GEOLOGIC MAP OF THE LANDIS QUADRANGLE BAXTER, STONE, AND SEARCY COUNTIES, ARKANSAS

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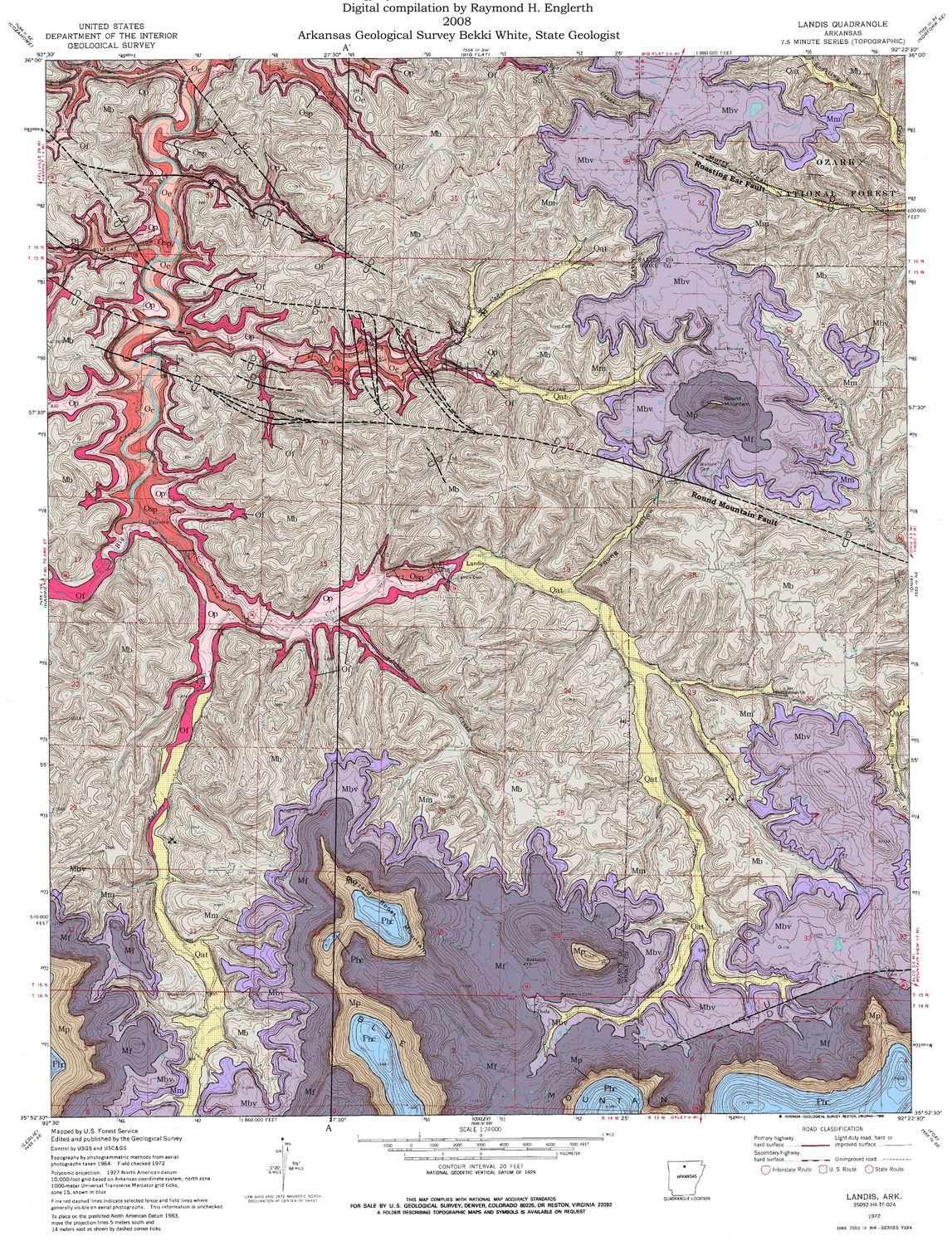

