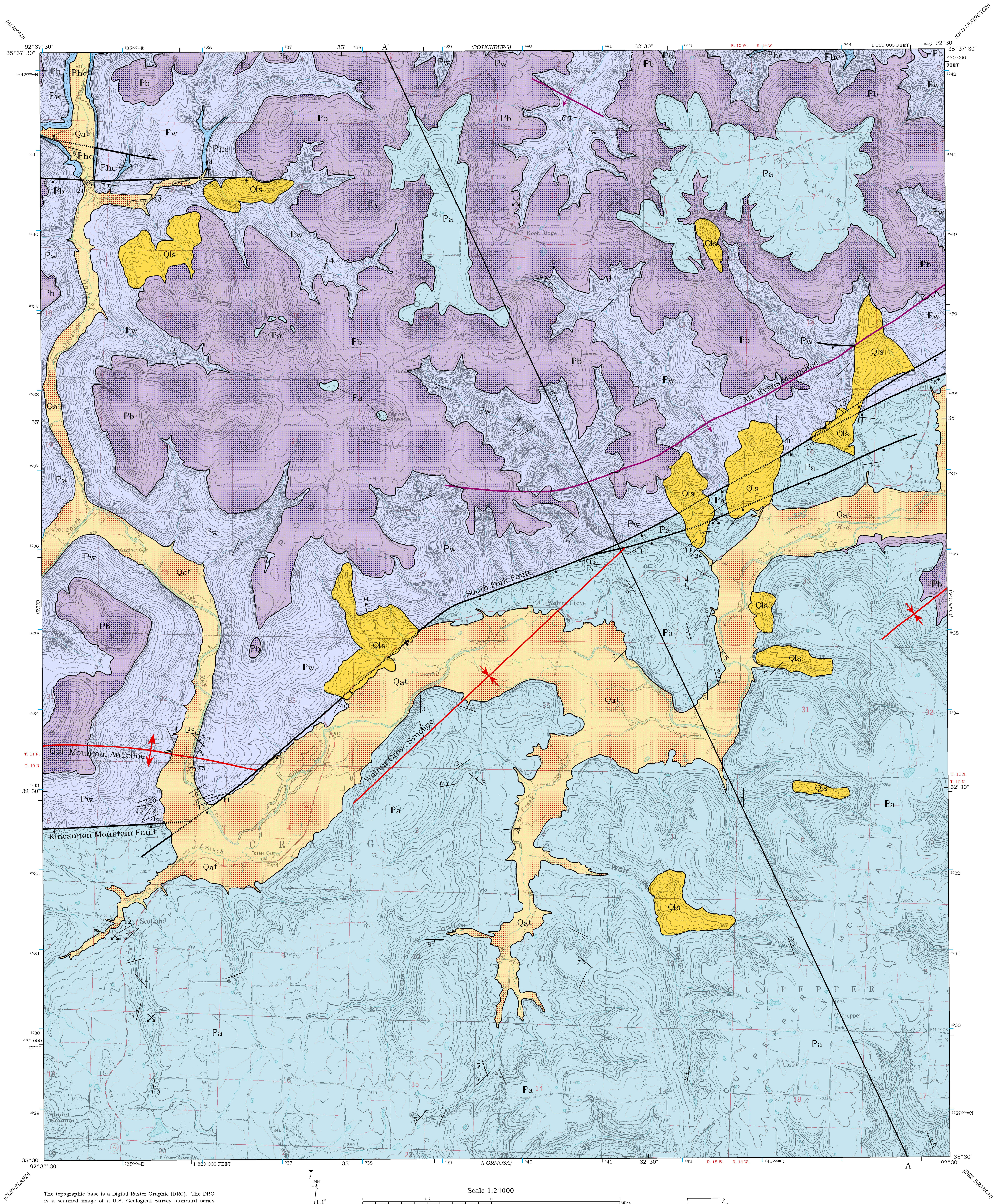
Arkansas Geological Survey
Bekki White, State Geologist and Director

Geologic Map of the Scotland Quadrangle, Van Buren County, Arkansas

Richard S. Hutto and Daniel S. Rains

2011



The topographic base is a Digital Raster Graphic (DRG). The DRG is a scanned image of a U.S. Geological Survey standard series topographic map published in 1965. Some of the colors of the DRG have been modified and it is displayed at 50% transparency.

