. Frequently, either lithology will be dark brown to black when enough carbonaceous material is included. The lignites occur throughout the sequence, controlled by depositional environment rather than stratigraphic position. Some workers divide the Wilcox of Arkansas into three formations: the Berger, the Saline, and the Detonti. Plant fossils and trace fossils, associated with the lignites and lignitic clays, are the most commonly found biologic indicators. The lower contact of the Wilcox is unconformable and unconformities occur within the sequence. The thickness of the Wilcox ranges from a feather edge to as much as 1025 feet with 850 feet often reported as average.

Original reference: A F. Crider and L. C. Johnson, 1906, U. S. Geological Survey Water-Supply Paper 159, p. 5, 9; A. F. Crider, 1906, U. S. Geological Survey Bulletin 283.

Type locality: Named for extensive development in Wilcox County, Alabama

CLAIBORNE GROUP

Age: Tertiary Period, Eocene Epoch

Distribution: West Gulf Coastal Plain of southern Arkansas and Crowley's Ridge in eastern Arkansas; Gulf Coastal Plain from Georgia to southern Texas.

Geology: The Claiborne is chiefly non-marine in origin but does contain some marine intervals. The unit is composed of medium to very-fine sands, silts, and silty clays. The sands tend to be light- to dark-gray, white, brown, or red depending on the degree of weathering. The silts and clays are light to dark gray and sometimes variegated. Intervals enriched in carbonaceous material are dark brown to black. The silts are usually clayey and the clays are normally silty or sandy. Lignite beds are found in this interval and seem to be environmentally rather than stratigraphically controlled. In the subsurface the Claiborne Group has been divided into the Carrizo Sand, Cane River Formation, Sparta Sand, Cook Mountain Formation, and Cockfield Formation. Fossils include fish and reptile bones and teeth, leaf impressions and lignitic wood, and trace fossils. The lower contact of the Claiborne is poorly known but considered unconformable. The thickness of the Claiborne ranges from a thin edge to as much as 1500 feet.

Original reference: T. A. Conrad, 1847, Philadelphia Academy of Natural Science Proceedings, v. 3, p. 280-282

Type locality: Named for exposures at Claiborne Bluff and Claiborne Landing, on the Alabama River, in Monroe County, Alabama.

JACKSON GROUP

Age: Tertiary Period, Eocene Epoch (upper)

Distribution: Southeast Arkansas and southern Crowley's Ridge in eastern Arkansas; Gulf Coastal Plain from Georgia to southern Texas.

Geology: The Jackson is divided into two distinct units in Arkansas: a lower marine unit called the White Bluff Formation and an overlying non-marine unit called the Redfield Formation. The blue gray to off white White Bluff has three dominate facies: an argilaceous sand containing glauconite and rich in molluscan fossils, a calcareous glauconitic clay with common invertebrate fossils, and a blocky clay with some silt and a trace of sand and invertebrate (mostly molluscan) molds. The Redfield is typically a sequence of light gray, thinly laminated silts, silty clays, and silty sands. Crossbedded sands and minor lignite beds have been noted in the Redfield and plant remains are generally abundant. A minor disconformity is thought to exist at the base of the Jackson sequence. The thickness of the Jackson may be as much as 300 feet but no outcrop areas exhibits the entire Arkansas section.

Original reference: T. A. Conrad, 1856, Philadelphia Academy of Natural Science Proceedings, v. 7, p. 257-258; E. W. Hilgard, 1860, Rept. Geology and Agriculture Mississippi, p. 128-135.

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

SAND AND GRAVEL

Age: Quaternary Period, Pleistocene Epoch (Late Tertiary, Pliocene Epoch?)
Distribution: Crowley's Ridge in eastern Arkansas
Geology: Sands and gravels found on Crowley's Ridge underlying loess deposits. This interval has not been assigned to specific stratigraphic unit nor studied in detail.

LOESS

Age: Quaternary Period, Pleistocene Epoch
Distribution: Crowley's Ridge in eastern Arkansas
Geology: Although loess undoubtedly occurs in other places, only on the middle and southern portions of Crowley's Ridge is it specifically mapped. It consists of tan, brown, reddish brown calcareous silt in thin to massive beds. Many workers recognize three loesses: an upper thick loess, a middle thin loess, and a lower thick loess. The loess will often hold a high vertical slope. Calcareous concretions are regularly found in the unit. Fossils of pulmonate gastropods are fairly common with fresh water mollusks and proboscidean bones occasionally found. The lower contact of the loess is unconformable. The thickness increases from north to south reaching as much as 140 feet of loess, although 40 to 60 feet is more common at the southern end of Crowley's Ridge,.

