Geologic Float Guide to Big Piney Creek
Helton's Farm to Twin Bridges, Pope County, Arkansas

Angela Chandler and Richard Hutto

Bekki White
Director and State Geologist
2010

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2010

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Introduction

This geo-float guide leads you through a section of Big Piney Creek in Pope County, Arkansas and describes various points of geological interest along the way. It is designed to be used on one continuous float trip from Helton's Farm to Twin Bridges, a distance of about 13.6 river miles. The float can be broken up into two sections with Long Pool Campground being the intermediary take out or starting point for a shorter trip. The upper section is about 8.8 miles in length, and the lower about 4.8 miles. Stream gradient is about 15 feet per mile on the upper section, and 9 feet per mile on the lower.

The starting point for the long float and this guide is Helton's Farm near Treat. River access is on private property and a small fee is required. Moore Outdoors located on Long Pool Road just north of Highway 164 is the only outfitter/shuttle service along the Piney. Canoes, kayaks, rafts and other river gear are also available. Starting or taking out at Long Pool will require payment of a day use fee at the National Forest Service campground there.

To get to the access points from Little Rock, proceed west on Interstate 40 until you reach Exit 81 at Russellville. Turn north (right) on Highway 7 and travel 9 miles to the junction with Highway 164 north of Dover and turn west (left). Drive 3.4 miles, then turn north (right) on Long Pool Road, just before the Owens Cemetery. Continue on for 3.4 miles and for the short trip, veer left and proceed another 3.6 miles to Long Pool Campground. For the long trip proceed north and stay on this unimproved road a distance of approximately 7.5 miles to its junction with Treat Road just across the low water bridge over Indian Creek. About 3.5 miles from this intersection, you can pull off at an overlook called the "The Narrows". From there you can see a magnificent panorama of the Big Piney valley including the Wainscott Bottoms meander bend which you will be viewing at river level in the near future. At the junction with Treat Road, turn west (left) and drive 3 miles to another left hand turn that continues west another mile to Helton's Farm. Distance traveled is about 96 miles from Little Rock with about 27 miles of that total north of Interstate 40. A road map (Fig. 1) starting north of Dover is provided on the next page.