10,000-foot grid based on Arkansas coordinate system, north zone. (Polyconic projection).

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

2011 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Scale 1:24000

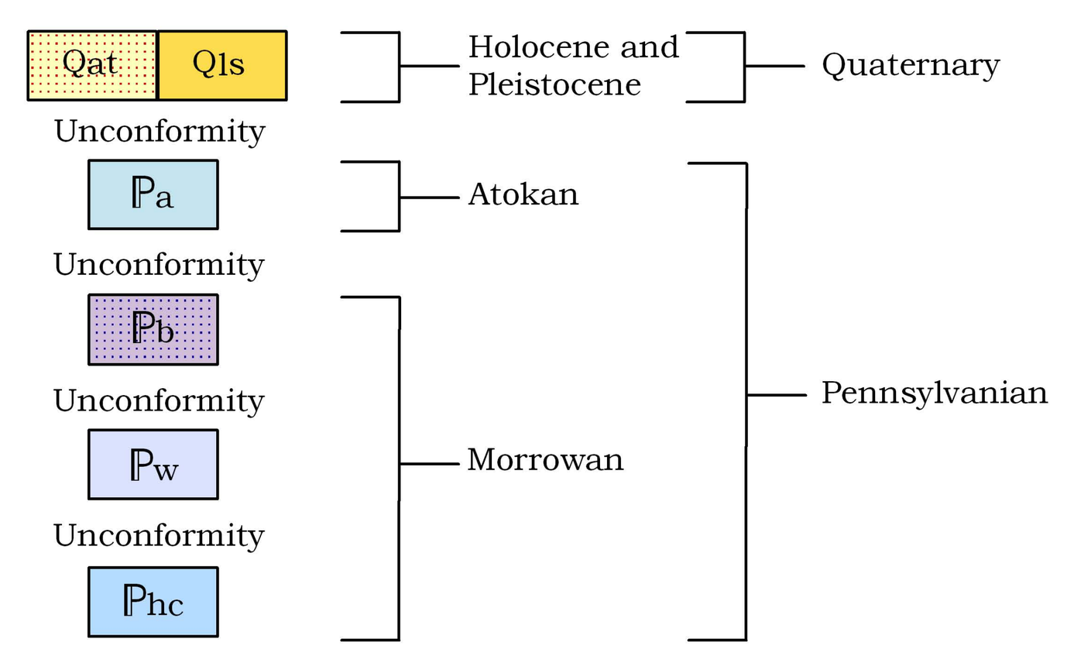
Contour Interval 20 Feet
National Geodetic Vertical Datum of 1929

Quadrangle Location

Road Classification

Medium-duty — Light-duty — Unimproved dirt

Correlation of Map Units



Introduction

This map graphically summarizes the bedrock geology of the Scotland 7.5-minute quadrangle. In this area over 1000 feet (305 meters) of middle Pennsylvanian clastic sedimentary rocks are exposed. Regional structure is controlled by an uplift centered in southeastern Missouri known as the Ozark Dome and an east-west trending structural low to the south called the Arkoma Basin. Progressively younger rocks form a series of increasingly elevated plateaus from the core of the uplift southward into Arkansas. The area of this map overlaps the southern edge of the highest of these plateaus, the Boston Mountains Plateau, and the northern edge of the Arkoma Basin. The northern part of the basin is characterized by thick sequences of mostly fluvial sedimentary rocks disrupted by growth faults and gentle folds. Faulting occurred under conditions of rapid sedimentation and progressive subsidence to the south during the mid- to late-Pennsylvanian. Folding may be contemporaneous with the faulting or have occurred later during the Ouachita orogeny.

