Arkansas Geological Survey
Bekki White, State Geologist and Director

Digital Geologic Quadrangle Map
Eula Quadrangle, Arkansas
DGM-AR-00269

Geologic Map of the Eula Quadrangle, Newton and Searcy Counties, Arkansas

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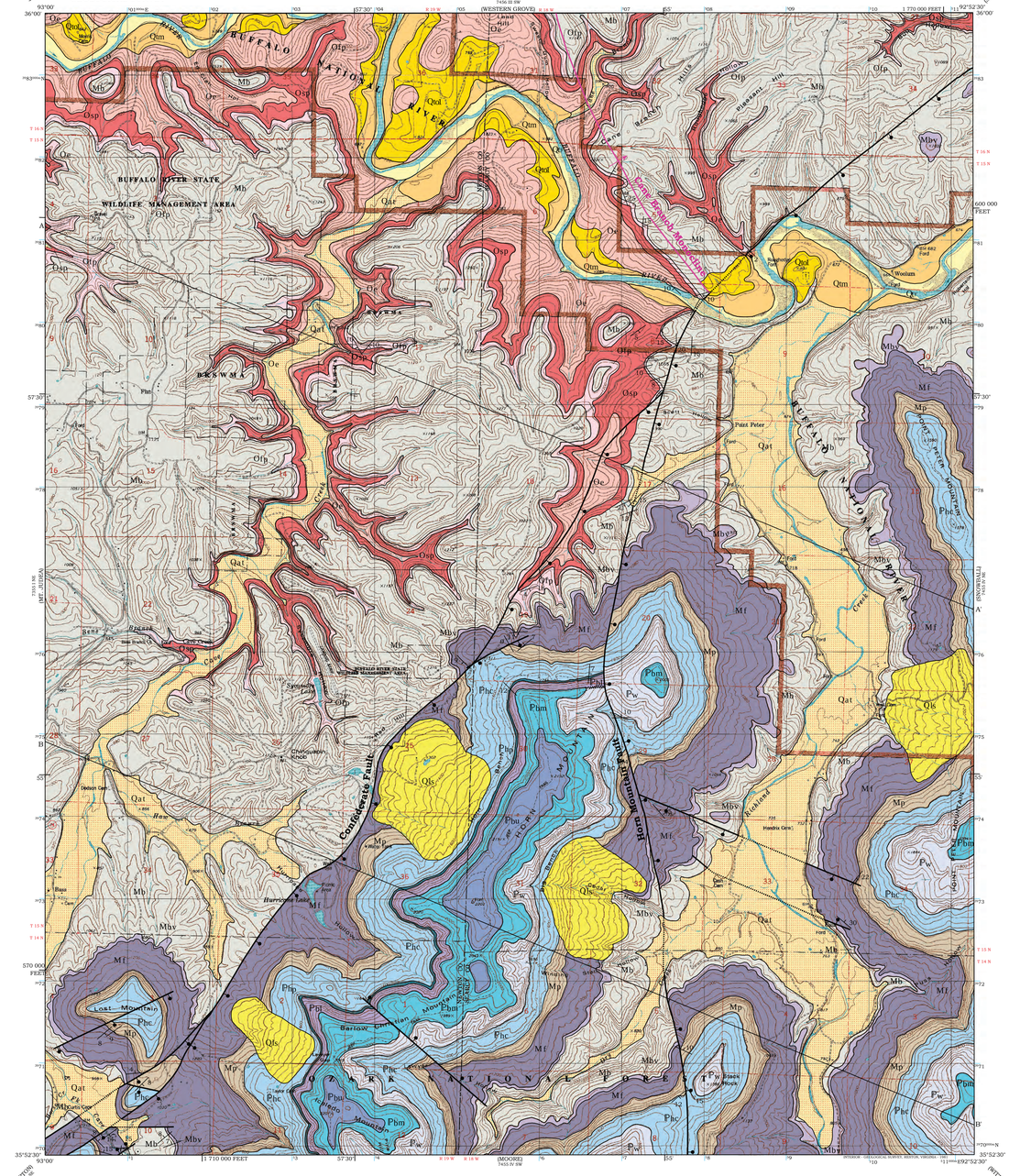
2003
Revised 2015

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EULA QUADRANGLE
ARKANSAS
7.5 MINUTE SERIES (TOPOGRAPHIC)



The topographic base is a collarless Digital Raster Graphic (DRG). The DRG is a scanned image of a U.S. Geological Survey standard series topographic map published in 1980.

