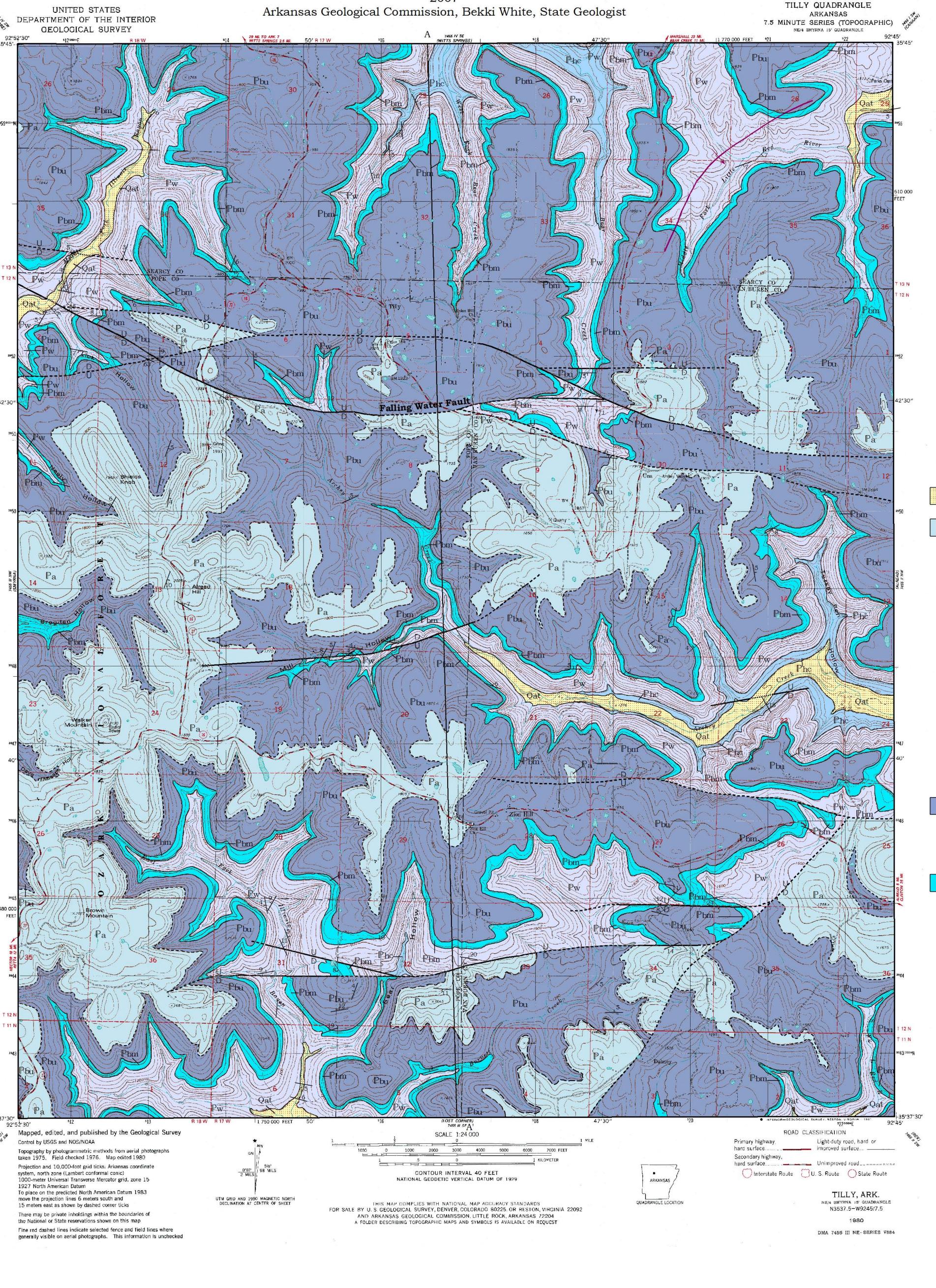
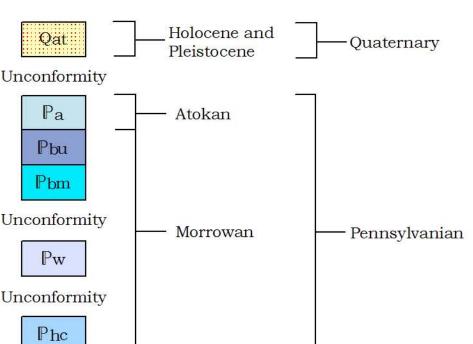
GEOLOGIC MAP OF THE TILLY QUADRANGLE, POPE, SEARCY, AND VAN BUREN COUNTIES, ARKANSAS