In this area, the Prairie Grove Member of the Hale Formation and members of Bloyd Formation cannot be differentiated. Only the Cane Hill Member of the Hale Formation is recognizable. Rock units equivalent to the Prairie Grove along with rock units equivalent to the Lower part of the Bloyd Formation are termed the Witts Springs Formation, as mapped on adjacent quadrangles (Braden and Ausbrooks, 2003). Also, the recently named Parthenon sandstone of the Bloyd Formation (Chandler and Zachry, 2010) is indistinguishable in this area. Rock units equivalent to the Parthenon sandstone and the Upper part of the Bloyd Formation are termed the undifferentiated Bloyd Formation, as mapped on adjacent quadrangles (Hutto and Smith, 2007).

Structural features in the study area are subtle, with the exception of the South Fork Fault which is relatively sizeable. It is a normal fault oriented southwest-northeast across the middle of the quadrangle with a displacement of greater than 800 feet (244 meters) to the south. Flanking this fault are the Mt. Evans Monocline to the north and the Walnut Grove Syncline to the south. On the eastern edge of the map is the western end of the Clinton Syncline. The Kincannon Mountain Fault and the Gulf Mountain Anticline terminate against the South Fork Fault near the western edge. These structures are probably related to the Mulberry Fault System which divides the Ozark Dome from the Arkoma Basin.

The South Fork of the Little Red River is the largest drainage in the area. Where it crosses the fault, flow direction reorients along the fault trend. Where it intersects the nose of the Walnut Ridge Syncline, it diverts around the structure and rejoins the fault trend to the east.

This quadrangle was mapped by Glick circa 1973 on the 1:250,000 scale Russellville Quadrangle, and by Haley at the 1:24,000 scale in preparation for the 1976 Geologic Map of Arkansas. The current mapping builds on the previous work, but uses a revised section and depicts structures and rock units in more detail. The contacts and structural features on this map were derived from field observations made between July 2010 and April 2011. 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 deposited along major streams with intermittent outcrops of bedrock also present. Includes deposits on one or more low terrace levels.

Qls — **Landslide deposits (Quaternary)** – a mass of rock and debris that has moved downslope as a result of destabilization and subsequent failure of surficial materials.

Pa — **Atoka Formation (Pennsylvanian, Atokan)** – primarily shale interbedded with very thin- to thin-, ripple-bedded siltstone and thin- to medium-bedded, flat- to cross-bedded sandstone. Shale is gray to black on fresh surfaces and weathers tan to brown. Siltstone is tan to gray on fresh surfaces and weathers tan to brown. Sandstone is very fine- to fine-grained, tan to brown and medium- to dark-gray on fresh surfaces and weathers brown. Locally exhibits liesegang banding, bioturbation and manganese staining. Commonly contains shale partings and shale-pebble conglomeratic zones. *Zoophycus* and other trace fossils are common at the top of sandy units. Unconformable with the underlying Bloyd Formation. A thickness of up to approximately 460 feet (140 meters) is exposed.

Pb — **Bloyd Formation (Lower Pennsylvanian, Morrowan)** – primarily shale with siltstone and very thin- to thin-bedded sandstone interbedded. Shale is clay to silt, tan to black on fresh surfaces and weathers orange to brown. Siltstone is very thin- to medium-bedded, light- to medium-gray on fresh surfaces, and weathers tan to brown. Typically there is at least one thin- to very thick-bedded, locally calcareous massive sandstone in the lower part of the sequence. It is very fine- to medium-grained, ranges from orange to brown, buff to tan and pink to red on fresh surfaces, and weathers light- to dark-brown. Commonly contains rounded or angular shale pebbles, quartz granules and fossil casts. Locally micaceous, stylolitic and friable. Well-developed ripple-beds or trough, hummocky or chevron cross-beds are typical. Commonly exhibits siliceous case-hardening and liesegang banding. At the base of these units, coal stringers, wood prints and load casts are locally present. Fossiliferous sandstone lenses are also locally interbedded in shale. They are typically cross-bedded, very fine- to fine-grained, light- to dark-gray or red on fresh surfaces, and weather gray to brown. Usually contain conglomeratic zones and shale partings. Fossil material is typically a hash which includes crinoid and brachiopod fragments. The Bloyd is unconformable with the Witts Springs Formation below. Thickness ranges from approximately 240 to 380 feet (73 to 116 meters).