Correlation of Map Units

Qat	Holocene and Pleistocene	Quaternary	
Unconformity			
Phc	Morrowan	Pennsylvanian	
Unconformity			
Mp	Chesterian	Mississippian	
Mf			
Mbv			
Mm	Meramecian		
Unconformity			
Mb	Osagean and Kinderhookian		
Unconformity			
Su	Silurian		
Unconformity			
Ofk	Upper Ordovician	Ordovician	
Unconformity			
Op	Middle Ordovician		
Unconformity			
Osp			
Unconformity			
Oe			

Introduction

This map graphically summarizes the surface geology of the Landis 7.5-minute quadrangle. In this area over 1150 feet (351 meters) of Middle Ordovician to Lower Pennsylvanian carbonate and clastic sedimentary rocks are sparsely exposed. The bedrock is typically overlain by a veneer of unconsolidated residuum, colluvium or alluvium, but this map depicts the rock units which would be at the surface if that erosional cover were removed. Alluvial and terrace deposits along the major drainages are shown in areas where they do not overlap the Ordovician section on the western half of the map to better show the structure of these units. The mapped area lies just north of the Boston Mountains Plateau, the highest plateau on the southern flank of the Ozark Dome which is centered in southeast Missouri. This plateau has a very distinct escarpment which is expressed as the steep face of the Blue Mountains to the south. North of the escarpment the Springfield Plateau spreads out to the edges of this map and beyond. It is formed by the ridge tops of the Boone Formation approximately 600-700 feet (183-213 meters) below. An exception to this general topography is a prominent landmark within the northeastern quadrant called Round Mountain. It is an erosional remnant of upper Mississippian shale and limestone sitting atop a large mesa of Batesville Sandstone or "Big Flat" as it is named. This outlier is a result of down-dropping to the north on Round Mountain fault which was described by Newsom and Siebenthal as early as the 1890's (Branner, 1900). It extends from near the western edge of this map to the south side of Cow Mountain on the Fifty-six quadrangle and beyond (Braden et al., 2002). The westernmost extension of Roasting Ear fault is found in Murray Treat Hollow, and several other faults are mapped including a small graben on Cedar Creek. The major drainages in this area are Big Creek and Long Creek which flow north after their confluence and eventually into Buffalo River. The lowest elevation on the Landis quadrangle is on Big Creek at the north edge of the map. Alco Mountain on the southeast corner is the highest point.

The geology of this quadrangle was first mapped by Glick in 1973 for the 1:500,000 scale Geologic Map of Arkansas. The current map builds on the previous work while using a revised stratigraphy and adding certain stratigraphic refinements and structural details. The contacts and structural features on the map were derived from field observations made at numerous sites from July 2007 through April 2008. Site locations were generated with the aid of a global positioning satellite receiver. Bedrock dipping at less than 2° was considered horizontal.

Description of Map Units

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

Phc **Hale Formation (Lower Pennsylvanian, Morrowan)** – consists of two members: the Prairie Grove Member and the Cane Hill Member. Only the Cane Hill is present on this quadrangle.

Cane Hill Member – is typically fissile, silty to clay shale containing iron nodules and small limonite boxwork fragments. Color varies from dark-gray to black on fresh surfaces, and from light-gray to light-orange-brown on weathered surfaces. A persistent, thick to very thick-bedded, massive-bedded sandstone is present in the lower portion of the Cane Hill Member usually within 50-120 feet (15-37 meters) of the top of the Pitkin Limestone. This sandstone is fine to medium-grained, is often stylolitic, contains trough cross-beds, and displays honeycomb weathering. It is tan to buff-colored on fresh surfaces, and weathers dark-brown. It ranges 15-25 feet (5-8 meters) in thickness. The Cane Hill is unconformable with the Pitkin, and reaches a maximum thickness of approximately 260 feet (79 meters).

