GEOLOGY OF

BLENDON WOODS METRO PARK

Stream anticline formed in Bedford Shale, see geologic map for location.

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OHIO GEOLOGICAL SURVEY
DEPARTMENT OF NATURAL RESOURCES

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Metro Parks

Introduction

Blendon Woods Metro Park is located in northeastern Columbus, near the intersection of Interstate 270 and State Route 161 in central Ohio. Much of the park is covered by Quaternary-age alluvial deposits and glacial till sediments. However, Devonian-age Ohio Shale and Bedford Shale are exposed along the creeks and nearby steep slopes. These geologic units were deposited 380–365 million years ago (m.y.a.) in deep-sea or shallower deltaic environments. Ripple-marked sandstone layers in the Bedford Shale and stream anticlines are some of the most interesting exposed geologic features in the park.

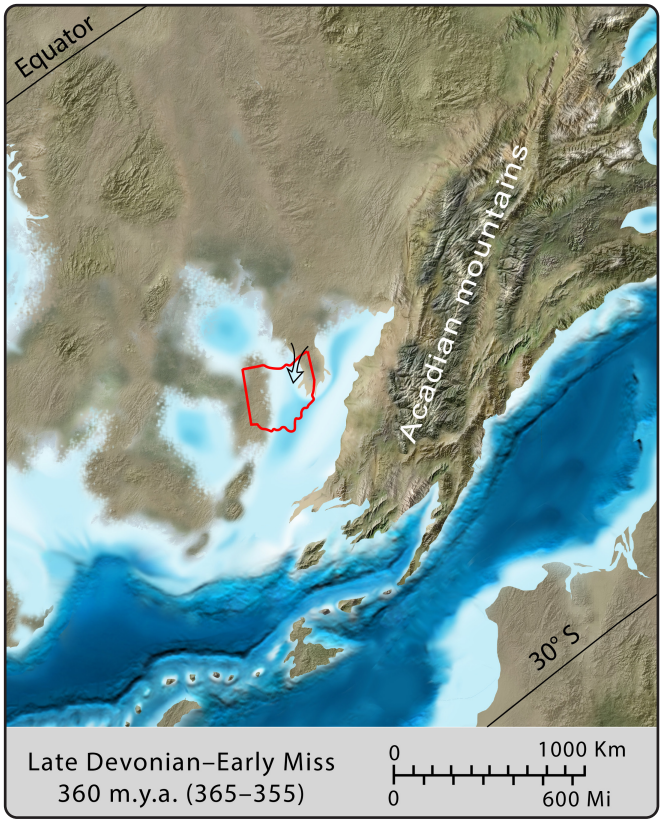


Figure 1. Paleogeographic reconstruction of eastern North America during the Late Devonian–Early Mississippian, about 360 m.y.a., (modified from Key Time Slices of North America © 2013 Colorado Plateau Geosystems Inc.) when deposition of the Bedford Shale and Berea Sandstone was in progress. Transportation of Bedford Shale detrital material is shown by black arrow northeast of Ohio. Present-day Ohio is outlined in red.

Figure 2. Ohio Shale exposed in the main creek (see geologic map for location); black-and-white scale segments are 10 and 20 cm (4 and 8 inches). Directions south (S) and north (N) are indicated.

Geologic History

The sedimentary bedrock units (Ohio and Bedford Shales) exposed in the park were deposited during the Late Devonian of the Paleozoic Era, about 380–365 million years ago. At this time, Ohio was covered by a deep sea and was in the southern hemisphere around 15-degrees latitude, about 1,600 km (1,000 mi) south of Earth's equator (fig. 1). During the Mississippian through Permian Periods (370–250 m.y.a.), more sediments were deposited in the region. Over the last 250 million years, plate tectonic processes repositioned Ohio from south of the Equator to its current position, 4,500 km (2,800 mi) north of the Equator. During this time, the region elevated, and the younger rock formations were eroded.

Ice Age glaciers advanced into Ohio during the Quaternary Period and finally retreated during the Late Wisconsinian (18,000–14,000 years ago), leaving behind heterogenous clay, sand, gravel, and boulder deposits (called *till*) eroded from areas to the north. This till is among the youngest sediment covering most of the park (see geologic map on back cover).

