Arkansas Geological Survey
Bekki White, State Geologist and Director

DIGITAL GEOLOGIC QUADRANGLE MAP
CANAAN QUADRANGLE, ARKANSAS
DGM-AR-00128

GEOLOGIC MAP OF THE CANAAN QUADRANGLE, SEARCY AND VAN BUREN COUNTIES, ARKANSAS

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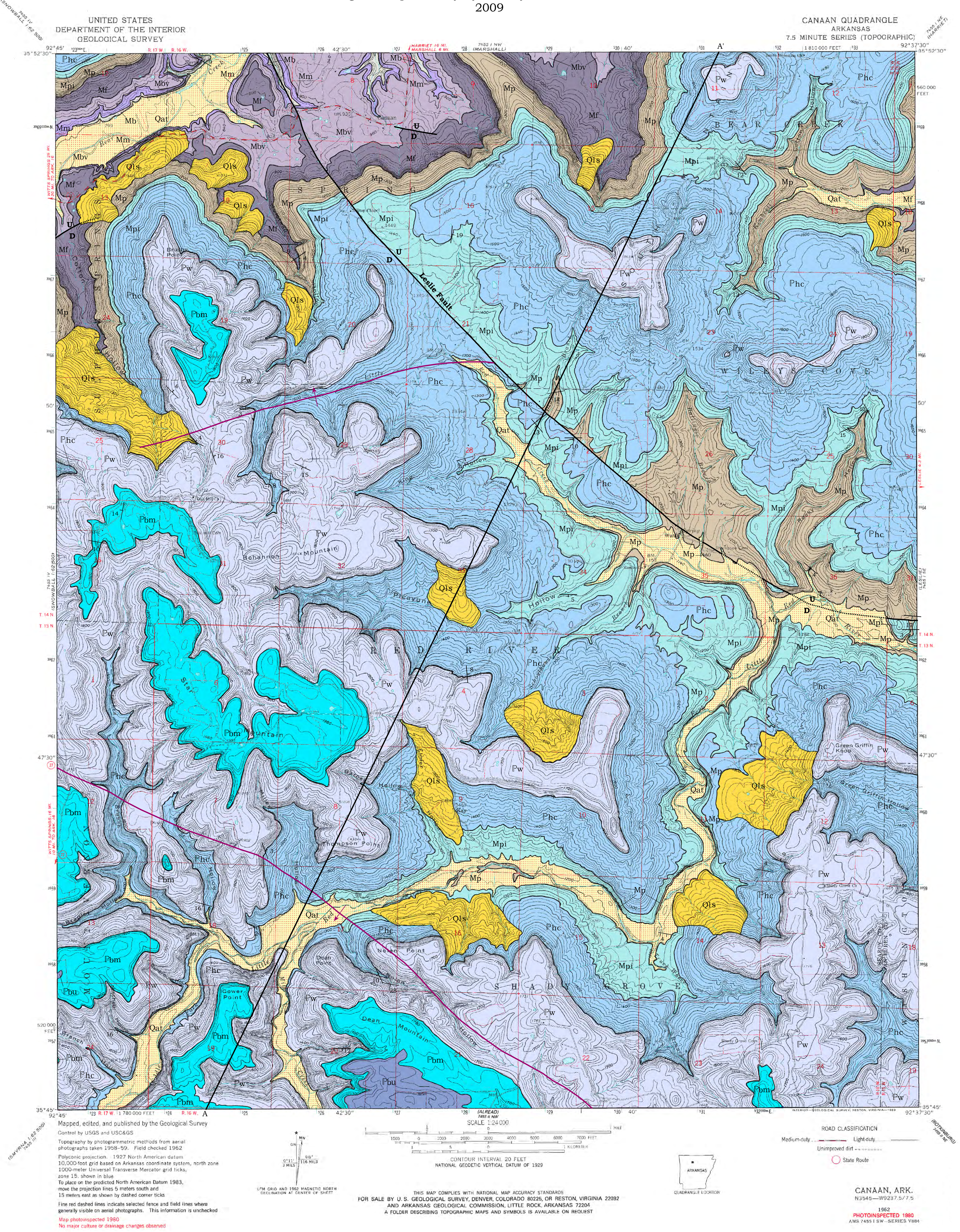
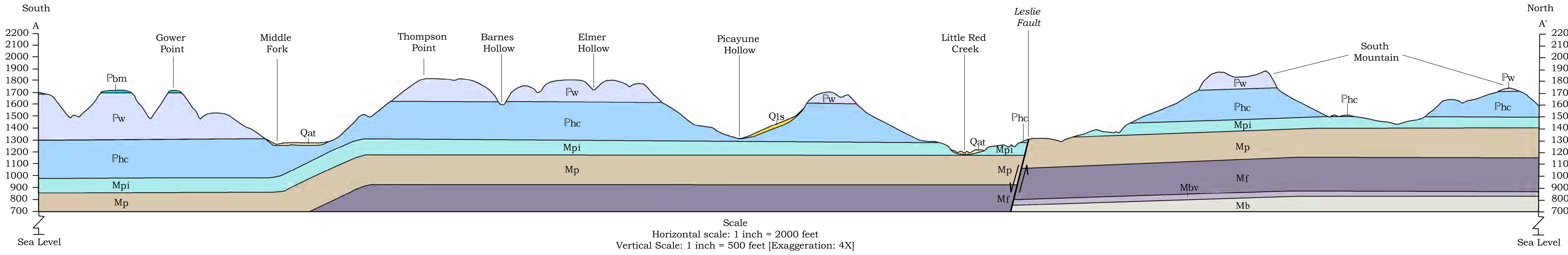
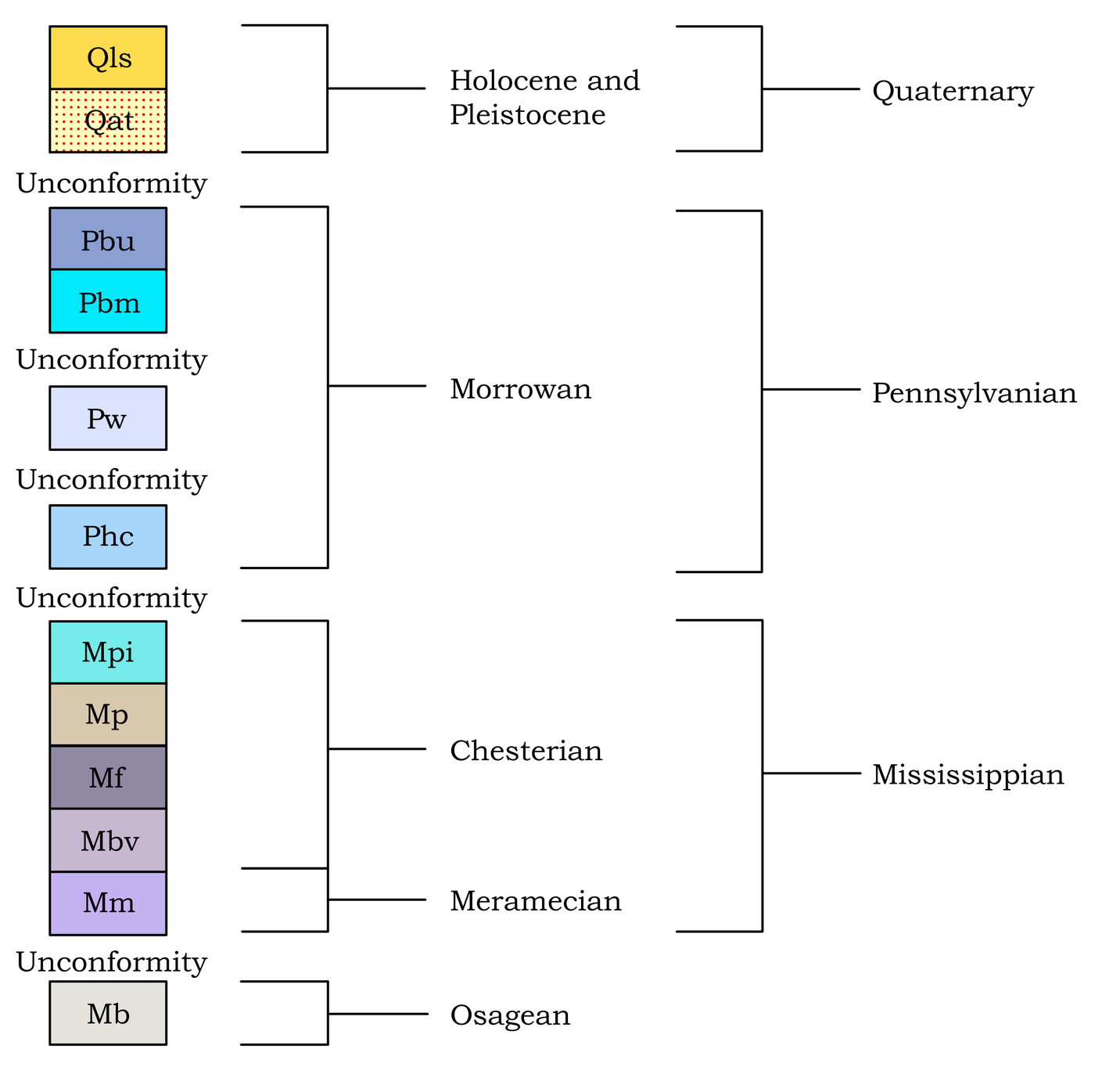
Digital compilation by Kyle Coffey and Daniel S. Rains
2009





