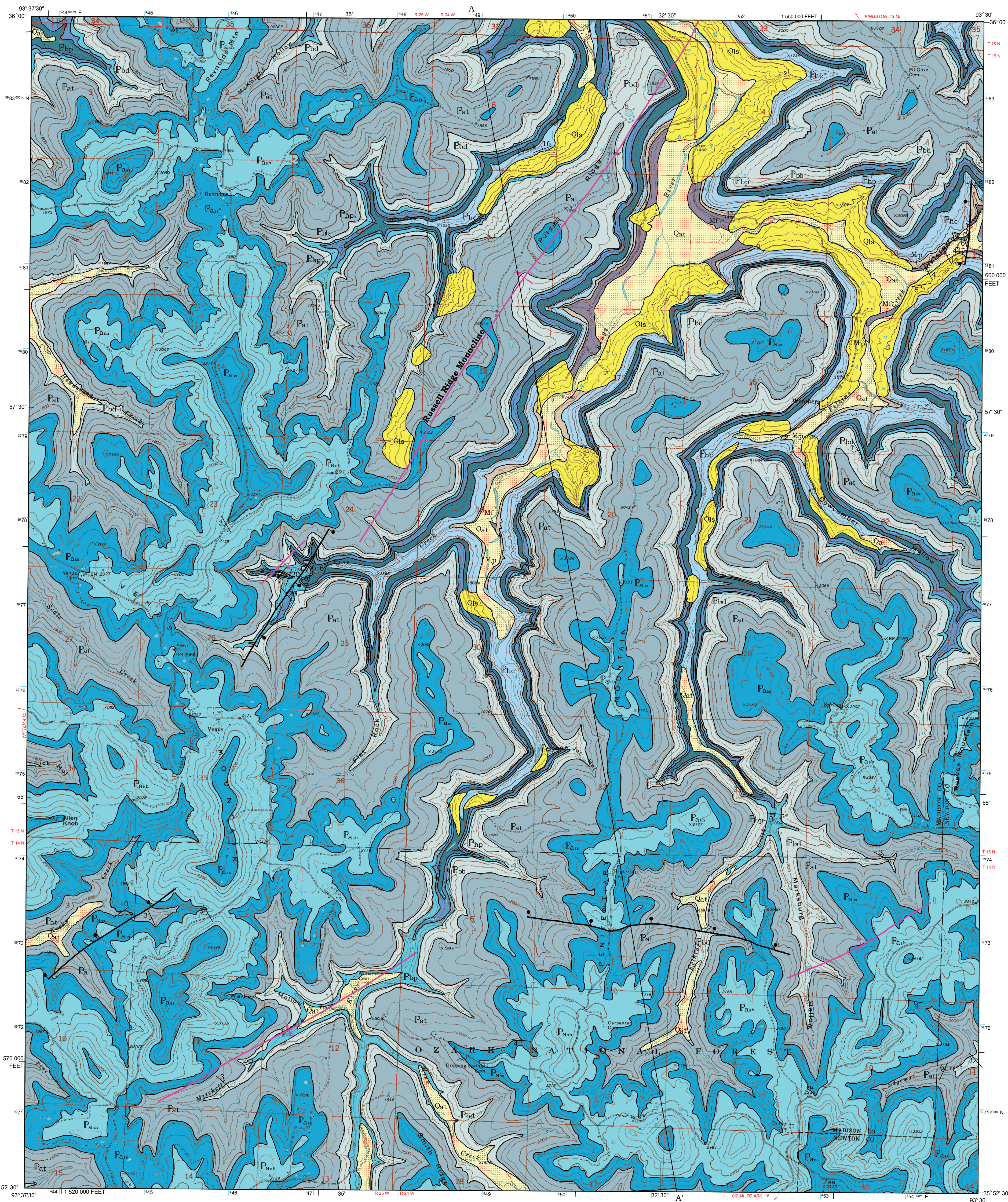


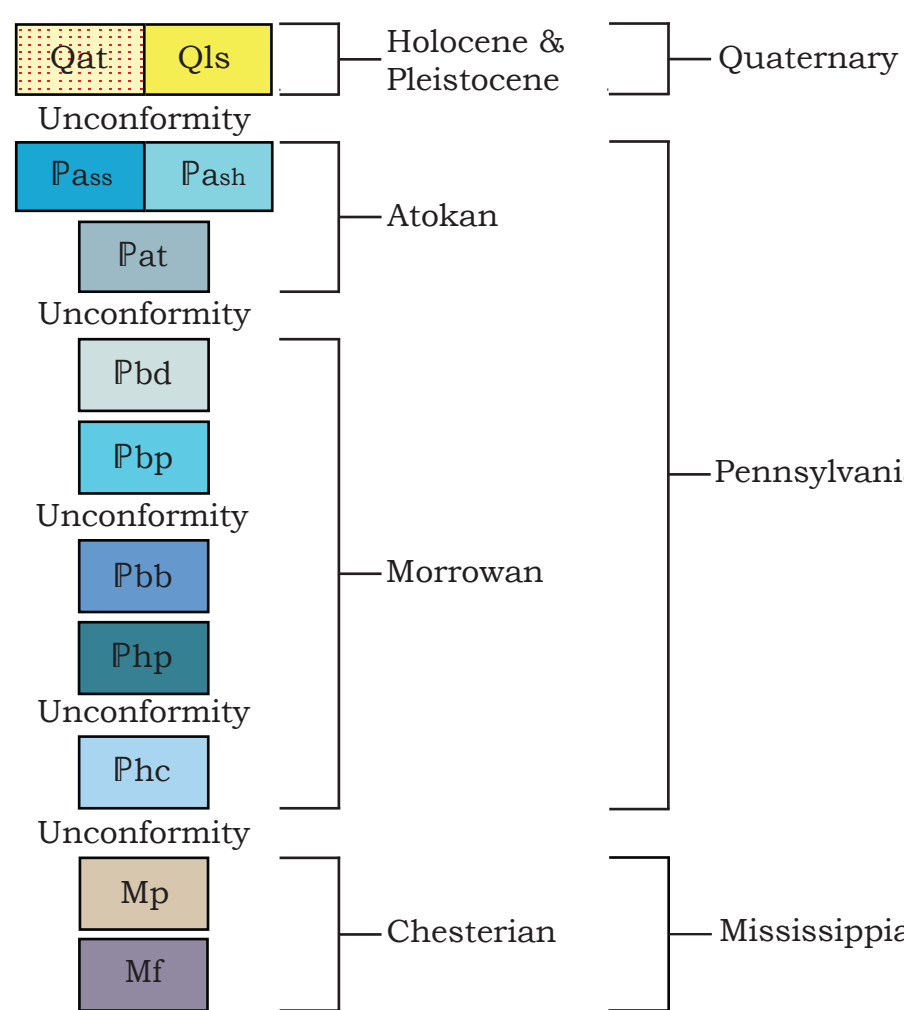


Geologic Map of the Weathers Quadrangle, Madison