SILT AND SAND

Age: Quaternary Period, Pleistocene Epoch
Distribution: Crowley's Ridge in eastern Arkansas
Geology: The northern portion of Crowley's Ridge is capped by a interval of unconsolidated silt and sand with lenses of clay and gravel. This unit has never been studied in Arkansas.

DUNE SAND

Age: Quaternary Period, Pleistocene Epoch
Distribution: Mississippi River Embayment in eastern Arkansas
Geology: The sand dunes generally consist of homogeneous, massive, well-sorted, tan or buff to grayish or reddish brown, fine sands. Cross-stratification and bedding features seem to be lacking in the interval apparently due to extensive weathering and biogenic reworking. It is thought that these sands were derived from glacial outwash originally deposited along major drainages during the initial stages of interglacial times. The dunes are best developed on the east side of the White, Current, and Black rivers. The sand of these dunes is observed to fine with distance from these rivers. The dunes are present on all terrace levels but not on

present day alluvium. No significant fossils have been found associated with these sands. The lower contact seems to be unconformable in most places.

TERRACE DEPOSITS

Age: Quaternary Period, Pleistocene Epoch

Distribution: eastern and southern Arkansas, Mississippi River Embayment, West Gulf Coastal Plain

Geology: The terrace deposits include a complex sequence of unconsolidated gravels, sandy gravels, sands, silty sands, silts, clayey silts, and clays. The individual deposits are often lenticular and discontinuous. At least three terrace levels are recognized with the lowest being the youngest. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ALLUVIUM

Age: Quaternary Period, Holocene Epoch

Distribution: state wide

Geology: The deposits indicated by this notation are alluvial deposits of present streams. Sediments will include gravels, sands, silts, clays and mixtures of any and all of these. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare and modern. The lower contact is unconformable. The thickness is variable.

ALLUVIUM (STREAM OVERBANK)

Age: Quaternary Period, Holocene Epoch

Distribution: eastern Arkansas, Mississippi River Embayment

Geology: The deposits indicated by this notation are alluvial deposits of small streams, the overbank deposits of major streams, or older meander belt deposits of major streams. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare. The lower contact is unconformable. The thickness is variable.

ALLUVIUM (CHANNEL MEANDER)

Age: Quaternary Period, Holocene Epoch

Distribution: eastern Arkansas, Mississippi River Embayment

Geology: This unit represents the more recent channel meanders and current flood plain deposits of significant streams. Channel meander scars are distinct in this unit. The partition of this unit from other Holocene alluvial deposits was based more on geomorphic considerations than lithic or age considerations. Fossils are rare. The lower contact is unconformable. The thickness is variable.

IGNEOUS ROCKS

The majority of exposures of igneous rocks in Arkansas are present in Pulaski, Saline, Hot Spring, and Garland Counties. Scattered small peridotite-carbonatite dikes, breccia pipes, and sills are exposed in the Arkansas Valley, a single outcrop of igneous rock with ultramafic affinities is known in the Boston Mountains. The total mapped area of the various exposures encompasses less than 15 square miles. The largest of these bodies is a partially buried batholith that is composed of varieties of nepheline syenite and has been exposed by erosion in both Pulaski and Saline Counties (Granite Mountain and Saline County intrusions) The Magnet Cove and Potash Sulphur Springs complex between Malvern and Hot Springs are more mafic in composition, contain a greater variety of rock types, and had a different style of intrusion structurally than the Pulaski/Saline County batholith. Several small explosive vents containing diamondiferous lamproite breccia and magmatic lamproite (formerly termed kimberlite breccia and peridotite, respectively) are present in Pike County. Numerous mafic and alkalic dikes are present in the eastern Ouachitas. All of the above mentioned rocks that have been dated by stratigraphic or isotopic methods are Cretaceous in age, ranging from 87 to 105 million years old. Small bodies of metagabbro and serpentine/soapstone exposed in Saline and Pulaski Counties represent altered ultramafic rock units which date from the late Precambrian Era (as old as one billion years). These bodies were emplaced into the Ouachita rocks as a solid mass during the Paleozoic Era.

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