10,000-foot grid based on Arkansas coordinate system, north zone.

100-meter Universal Transverse Mercator grid ticks, zone 15 shown in blue. 1927 North American Datum.

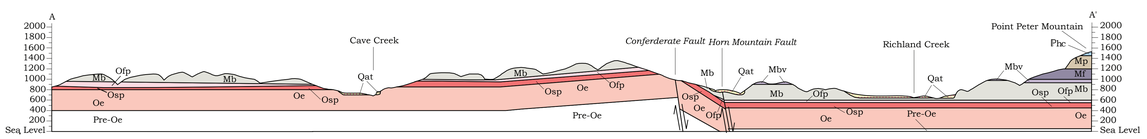
Approximate mean declination 2015

SCALE 1:24 000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

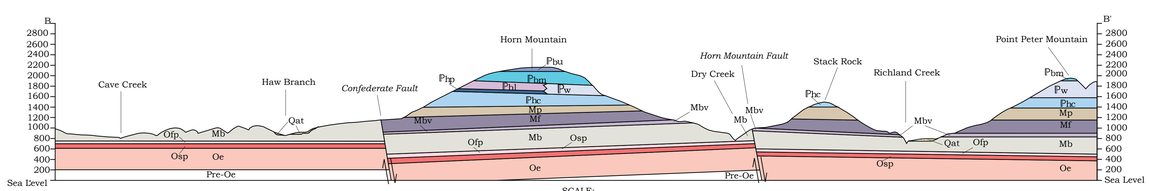
Contour Interval 40 Feet
National Geodetic Vertical Datum of 1929

ARKANSAS
Quadrangle Location

Secondary highway
Light duty road
Unimproved road



SCALE:
Horizontal: 1 Inch = 2000 Feet
Vertical: 1 Inch = 1000 Feet (Exaggeration: 2x)



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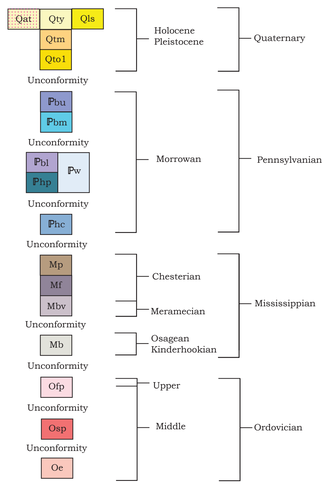
Correlation of Map Units



Introduction

This map illustrates the surface geology of the Eula quadrangle. This quadrangle was previously mapped at a 1:62,500 scale by Glick and Frezon in 1965 and Haley in 1976 for the Geologic Map of Arkansas. The geology was mapped at a 1:24,000 scale from 2002-2003 for the National Cooperative Geologic Mapping Program through STATEMAP. During 2014-2015, the terrace deposits along the Buffalo National River were mapped with funding provided by the National Park Service. Approximately eight miles of the Buffalo National River are located in this quadrangle and are managed by the National Park Service.

Approximately 2,400 feet (731 meters) of Middle Ordovician to Pennsylvanian age strata crop out in this quadrangle. The Ordovician dolostone, sandstone, and limestone units are present mainly along the Buffalo National River and Cave Creek in the northwestern portion of the map where it they are upthrown due to the Confederate Fault. The Boone Formation forms a dissected Springfield Plateau surface over a portion of the map. Upper Mississippian to Pennsylvanian sandstone, shale, and limestone form steep slopes and bluffs on Horn and Point Peter Mountains.

Quaternary alluvium and terrace deposits are present in the valley of the Buffalo National River and its tributaries. Two terrace levels are well developed along the Buffalo River: a younger and a medial. Older terraces are located 80-100 feet (24-49 meters) above the river in most meander bends.

This area was prospected in the late 1800's and early 1900's for lead and zinc. Mines and prospect pits are present throughout the quadrangle, however, they are not shown in the National Park since they are considered sensitive park resources.

Description of Map Units

Landslide deposits (Quaternary) - Mostly blocks of sandstone derived from the Morrowan units. Also contains shale slumps from Morrowan and upper Mississippian units.

Alluvium and terrace deposits (Quaternary) - Unconsolidated clay, silt, sand and gravel including deposits on one or more terrace levels.

Young terrace and active channel deposits (Quaternary) Unconsolidated clay, silt, sand and gravel in gravel bars and sandy point bar deposits along the Buffalo River. Primarily clay, silt, and sand in youngest terrace above the river. The tops of terraces are generally hummucky and tree-covered but can be flat and commonly dissected by tributaries. Approximately 20-30 ft. (6-9 m.) thick.