Correlation of Map Units



Introduction

This map graphically summarizes the bedrock geology of the Canaan 7.5-minute quadrangle. In this area over 1220 feet (372 meters) of Lower Mississippian to Lower Pennsylvanian carbonate and clastic sedimentary rocks are exposed. The mapped area lies on the northern edge of the Boston Mountains Plateau, the highest in a series of south-dipping plateau surfaces composed of progressively younger rocks in the Ozark Plateaus Region.

There are two major structures in this area. The Leslie Fault, which runs from the north side to the east side of this map and beyond, is a normal fault downdropped to the southwest that offsets the rocks approximately 60 feet (18 meters) in the north to approximately 220 feet (67 meters) in the east. The monocline that runs across the southwest corner dips southwest and offsets the rock units by approximately 320 feet (98 meters). The major drainages in this area include Bear Creek, which flows north to the Buffalo River and the Middle Fork of the Little Red River, which flows southeast to Greers Ferry Lake.

The geology of this area was mapped in 1973 by Glick for the 1:500,000 scale Geologic Map of Arkansas. The current mapping builds on the previous work but uses a revised stratigraphy and adds certain structural details. The contacts and structural features on the map were derived from field observations made from July 2008 through April 2009. 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)** – composed of unconsolidated clay, silt, sand and gravel deposited by major streams, including deposits on one or more terrace levels.

Qls — **Landslide deposits (Quaternary)** – typically derived from Morrowan units, especially breakdown of thin-bedded, flaggy sandstone in the Cane Hill Member and undercutting of massive-bedded, blocky sandstone in the basal Witts Springs Formation. Primarily develop on the Morrowan shales and to a lesser extent on the Chesterian shales.

Bloyd Formation (Lower Pennsylvanian, Morrowan) – informally divided into upper and lower parts on adjacent quadrangles (Braden, et al., 2003) separated by the "middle Bloyd sandstone" (Zachry and Haley, 1975). On this map, the "middle Bloyd sandstone" separates the "upper part" from the Witts Springs Formation. Rocks equivalent to the "lower part" of the Bloyd are mapped as the main body of the Witts Springs Formation.