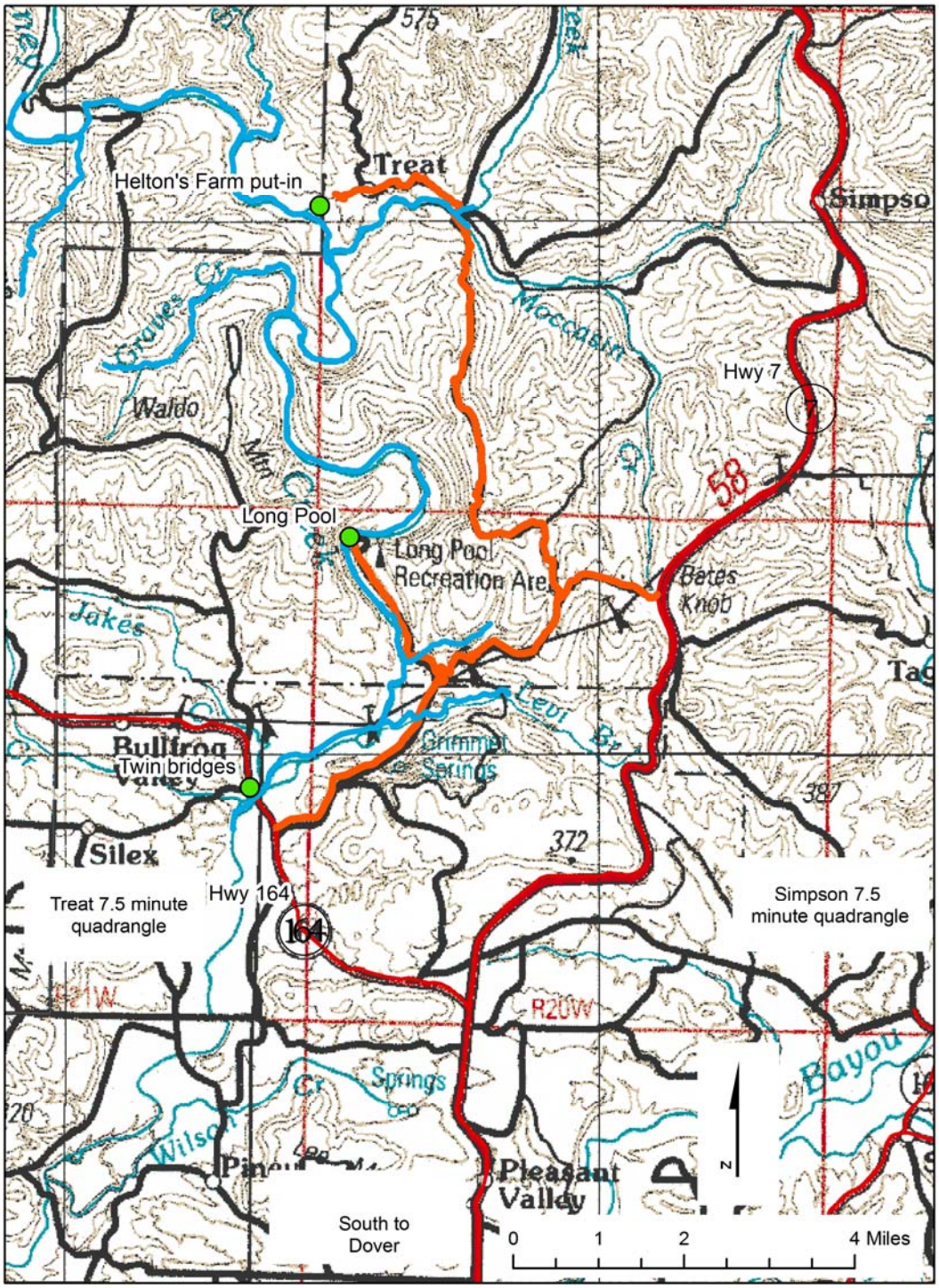


Figure 1. Location map of Big Piney Creek.

Geologic Setting

Big Piney Creek starts in Newton County near the Walnut Community. It is joined by several tributaries along the way, most notably Hurricane Creek and Indian Creek. It flows generally southward cutting deeply into the southern flank of the Boston Mountains Plateau, eventually emptying into Lake Dardanelle reservoir on the Arkansas River. The Boston Mountains Plateau is the highest plateau in the Ozark Plateaus Region with elevations reaching more than 2000 feet. Rocks exposed in this area are Mississippian to Pennsylvanian-age sandstones, shales and limestones that were deposited in fluvial and marginal marine environments. The creek channel is mostly cutting through alluvial deposits previously eroded upstream, but occasionally exposes the bedrock itself, and it is at those places that we will stop for a closer look. There are several meander bends with associated cut banks and point bars, and the channel forms a fairly regular set of pools and riffles in the straighter sections. Many of these riffles (rapids) are named, and have been included as landmarks, and to prepare floaters for the more technical stretches. There are a number of structural features along the way, the most significant of which is the Mulberry Fault (see geologic map). The rocks are offset more than 2500 feet there. North of the fault are rocks of the Bloyd Formation which are early Pennsylvanian (Morrowan) in age, while south of the fault only the middle Pennsylvanian Atoka Formation is present. Most of the bedding in the area is essentially flat-lying, however faults and other structures such as the Turnersville Syncline cause the rock layers to be inclined or dipping. The stratigraphic column (Fig. 2) indicates the geologic formations that are present along the creek. For a description of each formation refer to Appendix 1.

Figure 2. Meander bend in the Big Piney from “The Narrows”.