Mp **Pitkin Limestone (Upper Mississippian, Chesterian)** – consists of thin to very thick-bedded, massive-bedded, fine to coarse-grained, often oolitic or bioclastic limestone. It typically contains abundant fossils including the bryozoan *Archimedes*, crinoid stems and columnals, corals (solitary and colonial), brachiopods, gastropods, and trilobites. This limestone ranges from dark-gray to light-gray on fresh surfaces, and usually weathers light to medium-gray. It grades to tan near the upper contact, possibly due to an increase in silt percentage. It usually has a petroliferous odor when freshly broken. There are sporadic beds of black chert in the lower portion. Locally there are a few feet of dense, micritic limestone exhibiting conchoidal fracture just above the contact with the Fayetteville Shale. Midway through the section on Buzzard's Roost Mountain is a 15-20 feet (4.6 - 6.0 meter) shaly unit that is a good bench-former. It contains sparse interbedded nodular black chert and tripolitic brown chert. The Pitkin Limestone is conformable with the Fayetteville and ranges approximately 140-260 feet (43-79 meters) in thickness.

Mf **Fayetteville Shale (Upper Mississippian, Chesterian)** – is comprised of a black, fissile clay shale which is increasingly dominated by thin to medium-bedded, gray to black, micritic to finely crystalline limestone in its upper part. As the conformable contact with the overlying Pitkin Limestone is reached the shale forms only very thin partings between the beds of micritic limestone. This upper section typically contains septarian concretions, and near the contact, nodular or discontinuous, thin-bedded black chert. The micritic beds usually have a petroliferous odor when broken, and are sparsely fossiliferous. The upper Fayetteville Shale forms resistant and sometimes steep ledges where protected by the massive Pitkin above. The lower shale unit forms a gentle slope above the relatively flat-lying beds of Batesville Sandstone. Limonitic, calcareous siltstone beds and concretions are locally present near the base of the shale. The Fayetteville ranges from approximately 240-320 feet (73-98 meters) in thickness, and is unconformable with the Batesville.

Mbv **Batesville Sandstone (Upper Mississippian, Chesterian)** – is a very fine to medium-grained, subangular, moderately well-sorted, iron-cemented, calcareous sandstone which is thin to medium-bedded and often cross-bedded. Fresh surfaces are dark-gray to dark-brown and weather a light-red-brown to buff. Locally, a few thin to medium beds of micritic to very finely crystalline, light to medium-gray limestone are present near the top of the unit. The sandstone is rarely fossiliferous, but may contain molds where fossils have weathered out. It is widely quarried for dimension stone and its plateau-like upper surface is much favored for homesites. The Batesville Sandstone is conformable with the underlying Moorefield Formation, and thickness typically ranges from approximately 40-80 feet (12-24 meters), though it does thicken to approximately 120 feet (37 meters) at the north edge of the map.

Hindsville Limestone Member (Upper Mississippian, Chesterian) – is a discontinuous thin to medium-bedded, finely to coarsely crystalline limestone. It is light to dark-gray on fresh surfaces, but weathers gray to brown. It usually has a petroliferous odor when freshly broken. It is sporadically fossiliferous, oolitic and interbedded with very thin to thin-bedded clay shale, siltstone or sandy siltstone. Hindsville Limestone outcrops are rare, but can be as much as 15 feet thick. This thickness is not considered mappable at this scale, so the Hindsville is mapped with the Batesville Sandstone. It is conformable with the Moorefield Formation below.

Mm **Moorefield Formation (Upper Mississippian, Meramecian)** – is a silty shale with interbedded very thin to thin-bedded, locally conglomeratic siltstones. The shaly zones are usually dark-gray to black on fresh surfaces, but weather medium-gray with a yellow tint. The siltstones are dark-gray to dark-brown on fresh surfaces, but weather light-gray to buff. The Moorefield forms a gentle slope between the plateau-like surface of the Batesville Formation above and the Springfield Plateau (Boone Formation) below. The Moorefield is unconformable with the underlying Boone, and ranges from approximately 40 to 80 feet (12 to 24 meters) in thickness.

