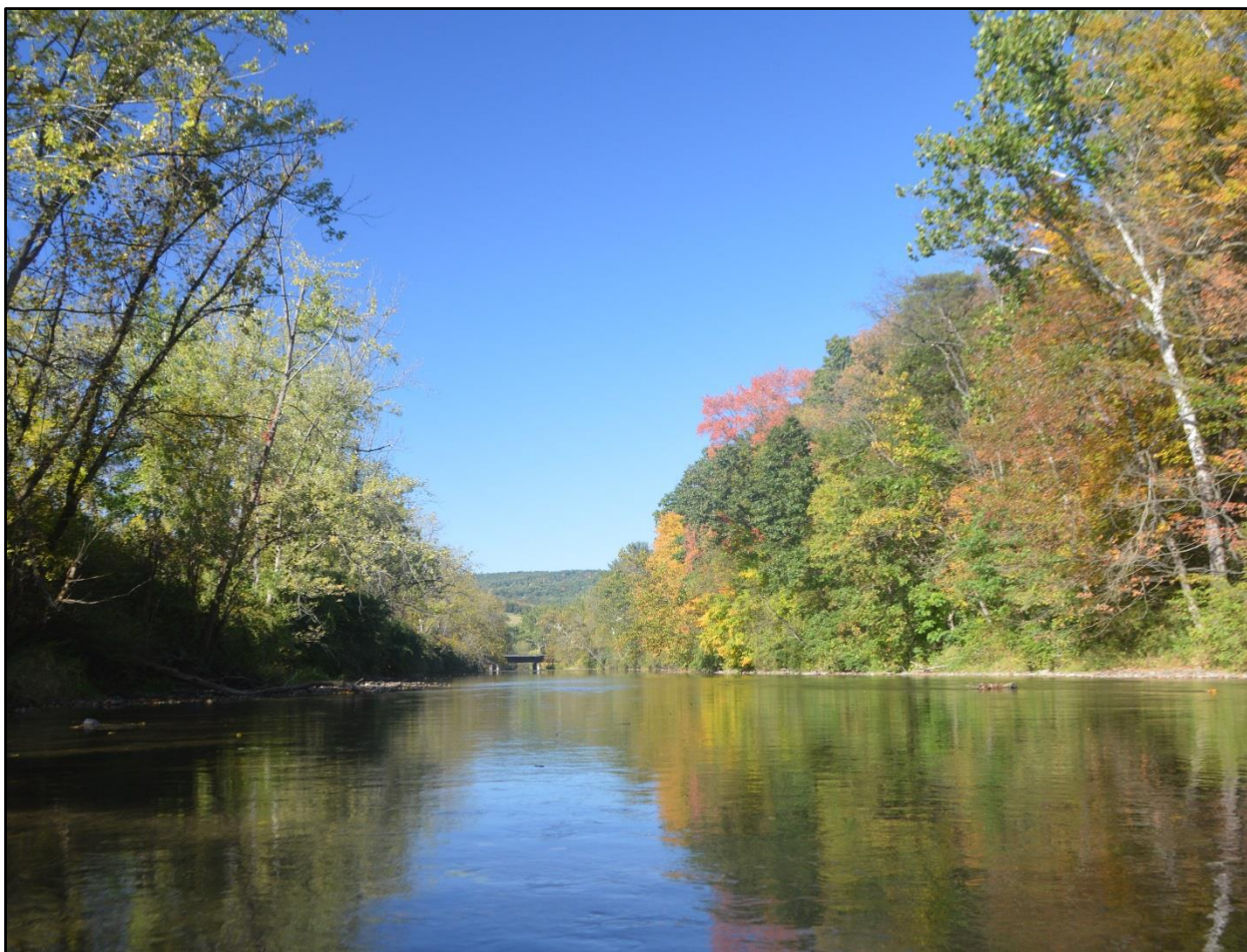


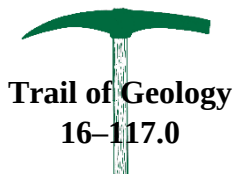


A float through the Devonian

A river guide to the geology of Bald Eagle Creek from Milesburg to Dowdy's Hole



Rose-Anna Behr, Bureau of Topographic and Geologic Survey



Material from this trail of geology booklet may be published if credit is given to the Pennsylvania Geological Survey

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Cover Photo: View looking downstream at the railroad bridge. Photo by A. Bierly.