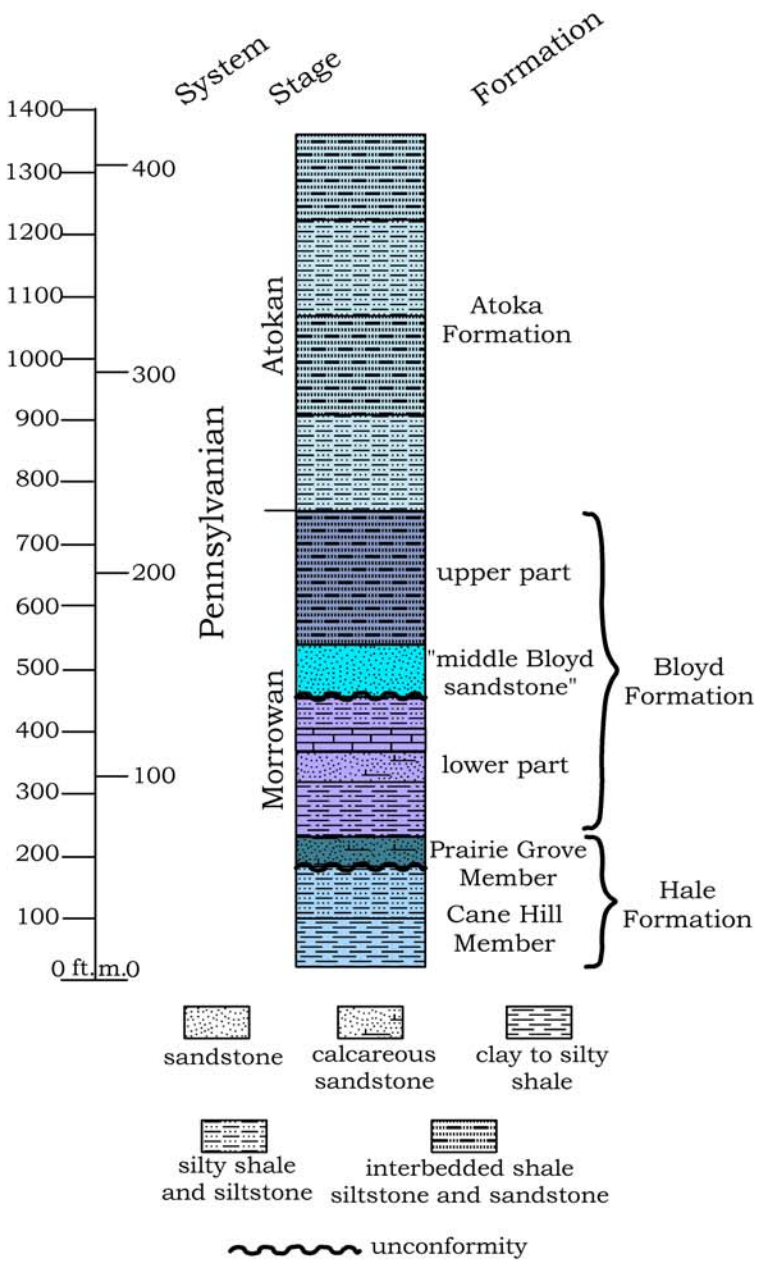


Figure 3. Stratigraphic column showing rocks present at the surface in this area. The Hale Formation is exposed upstream at Phillips Ford and north of Treat Cemetery on the north side of the Treat Fault. For a geologic map of the area around the creek see the map foldout.

River mileage is included as a reference, but landmarks will be used where possible to indicate stops since mileage while floating can be difficult to determine. Numbers appearing in parentheses from Long Pool downstream are mileages for the short float.

River Log

Mileage	Description
0.0	**Helton's Farm.** Inclined strata in the lower part of the Bloyd Formation is present from put-in to confluence with main body of creek. The thin-bedded, ripple-bedded siltstones and sandstones are dipping 15 to 22 degrees NNE probably due to a fault just north of the access point, and another fault half a mile downstream.
0.5	**Covered fault.** This is the approximate location for an east/west trending fault that cuts through Short Hollow to the west and Moccasin Creek to the east. The fault is downthrown on the south side.
1.1	**"The Ledge Rapid".** Thin- to medium-bedded, ripple-bedded sandstone in the lower part of the Bloyd Formation crops out across the creek here. The rock is dipping about 11 degrees to the north. This is opposite the normal regional dip which is approximately 2 degrees to the south. The outcrop actually starts dipping just upstream from this location where the creek parallels it. As the creek approaches this stop it turns southwest, crossing the dipping rock which forms a natural dam or "ledge" for the rapid.

Figure 4. “The Ledge Rapid” at low flow.

1.2 **Fault.** On the east bank there is massive, cross-bedded sandstone to the south faulted against dipping, shaly siltstone grading upwards to a thin to medium-bedded, ripple-bedded sandstone to the north. The fault appears to be striking about $N10^0$ W. This fault probably continues east into the headwaters of the next drainage downstream.

Figure 5. Fault (red line) downstream from “Ledge Rapid”.

2.4 **“1-2-3 Surprise Rapid”.**

3.5 **"Little Rock Beach".** An oolitic fossiliferous limestone is present in the creek bed and as large boulders creating "Little Rock Beach". The limestone contains flattened blastoids and sand stringers that when weathered create a striped appearance. Calcite veins are also present in the limestone. This limestone is probably equivalent to the Brentwood Member of the Bloyd Formation (see correlation chart in appendix).

Figure 6. Limestone at "Little Rock Beach".

3.8 **Spalling weathering in limestone.** Here the same limestone unit present at "Little Rock Beach" exhibits a spalling weathering profile and is weathering a reddish color. Notice the unconformable surface just above the limestone and possible accompanying mound development. The unit dips slightly south, coming down to water level around mile marker 4.3.

4.4 "**Roller Coaster Plus".** The name speaks for itself.

5.0 **Unconformable Limestone.** Here is an excellent outcrop of limestone showing the unconformable surfaces above and below it. Notice the large scale ripples in the rock below the limestone.

