Ponca Low Water Bridge to Kyle's Landing

Geo-float Guide to the Buffalo National River

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INTRODUCTION:

The starting point for this geo-float guide is the old Ponca low-water bridge just upstream from the Arkansas Highway 74 bridge across the Buffalo National River in northwest Newton County, Arkansas. As logged, this trip is about 10.5 miles long and ends at Kyle's Landing (see the Ponca Area Geologic Map). For a shorter trip (about 8 miles) you can put-in at the Steel Creek River Access. Canoes can be rented from any of several outfitters in Ponca or in nearby Jasper and Pruitt.

Water levels for safe canoeing can be obtained from the Buffalo National River Headquarters in Harrison, AR by calling 870-741-5443, the Corps of Engineers District Office in Little Rock, AR at 501-324-5150, any of the canoe outfitters near the river, or by logging on the Buffalo National River Hydrologic Data System (*http://165.83.166.250/*) via the Internet. The water level is usually sufficient for floating this portion of the river in the winter and spring.

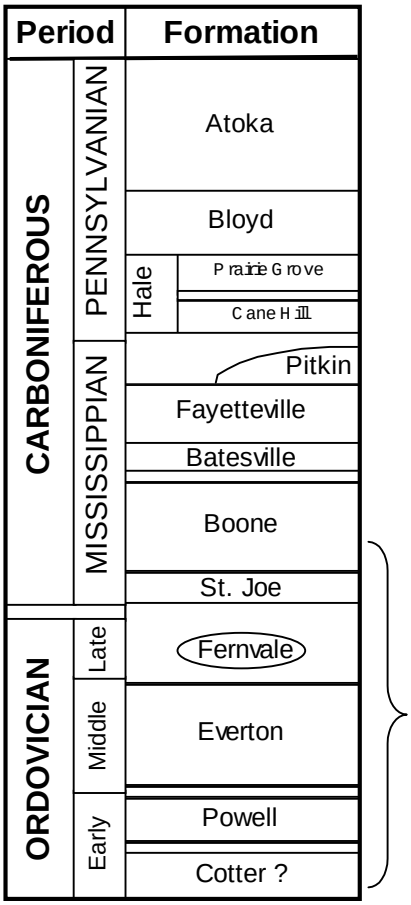
The stretch of the Buffalo River between Ponca and Kyles Landing is rated class I-II white water, with fairly frequent, generally unobstructed rapids. The river drops about 12 feet per mile along this route. Tricky turns, large boulders, and common shoals challenge the canoeist throughout. It is best to plan on mishap and bring along a set of dry clothes to change into after a trip. Personal observations indicate a high percentage of floaters tump over into the cool water. You should also plan on being off-river during part of your float trip and bring along suitable footwear. Some of the sites mentioned in this document require short hikes over rough terrain.

GENERAL GEOLOGY:

The rocks that are found along this stretch of the river are sedimentary rocks that were deposited in marginal and shallow marine environments. Two geologic Periods are represented by the rocks normally seen along this portion of the river: the Ordovician Period (505 to 438 million years ago) and the Mississippian Period (360 to 320 million years ago). The time gap between these two geologic Periods is represented by coalition of ancient erosional surfaces forming a major unconformity in the strata sequence. Evidence suggests that sediments did accumulate in this region during the Silurian and Devonian Periods (438 to 408 million years ago and 408 to 360 million years ago, respectively) but were removed by several intervals of uplift and erosion prior to Mississippian time. Likewise, the Ordovician and Mississippian rock sequences have

unconformities within them delineating other intervals of uplift and erosion during those times. Younger rocks from the upper Mississippian and Pennsylvanian Periods are found higher up the mountains, but are normally not seen from the river. On occasion, however, rocks from these younger units are found associated with the gravels in the river bed.

Geologists divide sequences of rock layers into natural categories of similar type and depositional environment for better understanding and communication. These units are called formations. The stratigraphic column below indicates the formations exposed at the surface in this area.



Exposed Stratigraphic Units in the Ponca Wilderness Area. The stippled areas indicate erosional unconformities. When the formation does not extend all the way across the chart it indicates that the formation has been removed in some parts of the region by erosion prior to the deposition of the overlying units.

Stratigraphic units seen in the bluffs along the Ponca to Kyles Landing portion of the river.

RIVER LOG

(The following River Log is based on the distance downstream from the Ponca low-water bridge.)