and Newton Counties, Arkansas

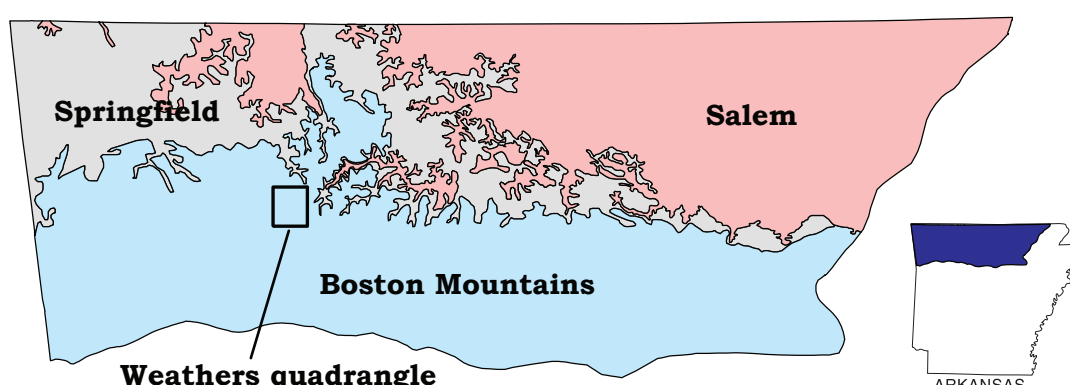
Richard S. Hutto and Garrett A. Hatzell
2019