5.6 "**Surfing Rapid".** The rocks exposed along the creek here are thin- to medium-bedded calcareous siltstone and sandstone. They are cross-bedded, ripple-bedded, and contain pieces of conglomerate. They are also fossiliferous including gastropods, crinoids, corals and ammonoids. Just downstream from here one can see a bluff of lower Bloyd sandstone on the northeast side of the creek.

Figure 7. Bluffline downstream from “Surfing Rapid” showing bluff-forming sandstone in the lower part of the Bloyd Formation.

6.8 “**The Mother” or “Wrecking Rock”.** Try to stay river right and be careful!

8.3 **Limestone outcrop.** Another cross-bedded, reddish limestone is exposed at this location. It is very fossiliferous including crinoids and gastropods, and may also contain limonite and chert pebbles. This limestone section is also considered to be equivalent to the Brentwood Member. The Brentwood interval referred to as the lower part of the Bloyd is much thicker than the Brentwood equivalent in the type area of northwest Arkansas. Perhaps this is a good time to point out regional dip of the strata. We have seen this limestone unit crop out here and there along the creek for about five miles now, and will continue to see it downstream for another two miles. If the rocks were totally flat-lying we would expect to continually drop down through lower units as the stream cuts ever deeper along its course. It is interesting to note here that we are staying within the same unit as we float downstream due to a regional dip to the south. This dip is a result of our location on the southern flank of a large-scale structure centered in southeast Missouri known as the Ozark Dome. We will continue to see this unit until we get close to the Mulberry Fault which finally truncates it.

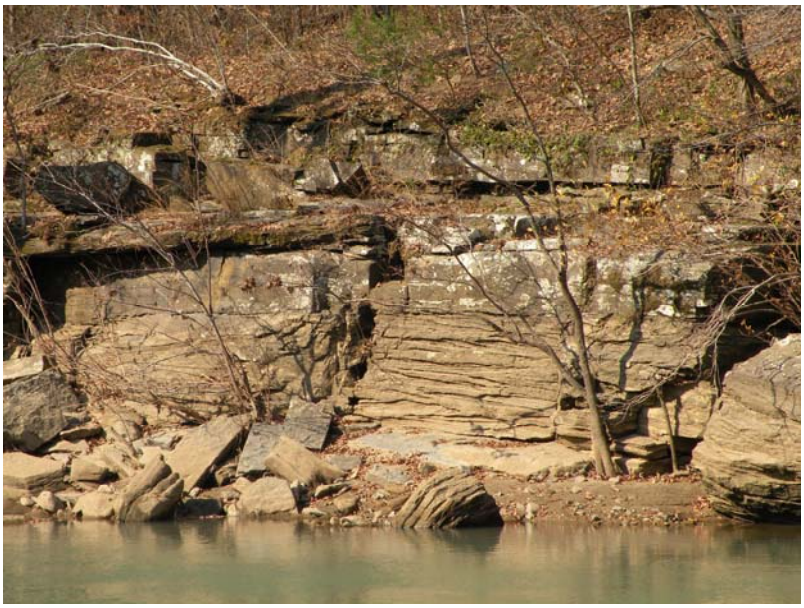


Figure 8. Limestone interbedded with sandstone above Long Pool (approx. 5 feet thick).

Optional hike to Waterfall Hollow-- see Appendix 2.

8.8 (0.0) **Long Pool Campground with "Split Decision" at lower end.** Look at the rock outcrop above the river on this section. Notice the white rock layer. This is the same limestone unit that was seen at "Little Rock Beach". Additional outcrops are present just north of "Slant Rock" where the creek is at its closest point to the road above. Some will be taking out here, and others putting in. Usually the left (east) side is the best choice at the end of the pool.

Figure 9. Just downstream from Long Pool on eastern side of "Split Decision" is an outcrop of sandy limestone probably correlative to the Brentwood Member.

10.2 (1.4) "**Slant Rock".** This is a local swimming hole that formed beside a large boulder of "middle Bloyd sandstone" that slid down the hillside to its present position.

Figure 10. "Slant Rock". View looking east.

10.3 (1.5) **Mulberry Fault System.** Just downstream we begin to see signs of the Mulberry Fault System. In the creek bed and on its west side many outcrops of inclined strata are exposed. North of the fault the rocks are dipping up to 26 degrees NNW, and south of the fault they are dipping up to 25 degrees SE. Physiographically, you will notice that south of the fault the valley widens dramatically, and that the hilltops are not nearly as high.

Figure 11. Dipping beds of rock rotated by the Mulberry Fault looking west.