Mileage Description

0.0 Ponca low-water bridge. The river bed and bluffs are middle Ordovician age Everton Formation for the next 2.3 miles. The Everton Formation is 300 to 370 feet thick in this area. It is composed of various mixtures of dolostone, sandstone,

and limestone, although traces of conglomerate, shale, and chert may be observed locally. The dolostones are more or less limy and the limestones are more or less dolomitic and sand is a common constituent of both rock types. The sandstones tend to be made up of clear (to white), well-rounded, frosted, coarse- to fine-sized sand grains with limy and dolomitic cements. The strata bedding ranges from thin to massive.

0.4 The bluff along here has several small waterfalls and paleokarst (ancient karst) features. When the trees are leafed-out the features are generally well hidden. Karst is a term used to refer to a type of terrain formed were solutioning of the rock is the dominant process of landscape development. This occurs in areas directly underlain by relatively thin bedded, highly jointed, limestones (and less importantly by dolostones, chalk, gypsum, calcite cemented sandstones, etc.) with at least moderate rainfall and nearby entrenched valleys to drain off the water. Caves and sinkholes are among the principle characteristics of karst areas. Paleokarst features have been found developed in the Everton but not in the Mississippian age strata of this region. Modern karst features are relatively common in the area but are usually restricted to the Mississippian limestones. (Only 3.5% of known modern caves in the region are developed in the Everton.)

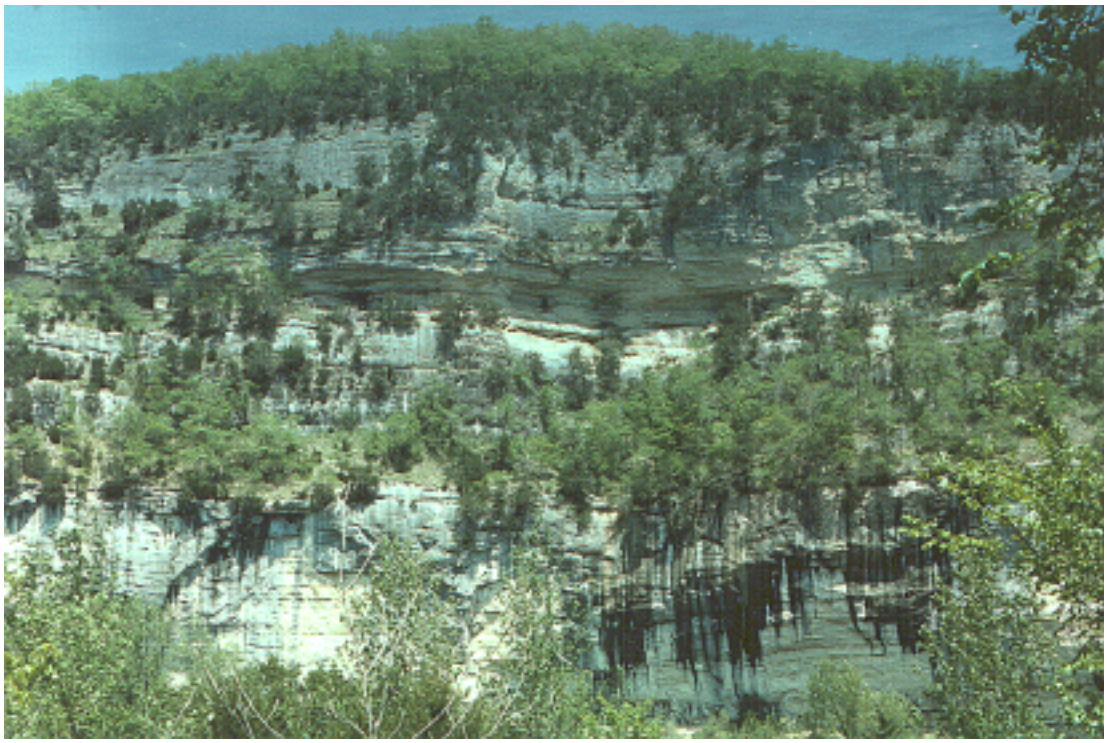
An Everton Formation bluff upstream from Wrecking Rock

1.5 Wrecking Rock! When the current and gravels are in the right configuration this group of boulders from the Everton Formation can cause the unwary canoeist to take an unscheduled swim. A close examination of these rocks shows them to be a jumble of sandstone boulders and cobbles held together with a similar quartz sandstone matrix. Two ideas seem indicated: 1) it may be that these sediments had become partially lithified as beach rock and then became disrupted by a storm or other aggressive process; or 2) we are seeing the left-overs of a paleokarst feature. A number of other small local areas of similar brecciation can be found throughout this region. The Steel Creek campground is adjacent to this site.