Pbu — **Upper part** – a thin- to thick-, ripple-bedded, micaceous sandstone interbedded with clay to silty shale. The sandstone is composed of fine to coarse, subangular to subrounded quartz grains. Fresh surfaces are light-brown to gray and weather brown to dark-gray. The shales are dark-gray to black on fresh surfaces and weather tan to brown. Contains many trace fossils and load features. Reaches a maximum thickness of approximately 80 feet (24 meters).

Pbm — **Middle Bloyd sandstone** – a thin- to very thick-, massive-, cross-bedded, locally micaceous sandstone. Grains are medium to very coarse, well-sorted, subangular to subrounded and silica- or iron-cemented. Fresh surfaces are white to buff or reddish- to brownish-tan. Weathered surfaces are buff to tan or reddish- to dark-brown. Typically contains well-rounded, milky quartz pebbles. Exhibits minor honeycomb weathering and liesegang banding. Unconformable with the Witts Springs below. Ranges from approximately 40-90 feet (12-27 meters) in thickness.

Pw — **Witts Springs Formation (Lower Pennsylvanian, Morrowan) -** equivalent to the "lower part" of the Bloyd Formation below the "middle Bloyd sandstone" (Braden, et al., 2003; Smith, et al., 2007), and the Prairie Grove Member of the Hale Formation. Unconformable with the Cane Hill Member below, and in some places has obviously scoured into it. Total thickness ranges from approximately 280-360 feet (85-110 meters).

Main body - primarily a very thin- to massive-bedded, very fine- to medium-grained, subangular to rounded, locally calcareous sandstone with some interbedded shale and siltstone. Fresh surfaces are orangey-brown to gray and weather gray to brown. Unit thickness ranges from approximately 220–300 feet (67–91 meters).

Basal sandstone – typically a massive-bedded, blocky to concave-weathering, micaceous sandstone. Grains are fine to medium, poorly to moderately well-sorted and subangular to subrounded. May also be present as a package of stacked, thin- to medium-, cross-bedded channel sands. Fresh surfaces are gray to gray-brown, or tan and mottled with brown iron-oxide blebs which can also form bands. Weathers gray to brown. Long horizontal pits resembling classic Prairie Grove-type weathering, honeycomb weathering and liesegang banding are present locally. Commonly contains fossils and shale pebbles along bedding planes, or external molds where they have weathered out. In some outcrops, a discontinuous, cross-bedded, fine- to coarse-grained sandy conglomerate is present. It contains inclusions of rounded milky quartz pebbles, ironstone concretions, light-gray to light-brown, flattened shale pebbles, fossil fragments and sandstone pebbles. This conglomerate is typically present just above the lower contact, and can be as much as 8 feet (2.4 meters) thick. Unit thickness ranges from approximately 40-60 feet (12–18 meters).

Hale Formation (Lower Pennsylvanian, Morrowan) – consists of two members: the Prairie Grove and the Cane Hill. Only the Cane Hill Member is present on this quadrangle. Rocks equivalent to the Prairie Grove Member are mapped with the Witts Springs Formation.

Phc — **Cane Hill Member** – typically a fissile silty to clay shale that contains ironstone nodules and discontinuous, thin-bedded, limonitic siltstone that weathers to form boxworks. Fresh exposures are dark–gray to black, and weather light-gray to light-orangey-brown. Discontinuous units of very thin- to thin-, ripple-bedded, very fine- to fine-grained, micaceous silty sandstone with shale partings are present throughout the Cane Hill. Near the base is an especially competent unit. This lower sandstone is typically light- to dark-gray on fresh surfaces, and weathers dark-gray to dark-brown. It ranges from approximately 40-60 feet (6-18 meters) in thickness, and erodes to form a thick, flaggy colluvium that is commonly collected for building stone. At the lower contact, a discontinuous, orangey-brown, limonitic shale-pebble conglomerate is present that is 12-36 inches (30-91 centimeters) thick. Unconformable with the "Imo shale" below. Ranges from approximately 220-360 feet (67-110 meters) in thickness.