Other signs of nearby faulting include deformation bands and veining in the rock, and well developed jointing. Deformation bands typically form in medium to coarse-grained sandstones due to the tremendous stresses on the rock. The stress actually causes individual sand grains to shatter along a fracture surface. This makes these linear features somewhat more resistant to weathering when exposed, allowing them to express their characteristic intersecting patterns in slight relief.

Figure 12. Deformation bands in block of “middle Bloyd sandstone”.

A great example of deformation bands can be found just up the east bank at mile 10.3. There a boulder of middle Bloyd sandstone displays classic deformation bands on its surface. In addition, the outcrops above it show

more deformation bands, and also classic boxwork structures and liesegang banding. The latter are essentially formed by iron solutioned by groundwater and deposited in various organic and geometric patterns. These outcrops are best accessed late Autumn or winter, and by disembarking at “Slant Rock” or hiking down from the road above.

Figure 13. Middle Bloyd sandstone boulder with deformation bands.

10.8 Bates Bluff. This is an extensive outcrop of thin- to medium-, ripple-bedded **(2.0)** sandstone in the Atoka Formation. It dips approximately 10-15 degrees southward. Above this section is a thick shale unit that we will begin to see as the dip brings the upper units down to creek level.

Figure 14. Bates Bluff

11.0 (2.2) **North limb of the Turnersville Syncline.** Thin- to medium-, ripple-bedded sandstone with interbedded shale in the Atoka Formation is dipping 18-23 degrees southward.

13.1 (4.3) "**Haystack Rapid".** Start of south limb of the Turnersville Syncline. Thin- to medium-, ripple-bedded sandstone in the Atoka Formation is dipping 5 degrees northeastward.

Figure 15. Haystack rapid just upstream from Twin Bridges.

13.6 (4.8) **Twin Bridges.** Take-out! Hope you enjoyed your geofloat on the Big Piney.

Acknowledgments

The work to generate the geologic map and data used in this guide was supported by the U.S. Geological Survey National Cooperative Geologic Mapping Program (STATEMAP), under assistance Award No. 05HQAG0089. STATEMAP is a matching-funds grant program between the USGS and the Arkansas Geological Survey. This section of the river is located on the Treat Quadrangle and was mapped during the 2005-6 field season. We would like to thank the various landowners for access to the river via their property. Thanks also to Bill Cains and Moore Outdoors for the names and locations of the rapids. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies or positions, either expressed or implied, of the U.S. Government.

Appendix 1 Geologic Descriptions of Formations

Atoka Formation (Middle Pennsylvanian, Atokan) - Consists of black to tan, silty, micaceous shales interbedded with very thin- to thin-bedded, ripple-bedded micaceous siltstones and thin- to medium-bedded, fine- to very fine-grained sandstones with sub-angular to sub-rounded quartz grains. The sandstones are tan to buff colored on fresh and weathered surfaces and may contain clay pebbles, liesegang bands, horizontal trace fossils and cross-beds. Locally the sandstones may contain pebble conglomerate zones with external molds of fossils. The sandstones vary from 10-20 ft. (3 - 6 m) thick. Lower Atoka is exposed north of the Mulberry Fault while Upper Atoka is present south of the fault due to a displacement of approximately 2500-3000 ft. (762-914 m) along the fault near this area (Haley, 1982). This lower contact is tentative because of its similarity to the underlying formation. Approximately 440-920 ft. (134-280 m) of the Atoka Formation is exposed in this area.

Bloyd Formation (Lower Pennsylvanian, Morrowan) - The Bloyd Formation cannot be divided into its individual members as at the type section in northwest Arkansas because its “marker beds” (the Brentwood and Kessler Limestones) are either missing or have become shaly and sandy. Therefore the Bloyd Formation is divided informally into lower and upper parts (Hudson et al., 2001) separated by the middle Bloyd sandstone (Zachry and Haley, 1975). North of Helton’s Farm the middle Bloyd sandstone cannot be recognized making the Bloyd Formation indivisible into lower and upper parts. The Bloyd Formation is undifferentiated in this area. Approximately 480-760 ft. (146-232 m) is exposed in this area.

Undifferentiated – Consists of sections of thin- to thick-bedded, ripple- to planar-bedded sandstone interbedded with very thin- to thin-bedded, ripple-bedded siltstones and clay to silty shale. The sandstones are fine- to medium-grained, gray to dark-gray or tan, may contain quartz pebbles, clay drapes and vertical trace fossils, and may be calcareous or cross-bedded. The shales and siltstones are charcoal gray to black, may weather reddish and contain siltstone concretions and *Asterosoma* trace fossils. Calcareous, fossiliferous conglomerate layers are locally present throughout the Bloyd Formation. Sandy cross-bedded limestones may be present in the lower portion of the formation. These are gray to dark gray on fresh surfaces, but weather reddish or light gray to white and may contain abundant fossils such as crinoids, brachiopods and blastoids and is locally oolitic. Approximately 320-440 ft. (98-134 m) is exposed in the northern portion of the map.