Everton Formation Bluffs at Steel Creek. The canoe launch is at the bottom of the picture. The camp ground is out of the picture to the top left.

2.3 Steel Creek put-in. This also marks the approximate location where the river is reported to cut down to the lower Ordovician age Powell Formation dolostones. The Powell is fine-grained, light gray to greenish gray, clayey dolostone. Traces of chert, shale, and sandstone have been reported in some areas. The Powell seems to be about 50 to 60 feet thick in this area, but is rarely fully exposed. River gravels and stream side vegetation cover most outcrops. The bluffs just down stream from the put-in are mostly eroded from strata of the Everton Formation with a little Mississippian age St. Joe and Boone Formation exposed at the top of the bluff high above the river.

4.1 Big Bluff may be seen at the end of this long pool. Big Bluff is over 500 feet tall and is reported to be the highest bluff on the Buffalo. Powell strata make up the base of the bluff, but are generally covered by talus and trees. As you approach the bluff, the massive Newton Sandstone Member of the Everton Formation forms the lower bluff seen just above the lowest tree tops. The vegetation break across middle of the bluff marks the approximate top of the Newton. The reentrant observed in the upper half of Big Bluff is formed in the lower Mississippian age St. Joe Limestone. Red limestones and shales in the St. Joe are visible on the bluff from this approach. The base of the reentrant marks the Goat Trail, a path leading across the bluff-face down to the river.



Big Bluff from the river. The Goat Trail can be seen as the reentrant above the vegetation break across the middle of the bluff.

5.0 Big Bluff. Canoes can be beached in a small slough just beyond the exit shoal of the pool at the base of Big Bluff. A path leads along the riverbank to the end of the bluff and then up the ridge to the Goat Trail across the face of the bluff. The trail is often faint and not well defined through the woods and up the lower slope until you reach the approximate top of the Newton Sandstone Member. From there to the Goat Trail the trail is more obvious. This trail is steep and slippery and often near the edge of the bluff. If you have any difficulty with heights or rugged terrain do not attempt this climb. Plan on about an hour or so to explore the bluff.

The riverside rocks are part of the Powell Formation (lower Ordovician) -- dolostones that here are generally covered by plants and rock debris. Along the base of the exposed bluff ground water has created small solution cavities and shelters in the basal Everton by removing soluble cements that hold the sand grains of the sandstones together. As you struggle on up the lower slopes you will notice that the soil is quite sandy. This clue gives you strong indications of the nature of the underlying rock. Keep an eye on the soils for changes in composition and compare the transition horizons with the strata of the bluff. The sandy soils will only be found on the lower slopes where we find the Ordovician sandstones; higher up the soil will become cherty reflecting the nature of the lower Mississippian rocks. About half way up the slope and near the edge of the bluff an exposure of the Newton Sandstone Member of the Everton Formation forms a small platform with an excellent view of the Bluff and river valley.

Big Bluff from the level of the top of the Newton Sandstone Member of the Everton Formation. The reentrant in the upper part of the bluff marks the base of the Mississippian age rocks.

The Goat Trail goes across the face of Big Bluff in a reentrant developed in the basal St. Joe Limestone (lower Mississippian). The floor of the track is frequently on a 4- to 6- foot thick bed of sandstone thought to be basal Mississippian age. About midway across the bluff a solutional letdown structure in the top of the Ordovician strata preserves a lens of limestones of the late Ordovician age Fernvale Formation beneath the basal Mississippian sandstone. Elsewhere along the Trail the basal Mississippian sandstone bed rests directly on sandstones belonging to the Everton Formation or a thin conglomerate. The St Joe is made up of thin to medium beds of limestone with some thin shale units in the lower 20 feet. It is because of these interbeds of thin shales that this portion of the St Joe weathers faster than the higher-up section and produces a reentrant. Close examination of the limestones will reveal small fossil fragments scattered through a finer matrix. The fossils fragments are mostly from crinoids and bryozoa. At the very base of the St Joe, just above the basal Mississippian sandstone, a shaly limestone interval contains rounded, black phosphate nodules. One of the distinguishing characteristics of the St Joe in this region is the brick-red coloration of some of the strata. The red color is due to trace amounts of iron oxide in the rock.

The contact of the Ordovician and Mississippian age rocks on Big Bluff. The lower strata of this image are mostly Everton sandstones. A lens of Fernvale Formation limestones can be seen just below the basal Mississippian sandstone (the prominent ledge in the top third of the image).