Geology by Daniel K. Smith and Richard S. Hutto Digital compilation by Brandy R. Rakes



Correlation of Map Units



This map graphically summarizes the surface geology of the Tilly 7.5-minute quadrangle. In this area over 1130 feet of early Pennsylvanian, clastic sedimentary rocks are exposed. The area lies on the northern edge of the Boston Mountains Plateau, the highest plateau on the southern flank of the Ozark Mountain dome which is centered in southeast Missouri. Within this area are located the headwaters of several major drainages including Bear Creek which flows north, the Middle, Archey and South Forks of the Little Red River which flow east, and the Middle and East Forks of the Illinois Bayou which flow south. Part of the Ozark National Forest lies on the western edge of the map.

aerial photography by Haley in 1972 as part of the Smyrna 15minute quadrangle for the Geologic Map of Arkansas. The current map is the first to be mapped on the ground at the 1:24,000 scale and 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 direct field observations at numerous sites. Site locations were generated with the aid of a global positioning satellite receiver. Bedrock

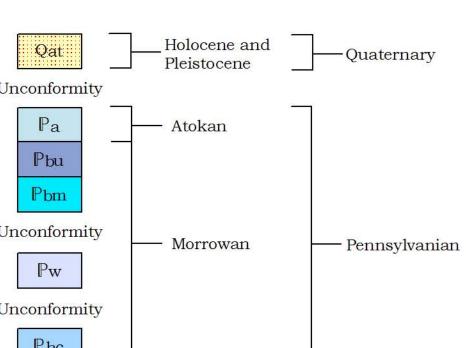
Descriptions of Map Units

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

Atoka Formation (Middle Pennsylvanian, Atokan) Consists of black to tan shales interbedded with very thin to thin, ripple-bedded, micaceous siltstones and thin to medium and occasionally massive-bedded, fine to very fine-grained sandstones with sub-angular to sub-rounded grains. The sandstones are usually buff to tan on fresh surfaces, but can range to dark-red, dark-purple and dark-brown. Weathered surfaces are typically a medium to dark-brown. Occasionally the sandstone exhibits trace fossils along bedding planes, pebble conglomerate zones usually with external fossil molds, liesegang bands and cross-beds. Some sandstone is calcareous and contains white clay clasts which are typically less than 0.04 of an inch (1 mm), gray clay shale pebbles which can be up to 0.71 of an inch (18 mm), quartz pebbles ranging up to 0.35 of an inch (9 mm), shale partings and coal stringers. This rock-type is best exposed in the Freshour Quarry near Una (Juddville). The lower contact is tentative and will be resolved with future mapping. As much as 440 feet (134 meters) of the Atoka is exposed on this quadrangle.

Bloyd Formation (Lower Pennsylvanian, Morrowan) - The individual members of the Bloyd formation (Brentwood and Kessler Limestones) cannot be differentiated on this quadrangle. These "marker zones" are used to divide the section into discernable units in the type section area in northwest Arkansas, and are either missing or have become unrecognizable on this quadrangle. Therefore, the Bloyd Formation is informally divided into upper, middle and lower parts on adjacent quadrangles (Braden, et al., 2005) using the "middle Bloyd sandstone" (Zachry and Haley, 1975). On this map the "middle Bloyd sandstone", which was formerly considered to be the basal Atoka, is used to separate the upper part from the Witts Springs Formation. The rocks equivalent to the lower part of the Bloyd are mapped as the main body of the Witts Springs. The Bloyd ranges approximately 200-280 feet (61-85 meters) on this quadrangle. Upper part - Consists of thin, ripple-bedded to thickbedded, micaceous sandstones interbedded with clay to silty shales. The sandstones consist of very fine to fine-grained, sub-angular to sub-rounded quartz with occasional shale clasts. They are tan to dark-brown on fresh surfaces and weather dark-brown to dark-gray. The shales are dark-gray to black on fresh surfaces and weather tan to brown. This interval contains many trace fossils along bedding planes. The upper part ranges approximately 160-240 feet (49-73 meters)