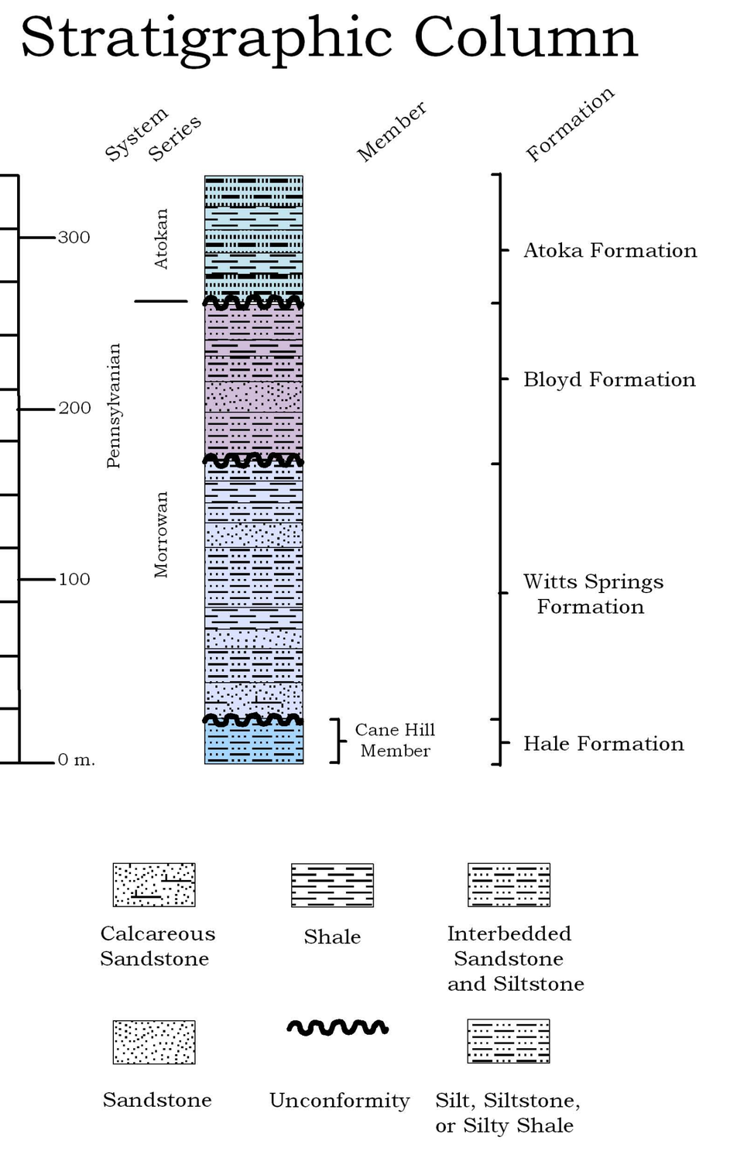
Pw — **Witts Springs Formation (Lower Pennsylvanian, Morrowan)** - a variable sequence of sandstone, siltstone and shale. Sandstone is typically medium- to very thick-bedded, massive and composed of very fine- to medium-grained sand. Ranges from orange to brown, white to buff and tan to light-gray on fresh surfaces, and weathers orange to dark-brown. Typically displays liesegang banding, honeycomb weathering, and fossil molds. Locally calcareous, micaceous and friable. Intervals of shale-, quartz- and sandstone-pebble conglomerate are common. Massive sandstone units are typically separated by units of clay to silt shale, siltstone and very thin- to thin-bedded, ripple- to flat-bedded, very fine- to fine-grained sandstone. Discontinuous, thin- to medium-bedded, cross-bedded, fossiliferous limy sandstone and sandy limestone units interbedded with shale are present at sporadic intervals throughout the sequence. These units are very fine- to fine-grained, finely to coarsely crystalline, light- to dark-gray on fresh surfaces and weather gray to brown. They commonly exhibit alternating bands of dark and light color depending on sand to carbonate ratio, and usually have shale partings and conglomeratic intervals. Crinoid fragments are well-represented, but other fossils include ammonoids, brachiopods, fenestrate bryzoans and rugose corals. Unconformable with the underlying Cane Hill Member of the Hale Formation. Thickness ranges from approximately 300 to 500 feet (91 to 152 meters).