The top of the St Joe is about 50 to 60 feet above the basal Mississippian sandstone and is accessible off the north end of the bluff where the trail leads to an abandoned dirt road. Beds of cherty limestone belonging to the Boone Formation (Mississippian) cap the bluff. The Goat Trail across Big Bluff is

estimated to be about 350 feet above the river and offers a splendid view of the Buffalo National River.

5.8 Jackies Big Hollow on the right. This small, steep hollow sports two nice pour-offs over Everton bluffs in wet weather.

6.5 Jim Bluff. The river meets Jim Bluff nearly head on. The lower, stream-side portion of the bluff is a sandstone of uncertain age; possibly upper Ordovician, maybe basal Mississippian, but likely a measure of each. The upper and greater portion of the bluff is composed of limestones and some thin shales of the St. Joe Limestone. Because the interlayered limestones and shales erode easier than the sandstones or the shale-free limestones, a deep notch has formed in the bluff. The base of the notch in the bluff marks the base of the St Joe Limestone. The red limestones and thin shales of the St. Joe can be witnessed here about 5 or 6 feet above the pale, blue-green, shaly limestones at its base.

Jim Bluff. All but the lower part of the bluff is Mississippian age limestone (with a trace of shale) of the St Joe Formation.

Consider what has happened here. You can't help but notice that the entire bluff is tilted generally downstream. When you are standing on Jim Bluff you are standing on a 1/3 mile wide, east-west trending block of the Earth's upper crust that has dropped down some 300 feet relative to either side. This type of feature

is called a graben and this particular graben is called the Jim Bluff Graben. Faults define the sides of grabens. As you face upriver from Jim Bluff, the fault marking the south side of the graben block passes a short distance in front of you (remember, you are on the fault block). By carefully walking (and/or crawling) to your right (west) toward the corner formed by the bluff with the hillside to the west, you will reach a point where the bluff is interrupted by the fault (and a drainage) as the fault passes through the mountain. This point is easily identified by the lack of limestones on the south (west) side of the fault. (The limestones are there, it's just that you are on a block that has been displaced about 300 feet.) In the winter or early spring when the leaves are off the trees you can usually determine where the fault cuts the ridge to the east of Jim Bluff. To gain a little perspective, remember that Big Bluff is just over the hill to the west. Where you are standing right now, a few feet above the river, is the same geologic horizon as the Goat Trail on Big Bluff some 350± feet above the river.

6.75 The river bed is carved into the St Joe Limestone until about mile 6.9

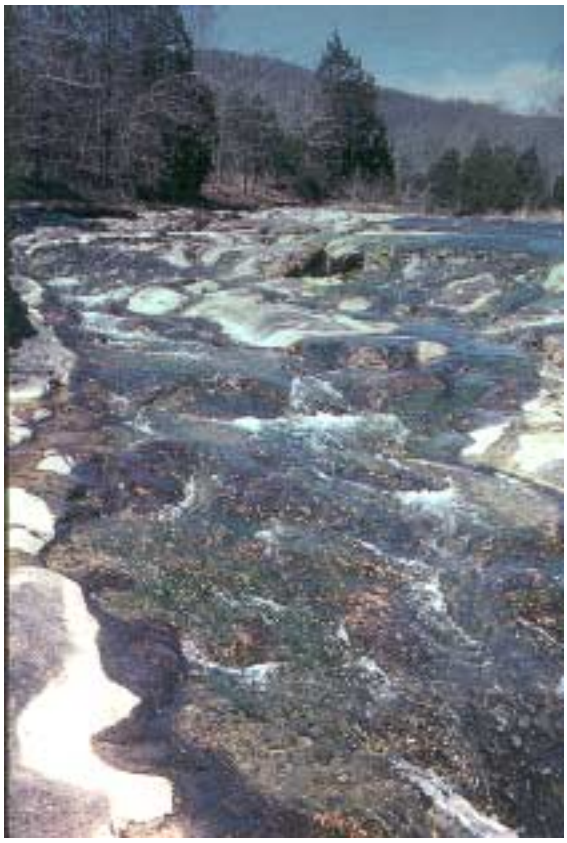
6.9 Crossing the normal fault (downthrown to the south) that marks the north boundary of the Jim Bluff Graben. The river bed is in Everton to Mile 8.5.