Ohio Shale

Deposition of the Ohio Shale (fig. 2) occurred in the deep Appalachian Foreland Basin west of the Acadian Mountains (fig. 1). It is the oldest bedrock unit exposed in the banks and beds of the creeks in the western part of the park (see geologic map on back cover). The Ohio Shale is dark grayish-black-brown, hard, fissile, brittle, and jointed. Clay minerals and bituminous (organic) remnants of oceanic organisms were deposited in a deep anoxic sea, similar to the present-day Black Sea, and then lithified by dewatering and compaction to become the Ohio Shale. Fresh broken pieces of the Ohio Shale give off a sulfurous petroleum odor. Ohio Shale is an organic-rich shale and a good source of oil and gas in the subsurface.

Bedford Shale

Deposition of the Bedford Shale (fig. 3) began with large amounts of clastic material (clay and silt) eroded from the newly developed highlands to the north and northeast (fig. 1). As clastic material built up, the basin became a shallow sea favorable for seafloor invertebrates (fig. 4A). Increasing numbers of siltstone and sandstone beds in the upper part of the Bedford Shale indicate that over time, more eroded clastic particles were transported to the basin and a deltaic environment dominated the region. Bedford Shale is composed of muddy gray or red shales (fig. 3) with thin gray or brown siltstone layers. The Bedford Shale overlies the Ohio Shale and is exposed in most of the park's creeks (see geologic map on back cover). Fossilized seafloor organism traces and tracks can be found in the siltstone layers in the Bedford (fig. 4A). Beautifully preserved symmetric ripple marks (fig. 4B) on the sandstone layers indicate that the sediments were deposited in a shallow sea with tidal influences.

As more clastic sand and silt were transported into the region, the Berea Sandstone was deposited on top of the Bedford Shale. The Berea Sandstone is not exposed in the park, but it could be present under the Quaternary deposits at the elevated eastern areas of the park.

Stream Anticlines

The gray shale layers of the Bedford in the park are frequently folded as anticlines and synclines (oval dome- and basin-shaped structures), called *stream anticlines*. Stream anticlines are the most impressive geologic feature in the park. There are more than 30 stream anticlines, synclines, and related thrust faults exposed in the park's creeks (see cover and fig. 5). Generally, folding in the bedrock and development of the anticlines and synclines occur because of compressional stress during plate tectonic movements. Tectonic anticlines are large, deeply rooted geometric structures on the scale of kilometers or miles. By contrast, stream anticlines are small-scale surficial folds developed in shaley or clayey layers in the streams and riverbeds, in the scale of meters or yards. In terms of geologic time, stream anticlines are very young and were formed during the Quaternary Period after erosion of the overburden and development of the modern streams. They form when the volume of a layer or layers increases and layers expand horizontally, caused by water absorption in clay minerals or by the release of inherited compressional stress in the layers. Numerous stream anticlines have been reported in the Ohio Shale at the stream beds in northeastern Ohio and within the Ordovician shales in southwestern Ohio. However, the geometric and structural variety, preservation, exposure quality, and sheer number of stream anticlines in Blendon Woods Metro Park is exceptional and unique for Ohio.

Glacial Till

Quaternary-age glacial till covers most of the park, sitting on the eroded surface of the Ohio and Bedford Shales. It is mainly composed of clay and includes igneous or metamorphic rocks (called *erratics*) carried by glaciers from Canada. Its thickness in the park varies between 0.5 and 10 meters (1–30 feet) and is covered by thin alluvium.

