Digital Geologic Quadrangle Map
Bethesda Quadrangle, Arkansas
DGM-AR-00073

GEOLOGICAL SURVEY

Geologic Map of the Bethesda Quadrangle, Independence, Stone, and Izard Counties, Arkansas

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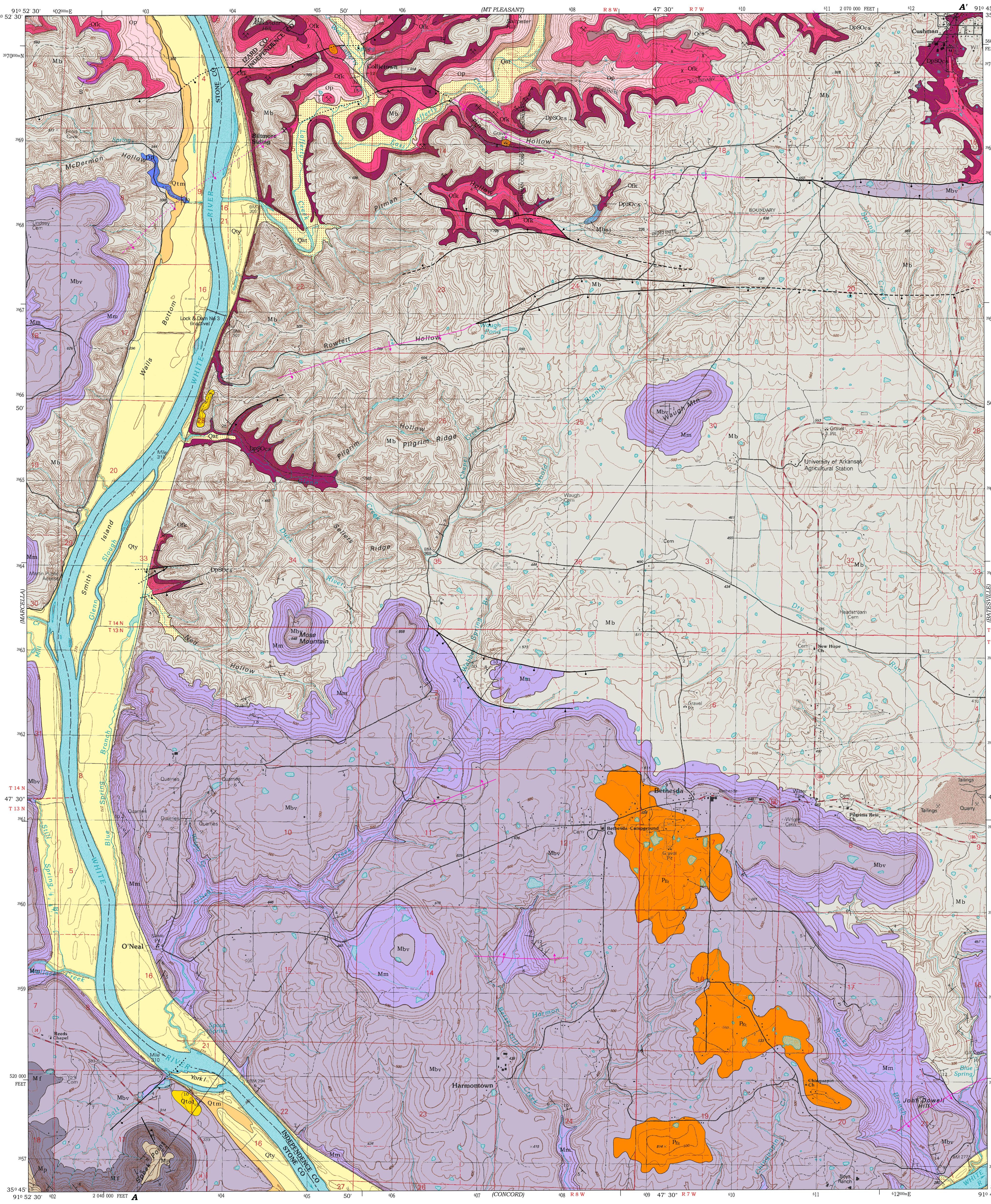


The topographic base is a collarless Digital Raster Graphic (DRG). The DRG is a scanned image of a U.S. Geological Survey 7.5-minute series topographic map published in 1989.