Upper part - Consists of thin- to thick-bedded, ripple-bedded, micaceous sandstones interbedded with clay to silty shales. The sandstones consist of fine to coarse-grained sub-angular to sub-rounded quartz. They are light-brown to gray on fresh surfaces, but weather dark-gray. The shales are dark-gray to black on fresh and weathered surfaces. This interval contains many trace fossils and load features. Approximately 200 - 360 ft. (60 - 110 m) is exposed in this area.

middle Bloyd sandstone - A thin- to very thick-, massive-bedded, medium to coarse-grained, cross-bedded quartz or iron-cemented sandstone with sub-angular to sub-rounded quartz grains. Reddish, gray or light-tan on fresh surfaces, but weathers brown to orange-brown due to the iron content. This unit displays tabular cross-bedded packages that can be up to three feet thick. The sandstone may contain lycopod fossils, rounded quartz pebbles, and occasionally marble-sized or smaller sandstone concretions. This sandstone forms a prominent bluff along Big Piney Creek but is more difficult to delineate in other areas. A pebble-clast conglomerate is present at some localities at the base of this sandstone. The "middle Bloyd sandstone" is unconformable with the lower part of the Bloyd Formation. Approximately 80-120 ft. (24-37 m) is exposed in this area.

Lower part - Consists of interbedded very thin to thin-bedded, ripple-bedded, micaceous siltstones and sandstones that are fine to medium-grained interbedded with black clay to silty shales. Throughout the lower portion is black fissile clay to silty shales and thin sandstones interbedded with thin to thick-bedded, fossiliferous, calcareous sandstones to sandy limestone beds. Thin-bedded pebble conglomerates are present within the interbedded shales and sandstones. The carbonate zones vary from red to gray on fresh and weathered surfaces and are locally mottled and cross-bedded. The quartz grains are medium-grained and sub-angular to sub-rounded. This unit contains abundant trace fossils and loading features. Near the base of this unit along Big Piney Creek, just south of the confluence of Graves Creek to south of Long Pool Recreation Area, is a limestone that is probably equivalent to the Brentwood Member in northwest Arkansas. This limestone is dark gray on fresh surface, but weathers buff to light gray. Sand stringers (sometimes along stylolites) throughout the limestone weather darker and in slight relief giving a striped appearance sometimes called “zebra rock”. This limestone is very fossiliferous and locally may contain oolites and possible blastoids (crushed). This unit ranges from 8-20 ft. (2-4 m) thick and has an unconformable upper and lower boundary which locally may contain mound-like structures. The contact between the lower part of the Bloyd Formation and the Prairie Grove is placed below a shaly layer which is conformable with an underlying massive calcareous sand just north of this area. Approximately 200-280 ft. (60-85 m) is exposed in this area.

Appendix 2 Waterfall Hollow Hike

Waterfall Hollow is easily accessed by a trail that starts at the eastern end of Long Pool Campground. Starting there, follow the trail toward the creek. As you walk along the creek you’ll notice a side trail on the left that goes down to creek level. That trail will take you to a small bluff consisting of sandy limestone interbedded with sandstone in the lower part of the Bloyd Formation.

Figure 1. Sandy limestone in the lower part of the Bloyd Formation near creek level.

Return to the main trail and follow it to the mouth of Waterfall Hollow. As you start up the hollow, notice the fine detail in the cross-beds weathering out of the sandy limestone in the lower part of the Bloyd Formation. Water pouring over this waterfall has differentially solutioned the carbonate-rich beds in the outcrop, leaving the sandier beds in relief.

Figure 2. Cross-bedding in sandy limestone of lower part of the Bloyd Formation.

Continue up the drainage toward the larger waterfall. Look around at the boulders in the streambed and the outcrops on the hillside. There is a fairly thick section of black shale in the lower part of the Bloyd Formation forming a large reentrant below the upper waterfall.

Figure 3. Predominantly shale outcrop from lower waterfall to upper waterfall.

Thin-bedded siltstone interbedded with shale crops out near the base of the waterfall and the section becomes more thick-bedded and coarse-grained at the top. Above that is a sandstone ledge that is a small bluff-former in the lower part of the Bloyd Formation.