Mb **Boone Limestone (Middle-Lower Mississippian, Osagean and Kinderhookian)** – is a finely to coarsely crystalline, fossiliferous limestone interbedded with anastomosing or discontinuous, thin-bedded chert. The limestone is light to medium-gray on fresh surfaces, but weathers light to dark-gray and may contain crinoid columnals or brachiopod fossils. The chert is white to dark-gray or rarely red on fresh surfaces, but usually weathers buff to white and tripolitic. In the northwestern quadrant, the Boone Formation locally contains dendritic manganese at the base. A regolith composed of red-brown residual clay and angular chert gravel nearly covers the entire surface of the Boone and the formations below it. Karst features including springs, sinkholes and small caves are common. The bedding broadly undulates due to settling of the Boone into paleokarst features of older units. The topography of the Boone features steep, relatively flat-topped ridges that are incised by ravine-like drainages. It is unconformable with the underlying formations, and ranges from approximately 240-340 feet (73-104 meters) in thickness.

St. Joe Limestone Member (Middle-Lower Mississippian, Osagean and Kinderhookian) – is a thin to medium-bedded, fine to coarse-grained, crinoidal limestone. Lithology can vary considerably between a coarse-grained, light-pink to light-gray, crystalline limestone and a fine-grained, light-green, shaly limestone with included white or pink crinoid fragments. It usually weathers light to dark-gray. It contains pyrite in the form of single crystals, clusters or rusty blebs where weathered. Manganese-rich zones exhibit dark-gray colors on fresh surfaces, and are typically fine-grained and shaly. The St. Joe Member typically ranges from 2-8 feet (0.6-2.4 meters) thick, but can be as much as 15 feet (4.6 meters) thick along the northern edge of the map. It is mapped with the Boone Formation because it is not considered thick enough to map as a separate unit.

Basal Mississippian sandstone – is a discontinuous outcrop of thin to thick-bedded, fine to medium-grained, subangular to subrounded, moderately well-sorted sandstone. Typically quartz-cemented, it can also be cemented by calcite. The calcite-cemented zones commonly display a poikilotopic texture in freshly broken samples. White to light-gray or tan on fresh surfaces, it usually displays a speckled or blotchy appearance due to the presence of fine-grained sand to pebble-sized, rounded phosphate clasts and conodont fossils. Weathered exposures are dark-brown to buff. The basal Mississippian sandstone ranges from approximately 6 inches to 4 feet (0.15 to 1.2 meters) in thickness. This unit was also deemed not mappable as a separate unit, and is therefore placed in the Boone.

Su **Silurian (undifferentiated)** – The only significant outcrop of this unit is in upper Short Creek. This particular outcrop contains approximately 15 feet of Lafferty Limestone resting on approximately 5 feet of Brassfield Limestone. Combined, these formations are thick enough to be considered mappable as an undifferentiated unit. The Silurian units are unconformable with each other and with the Fernvale Limestone below.

Lafferty Limestone – is a medium to thick-bedded, stylolitic, finely crystalline, sparsely fossiliferous limestone. On fresh surfaces, color ranges from light to medium-gray with light to dark-pink blebs throughout. It weathers medium to dark-gray and smooth along the streams, but blocky on the hillsides. It contains minor inclusions of glauconite pellets, pyrite crystals and rusty blebs where weathered. Typical fossils include crinoids, bryozoans and brachiopods.

Brassfield Limestone – is a thick to very thick-bedded, massive-bedded, coarsely crystalline, sparsely fossiliferous limestone. Its color ranges from light-gray to light to dark-pink on fresh surfaces, but weathers light to medium-gray or tan to brown. It generally contains small vugs and veins filled with coarsely crystalline calcite. Typical fossils include crinoids, cephalopods, bryozoans, and brachiopods.