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

1000-meter Universal Transverse Mercator grid zone 15. 1927 North American Datum.

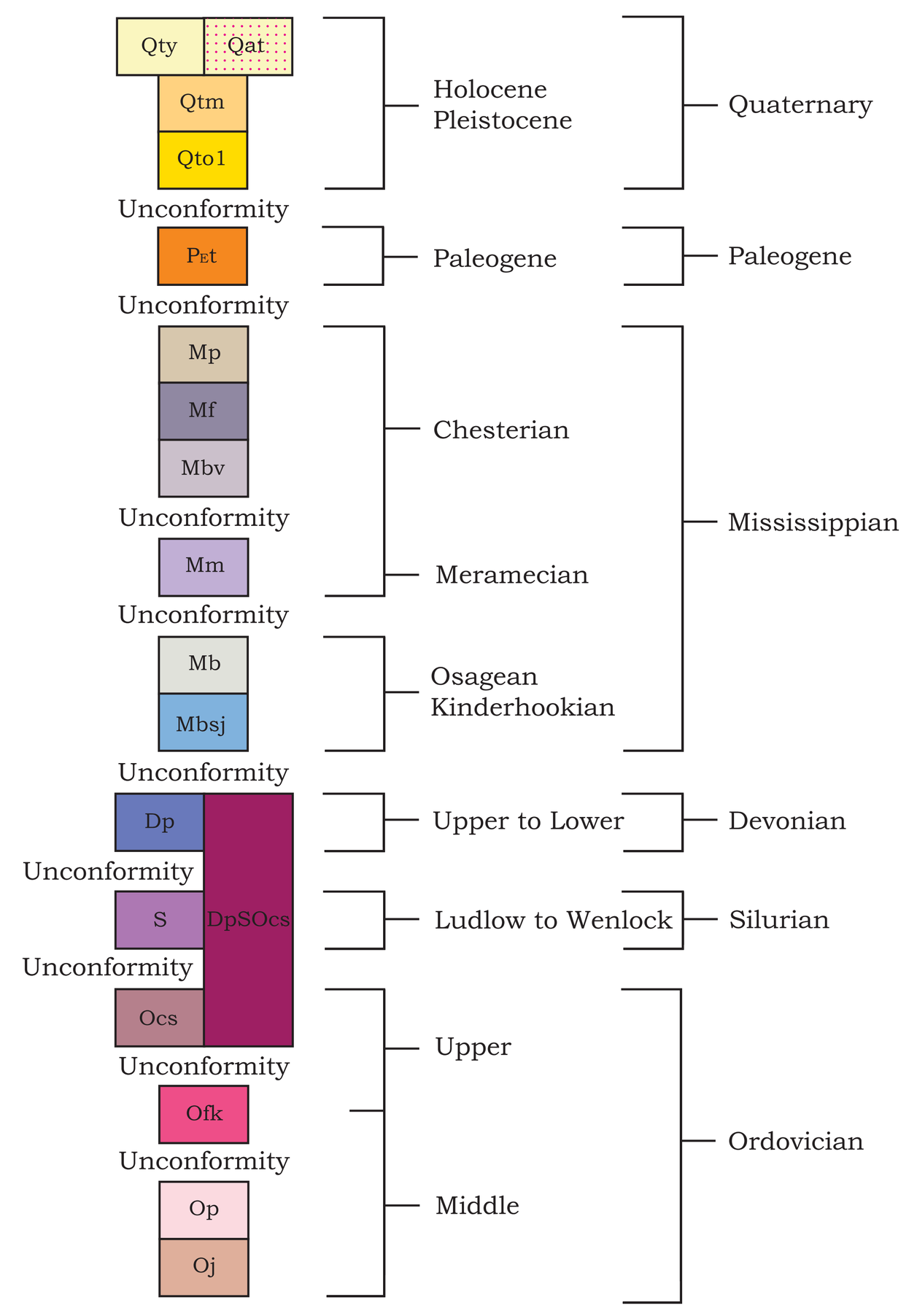
0° 28'
TRUE NORTH
MAGNETIC NORTH
Approximate mean declination 2022