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Introduction

Bald Eagle Creek is a limestone-influenced freestone stream that drains a 265 square mile area (Gough, 1977). It is located at the edge of the Ridge and Valley physiographic province (Sevon, 2000). To the south, you can see linear ridges of resistant sandstone, which give the province its name. To the north, you see rolling foothills and the Allegheny Front escarpment, which marks the beginning of the Appalachian Plateau province. This beautiful setting is the location for the “Float through the Devonian”. Our trip starts at the confluence with Spring Creek. Spring Creek is, as the name implies, a spring-fed creek, including fourteen to seventeen million gallons per day from Bellefonte (Big) Spring (Wood, 1980; Fulton and others, 2005). This is one of the limestone influences on Bald Eagle Creek, and provides a steady, year-round, supply of cool water.

Today’s trip will include five rock formations of the Lower and Middle Devonian period (419 to 382 Ma, International Commission on Stratigraphy, 2016) (Figure 1, Figure 2). What is now Pennsylvania was then located thirty degrees south of the equator. Warm shallow seas covered the continental shelf and supported abundant sea life (Figure

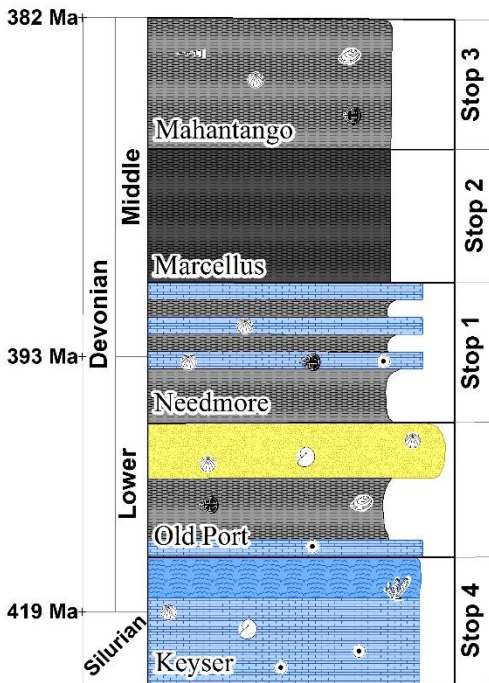


Figure 1. Stratigraphic column showing Lower and Middle Devonian formations. Blue is limestone, gray and black are shale, and yellow is sandstone.

3). The oldest rocks we will see, the upper Keyser Formation, started out as reefs in this tropical sea. Unlike today’s reefs made mainly of colonial coral, these reefs were made of sponges (stromatoporoids), blue-green algae (stromatolites), solitary corals, crinoids, and brachiopods. As the water deepened, reefs were replaced by lime mud on the fore reef, occupied by trilobites, brachiopods, and molluscs. An offshore sand bar, with its upper reaches in the wave zone, was host to only the strongest and most robust brachiopods and gastropods. We see the sand of this bar near the interstate and on the road to the take-out area. This is the upper Old Port Formation, known as the Oriskany sandstone. Beyond the sand bar, the water deepened to form the shelf, and alternating layers of lime and lime mud accumulated. These became the Needmore Formation. Off into even deeper water, an anoxic bottom layer formed due to restricted ocean circulation. Organic-rich mud that