Pitkin Formation (Upper Mississippian, Chesterian) – informally divided into two members, the Pitkin Limestone and the "Imo shale". Lower contact of the "Imo" placed at the top of the final limestone bed in the Pitkin, and upper contact placed below the base of a competent, very thin- to thin-, ripple-bedded silty sandstone that is the first recognizable unit in the Cane Hill Member (Smith, et al., 2007).

Mpi — **Imo shale (Upper Mississippian, Chesterian)** – consists of several shale units with intervening sandstone units. The lowest unit is a light-gray, calcareous or dark-gray, non-calcareous, fissile shale with interbedded, discontinuous sandstone and limestone. This limestone commonly takes the form of small, yellowish, platy concretions encrusted with fossils, especially *Chonetes*, or light-gray, lenticular, septarian concretions. Locally, loosely accreted, cigar-sized crinoid stems weather out. Above this shale is a persistent, fine- to medium-grained, thin- to massive- and locally cross-bedded sandstone. Fresh surfaces are buff to tan and locally mottled or banded with dark-red iron blebs. Weathers dark-orangey-brown to gray, and blocky. Commonly exhibits pronounced stylolites, liesegang banding, and honeycomb weathering. Unit thickness ranges from approximately 15-60 feet (5-18 meters). Above this sandstone is a fossil–bearing, dark-gray to black, fissile shale. Fossils are abundant and include bivalves (commonly nuculoids), cephalopods (commonly conical nautiloids), solitary corals (commonly rugose), crinoids, brachiopods, gastropods, trilobites and plant material. Typically contains lenticular, orange to dark-red, fossiliferous limestone tempestites, rounded, non-fossiliferous ironstone concretions, and secondary, fibrous calcite partings. Additional discontinuous, thin-bedded sandstone and limestone beds are interbedded within this upper shale unit. The limestone beds are dark-gray on fresh surfaces and weather dark-red. They are fine- to coarse-grained, oolitic and fossiliferous. Conformable with the underlying Pitkin. Ranges from approximately 40-140 feet (12-43 meters) in thickness.

Mp — **Pitkin Limestone (Upper Mississippian, Chesterian)** – a thin- to very thick-, massive-bedded, fine- to coarse-grained, locally oolitic bioclastic limestone. Contains abundant fossils including crinoid fragments, the bryozoan *Archimedes*, corals, nautiloids, brachiopods, gastropods, and trilobites. Fresh surfaces are light- to dark-gray, and weather light- to medium-gray. Grades to a tan color near the upper contact due to an increase in silt content. Commonly has a petroliferous odor when freshly broken. Conformable with the underlying Fayetteville Shale. Ranges from approximately 160-260 feet (49–79 meters) in thickness.

Mf — **Fayetteville Shale (Upper Mississippian, Chesterian)** – a black, fissile shale which is increasingly dominated by thin- to medium-bedded, dark-gray, micritic to finely crystalline limestone in its upper part. Shale forms only very thin partings between the beds of micritic limestone near the contact with the overlying Pitkin Limestone. Also near the upper contact, nodular or discontinuous, thin-bedded black chert is commonly present. Micritic beds usually have a petroliferous odor when broken, and are sparsely fossiliferous. Septarian concretions are common in the upper part, but isolated zones may be found in the lower, shaly part. Conformable with the underlying Batesville Sandstone. Ranges from approximately 140-300 feet (43–91 meters) in thickness.

Mbv — **Batesville Sandstone (Upper Mississippian, Chesterian)** – a thin- to medium- and locally cross-bedded sandstone. Grains are very fine to medium, moderately well-sorted, subangular and carbonate-cemented. Fresh surfaces are dark-gray to dark-brown and weather reddish-brown or tan to buff. Rarely fossiliferous, but locally contains external molds where fossils have weathered out. Conformable with the underlying Moorefield Shale. Ranges from approximately 40-80 feet (12-24 meters) in thickness.