Correlation of Map Units



Ozark Plateaus



Weathers quadrangle location within the Boston Mountains.

Introduction

This map depicts the bedrock and surficial geology of the 7.5-minute Weathers quadrangle. In this area, approximately 1100 feet (335 meters) of Mississippian (Chesterian) to Pennsylvanian (Atokan) carbonate and clastic rocks are exposed. These rocks formed from sediment deposited in distal to nearshore marine, tidal, deltaic, and fluvial environments. The quadrangle is situated on the Boston Mountains Plateau, the southernmost and highest of three broad plateau surfaces known as the Ozark Plateaus Province. It developed by differential erosion of Paleozoic sedimentary units deposited on the flanks of the Ozark Dome, a structural high centered in southeast Missouri that formed by volcanic activity during the Precambrian.

Structural features include the Russell Ridge Monocline, the axis of which is oriented parallel to other northeast-trending faults and lineations in northwest Arkansas. Presumably these align with regional faulting of Precambrian basement rock. The strata are depressed approximately 200 feet (61 meters) from southeast to northwest across this structure. A normal fault in upper Pine Creek is downthrown approximately 80 feet (24 meters) to the southeast, and strata dip steeply on the northwest side. Another normal fault in upper Kecks Creek is downthrown approximately 100 feet (30 meters) to the northwest. A normal fault across Penitentiary Mountain is downthrown approximately 80 feet (24 meters) to the north. A normal fault in Whispering Hollow is downthrown approximately 60 feet (18 meters) to the west, and apparently only breaks the Mississippian strata.

Most of the quadrangle is drained by the Kings River. Small drainages along the western edge of the map contribute to War Eagle Creek, Edgemon Creek, in the southeast corner, drains to the Buffalo River. All are tributaries of the White River.

The Ozark National Forest occupies parts of the southern third of this quadrangle and is maintained by the U. S. Forest Service. Along a reach of the Kings River, also in this southern portion, lies the Kings River Falls Natural Area which is maintained by the Arkansas Natural Heritage Commission.

Previous geologic mapping in this area includes a worksheet by B. R. Haley circa 1976 employing photogeologic methods to differentiate breaks between formation groups. A Master's thesis by M. R. Shinn in 1979 delineated three sandstone units in the lower Atoka and defined several minor structures on the western third of the quadrangle. The current mapping project is based primarily on data collected from field observations made between July and November, 2018. These data, along with site locations, were recorded in a geodatabase on a portable data collector/global positioning satellite receiver. Recently acquired imagery derived from LiDAR (Light Detection and Ranging) data aided in correlating and delineating stratigraphic intervals. Representative rock samples were collected to aid in classification and future petrographic studies.



Kings River Falls pours over the lowest ledge of the Parthenon sandstone which crops out extensively along the Kings River.