Medial terrace and alluvial deposits (Quaternary) - Unconsolidated clay, silt, sand, gravel, and cobbles located approximately 40 ft. (12 m.) above the Buffalo River. The contact with the underlying young terrace is located at a riser that is approximately 15-20 ft. (4-6 m.) high and usually coincides with the edge of the riparian zone along the river. Ranges in thickness from 20-60 ft. (6-18 m.).

Old terrace and alluvial deposits (Quaternary) - Unconsolidated gravel deposits on ridges above the Buffalo River. Deposit consists of coarse sand to cobble sized sub-angular to rounded chert and sandstone. It is located approximately 80-100 ft. (24-30 m.) above the river and ranges up to 160 feet (48 m.) above the river. Thickness variable.

Bloyd Formation (Lower Pennsylvanian, Morrowan) - In this quadrangle, the individual members within the Bloyd Formation cannot be recognized because the Brentwood and Kessler Limestones are either missing or have become shaly and sandy. There are no other "marker zones" to divide the section into the recognizable members known from the type section in northwest Arkansas. Therefore the Bloyd Formation is divided informally into lower and upper parts (Hudson et al., 2001) separated by the "middle Bloyd sandstone" (Zachry and Haley, 1975). Approximately 240-340 ft. (73-103 m) thick.

Upper part - Consists of interbedded thin ripple-bedded to thick-bedded micaceous sandstones and shales. The sandstones consist of fine- to coarse-grained sub-angular to sub-rounded quartz. They are light brown to gray on fresh surface but weather dark gray. The shales are dark gray to black on fresh and weathered surfaces. This interval contains many trace fossils, load features, and ball and pillow structures. Approximately 40-140 ft. (12-42 m) thick.

"middle Bloyd sandstone" - A thin to massive-bedded, medium- to coarse-grained, cross-bedded quartz- or iron-cemented sandstone with sub-angular to sub-rounded quartz grains. Reddish, gray, or light tan on fresh surface but weathers brown to orange-brown due to iron content. The cross-bedded packages can be up to three feet thick and locally overturned. Contains abundant lycopod fossils and rounded quartz pebbles. This sandstone forms a prominent bluff throughout this quadrangle and separates the upper from the lower part of the Bloyd Formation. A pebble clast conglomerate is present at the base of this sandstone. The "middle Bloyd sandstone" is unconformable with the lower part of the Bloyd Formation or the Witts Springs Formation. Approximately 80-140 ft. (24-42 m) thick.

Lower part - Consists of interbedded very thin to thin ripple-bedded micaceous siltstones and sandstones that are fine- to medium-grained, however, a very thin- to thick-bedded fossiliferous sandy fine-grained limestone is present beneath the "middle Bloyd sandstone" in a few locations. This limestone is gray on fresh surfaces but weathers light brown with a rounded profile. Throughout the lower part are black fissile clay- to silty-shales interbedded with thin- to thick-bedded fossiliferous carbonate to sandy carbonate layers. The carbonate layers vary from red to gray on fresh and weathered surfaces and can be mottled. Locally, the fossiliferous sandy layers look "rotten" due to decalcification. The quartz grains are medium-grained and sub-angular to sub-rounded. The contact between the lower part of the Bloyd Formation and the Prairie Grove is placed below a shaly layer conformable with the underlying massive calcareous sand of the Prairie Grove Member of the Hale Formation. Approximately 120-160 ft. (36-48 m) thick.

Witts Springs Formation (Lower Pennsylvanian, Morrowan)- Glick et. al., 1964, gave this name to a sequence of rocks in the Snowball Quadrangle equivalent to the Prairie Grove Member of the Hale Formation and the entire Bloyd Shale (Formation) of the type Morrowan region, northwestern Arkansas. In their definition of this unit, they identified the first massive quartz pebble sandstone they encountered above the Witts Springs as the Atoka Formation. Subsequently, the "middle Bloyd sandstone" which is not present in the type area of the Bloyd Formation in northwestern Arkansas was identified in north-central Arkansas by Zachry and Haley in 1975. The "middle Bloyd sandstone" is present above the Witts Springs Formation in the Snowball Quadrangle instead of the Atoka. Therefore, the Witts Springs Formation is equivalent to the Prairie Grove Member of the Hale Formation and the lower part of the Bloyd Formation in north central Arkansas. On the east side of Horn Mountain a blocky sandstone unlike the Prairie Grove is present above the Cane Hill. The Prairie Grove is equivalent to the lower portion of the Witts Springs Formation. The Witts Springs is underlain by the Cane Hill Member of the Hale Formation and overlain by the "middle Bloyd sandstone" and strata equivalent to the upper part of the Bloyd Formation. The Witts Springs Formation can be divided into two parts - a main body and a lower sandstone. The lower sandstone was not mapped separately due to a 40 foot contour interval. Approximately 200-320 ft. (60-97 m) thick.