Hindsville Limestone Member (Upper Mississippian, Chesterian) – a discontinuous thin- to medium-bedded, finely to coarsely crystalline limestone. Light- to dark-gray on fresh surfaces, but weathers gray to brown. Usually has a petroliferous odor when freshly broken. Locally fossiliferous and oolitic. Typically interbedded with very thin- to thin-bedded shale, siltstone or sandy siltstone. Only present in Cotton Hollow where it is less than 10 feet (3 meters) thick. Not considered mappable at this scale as a separate unit, therefore mapped with the Batesville. Conformable with the underlying Moorefield.

Mm — **Moorefield Shale (Upper Mississippian, Meramecian)** – a silty shale with interbedded very thin- to thin-bedded siltstone. Shaly zones are usually dark-gray to black on fresh surfaces, but weather medium-gray to yellowish-brown. Siltstone is dark-gray to dark-brown on fresh surfaces, but weathers light-gray to buff. Unconformable with the Boone Limestone below. Ranges from 20-60 feet (6-18 meters) in thickness.

Mb — **Boone Limestone (Lower Mississippian, Osagean)** – is a finely to coarsely crystalline or coarse-grained, fossiliferous limestone interbedded with anastomosing or lenticular chert. The limestone is light- to medium-gray on fresh surfaces, but weathers light- to dark-gray and locally contains abundant fossils, especially crinoid columnals and brachiopods. The chert is white to dark-gray on fresh surfaces, but usually weathers buff to white and tripolitic. Reaches a maximum exposure of approximately 80 feet (24 meters).

Symbols

- Contact
- 45 Strike and Dip
- U / D Fault — U - Upthrown, D - Downthrown
- Monocline

Contact between "Imo" sandstone unit and lower "Imo" shale in Picayune Hollow.