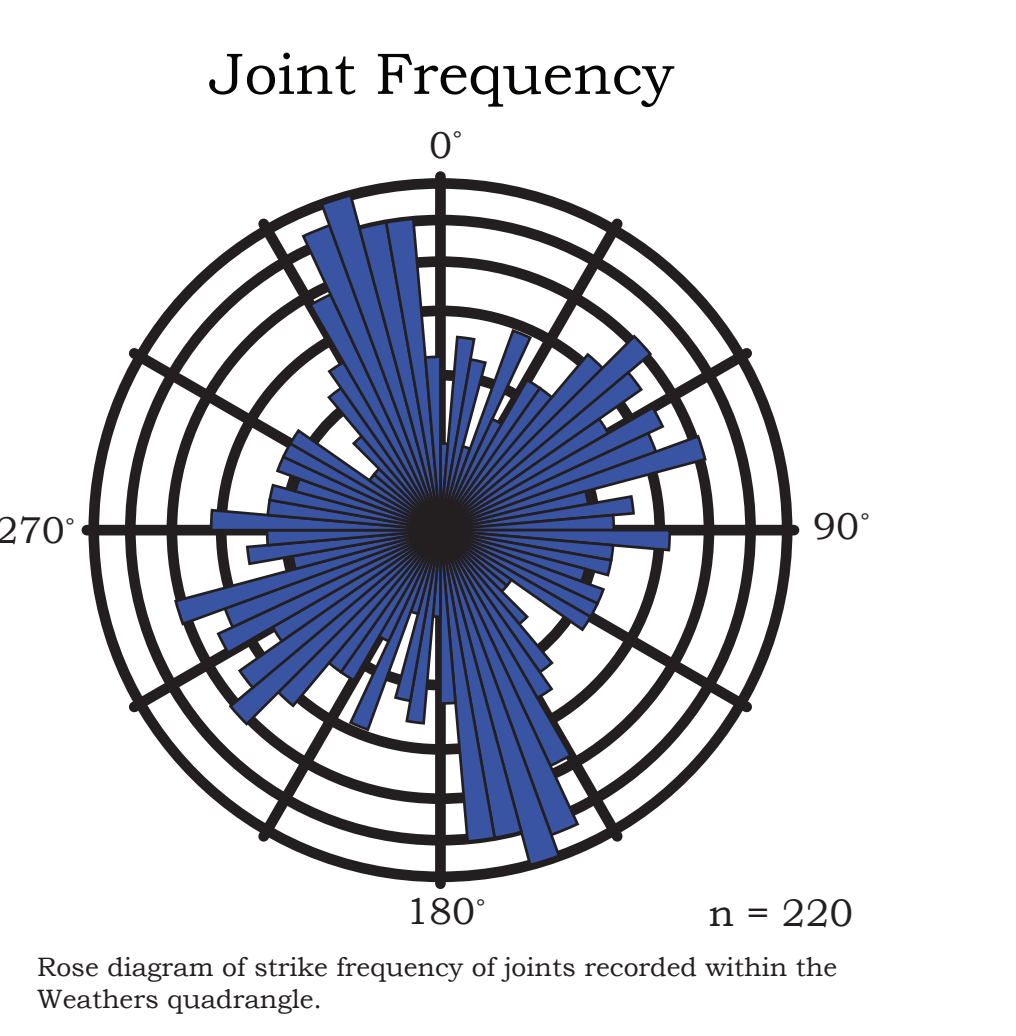