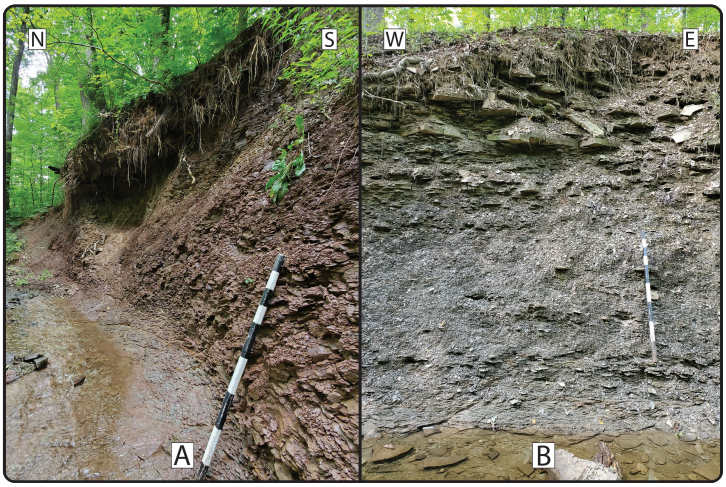


Figure 3. A: Red Bedford Shale exposed along the main creek. B: The Bedford Shale exposed off of Ripple Rock Trail. Increased siltstone beds indicate a deltaic environment at the end of the Bedford deposition. Black-and-white scale segments are 10 and 20 cm (4 and 8 inches). See geologic map for locations. Directions north (N), south (S), west (W), and east (E) are indicated.

Figure 4. A: Seafloor organism burrows and tracks in Bedford Shale siltstone layers. B: Example of symmetric ripple marks in Ripple Rock Trail outcrop, exposed upstream near the restricted area fence.