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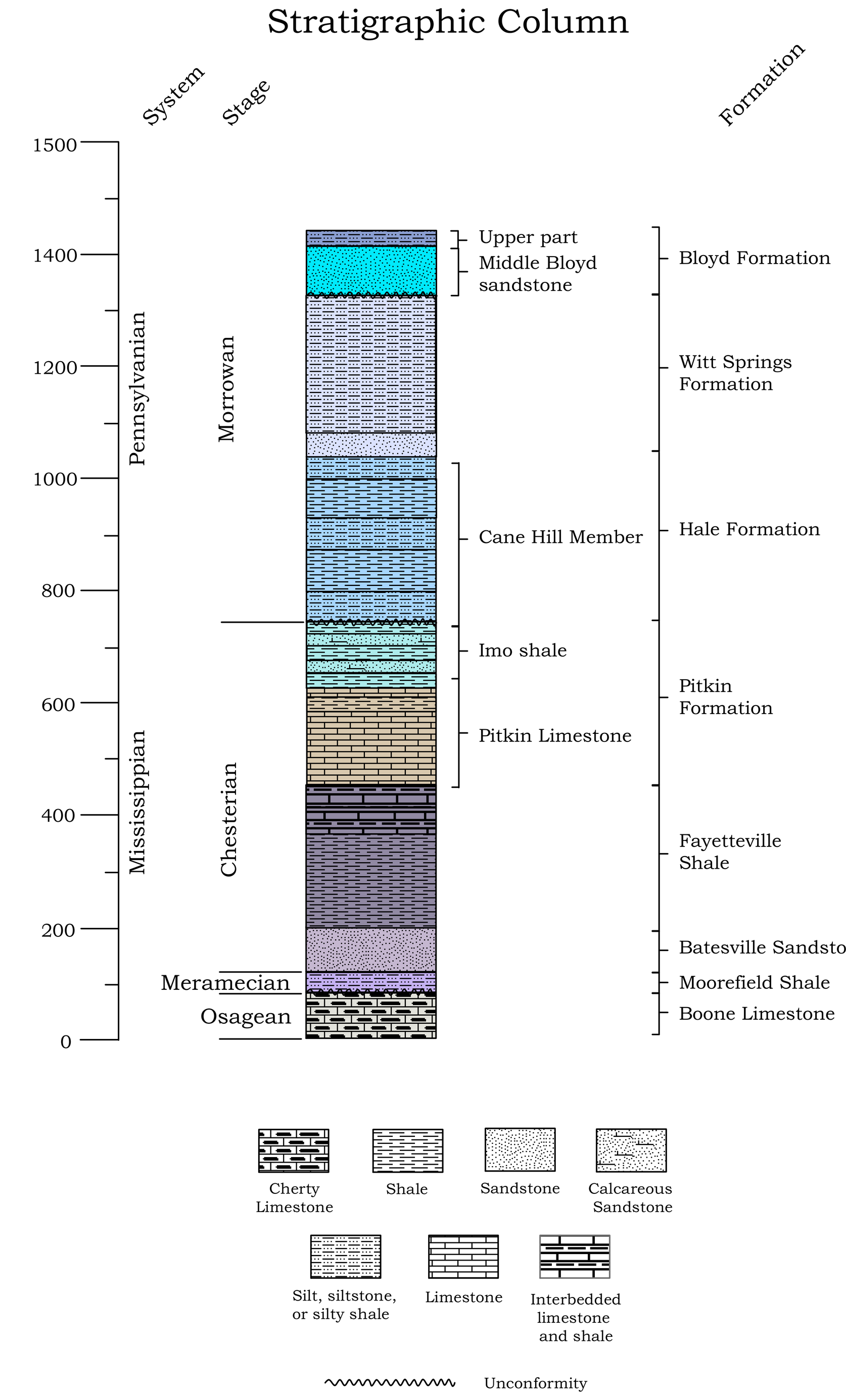
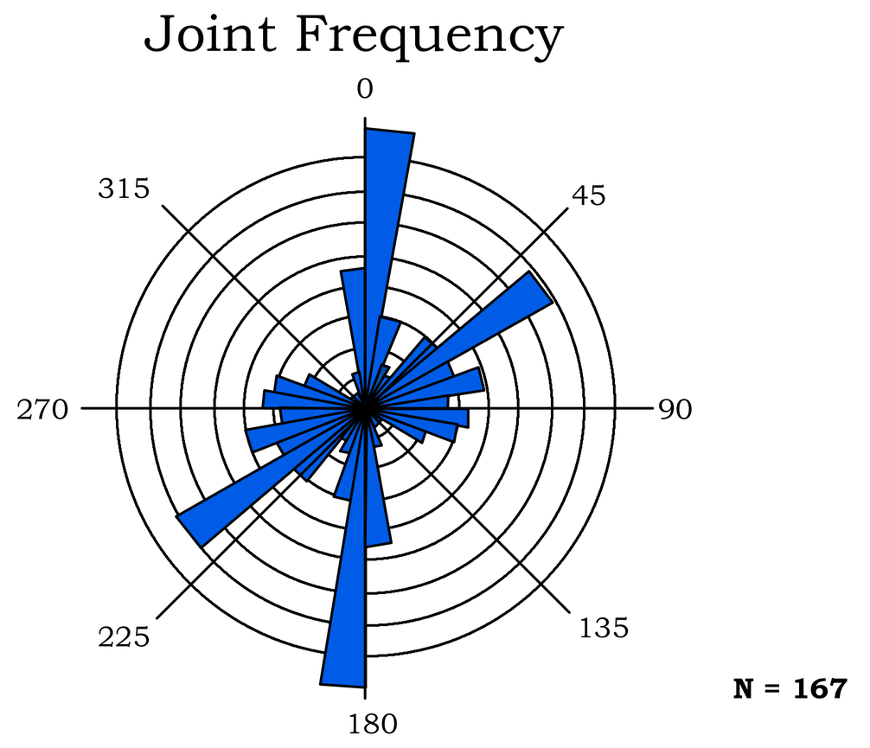
Stratigraphic Column



Joint Frequency



Rose diagram dipicting strike frequency of joints recorded within the Canaan Quadrangle

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