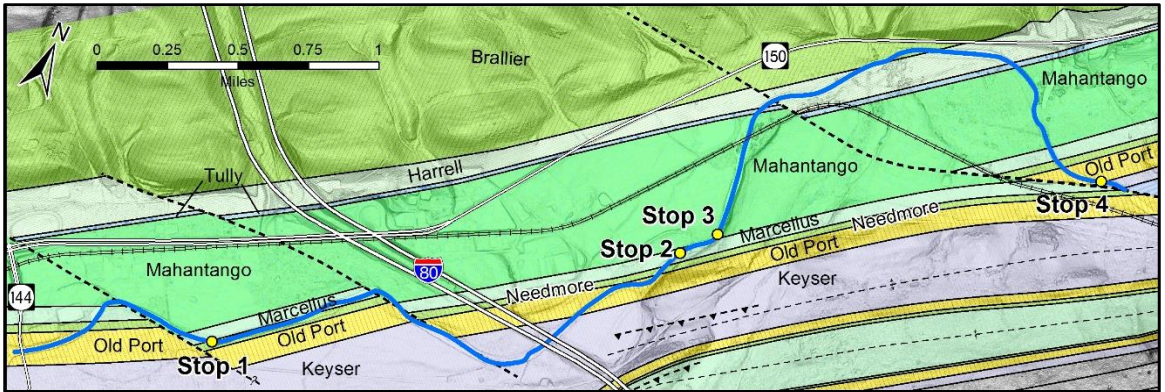


Figure 2. Geologic map showing river route and stops. Interpretations by author.

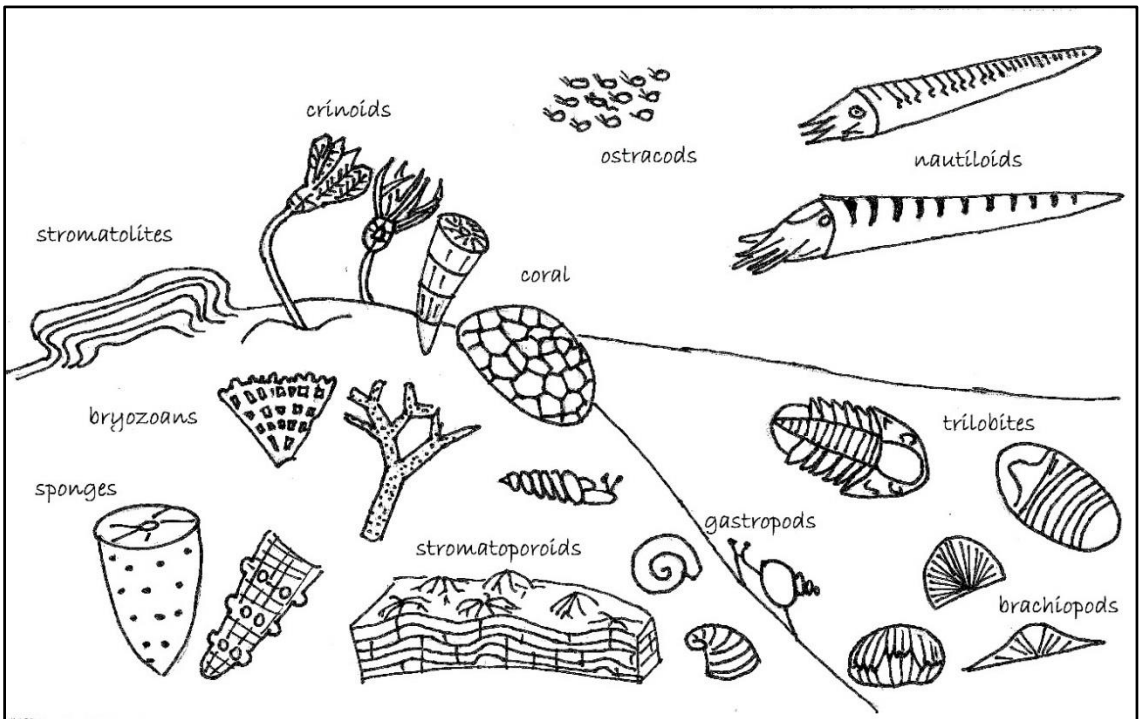


Figure 3. Sketch of variety of Devonian sea life.

rained down into this zone did not decompose, and is preserved as black shales of the Marcellus Formation. As the basin filled with sediment, water became shallower, and again oxygenated. It could now support life. Gray muds and silts accumulated on the shallow ocean floor, as trilobites, brachiopods, and molluscs once again enjoyed room to roam. They are preserved in the Mahantango Formation.