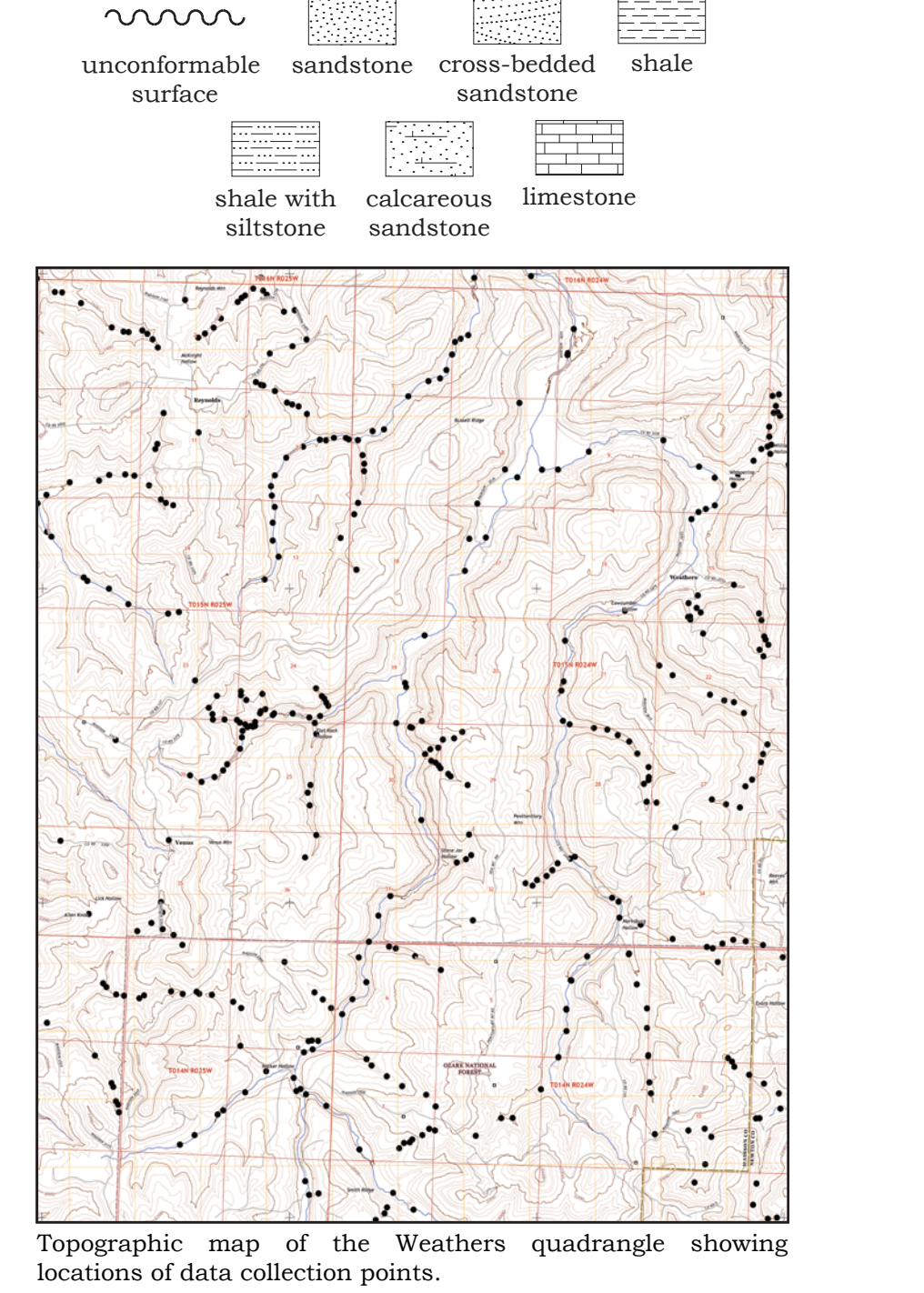