7.0 Sneeds Creek enters from left (west). A trail head starts here for routes into Sneeds Creek and Hemmed-In Hollow.

A half mile hike up Sneeds Creek brings you to a long, wide, and relatively flat exposure of sandstone locally called Rocky Bottoms. The valley flooring sandstone at Rocky Bottoms lies just below the St Joe and is either Basal Mississippian or Everton (or both). The hike in takes you past an old roadbed that leads to a long abandoned house site. This road crosses Sneeds Creek on the edge of a sandstone slab. The bed of sandstone is inclined to the west-southwest (upstream) and cut off just downstream of the road crossing where it forms a low ledge. This drop-off marks the approximate surface trace the fault bounding the north edge of the Jim Bluff Graben. (The fault that marks the south side of the graben is found at Jim Bluff.)

This same fault trace can be seen again about 200 yards upstream on the north side of Rocky Bottoms where a small tongue of the exposed slab extends northward. A small drainage comes in here, over a rounded sandstone bank. There is a slight trench between the bank and the valley floor slab. This trench is the trace of the fault. The trench is formed because the rock along the fault has been fractured and displaced allowing faster erosion. You can also see how the rock layers have been bent by the drag induced by the movement of the fault. (if you are standing on the slab you are on the side that has dropped down relative to

the north bank.) Looking up the main stream (west), notice that the rest of the slab is not flat, it is tilted toward you. This incline is not due to frictional drag related to a fault, but rather the overall geometry of the Jim Bluff Graben. On a geologic map of the area you can see that the graben dies out to the east and west of this site. The graben block is hinged on each end and sunk down over 300 feet in the middle. The slope you observe on the slab to the west is the result.



Sneeds Creek at Rocky Bottoms. The stream is flowing on sandstone that lies just below the St Joe Formation limestones.

The sandstone exposure displays fractures known as joints. These joints tend to be fairly straight and trend in just a few specific directions. Joints are not considered faults as no displacement has occurred along them. However, like faults they do tend to be conduits for water and exhibit greater erosion than the surrounding rock. Joints in the rock often control the initial development of stream flow, mineralization, caves, and even valleys. At the upper end of Rocky Bottoms the stream has cut a channel into the sandstone. The joints there have guided this process to a minor degree. The process of joint development is not well understood. Geologists have observed that they are often an early development, frequently found in the firm sediment of modern deposits prior to lithification (turning to stone).

7.4 Entrance and trail head to Hemmed-In Hollow on left. A few yards upstream on the Buffalo from the mouth of Hemmed-In Hollow a small collapse structure or sinkhole is developed in the river bed outcrops (Everton Formation).

The top of a sinkhole feature in the Everton Formation strata just upstream from the entrance to Hemmed-In Hollow.

The hike to Hemmed-In Hollow Falls is a little over a half mile and will take about an hour or so (round trip). A normal fault (downthrown to the south) is crossed right at the entrance to the Hollow. Outcrops of Powell Formation dolostones occur along the streams that the trail crosses and follows within the Hollow. As you approach the upper end of the gorge chert beds are exposed in the main stream bed. These cherts are similar to cherts commonly found in a sequence of rock below the Powell interval, but in this case geologists have assigned them to the Powell. Stromatolite laminations can be seen in the rock ledges near the base of the falls. Stromatolites are structures created by various algae (principally cyanobacteria) living in association with anaerobic bacteria. These algae and bacteria produced a sticky organic mat that trapped sediment creating the laminations we now see.

Hemmed-In Hollow Falls. The contact between the Powell and Everton Formations is indicated by an arrow. Stromatolite fossils can be found in the rocks surrounding the base of the falls.

Several small waterfalls are found near the head of the Hollow. The main waterfall is quite tall but normally fairly slight, with only a small flow or, for much of the year, a drip. If you happen to be on the river the day after a good rain or just after a cloud burst, the fall becomes truly impressive. The wind tends to blow the fall around frequently delivering unexpected showers to visitors who venture too close to the base of the falls. The waterfall at the head of the Hollow is reported to be about 200 feet high and is thought to be the highest waterfall between the Cumberland Plateau in eastern Tennessee and the Rocky Mountains. The basal 50 to 60 feet of this cliff face is part of the Powell Formation. Everton strata makes up the rest of the bluff. The waterfall brinks in the Newton Sandstone Member of the Everton Formation.

The trail that comes from Sneed's Creek has a spur that leads to the top of the cliff enclosing the Hollow. A trail follows the rim of the hollow and offers some tremendous views of the countryside. This trail is narrow and very close to the edge of the bluffs, so great care should be taken if you plan to hike there.