Main body - Consists mostly of thin- to medium-bedded sandstone and interbedded clay-shale. The sands are very fine to medium grained and usually ripple bedded near the top of the unit. Calcareous fine- to medium-grained fossiliferous sandstones with sub-angular to rounded grains are present and contain clay pebble clasts and fine- to coarse-grained quartz pebbles. Gray on fresh surfaces but weathers brown or dark gray. Approximately 170-290 ft. (51-88 m) thick.

Lower sandstone - A massive coarse-grained iron-cemented sandstone with sub-angular to sub-rounded quartz grains. Sometimes friable. White to yellow on fresh surfaces but weathers a light brown. Contains plant fragments, iron banding, stylolites and pock marks. This unit has a blocky appearance and forms a prominent bluff on the east side of Horn Mountain and the southwest side of Point Peter Mountain. A dark-gray shale pebble conglomerate is present at the base of the sandstone. The lower sandstone is unconformable with the Cane Hill Formation. 0- approx. 30 ft. (0-9 m) thick.

Hale Formation (Lower Pennsylvanian, Morrowan)- The Hale Formation consists of two Members; the Prairie Grove Member and the Cane Hill Member. Approximately 180 -340 ft. (54-103 m) thick.

Prairie Grove Member - A fine- to coarse-grained quartz sandstone with varying amounts of carbonate, crinoidal fragments and quartz pebbles. Reddish-gray to brown or mottled on a fresh surfaces but weathers dark-reddish-brown. Bedding varies from thin to massive and exhibits a rounded weathering profile. This unit is a prominent bluff former that often contains cross-beds and a pitted surface that is referred to as honeycomb weathering. The base of the Prairie Grove Member contains a fossiliferous quartz pebble conglomerate that contains clasts of shale, siltstone, and sandstone as large as almost one foot in diameter. The Prairie Grove Member is unconformable with the Cane Hill Member. 0- approx. 40 ft. (0 - 12 m) thick.

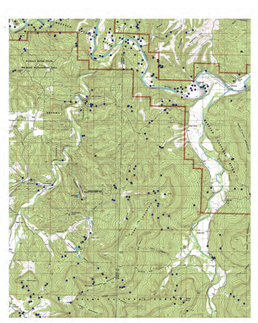
Cane Hill Member - A gray to black fissile clay- to silty-shale containing iron nodules and small limonitic box work fragments. Varies from black to dark gray on fresh surfaces and light gray and light orange-brown on weathered surfaces. Thin-bedded ripple-marked siltstones and sandstones are present above the clay shale. Trace fossils are abundant. A 5-20 foot thick sandstone is present beneath the typical Cane Hill black in this quadrangle. It is thin to thick bedded, fine grained, cross bedded, and contains stylolites, plant fragments, and iron banding. One outcrop exposes the contact with the Pitkin as interbedded sandstone with underlying oolitic Pitkin. The Cane Hill Member is unconformable with the Pitkin Limestone. Approximately 180 - 300 ft. (54-91 m) thick.

Pitkin Limestone (Upper Mississippian, Chesterian) - A fine- to coarsely-crystalline locally fossiliferous limestone containing crinoid fragments, *Archimedes* bryozoa, gastropods, coral (rugose and colonial) and ooliths. Varies from light gray to dark gray on fresh surfaces but usually weathers light or medium gray. Medium- to massive-bedded. Often has a petroliferous odor on freshly broken surfaces. A black shale occurs at the top of the Pitkin just beneath the Cane Hill Member of the Hale Formation at a few localities. It is distinctive from the Cane Hill in that it is not silty and does not contain box work fragments. No fossils were found from this shale interval. The Pitkin Limestone is conformable with the Fayetteville Shale. Approximately 120-240 ft. (36-73 m) thick.