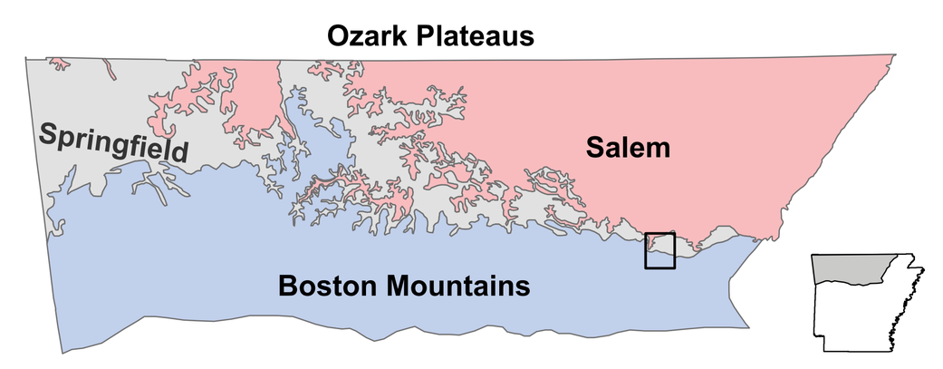
SCALE 1:24 000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
Contour Interval 20 Feet
National Geodetic Vertical Datum of 1929

ARKANSAS
Quadrangle Location

Secondary highway
Light duty road
Unimproved road

Correlation of Map Units





Location of the Bethesda quadrangle within the Ozark Plateaus.

Introduction

This map depicts the surface geology of the Bethesda quadrangle, a 7.5-minute series USGS topographic map. This area was mapped as part of the Earth Mapping Resources Initiative (EMRI) and STATEMAP programs. The focus of this project was detailed mapping of the Batesville Manganese District with an emphasis on the Cason Formation. In this area, approximately 900 feet (274 meters) of Middle Ordovician to Late Mississippian carbonate and clastic rocks are exposed.

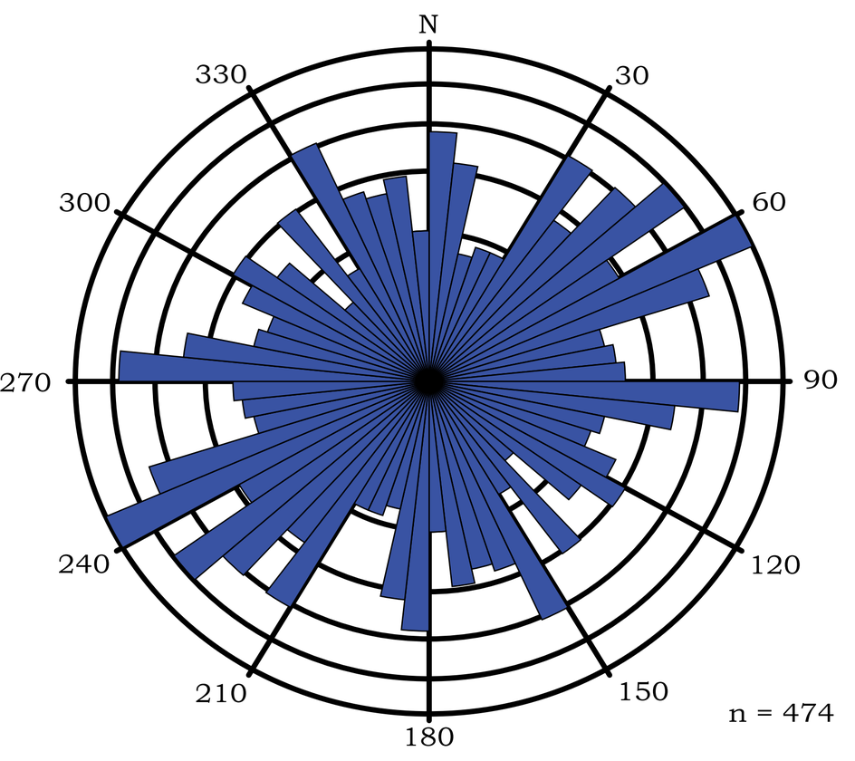
The area spans the Springfield, Salem, and Boston Mountain Plateaus within the Ozark Plateaus Province. Generally, the rock formations dip gently southward with local variations due to monoclines and normal faults. Karst features such as springs, disappearing streams, caves, and sinkholes are common throughout the area.