Figure 4. Thin to thick bedded sandstone in the lower part of the Bloyd Formation.

Trace fossils called *Asterosoma* are present in the interbedded siltstone/shale section. These impressions were made by an unknown Pennsylvanian-aged animal as it fanned out in a radial feeding pattern which left a star-shaped trace in the mud which was later filled by silty sediments. All these layers became buried then lithified over time. Here they have resurfaced allowing the shales to weather away and leaving behind a cast of the original impression.

Figure 5. *Asterosoma* trace fossils, approximately 2-3 inches in width.

Continue to the right along the floor of the bluff shelter and you will find a trail leading steeply upward and then leveling out toward the upper waterfall. Thin-bedded sandstone in the lower part of the Bloyd Formation is exposed from the top of the waterfall on up the drainage. Cross this stream, and continue up the ridge to an outcrop of limestone. This limestone is very fossiliferous and contains crinoids, coral, bryozoa and oolites. It is the last limestone in the lower part of the Bloyd Formation.

Figure 6. Highest fossiliferous limestone outcrop in the lower Bloyd.

Continue up the slope to the base of the middle Bloyd sandstone. This sandstone contains the large tabular cross-bed sets and quartz granules

characteristic of this unit. The contact with the lower part is exposed further down the bluff line.

Figure 7. Bluff of middle Bloyd sandstone above Waterfall Hollow.

Figure 8. Contact between middle Bloyd sandstone and shale in the lower part of Bloyd Formation.

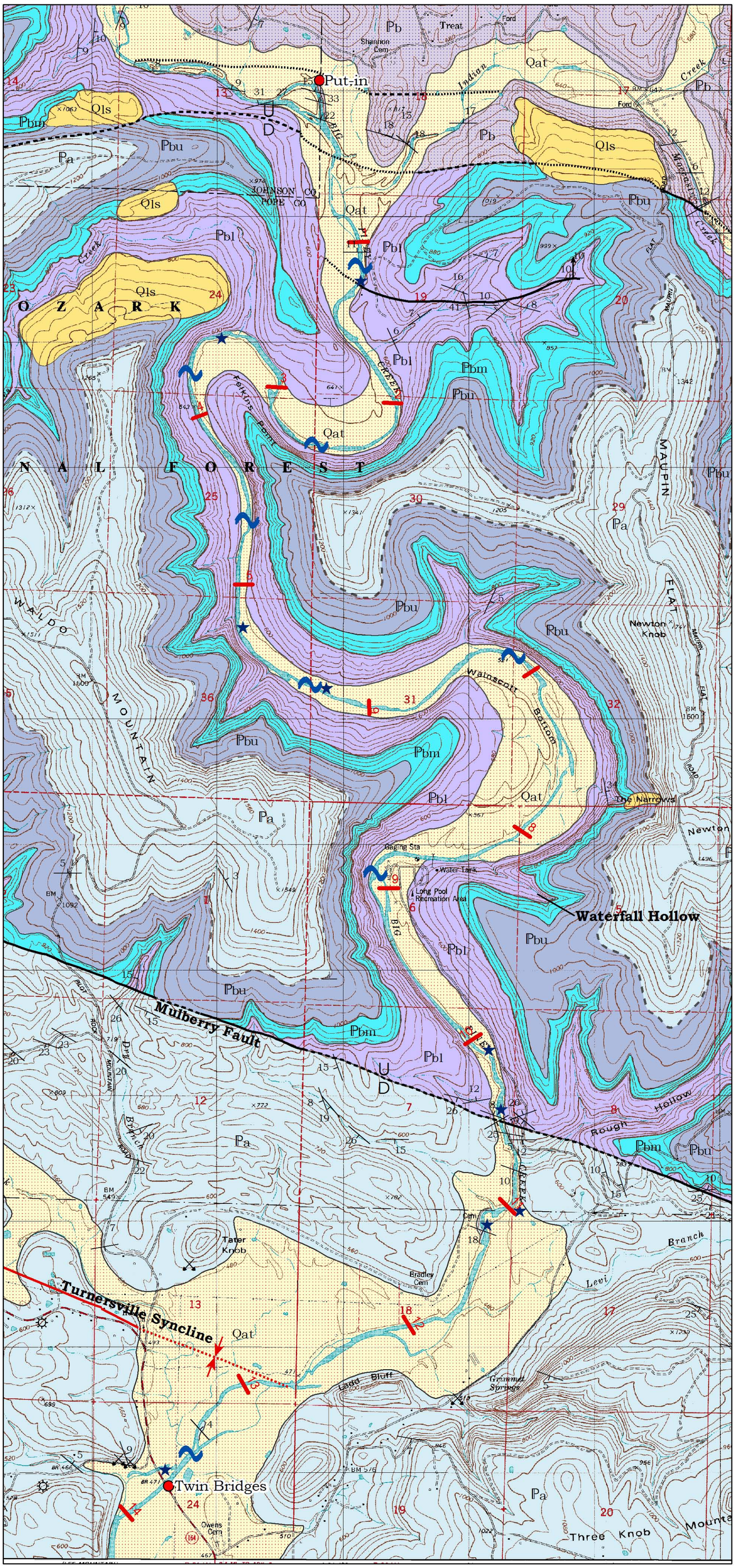
The Waterfall Hollow side hike ends here at the base of the middle Bloyd sandstone. If you wish to continue you can hike up to the top of the bluff where there is a great view of the Big Piney valley, or just retrace your steps back to the campground.