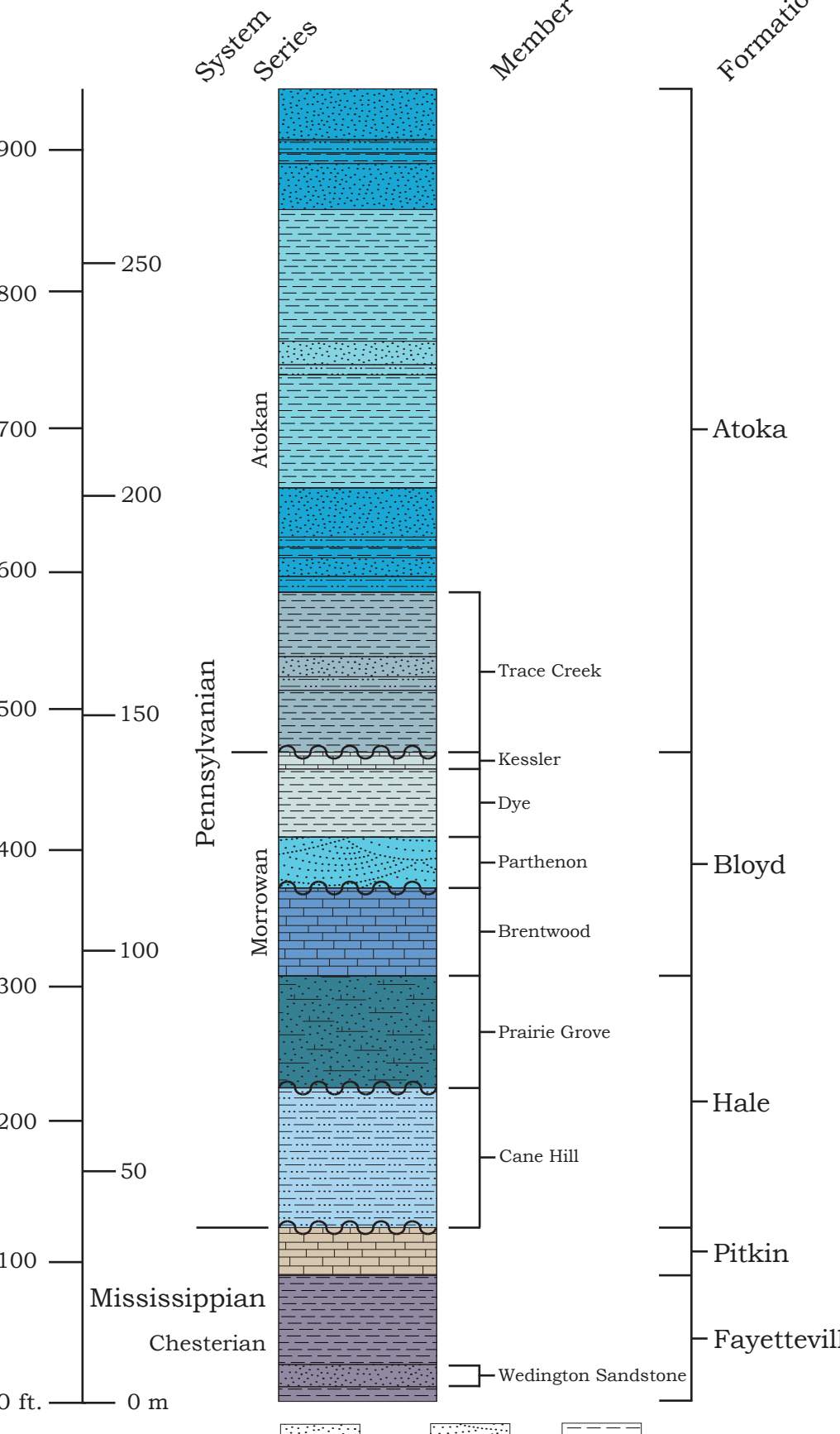
Symbols