Figure 4. Aerial photograph showing river route and stops.

The sediments in this shallow sea lithified to create the limestone, shale, sandstone, and siltstone that we see today in the outcrops near the creek.

The river log begins at the Milesburg Access at the confluence of Spring Creek and Bald Eagle Creek and continues 4.9 miles downstream to the Dowdy's Hole take-out (Figure 4). The stream is a technical Class 1 paddle with a series of pools and riffles (Canoe Club of Centre County, 2016). It can be kayaked year round, even with stream levels as low as -0.4 feet, with minor scraping. Canoeists will want -0.15 feet or more. Stream levels can be found at http://waterdata.usgs.gov/nwis/uv?site_no=01547200.

In Milesburg, park at the Milesburg Community Center on the southwest corner of the yellow iron bridge on Route 144. To get to the take out place by vehicle from the Community Center, take Route 144 north and Route 150 east 4.3 miles. Turn right on Dowdy Hole Road by the township maintenance yard. Follow the paved road until it turns at an unmarked gravel road, stay straight on the gravel road. Proceed to the end and park near the creek.

Mileage is estimated based on aerial photos and GPS coordinates. **Stop** refers to the numbered locations shown on Figure 4. **Inc.** refers to the incremental mileage between points of interest, whereas **Cum.** refers to the total mileage from the boat launch. River Right refers to the right side of the river, when looking downstream. River Left is the converse. It will take 2.5 hours of paddling to travel the 4.9 river miles. Allow additional time for exploring the rocks and enjoying the scenery.

River Log

Inc	Cum	Things to See
0	0.00	Milesburg Access Launch, 40.94291/-77.78711 River Right Note an outcrop of nearly flat-lying Oriskany sandstone with large fossils in Spring Creek by the launch. The USGS stream gage is 130' downstream of bridge.
0.44	0.44	White pump house with chain-link fence on River Left for Hilex Poly facility emergency fire suppression. (Roger Pollok, personal communication, 2016)
0.36	0.80	Stop 1. <u>Needmore Formation</u> 40.94769/-77.77549 River Right Just as the pump house disappears from view behind you, you will see several resistant ledges across the creek at low flow. As creek bends to the left, it follows the direction of the bedrock, and rocks are visible on the right bank, even in high flow. The stream parallels the trend of the rocks, which is N50E.  Figure 5. View looking downstream at beds of resistant limestone with shale interbeds of the Needmore Formation. The Needmore Formation was deposited in shallow water where lime production alternated with mud accumulation. The rocks consist of interbedded dark gray limestone and calcareous shale (Figure 5). Average bed thickness is a half foot. Within the limestones, there are

		rare brachiopod fragments, and ostracods (seed shrimp) in one bed on the stream bank. The limestone beds show nice sets of joints. Joints are fractures without any offset (Figure 6).  Figure 6. View looking down on regular joints in a limestone bed of the Needmore Formation.
0.40	1.20	Go around the left side of this large island. This island is made of sediment from an unnamed tributary coming down from Bald Eagle Mountain to your right. Near this creek is a municipal water well, which encountered, top to bottom, 25 feet of Needmore Formation similar to Stop 1, 80 feet of sandstone and 150 feet of limey shale and limestone of the Old Port Formation, and about 120 feet of Keyser Formation limestone (Stop 4).
0.22	1.42	Holt Run enters from left.
0.72	2.14	Interstate-80 bridge. Half a mile of streambed here was realigned during construction of the interstate, moving this segment farther south.
0.43	2.57	Very sandy soil visible on slope. This sandy soil is the weathering product of the upper member of the Old Port Formation. The Oriskany Member started out as an offshore sandbar, similar to one you might find near a beach today. Regular wave action moved the sand often so only robust creatures like gastropods and brachiopods could survive that regular beating.
0.15	2.72	Stop 2. <u>Marcellus Formation</u> 40.96204/-77.74910 River Right <i>This small outcrop can be easy to miss!</i> It is just after a triple-trunked maple and just before a creekside sycamore. There is abundant platy shale in the streambed. The Marcellus Formation is known for its beds of organic-rich black shale (Figure 7), the source

of natural gas. As you examine this small outcrop, you will notice beds less than an inch thick, grayish black in color, often crusted with white and yellow metal salts. These salts are the weathering product of pyrite, or “fool’s gold,” within the black shale (Tuttle and others, 2001).