Bekki White
Director and State Geologist

Guidebook 2010-1
Map 1

Geology of Big Piney Creek and Surrounding Area

Angela Chandler, Richard Hutto and Walter Mayfield
Arkansas Geological Survey
2010



Description of Map Units

Qls **Landslide deposits (Quaternary)** - Mostly blocks of sandstone and covered shale slumps derived from the Bloyd Formation.

Qat **Alluvium and terrace deposits (Quaternary)** - Unconsolidated clay, silt, sand and gravel including deposits on one or more terrace levels of local streams.

Pa **Atoka Formation (Middle Pennsylvanian, Atokan)** - Consists of black to tan silty micaceous shales interbedded with very thin to thin ripple-bedded micaceous siltstones and thin to medium bedded, fine to very fine-grained sandstones with sub-angular to sub-rounded quartz grains. The sandstones are tan to buff colored on fresh and weathered surfaces and may contain clay pebbles, liesegang bands, horizontal trace fossils, and cross-beds. Occasionally the sandstones contain pebble conglomerate zones with external molds of fossils. The sandstones vary from 10 - 20 ft. (3 - 6 m) thick. Lower Atoka is exposed north of the Mulberry Fault while Upper Atoka is present south of the fault due to a displacement of approximately 2500-3000 feet (762-914 m) along the fault near this area (Haley, 1982). This contact is tentative and will be resolved with future mapping. Approximately 440-920 ft. (134-280 m) thick.

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Pbu **Upper part** - Consists of thin to thick ripple-bedded micaceous sandstones interbedded with clay to silty shales. The sandstones consist of fine to coarse-grained sub-angular to sub-rounded quartz. They are light-brown to gray on fresh surface but weather dark-gray. The shales are dark-gray to black on fresh and weathered surfaces. This interval contains many trace fossils and load features. Approximately 200 - 360 ft. (60 - 110 m) thick.

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Pbl **Lower part** - Consists of interbedded very thin to thin ripple-bedded micaceous siltstones and sandstones that are fine to medium-grained interbedded with black clay to silty shales. Throughout the lower portion is black fissile clay to silty shales and thin sandstones interbedded with thin to thick-bedded fossiliferous calcareous sandstones to sandy limestone beds. Thin-bedded pebble conglomerates are present within the interbedded shales and sandstones. The carbonate zones vary from red to gray on fresh and weathered surfaces and can be mottled and cross-bedded. The quartz grains are medium-grained and sub-angular to sub-rounded. This unit contains abundant trace fossils and loading features. Near the base of this unit along Big Piney Creek just south of the confluence of Graves Creek to south of Long Pool Recreation Area is a limestone that is probably equivalent to the Brentwood Member in northwest Arkansas. This limestone is dark gray on fresh surface but weathers buff to light gray. Sand stringers (sometimes along stylolites) throughout the limestone weather dark in relief giving the appearance of "striped or zebra rock". This limestone is very fossiliferous and sometimes contains oolites and possible blastoids (crushed). This unit ranges from 8-20 ft. (2-4 m) thick and has an unconformable upper and lower boundary sometimes containing mound-like structures. The contact between the lower part of the Bloyd Formation and the Prairie Grove is placed below a shaly layer conformable with the underlying massive calcareous sand of the Prairie Grove Member of the Hale Formation. Approximately 200-280 ft. (60-85 m) thick.

Symbols

- Milemarker
- Contact
- Contact - inferred
- Fault - arrow showing dip of the fault plane (U - upthrown, D - downthrown)
- Fault - inferred
- Fault - concealed
- Strike and dip of inclined bedding
- Syncline (dotted where concealed)
- Gas well
- Shale pit
- Prospect pit
- Points of Interest
- Rapids

N

1 Miles