- Contact
- Normal fault - bar on downthrown side, arrow indicates dip direction and magnitude.
- Strike and dip of units
- Line of cross-section
- Monocline
- Syncline

Description of Map Units

- Qat** Alluvium and terrace deposits (Quaternary) - composed of shale, siltstone, and sandstone units, differentiated by the relative abundance of sandstone and shale. The only formally recognized member is the Trace Creek Shale. Up to 600 feet (183 meters) thick.
- Qls** Landslide deposits (Quaternary) - unsorted, unconsolidated rock and debris material typically resulting from failure of oversteepened slopes, especially those composed of interbedded sandstone and shale units in the Cane Hill Member of the Hale Formation.
- Pat** Atoka Formation (Middle Pennsylvanian, Atokan) - composed of shale, siltstone, and sandstone units, differentiated by the relative abundance of sandstone and shale. The only formally recognized member is the Trace Creek Shale. Up to 600 feet (183 meters) thick.
- Pbd** Atoka (shale-dominant interval) - mostly shale and silty shale punctuated by thin- to thick-bedded, locally cross-bedded or flaser-bedded siltstone and silty sandstone, usually forming ledges less than 15 feet (4.6 meters) thick. Shale is gray to black or tan on fresh surfaces, but weathers tan or orange. Sandstone is typically micaceous and very fine to fine grained, though locally rounded quartz granules and pebbles are present. Typically tan, brown, or buff on fresh surfaces, but weathers tan to dark brown. Locally contains shale pebbles or partings, limesteag banding, plant fossil molds, and horizontal and vertical trace fossils. Locally calcareous. Thickness ranges from 160 to 240 feet (49 to 73 meters).
- Pbp** Atoka (sandstone-dominant intervals) - mostly thin- to thick-bedded siltstone, silty sandstone, and sandstone with significant interbedded shale and silty shale. Typically sandstone ledges are less than 30 feet (9.1 meters) thick. Sandstone is locally cross bedded, flaser bedded, or massive. Typically micaceous and very fine to fine grained, though locally rounded quartz granules and pebbles are present. Commonly friable. Typically tan, brown, gray, or buff on fresh surfaces, but weathers tan, brown, or orange. Locally contains quartz grains coated with white clay, shale pebbles or molds, shale partings, limesteag banding, plant fossil molds, coal stringers, and horizontal and vertical trace fossils. Ripple bedding is common though usually occluded due to bioturbation. Locally calcareous. Shale is gray to black on fresh surfaces, but weathers tan or orange. Up to 160 feet (49 meters) thick.
- Pbb** Trace Creek Shale - dominated by dark-gray to black shale interbedded with thin- to medium-bedded, flaser-bedded siltstone and silty sandstone. Locally, channel-bedded sandstone units are medium to very thick bedded, usually thickening upward, and very fine to coarse grained, usually coarsening upward. Typically tan, orange-brown, or buff on fresh surfaces, but weathers brown to dark brown. Locally contains shale partings, quartz pebbles, limesteag banding, trace fossils (especially conodonts and asterozoans), coarled wood, and coal stringers. Locally calcareous. Unconformable with the underlying Bloyd Formation. Thickness ranges from 80 to 200 feet (24 to 73 meters).
- Pph** Bloyd Formation (Lower Pennsylvanian, Morrowan) - composed of shale, sandstone, and limestone units divided into several members. From youngest to oldest they are: Kessler Limestone, Dye Shale, Parthenon sandstone, and Brentwood Limestone. Thickness ranges from 160 to 200 feet (49 to 61 meters).
- Phc** Kessler Limestone - thin- to medium-bedded, sandy fossiliferous limestone. Light gray on fresh surfaces, weathers dark gray. Fossils include: crinoids, tabulate corals, brachiopods, and bryozoans. Herringbone cross-bedding within sandy limestone intervals commonly exhibits differential weathering due to variable sand content. Locally contains quartz pebbles, phosphatic pebbles, and limonitic siltstone pebble-conglomerate. Because this unit is so thin, it is mapped with the Dye Shale. Conformable with the underlying Dye Shale. Thickness ranges from 5 to 40 feet (1.5 to 12 meters).
- Mp** Dye Shale - mostly gray to black shale or tan to brown silty shale. Locally contains limonitic siltstone concretions. In the northwestern corner, a massive-bedded, friable sandstone unit scours into underlying shale near the base. Conformable with the underlying Parthenon sandstone. Thickness ranges from 40 to 80 feet (12 to 24 meters).