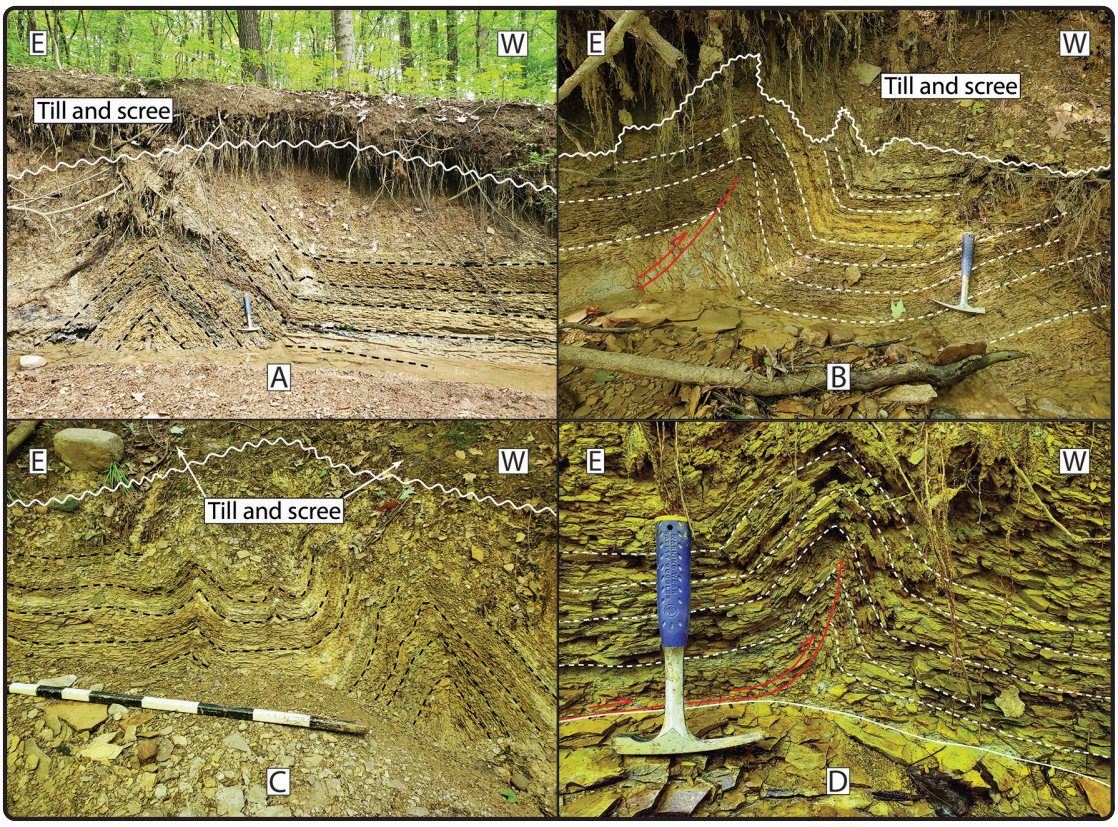


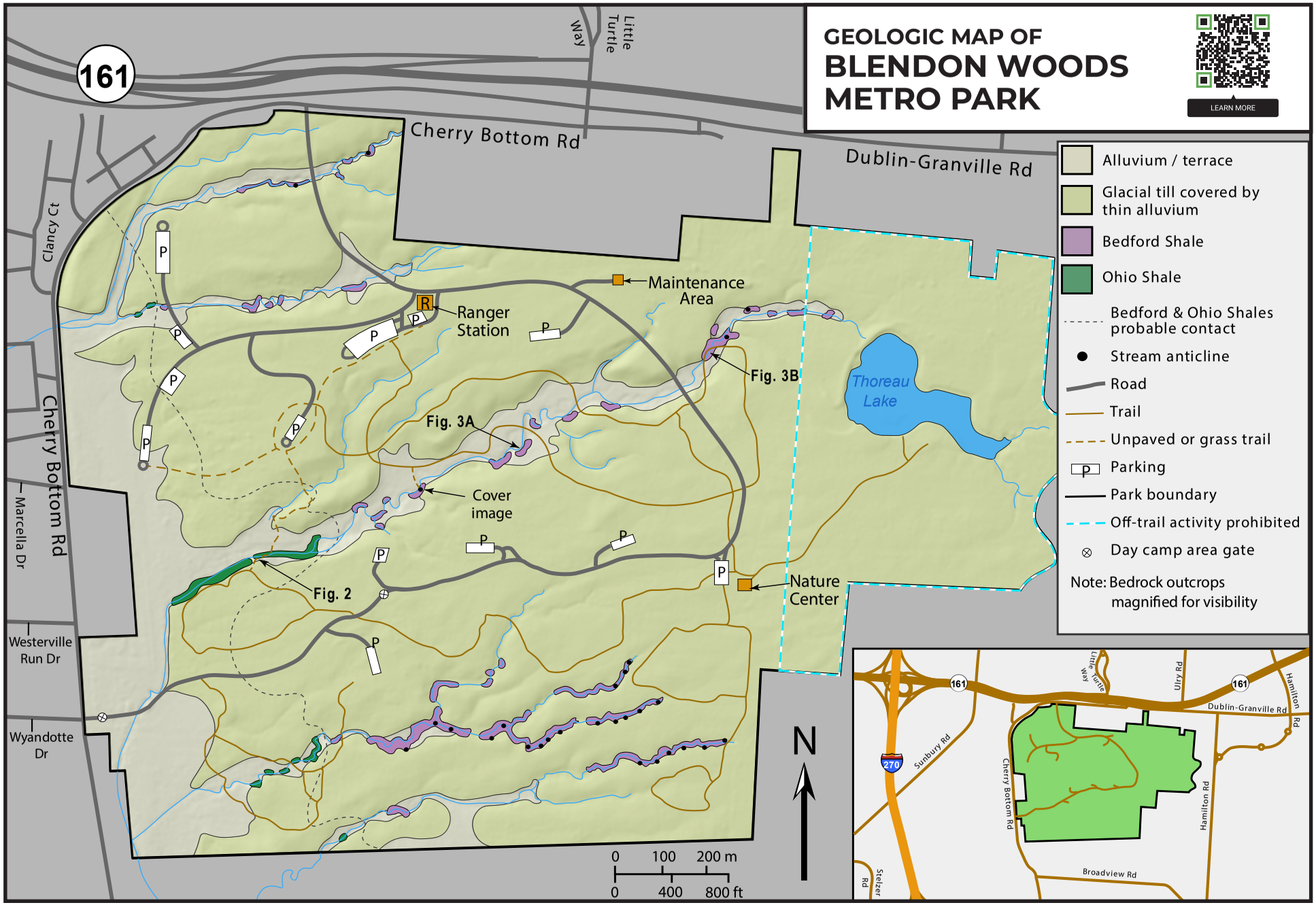
Figure 5. Examples of stream anticlines developed in Bedford Shale layers annotated by dashed lines. Directions east (E) and west (W) are indicated.

A: A chevron fold (anticline).

B: A syncline and asymmetric anticline with thrust fault in the core.

C: Two small chevron anticlines and an asymmetric anticline. Deformation and folding of the layers caused by volume increase and lateral expansion of the layers by water absorption in clay minerals. Black-and-white scale segments are 10 and 20 cm (4 and 8 inches).

D: A very small stream anticline and related thrust fault in clayey layers of the Bedford Shale, formed by lateral expansion and volume increase above the less-clayey, undeformed, horizontal siltstone layers. The solid white line is the detachment surface between folded and undeformed layers.



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