The Bethesda quadrangle lies on the southern margin of the Batesville Manganese District. Glick (1973) mapped the Bethesda quadrangle after Gordon and Kinney (1944) and Straczek et al., (1950), in preparation for the 1:500,000-scale Geologic Map of Arkansas. New field data was recorded on a portable GPS data collector and uploaded to a geodatabase. Eleven samples were collected on the Bethesda quadrangle for analysis using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) to determine rare earth element concentrations in the Cason Formation. Representative rock samples were also collected for description and petrographic analysis.

Symbols

Contact
A — A' Line of cross-section
Normal fault - ball and bar on downthrown side. Dashed where inferred. Dotted where concealed.
Monocline
Strike and dip
Mine
Pit
Prospect

Joint Frequency



Rose diagram of the strike frequency of joints recorded on the Bethesda quadrangle.

Description of Map Units

Qat — **Alluvium and terrace deposits (Quaternary)** - unconsolidated clay, silt, sand, and gravel, including deposits on one or more terrace levels along larger tributaries. Approximately 10-15 feet (3-5 meters) thick.

Qty — **Young terrace and active channel deposits (Quaternary)** - unconsolidated clay, silt, sand, and gravel in gravel bars and sandy point bars along the White River. Includes the youngest terraces above the river which are primarily clay, silt, and sand. Uppermost surfaces are generally flat but are locally hummocky and dissected by tributaries. Approximately 20-30 feet (6-9 meters) thick.

Qtm — **Medial terrace and alluvial deposits (Quaternary)** - older terraces composed of unconsolidated clay, silt, and sand in a deposit approximately 30 feet (9 meters) above the White River. Ranges from 20-30 feet (6-9 meters) thick.

Qto1 — **Old terrace and alluvial deposits (Quaternary)** - older terraces composed of unconsolidated clay, silt, and sand in a deposit approximately 80-100 feet (24-30 meters) above the White River. Ranges from 20-40 feet (6-12 meters) thick.

PEt — **Terrace deposits (Paleogene?)** - stranded gravel deposits that consist of unconsolidated, coarse sand- to cobble-sized, angular to rounded chert and sparse sandstone on hilltops 200-300 feet (60-91 meters) above nearby drainages. Historically, these deposits were assigned to the Tertiary (Glick, 1973). Ranges from a veneer to approximately 80 feet (24 meters) thick.

Mp — **Pitkin Formation (Upper Mississippian, Chesterian)** - medium -bedded, buff to gray, fine- to medium- crystalline grainstone. Approximately 20-40 feet (6-12 meters) thick. Conformable with the underlying Fayetteville Formation.

Mf — **Fayetteville Formation (Upper Mississippian, Chesterian)** - thin- to massive-bedded, finely crystalline, light- to dark-gray limestone and black shale. Crinoids and abundant brachiopods are locally preserved in the limestone. Septarian concretions up to 2 feet (60 centimeters) in diameter are locally present in the shale intervals. Conformable with the underlying Batesville Formation. Up to 280 feet (85 meters) thick.

Mbv — **Batesville Sandstone (Upper Mississippian, Chesterian)** - fine- to medium-grained, sub-angular, moderately sorted, iron-cemented sandstone. Thin to medium bedded and locally flat bedded or cross-bedded. White to buff, tan, orange, and light brown on fresh surfaces and commonly banded. Weathers light to dark gray and dark brown. Conformable with the underlying Moorefield Formation. Ranges from 40-150 feet (12-46 meters) thick.

Mm — **Moorefield Formation (Upper Mississippian, Chesterian and Meramecian)** - fissile shale interbedded with very thin- to thin -bedded siltstone and micrite. Shale is dark gray to black on fresh and weathered surfaces. Siltstone is dark gray to brown on fresh surfaces but weathers light gray to buff. Solutioning along joints is common in calcareous zones. Sparsely fossiliferous with mostly crushed brachiopods. Unconformable with the underlying Boone Formation. Ranges from 60-180 feet (18-55 meters) thick.

Mb — **Boone Formation (Lower Mississippian, Osagean and Kinderhookian)** - fine-grained limestone interbedded with anastomosing and bedded chert. Light to medium gray on fresh surfaces but usually weathers to dark gray. The chert varies in color from white to light gray in the upper portion to dark gray or blue gray in the lower portion. Springs, caves, and sinkholes are common. A thick regolith of angular chert fragments in a red clay matrix is present on the Boone thoughout the quadrangle. Unconformable with the underlying Penters Chert or Lafferty Limestone. Ranges from 80-200 feet (24-60 meters) thick.