Figure 7. Outcrop of Marcellus black shale with rock hammer for scale.

On the bank, about six feet above you is an old tow path and canal of the Bald Eagle and Spring Creek Navigation Company (Bald Eagle and Spring Creek Navigation Company, 1835; Figure 8). The canal linked Bellefonte to Flemington, near Lock Haven. Work began in 1837 and was completed in 1848. The canal carried coal, pig iron, and agricultural goods until the disastrous year of 1865. Heavy flooding destroyed much of the canal the same year that the Bald Eagle Valley Railroad was completed along a similar route. The canal was never rebuilt.

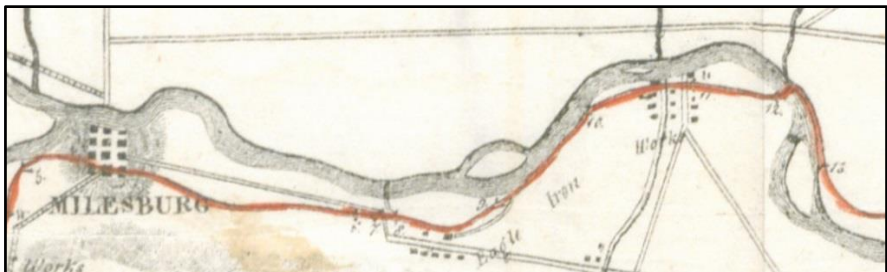


Figure 8. Map from 1835 showing location of Bald Eagle and Spring Creek Navigation canal in red.

0.15

2.87

Stop 3. Mahantango Formation 40.96375/-77.74741 River Right

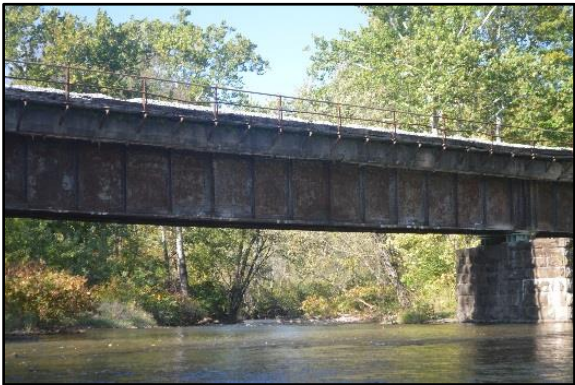
Just as the railroad bridge comes into view, look along the right side of the creek for a fin of rock above the water level (Figure 9). Follow it to the shoreline for a small outcrop of Mahantango Formation rocks (Figure 10). Dark gray calcareous siltstones and papery shale make up the outcrop. One bed is bioturbated, meaning the internal layers are not visible because burrowing animals mixed up the sediment before it turned to rock. The Mahantango Formation contains many small fossils, including trilobites, brachiopods, crinoids, and molluscs.



Figure 9. Resistant ledge of siltstone in creek bed deflects the water.



Figure 10. Outcrop on the right bank of siltstone and shale of the Mahantango Formation. Rock hammer for scale.