Ofk **Cason Shale (Upper Ordovician)** – is rarely exposed and of abbreviated thickness and therefore is mapped with the Fernvale Limestone. It is composed of silty to clay shale that is light-blue-green on fresh surfaces, but weathers medium-green-gray to dark brown. Locally it contains dark-brown to black, irregularly rounded phosphate pebbles especially near the contact with the overlying Silurian or Mississippian units. In locations where these pebbles have weathered out, they may provide the only trace of the Cason Shale in that outcrop. It is typically only a few inches thick, but in one location on Seller's Creek in the south 1/4 of section 21, it is approximately 15 feet (4.6 meters) thick. The Cason is unconformable with the older units below.

Fernvale Limestone (Upper Ordovician) – is a medium to coarsely crystalline, sparsely fossiliferous limestone. On fresh surfaces it is white to light-gray with a light to dark-pink tint or pink mottling. Weathers light to dark-gray. Medium to very thick bedding is typically massive, but is locally cross-bedded. Exposures of the Fernvale Limestone typically weather into rounded, moss-covered masses that are noticeably friable when broken. Locally it contains barrel-shaped crinoid columnals, nautiloids and brachiopods that stand out in relief on weathered surfaces. It typically ranges from 10-20 feet (3-6 meters) thick, but is absent in some areas and as much as 80 feet (24 meters) thick in others. The Fernvale is unconformable with the older units below.

Kimmswick Limestone (Middle Ordovician) – is a fine to medium-crystalline, sparsely fossiliferous limestone. Light-gray on fresh surfaces, it will weather light to dark-gray. The Kimmswick Limestone is exposed in only a few places, and there it is only a few feet thick, therefore it was mapped with the Fernvale Limestone. It is unconformable with the Plattin Limestone below.

Op **Plattin Limestone (Middle Ordovician)** – is a thin to thick-bedded, micritic limestone that is intermittently fine-grained. It is very dense and usually breaks with a conchoidal fracture. It is light-beige-gray to dark-gray on fresh surfaces, but weathers white to medium-gray. It can have interbedded, calcareous shales that are a few inches thick. Near the top of the unit, a buff-colored, very fine-grained, angular, moderately well-sorted, calcareous sandstone is present. It is typically 4-8 feet (1.2-2.4 meters) thick, and can include calcite veins, pyrite clusters and rusty blebs where weathered. The Plattin Limestone is resistant enough to form a persistent blocky ledge. Springs or seeps commonly emerge at or near the contact with the St. Peter Sandstone. The Joachim Dolomite is absent, therefore the Plattin rests unconformably on the St. Peter Sandstone. It ranges from approximately 60-120 feet (18-37 meters) in thickness.

Osp **St. Peter Sandstone (Middle Ordovician)** – is a fine to medium-grained, angular to rounded, well-sorted, calcite-cemented sandstone, generally displaying a sugary texture. Where the calcite cement has leached out, the sandstone is friable when broken. Locally it is dolomitic toward the top as near Fairview at the confluence of Big Creek and Long Creek. White or green-white to light-tan on fresh surfaces, it weathers dark-tan or gray. Thick to very thick-bedded, locally cross-bedded, this massive sandstone usually crops out as a distinctive smooth, concavely or convexly rounded bluff. Outcrops and especially loose boulders commonly contain *Scolithos* (Adams et al., 1904), trace fossils that form small tubes of more resistant sandstone perpendicular to bedding that, when weathered, resemble tightly-packed icicles. Vertical cylindrical structures called sandstone pipes (McKnight, 1935) are weathering out of the bluff faces in a few locations. They range from a few inches to a few feet in diameter, and span the entire thickness of the unit,. The St. Peter is a tight sandstone that acts as a confining unit for groundwater, thereby creating many springs and seeps along its upper contact. Travertine is locally precipitated by these springs. The St. Peter is unconformable with the Everton Formation below, and typically displays an undulating contact where depositional channels cut down into its surface or perhaps where the surface was solutionod before deposition. Typical exposures are approximately 20-40 feet (6-12 meters) thick, but can be as much as approximately 80 feet (24 meters) thick in some places.