Fayetteville Shale (Upper Mississippian, Meramecian) - A black fissile clay shale. Alternating beds of micrite and shale occur in the upper portion. Black chert is present within the micrite. The micritic beds in the upper portion of this unit form resistant and commonly form steep ledges. Septarian concretions are present near the base of the shale. Very thin fine-grained sandstones are interbedded within the lower portion of the shale. Thin sandstone dikes with flow structures on both sides are present on the west side of Point Peter Mountain in the lower portion of the shale. The Fayetteville Shale is conformable with the underlying Batesville Sandstone. Approximately 120-280 ft. (36-85 m) thick.

Batesville Formation (Upper Mississippian, Chesterian) - A very fine- to medium-grained, sub-angular, moderately-sorted, iron-cemented sandstone. Thin- to medium-bedded. Light brown to cream-colored on fresh surfaces. Weathers light to dark gray. Minor amounts of sandstone are present in this quadrangle. This interval consists mostly of the Hindsville Limestone Member. The Batesville Sandstone is unconformable with the Boone Formation. Approximately 5 -40 ft. (1.5 -12 m) thick.

Hindsville Limestone Member - A thin-bedded, fine- to coarsely-crystalline limestone. Light to dark gray on fresh surfaces but generally weathers light gray or brown. Typically has a strong petroliferous odor on freshly broken surface. The limestones are fossiliferous and/or oolitic, contain pyrite and are sometimes interbedded with thin layers of clay shale and thin beds of siltstone to fine-grained sandstone. A breccia containing angular chert and limestone fragments is present at the base of this interval at some localities.



Topographic map of the Eula quadrangle showing location of data collection points.

Boone Formation (Lower Mississippian, Osagean and Kinderhookian) - Coarse-grained fossiliferous and fine-grained limestones interbedded with anastomosing and bedded chert. Light to medium gray on fresh surfaces but usually weathers dark gray. The chert varies in color from light gray to dark gray. Springs and sinkholes are abundant. In this area the Boone Formation exhibits an undulating topography that tends to form steep hillsides separated by ravine-like drainages. Approximately 220-400 ft. (67-121 m) thick.

Short Creek Oolite - A thin to massive cross-bedded, oolitic crinozoan biosparite and oolitic biomicrite in the upper part of the formation. White to gray on fresh and weathered surfaces. Easily recognized by a chalky appearance and in some places a concave weathering profile. Locally, intervals are durable while other intervals are friable. The Short Creek Oolite is present at Eula in the section of Boone exposed on the northeast side of Richland Creek at Eula ford. 0- approx. 8 ft. (0-2.4 m) thick.

St. Joe Limestone Member - A medium-grained thin-bedded crinoidal limestone containing very thin shaly limestones. Dark gray to reddish in color but sometimes with green mottling on fresh surfaces. Typically weathers a medium to dark gray color. Sometimes contains phosphate nodules near the lower contact. Approximately 0-30 ft. (0-9 m) thick.

Basal sandstone - A fine- to medium-grained, moderately sorted, sub-rounded to rounded, iron- or quartz-cemented sandstone. White to light gray and tan on fresh surfaces with a salt and pepper appearance that is commonly blotchy due to iron staining. Weathers tan to white. Thin to thick bedded but most often seen as float. Contains phosphate pebbles and angular white and light-gray chert fragments. This unit yields abundant conodonts. The basal sandstone is unconformable with the Lafferty or the Fernvale Limestone. 0- approx. 5 ft. (0-1.5 m) thick.

Lafferty Limestone (Silurian) - A sparsely fossiliferous finely-crystalline limestone. Medium gray with small red blebs on fresh surfaces but weathers light gray. Commonly contains pyrite cubes near the upper contact. Thin to thick bedded with stylolites along bedding planes. This limestone is present on the north hillside along County Road 252 after crossing Cave Creek heading east. It is also present in the head of the drainage in Sec. 19, T15N, R18W on the north edge of Horn Mountain. Unconformable with the Fernvale Limestone. O- approx. 15 ft. (0-4 m) thick.

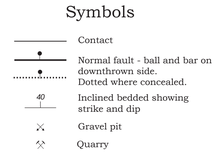
Fernvale Limestone (Upper Ordovician) - A medium- to coarsely-crystalline crinoidal limestone. Medium to massive bedded. White to light gray with a pink to reddish tint or mottling on fresh surfaces but weathers a dark-gray. Contains nautiloids, barrel-shaped crinoids, and brachiopods that are accentuated on a weathered surface. Commonly contains pyrite. Locally cross-bedded when beds are massive. On a weathered slope the Fernvale Limestone occurs as rounded masses that are usually friable. The Fernvale is unconformable with the Plattin Limestone. 0- approx. 15 ft. (0-4 m) thick.