7.9 Paleo Sinkhole. A sinkhole complex is developed in the low Everton bluff on the west bank (right side facing downstream) at the lower end of this small pool. Based on other solution features in the region and the nature of the sinkhole filling, this complex is interpreted as being formed before the Mississippian age St Joe sediments (limestones) were laid down. The core of the sinkhole is filled with a rock that is quite similar to the surrounding rocks, but nevertheless distinctive from them, strongly suggesting that the sink was developed while the Everton was the eroding surface (during the latter part of the Ordovician?). If you keep a sharp eye along the bluffs and rock outcrops through this entire stretch of the river, you will see several narrow zones where the bedding has been briefly interrupted by small paleo sinkholes. These other features exhibit many similarities to this large paleo sinkhole -- they tend to display a definite demarcation and a disharmonious fabric relative to the enclosing rock, and show little or disrupted bedding. The bedding of the adjacent bedrock sometimes displays a sag or downward flexure marginal to the ancient sink. Some of the paleo sinkholes exhibit a jumble of bedded blocks within the sink that apparently fell from the sides and ceiling of the sinkhole when it was being formed and was open space.

Paleo Sinkhole in the Everton Formation near mile 7.9.

Some of the paleokarst features observed along this reach of the river may represent just a very local and slight shifting of the sediments, just enough to obscure the strata's bedding and change the apparent fabric of the sediments. In most cases the lithology of the sinkhole filling is the same or quite similar to the surrounding sediments. Descending ground water may have just removed or weakened the original sediment cements to the point of internal collapse without developing a true vertical cave.

8.1 Fault. A small normal fault can be seen on the right bank as you enter this pool. The fault may be associated with the Jim Bluff Graben that passes just south of this location. The fault seems to die out as you explore up the hill and no significant offset is observed, except right at the fault trace, suggesting its association with a local paleokarst process. At the downstream end of this bluff you will see another paleokarst feature.

8.5 River bed in Powell Formation to Mile 8.8

8.8 Fault. The river crosses a normal fault (downthrown to the south) and back into the Jim Bluff Graben. St Joe Limestone in the river bed to Mile 8.9

8.9 River bed in Everton to Mile 9.75

9.1 Fault. This fault is the south edge of the Jim Bluff Graben. It is downthrown to the north. You will leave the graben for a brief reach, but cross it one more time.

9.6 Indian Creek Shoals and Gray Rock are just ahead! The fault that is the south boundary of Jim Bluff Graben passes through here and can be observed on the southeast side of the river in the bluff at the head of the shoal. Typical of many faults the displacement has produced several secondary faults. Some of these can be seen in this outcrop as well. Drag on the fault has apparently bent the strata in this bluff.

Indian Creek enters from the right (east). Indian Creek is one of the finest karst valleys in the entire area. It has cut a deep and narrow canyon into Sherman Mountain here and is well worth the hike (and climb) to the upper reaches. Several cascades and waterfalls, a few small caves (the Arkansas Cave at Jason's Leap is closed much of the year to protect endangered bat species), bluffs, sinkholes, springs, and the fascinating Needle's Eye natural bridge are among its geomorphic points of interest. This is not an easy hike so if you plan to explore

this valley allow plenty of time (4 to 8 hours) and take great care. The best approach is from Kile's Landing campground.

Arkansas Cave in Indian Creek valley. The contact between the Everton and the St. Joe Formations is about two feet below the top of the cave's entrance.

9.75 Gray Rock! This limestone rock and the shoal just above it has caused more people to get tumped out of their canoes than just about any other single place on this portion of the river. So well known was this site that it was not unusual for people to be lined up on the banks and standing atop the Rock cheering the paddlers and the spills. However, streams are dynamic systems that do not stay in the same place or maintain the same features year after year. During the 1990s the gravels at the lower end of Indian Creek Shoal migrated and adjusted the principle current away from Gray Rock. The rock is no longer the hazard it once was, but the shoal is still somewhat of a challenge.

Grey Rock juts out into the river from the left at the bottom of the shoal. Just downstream from the Rock you will pass out of the north side of the Jim Bluff

Graben. The river bed is in the Powell to the end of the float, but the Bluffs are cut from the overlying Everton Formation rocks.

Gray Rock (looking downstream). Gray Rock is within the Jim Bluff Graben. The fault marking the north side of the graben is crossed a short distance downstream from Gray Rock. The bluff in the distance is carved from Everton Formation rocks.

10.6 Kyle's Landing and end of this geo-float.