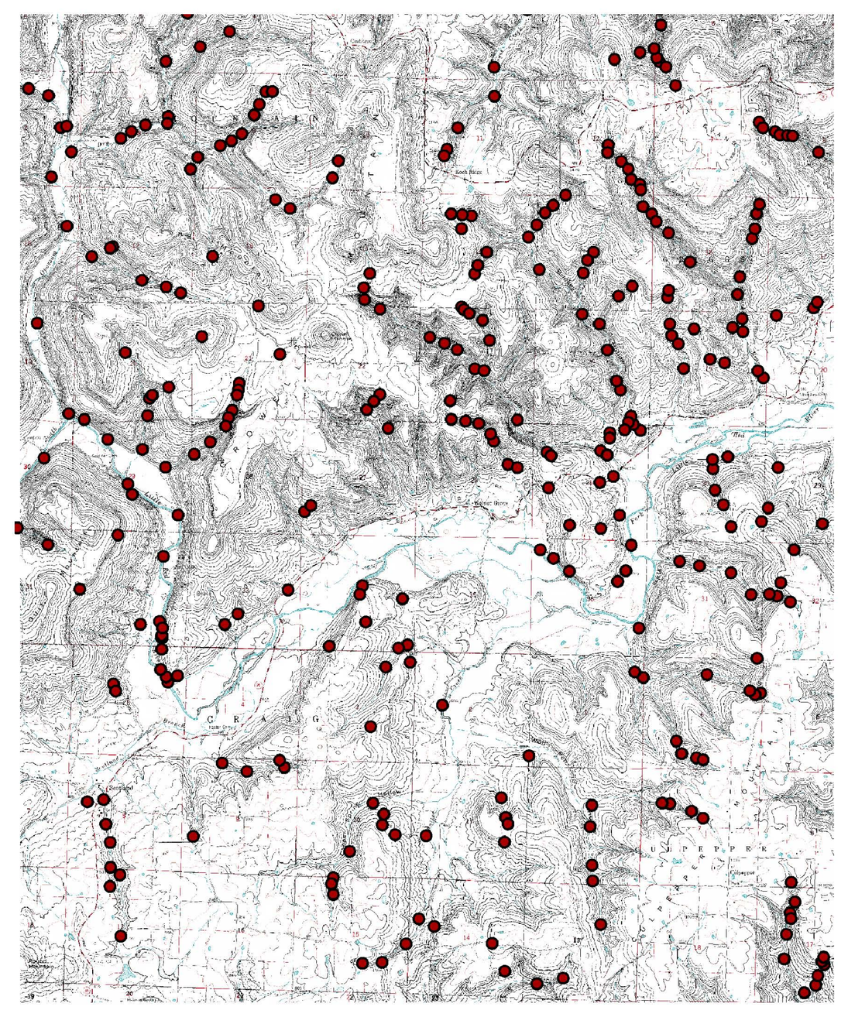
Phc — **Hale Formation (Lower Pennsylvanian, Morrowan) – Cane Hill Member –** dark-gray to black clay to silt shale and siltstone interbedded with medium- to dark-gray, thin-, ripple- to cross-bedded sandstone. Locally calcareous with associated zones of fossil fragments commonly present. Trace fossils and load casts are typically present at the base of sandy units. Up to approximately 80 feet (24 meters) of the uppermost Cane Hill is exposed.