"middle Bloyd sandstone" - A thin to massive-bedded, cross-bedded, fine to medium-grained, poorly to moderately well-sorted, quartz or iron-cemented sandstone with subangular to sub-rounded quartz grains. Fresh surfaces are light-tan, light-gray or yellowish to reddish-brown, whereas weathered surfaces are light to dark-gray or light to dark brown depending upon iron content. Well-rounded, milky quartz pebbles which measure up to 0.24 of an inch (6 mm) are commonly present especially in the north-central section, and help to distinguish this sandstone from adjacent units. It is often somewhat micaceous and will sometimes contain shale pebbles measuring up to 1.57 inches (40 mm) and lycopod prints. It may also exhibit minor honeycomb weathering and liesegang banding. This sandstone is a prominent bluff-former throughout the quadrangle especially along the north side of the Archey Creek drainage. The "middle Bloyd sandstone" is unconformable with the Witts Springs Formation. Thickness ranges approximately 40-80 feet (12-24 meters).



Introduction

The geology of this area was first mapped chiefly from dipping at less than 2° was considered horizontal.

Member is interpreted to be present on this quadrangle. Cane Hill Member - Typically gray to black, fissile, clay to silty shale sections with thin-bedded, ripple-marked

siltstone and sandstone. As the upper contact is approached, more massive, cross-bedded, calcareous sandstone is interbedded with the shale and siltstone. The sandstone is mostly well-sorted, sub-angular, and very fine to fine-grained. It can occasionally contain fossil material, mica, shale partings, shale pebbles and trace fossils. The sandstone varies in color from light to dark-gray on fresh surfaces, and from dark-gray to dark-brown on weathered surfaces. As much as 160 feet (49 meters) of the Cane Hill is exposed on this quadrangle.

Witts Springs Formation (Lower Pennsylvanian, Morrowan)

In 1964, Glick et al. gave this name to a sequence of rocks in

the Snowball Quadrangle equivalent to the Prairie Grove

Member of the Hale Formation and the entire Bloyd Shale (Formation) of the type Morrowan region, northwestern Arkansas. In their description of this unit they defined its upper limit as the base of the Atoka Formation which they identified as the first massive quartz pebble sandstone they encountered above the Witts Springs Formation. In 1975, the

"middle Bloyd sandstone", which is not present in the type area in northwestern Arkansas, was identified and described as belonging in the Bloyd Formation in north-central Arkansas by Zachry and Haley. It is this sandstone to which Glick referred when defining the upper limit of the Witts Springs. Therefore, in current mapping, we have defined the upper limit of the Witts Springs Formation as the base of the "middle Bloyd sandstone" and divided it from the middle and upper Bloyd. The unit is underlain by and unconformable with the

Cane Hill member of the Hale Formation. The Witts Springs

Formation is equivalent to the Prairie Grove Member of the Hale Formation and the lower part of the Bloyd Formation