Mbsj — **St. Joe Limestone Member (Lower Mississippian, Kinderhookian)** - consists of thin-bedded reddish, to gray crinoidal limestone. Locally contains white crinoid fragments in a red, fine-grained matrix. The St. Joe Limestone was only seen at two localities in the quadrangle. Up to 20 feet (6 meters) thick.

The following units are discontinuous and typically too thin to be mapped at this scale and are therefore grouped with adjacent units. The Cason Formation is mapped separately wherever possible and thickness may be locally exaggerated.

DpSOcs

Dp — **Penters Chert (Lower to Middle Devonian)** - medium- to thick-bedded chert. Gray and white banding is common but red, orange, and white mottling is also present. Commonly brecciated and highly fractured. Contains drusy quartz and manganese oxide coatings. Sandstone boulders are locally preserved above or in place of the chert. Sandstone is clean, white, silica-cemented, and contains chert fragments. Chert is present as residual boulders on hilltops throughout the area. Historically mined for manganese. Unconformable with the underlying Lafferty Limestone. Ranges from 20-40 feet (6-12 meters) thick.

S — **Lafferty Limestone (Silurian, Ludlow to Wenlock)** - sparsely fossiliferous, finely crystalline limestone. Medium gray with red crinoidal fragments or blebs on fresh surfaces and weathers light gray. Locally contains light-red finely crystalline limestone. Thin to thick bedded and commonly stylolitic along bedding planes. Locally contains manganese dendrites and nodules, green clay, pyrite, and nautiloid fossils. Historically mined for manganese. Conformable with the underlying St. Clair Limestone. Up to 20 feet (6 meters) thick.

St. Clair Limestone (Silurian, Wenlock) - coarsely crystalline fossiliferous limestone. Locally contains abundant trilobite fossil fragments and green clay. Light gray to white on fresh surfaces but weathers medium gray. Unconformable with the underlying Cason Formation. Up to 15 feet (5 meters) thick.

Ocs — **Cason Formation (Upper Ordovician)** - thin- to medium-bedded, reddish-brown to buff siltstone interbedded with silty shale. Locally contains white chert fragments, glauconite grains, limonite blebs, and flattened button-shaped impressions. This unit was previously mined for phosphate and manganese. Unconformable with the underlying Fernvale Limestone. Up to approximately 20 feet (6 meters) thick.