Plattin Limestone (Middle Ordovician) - A thin- to thick-bedded micritic limestone that locally displays a sugary texture. Light gray to dark gray on fresh surfaces and weathers white to dark gray. A dolomitic interval is present at the top of the formation. The Plattin Limestone is unconformable with the St. Peter Sandstone or Everton Formation in this quadrangle. 5- approx. 80 ft. (1.5-24 m) thick.

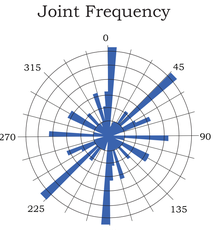
St. Peter Sandstone (Middle Ordovician) - A thin- to thick-bedded very fine- to fine-grained sandstone. White to green on fresh surfaces but weathers light gray-green to brown. Green shale clasts are present and locally weather to give the sandstone a green color. Contains a calcite cement that when leached leaves sandstone friable. The quartz grains are rounded. Green siltstones and shales are interbedded with the sandstone. Contains vertical trace fossils referred to as *Scolithus* by Adams et. al. 1904, that weather to resemble icicles in cross-section view. The St. Peter Sandstone is unconformable with the Everton Formation. Approximately 20-160 ft. (6-48 m) thick.

Everton Formation (Middle Ordovician) - Very fine- to fine-grained crystalline, sandy and limy dolostones that are thin- to massive-bedded. Thin to medium beds of fine- to medium-grained quartz sandstone are common and similar to the overlying St. Peter Sandstone. Medium to dark gray on fresh surfaces but usually weathers light gray. Approximately 10-360 ft. (3-109 m) exposed at the surface.

Symbols

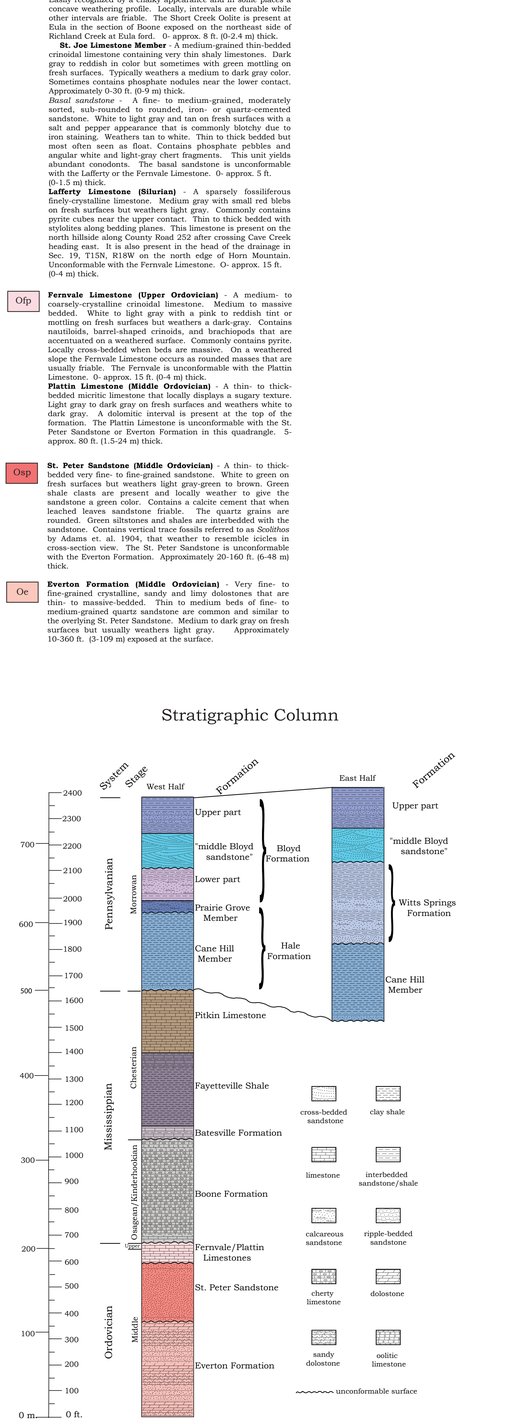


Joint Frequency



Rose diagram of strike frequency of joints recorded within the Eula quadrangle.

Stratigraphic Column



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Limitations: This map, like all geologic maps, is based on interpretations which were made from the data available at the time it was created. As work continues and new data is collected, the contacts and structures depicted on this map may be changed.

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