(Braden, et al., 2003). Formation thickness ranges

Main body - consists primarily of very thin to massive-bedded, very fine to medium-grained, sub-angular to rounded, often calcareous sandstone units with some interbedded shale and siltstone. These sandstone units can form good ledges, but more often form steep, covered slopes perhaps due to the carbonate cementation quickly weathering out at the surface. The sandstones range from orange-brown to gray on fresh surfaces and weather gray to brown. Calcareous, fine to medium-grained, fossiliferous sandstone is present and may

contain clay shale pebble clasts and fine to coarse quartz

Basal sandstone - A massive, blocky to concave-weathering,

poorly to moderately well-sorted, sub-angular to sub-rounded,

fine to medium-grained sandstone which is sometimes

bedded. It may also outcrop as a thick stack of thin to

medium-bedded, cross-bedded channel sands. On a fresh

surface the sandstone is typically gray to gray-brown, or tan

and mottled with brown iron-oxide blebs which sometimes

form bands. The sandstone is sometimes decalcified resulting

in a dark brown color and a "rotten" appearance. It is often

fossiliferous along bedding planes, or where weathered out,

will exhibit external fossil molds. Also, it commonly contains

shale pebbles or voids where the pebbles have weathered out.

Occasionally a lenticular, cross-bedded, fine to course-grained

sandstone conglomerate is found with inclusions of rounded

milky quartz pebbles, ironstone concretions, light-gray to

light-brown shale pebbles, fossil fragments and sandstone

pebbles. This conglomerate mostly occurs just above the

lower contact, but can occur throughout the basal sandstone

unit. Long horizontal pits are visible in outcrop at some

locations that resemble classic Prairie Grove weathering.

Sometimes these intervals are found above the more blocky

massive units. The sandstone can exhibit spalling weathering

honeycomb weathering, and minor liesegang banding. The top is mostly indistinguishable from additional packages of

massive sandstone above. The basal sandstone ranges

Hale Formation (Lower Pennsylvanian, Morrowan) - The

Hale Formation consists of two members: the Prairie Grove

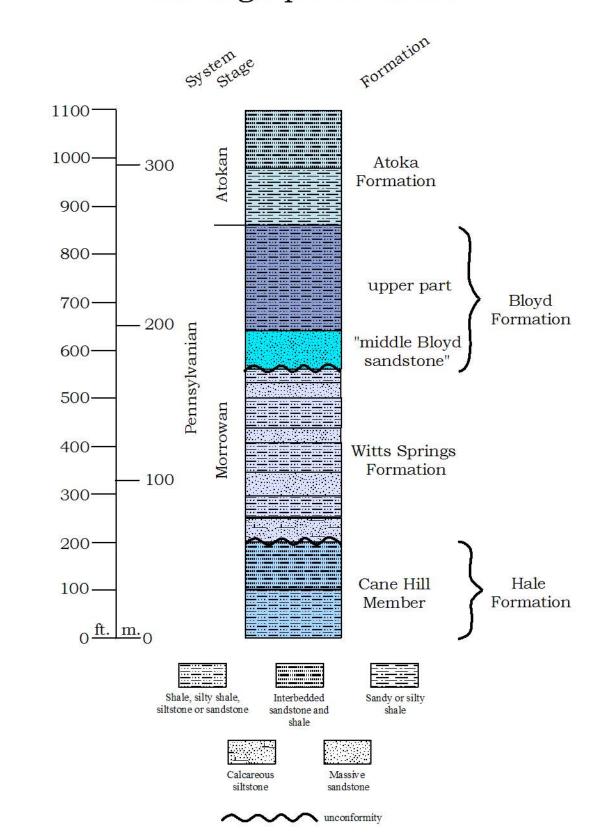
Member and the Cane Hill Member. Only the Cane Hill

approximately 60-80 feet (18-24 meters) in thickness.

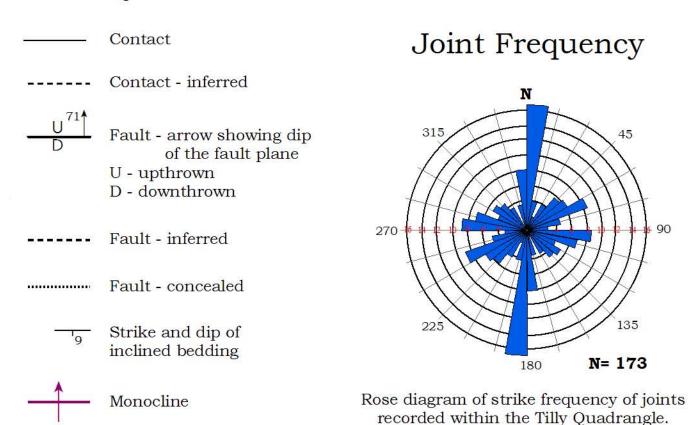
micaceous, and usually calcareous, especially where cross-

approximately 280 - 400 feet (85 - 122 meters).