Symbols

- Contact
- Normal fault - dotted where concealed
  - Indicates downdropped block
  - Indicates dip of fault plane
- Line of cross-section
- Anticline axis
- Syncline axis
- Monocline axis
- Strike and Dip
- Gravel pit

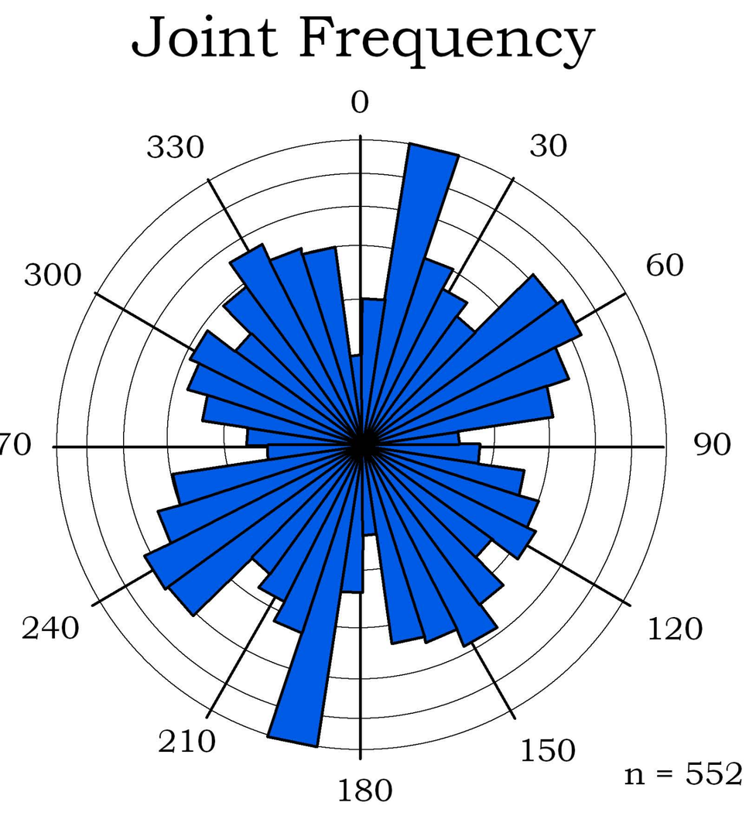
Stratigraphic Column





Topographic map of the Scotland quadrangle. Dots indicate location of data collection points.

Joint Frequency



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

References

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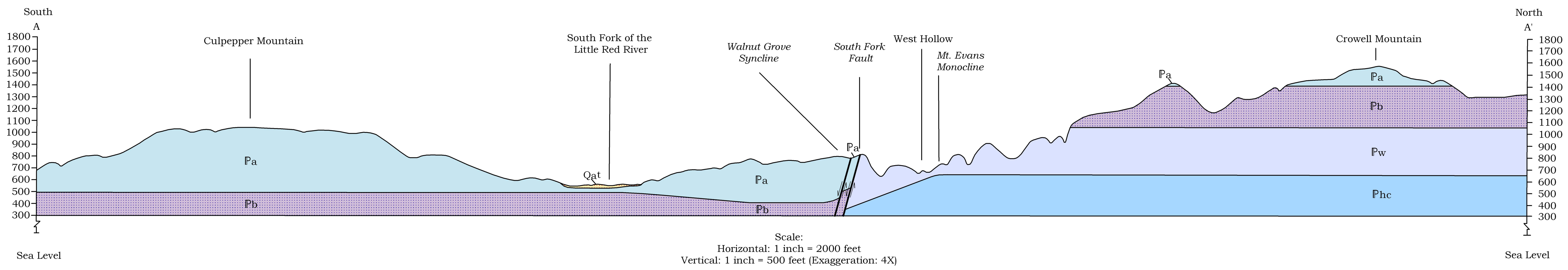

Scale:
Horizontal: 1 inch = 2000 feet
Vertical: 1 inch = 500 feet (Exaggeration: 4X)

Map and cross-section digitized by Nathan Taylor