- Mf** Parthenon sandstone - thin- to massive-bedded, cross-bedded, very fine- to coarse-grained, well-indurated, micaceous sandstone. Typically tan on fresh surfaces, but weathers tan to brown. Commonly contains rounded, white quartz pebbles and wood prints. Thickens on the southern half of the quadrangle where it forms two benches divided by black shale. The Parthenon sandstone is a prominent bluff-form along the Kings River and its tributaries. Kings River Falls pours over the Parthenon-Brentwood contact within the Kings River Falls Natural Area. Unconformable with the underlying Brentwood Limestone. Thickness ranges from 40 to 100 feet (12 to 30 meters).
- Mf** Brentwood Limestone - thin- to thick-bedded, coarsely crystalline, fossiliferous limestone interbedded with sandy limestone and light-gray siltstone which is locally cross bedded. Lenses of sandy limestone conglomerate containing pebbles and cobbles of sandstone, fossiliferous sandstone, siltstone, and shale are locally present. Limestone is light gray on fresh surfaces and weathers light gray to white. Locally cross bedded. Locally contains corals and stringers. Fossils include: crinoids (including spines and cup plates), tabulate and rugose corals, brachiopods, gastropods, ammonoids, nautiloids, and fenestrate bryozoans. Conformable with the underlying Prairie Grove Member of the Hale Formation. Thickness ranges from 30 to 60 feet (9 to 18 meters).
- Mf** Hale Formation (Lower Pennsylvanian, Morrowan) - composed of interbedded sandstone, siltstone, shale, and limestone units divided into two members: the Prairie Grove and the Cane Hill. Thickness ranges from 140 to 200 feet (43 to 61 meters).
- Mf** Prairie Grove - medium- to massive-bedded, very fine- to medium-grained, calcareous sandstone or sandy limestone interbedded with thin units (less than 2 feet (0.6 meter) thick) of black shale. Contains lenses of relatively pure, finely crystalline, fossiliferous limestone. Sandstone is light gray to light brown on fresh surfaces and weathers dark brown. Commonly contains shale pebbles and partings, fossil molds, and cross-bedding. Fossils include: crinoids (including cup plates), brachiopods, gastropods, ammonoids, and tabulate and rugose corals. Unconformable with the underlying Cane Hill. Thickness ranges from 80 to 160 feet (24 to 49 meters).
- Mf** Cane Hill - interbedded shale, silty shale, siltstone, and thin- to thick-bedded, very fine- to fine-grained, micaceous sandstone. Commonly contains pyrite and siltstone concretions. Sandstone is tan to light gray on fresh surfaces, but weathers tan to gray. Flaser bedding, ripple bedding, and soil-sediment deformation are common. A limestone-pebble conglomerate locally marks the basal contact. A cross-bedded, medium to thick-bedded, very fine- to fine-grained, calcareous sandstone unit, approximately 25 feet (8 meters) thick, is locally present near the base. Unconformable with the underlying Pitkin Limestone. Thickness ranges from 60 to 140 feet (18 to 43 meters).
- Mf** Pitkin Limestone (Upper Mississippian, Chesterian) - micritic to coarsely crystalline, medium- to thick-bedded, locally cross-bedded, fossiliferous limestone. Typically light to dark gray on fresh and weathered surfaces. Fossils include crinoids, brachiopods, gastropods, bryozoans (including Archimedes), and tabulate corals. Conformable with the underlying Fayetteville Shale. Thickness ranges from 30 to 40 feet (9 to 12 meters).
- Mf** Fayetteville Shale (Upper Mississippian, Chesterian) - composed of black shale, divided by the Wellington Sandstone. Sandstone is very fine grained, medium- to thick-bedded, locally cross bedded, typically tan to orange on fresh surfaces, but weathers gray to brown. Rounded, limonitic siltstone concretions, some of which are septarian, are locally present in the shale and typically range from 2 to 8 inches (5 to 20 centimeters) in diameter. Exposures are limited to beds in Felkins Creek, Whispering Hollow, and Kings River. Up to 100 feet (30 meters) thick.

Stratigraphic Column



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

References

- Haley, B. R., 1976, Preliminary geologic map of the Weathers quadrangle, Madison and Newton Counties, Arkansas: Arkansas Geological Survey, Geologic Worksheet, 1 sheet, 1:24,000.
- Shinn, M. R., 1979, Structural geology of the Brentwood-St. Paul area, northwest Arkansas, (Master's thesis, unpublished): University of Arkansas, 99 p., 12 pl.
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- Limitations:** This map, like all geologic maps, is based on interpretations which were made from data available at the time it was created. As work continues and new data is collected, the contacts, structures, and other features depicted on this map may be changed.

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Map and cross-section digitized by Brian Kehner and Kerstein Dunn.