0.36	3.23	Railroad bridge The wooden beams across the stream just upstream of the railroad bridge (Figure 11) were part of the dam used to pool water in this stretch of the stream for the canal boats. They exited the river on the right here, and continued downstream past Curtin Village.  Figure 11. The Bald Eagle Valley Railroad bridge was built in 1865. This newer bridge still carries train traffic.
0.57	3.80	Curtin Village Road bridge and Curtin Village Access boat launch. Immediately upstream of the bridge, Antis Run enters on the left, and Nittany Creek enters from the right. On the right bank is Curtin Village—all that is left of more than a century’s-long iron-making empire. In 1810, Roland Curtin opened a forge at this location (Eggert, 1994). In 1817, he added Eagle Furnace (d’Invilliers, 1884). Pleasant Furnace replaced it in 1848 and operated until 1921. The iron ore they smelted came from Curtin’s Fishing Creek Banks (which includes Yellow Bank), Dysart Bank, Logan Bank, Red Bank, Stover Bank, and Zimmerman Bank in the Nittany Valley (d’Invilliers, 1884; Eggert, 2000). Later, ore came from the fossil ore beds on the north side of Bald Eagle Mountain in what is now Bald Eagle State Park (Eggert, 2000). Limestone for flux was quarried along Old Route 220 (d’Invilliers, 1884) and charcoal for fuel came from the surrounding land. The furnaces needed nearly 100 bushels of charcoal for a ton of iron produced (d’Invilliers, 1884). An acre of trees per day was used to meet this demand (Eggert, 1994), leading to rapid denudation of the hillsides.

The half mile of stream downstream of the bridge was moved when Route 150 was created. The stream realignment has caused the stream to cut into sand and gravel deposits of the old stream and flood plain (Figure 12). A closer examination will reveal pieces of charcoal in the sediment. We may be looking at the legacy of clear-cutting to make charcoal, forest fires, and soil erosion that took place in the 1800's because of the iron industries need for charcoal fuel.



Figure 12. Stream bank reveals sediment from the former stream channel and floodplain. Inset shows piece of charcoal in the sediment.

1.08 4.88 **Stop 4. Keyser Formation and Spring 40.97451/-77.72528 River Right**

The Keyser Formation spans the Silurian-Devonian contact. This outcrop is in the upper Keyser, and represents a fossilized reef. Thick beds of nodular to planar brownish gray limestone host abundant fossils including stromatolites, bryozoans, horn coral, and brachiopods. Stromatolites are blue-green algal mounds that built reefs (Figure 13, Figure 14). Bryozoans (Figure 15), coral, and brachiopods also built low reefs.



Figure 13. Stromatolite reef in the Keyser Formation



Figure 14. Growth layers of blue-green algae that started on a horn coral.



Figure 15. Bryozoan fossil in the upper Keyser Formation.

One hundred feet downstream of the Keyser reef outcrop is a spring (Figure 16). In October 2016, at very low stream levels, the spring was producing 470 gallons per minute (Bierly, personal communication, 2016). The temperature was 54.5 °F (12.5°C).



Figure 16. View looking down on the large spring at the edge of Bald Eagle Creek.

0.07	4.95	Take Out Dowdy's Hole, 40.97474/-77.72354 River Left Watch for the small sign in the tree overhanging the creek (Figure 17). Near the parking area, there was a sawmill and grist mill in 1874 (Nichols, 1874). The Bald Eagle and Spring Creek Navigation Company canal crossed to the north side of the stream in this area (Figure 8). As you exit the parking area, you will notice an outcrop of the upper member of the Old Port Formation. Unlike the section along the stream that is weathering to loose sand (River Mile 2.57), this outcrop is resisting erosion. The sandstone here is cemented with silica, as opposed to calcite that cements the streamside outcrop.
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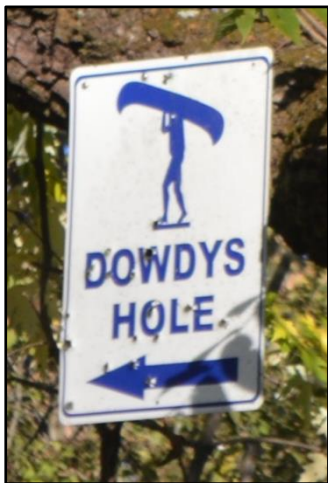


Figure 17. Sign at take-out.

We hope you have enjoyed your geology tour!

Acknowledgments

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River Rules

- Launch areas are open year round, dawn until dusk.
- Launch permits are required.
- From November 1st through April 30th, personal floatation devices must be worn.
- Stream levels may be checked by visiting
http://waterdata.usgs.gov/nwis/uv?site_no=01547200
- Please stay on the creek, as property adjacent to it is privately owned, except everything 0.2 miles downstream of Interstate-80 bridge, then it is US Government so feel free to explore near the stream.