Stratigraphic Column

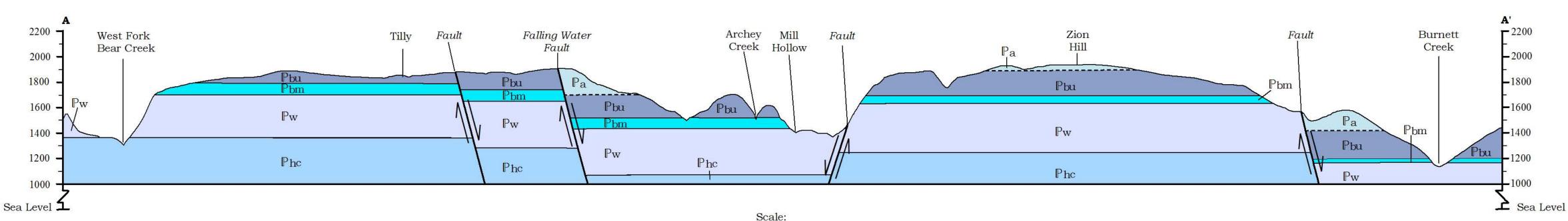


Symbols



References

- Braden, Angela K., and Ausbrooks, Scott, M., 2003, Geologic map of the Snowball Quadrangle, Searcy County, Arkansas: Arkansas Geological Commission Digital Geologic Quadrangle Map, DGM-AR-00800, 1 sheet.
- Braden, Angela K., and Smith, James M., 2005, Geologic Map of the Smyrna Quadrangle, Newton, Pope and Searcy Counties, Arkansas: Arkansas Geological Commission Digital Geologic Quadrangel Map, DGM-AR-00792, 1
- Glick, E.E., Frezon, S.E., and Gordon, M. Jr., 1964, Witts Springs Formation of Morrow age in the Snowball Quadrangle north central Arkansas: in Contributions to stratigraphy, U.S. Geological Survey Bulletin 1194-D, p.
- Haley, Boyd R., 1972, Geologic map of the Smyrna Quadrangle, 15-minute series: Arkansas Geological
- Commission Geologic Worksheet, 1 sheet. McFarland, J.D., 1998, Stratigraphic Summary of Arkansas, Arkansas Geological Commission, Information Circular 36, p. 13-15.
- Zachry, D.L., and Haley, B.R., 1975, Stratigraphic relationships between the Bloyd and Atoka Formations (Pennsylvanian) of northern Arkansas: in Contributions to the Geology of the Arkansas Ozarks, Arkansas Geological Commission Miscellaneous publication 12,



Horizontal: 1 inch= 2000 Feet

Vertical: 1 Inch= 500 Feet

grants program administered by the US Geological Survey, under Cooperative Agreement Award 06HQAG0040. Special thanks to the U.S. Forest Service and to private landowners who graciously allowed access to their property. Very special thanks to William D. Hanson, Scott M. Ausbrooks and Brandy R. Rakes for their invaluable assistance in the field, and to Angela K. Chandler for her tireless dedication to this Disclaimer: This map was prepared in a digital format using ArcGIS ArcView 9 software on computers at the Arkansas Geological Commission. The Arkansas Geological Commission does not guarantee the accuracy of this map especially when used on any other system or with any other software. As mapping continues and is refined, the data presented on this map may be updated. For the latest edition of this publication please contact our office For information on obtaining copies of this map and other Arkansas Geological Commission maps and publications call:

501-296-1877

Acknowledgments: This map was produced for The National Cooperative Geologic Mapping Program (STATEMAP), a matching-funds