Oe **Everton Formation (Middle Ordovician)** – is a very fine to fine-grained, very thin to very thick-bedded, sandy to limy dolostone. It is medium to dark-gray on fresh surfaces, but usually weathers light-gray. Very thin beds near the contact are composed of interbedded sandstone and dolostone that show evidence of soft sediment deformation. Thin to medium beds of fine to medium-grained quartz sandstone, similar to the overlying St. Peter Sandstone, are present in the upper section. The dolostone is typically mottled or banded, may contain stromatolites, mudcracks or rarely, pellets of glauconite. Calcite or dolomite-filled veins and vugs up to 1 inch (2.5 centimeters) in diameter are locally present, especially near fault zones. A strong petroliferous odor is evident in freshly broken pieces. Only the upper part of the Everton Formation crops out in the northwestern quadrant of this map, therefore a maximum of approximately 140 feet (43 meters) is exposed.

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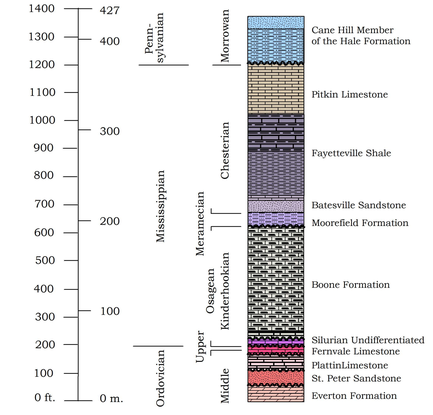
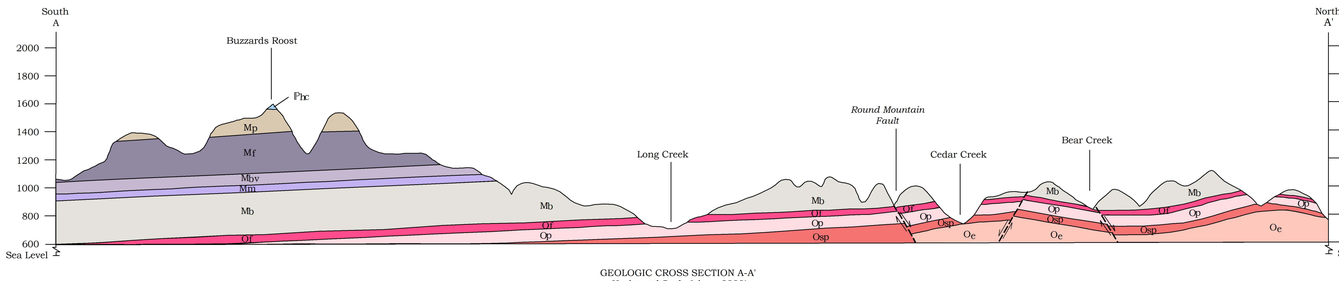
Stratigraphic Column



Dolomite | Bedded Limestone | Cherty Limestone | Clay or clay shale | Calcareous Siltstone

Massive sand or sandstone | Limestone | Silt, siltstone, or silty shale | Interbedded limestone and shale

unconformity

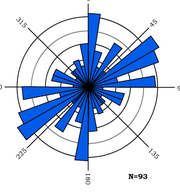


GEOLOGIC CROSS SECTION A-A'
Horizontal Scale 1 in. = 2000'
Vertical Scale 1 in. = 400'
Exaggeration = 5X

Symbols

- Contact
- 45 Strike and Dip
- Fault - dashed where inferred; U - upthrown; D - downthrown
- Fault - Concealed; U - upthrown; D - downthrown
- Abandoned Mine or Quarry
- Gravel Pit

Joint Frequency



Rose diagram of strike frequency of joints recorded within the Landis Quadrangle

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