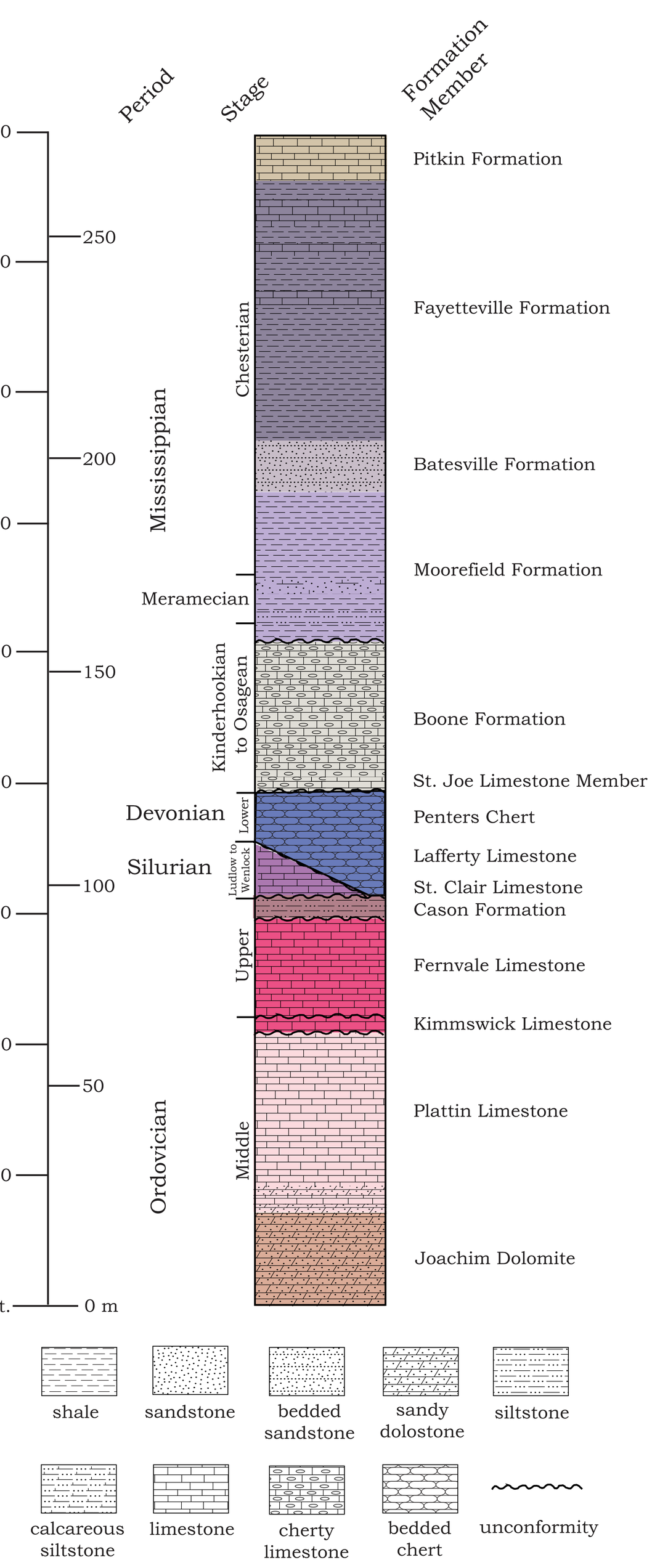
Ofk — **Fernvale Limestone (Upper-Middle Ordovician)** - medium- to coarse crystalline limestone. Medium- to thick or massive bedded. Light pink to reddish on fresh surfaces and weathers dark gray to brown. Fossils include barrel-shaped crinoids, brachiopods, bryozoans, and corals. Caves and sinkholes are abundant. Manganese oxide is present in nodules and thin horizontal zones within the upper section. The top of this unit is heavily solutioned and was mined for manganese at multiple locations. Unconformable with the underlying Kimmswick Limestone where present. Ranges from 40-200 feet (12-60 meters) thick.

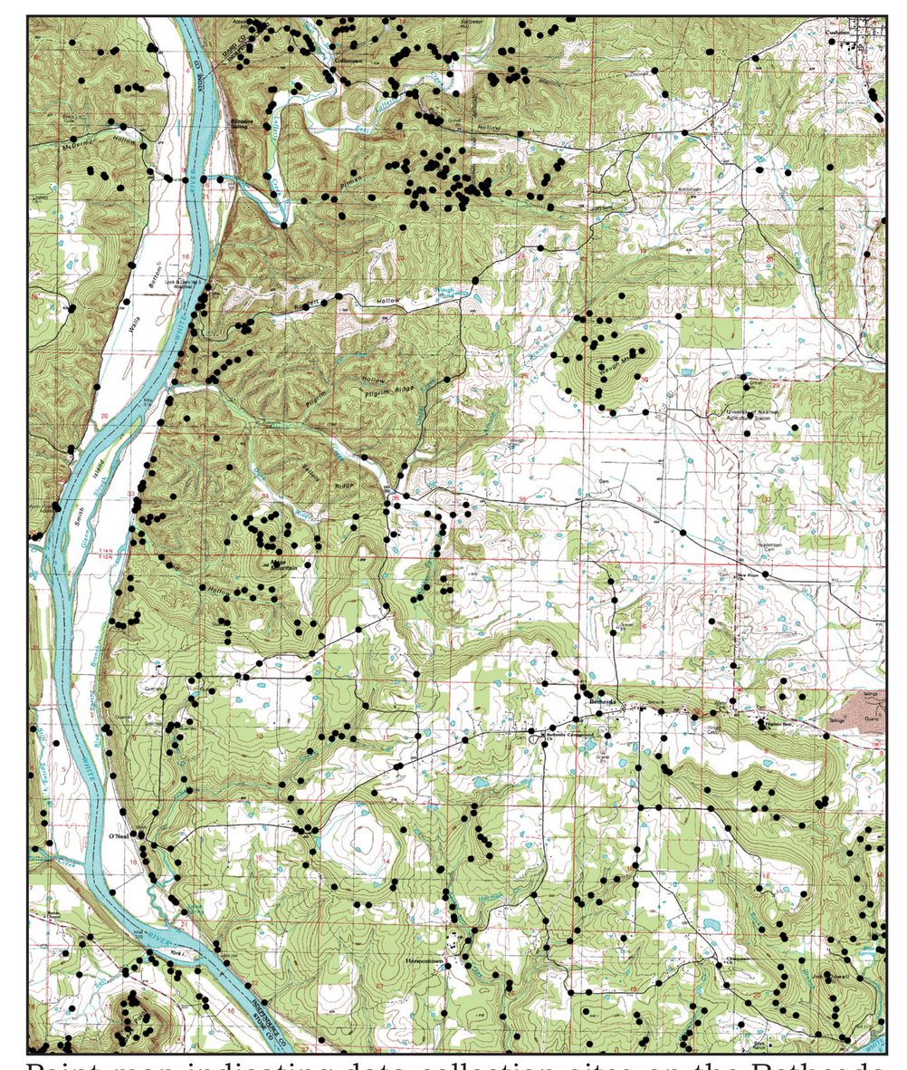
Kimmswick Limestone (Middle Ordovician) - medium crystalline, gray to white, stylolitic limestone. Locally contains chert fragments. Contains brachiopods, bivalves, crinoids, horizontal trace fossils, and *Prismostylus*, a type of fossilized red algae. Unconformable with the underlying Plattin Limestone. Up to 20 feet (6 meters) thick.

Op — **Plattin Limestone (Middle Ordovician)** - very thin- to medium-bedded, micritic to finely crystalline limestone. Light to medium gray on fresh surfaces but weathers white to light gray and is locally mottled. Contains gastropods, brachiopods, bryozoans and stromatolites. Horizontal and vertical trace fossils are locally infilled with silt, especially in the upper section. Very thin shale layers are present in the top of the unit. Interbedded dolostone is present in the lower section making it difficult to locate the lower contact. Limestone glades containing abundant solutionally enlarged orthogonal joint sets are present. Sinkholes and springs are abundant. The top of the unit is heavily solutioned and contains manganese prospects at various locations. Conformable with the underlying Joachim Dolomite. Ranges from 60-240 feet (18-73 meters) thick.

Oj — **Joachim Dolomite (Middle Ordovician)** - fine- to medium crystalline sandy dolostone that is thin- to medium bedded. Medium to dark gray on fresh surfaces but weathers light gray to white. Mudcracks are common. Locally contains calcite veins, calcite blebs, stromatolites, and dolostone breccia. Contains solutionally enlarged fractures, caves, and springs. A thin oolitic interval is present near the top of the unit. Conformable with the underlying St. Peter Sandstone. Ranges from 20-80 feet (6-24 meters) thick.

Stratigraphic Column





Point map indicating data collection sites on the Bethesda quadrangle.

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Limitations: This map is based on interpretations which were made from the data available at the time it was created. As new information is collected, the features depicted on this map may be changed.

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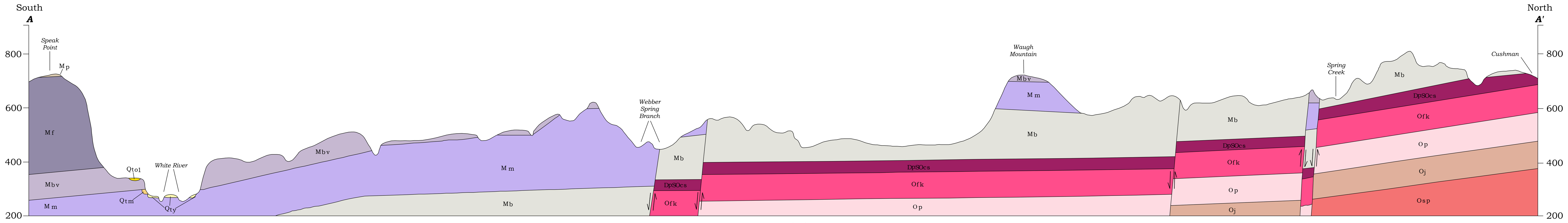
Map and cross section digitized by Jerry Clark.



Scale:
Horizontal: 1 Inch = 2000 Feet
Vertical: 1 Inch = 200 Feet (Exaggeration: 10x)