



# GEOLOGY OF SHALLENBERGER STATE NATURE PRESERVE

by Michael P. Solis

STATE OF OHIO  
DEPARTMENT OF NATURAL RESOURCES  
DIVISION OF GEOLOGICAL SURVEY



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## Introduction

Shallenberger State Nature Preserve is located approximately 30 miles southeast of Columbus and 4 miles southwest of Lancaster. The preserve lies within the western portion of the Appalachian Basin, and is situated within the outcrop belt of Mississippian-age rocks. Older Devonian-age rocks are located 11 miles northwest of the preserve. Younger Pennsylvanian-age rocks are located 12 miles southeast of the preserve. Shallenberger is approximately 1 mile north of the Quaternary-age glacial/nonglacial boundary (fig. 1).

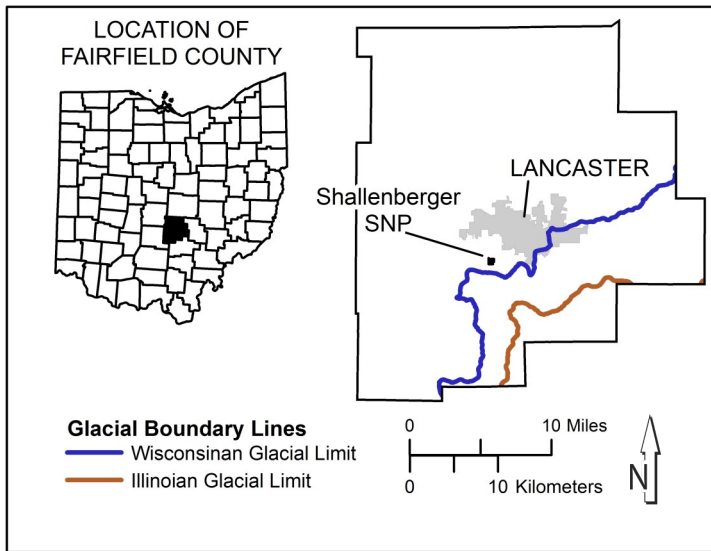


Figure 1. Location of Fairfield County and its relation to glacial extents in Ohio.

Shallenberger contains two knobs (small, isolated, and rounded hills): Allen Knob, the westernmost knob, and to the east, Ruble Knob. These knobs are composed of Mississippian-age sedimentary bedrock named the Black Hand Sandstone Member of the Cuyahoga Formation. The slopes surrounding Shallenberger's knobs are covered by glacial till. Till is a mixture of glacially deposited silt, sand, gravel, and erratics, which are rounded igneous or metamorphic rocks that have been transported. The dedication plaque is mounted on a glacial erratic, located at the trail head next to the preserve parking lot.

## Bedrock Geology

The only bedrock exposed at the preserve is the Black Hand Sandstone, which is best viewed along the stairs leading up to the top of Allen Knob (fig. 2). The formations above and below the Black Hand Sandstone are not exposed at Shallenberger. However, to the north at Beck's Knob, the Black Hand

Sandstone is underlain by the shales, siltstones, and thin sandstones of the Racoon Shale Member of the Cuyahoga Formation (fig. 2). At Shallenberger, the Racoon Shale is covered by glacial material and colluvium. Colluvium is loose rock and sediment that has weathered away from an outcrop and has been deposited on a hillside. The units overlying the Black Hand Sandstone have been removed by erosion.

The Black Hand Sandstone at Beck's Knob is approximately 130 feet thick and composed of yellow to reddish-brown, coarse-grained sandstone with abundant scattered milky-white quartz pebbles (fig. 2). Pebbles range in size from 0.16 to 2.52 inches in diameter. Beds are massive—few internal bedding features are evident—and thickness ranges from medium (4 to 12 inches) to very thick (40 to 120 inches). Sedimentary bedforms such as cross-beds or scour-and-fill are sparse. Cross-beds are small sets of inclined beds indicating deposition on an inclined surface in a fluid media. Scour-and-fill appears as

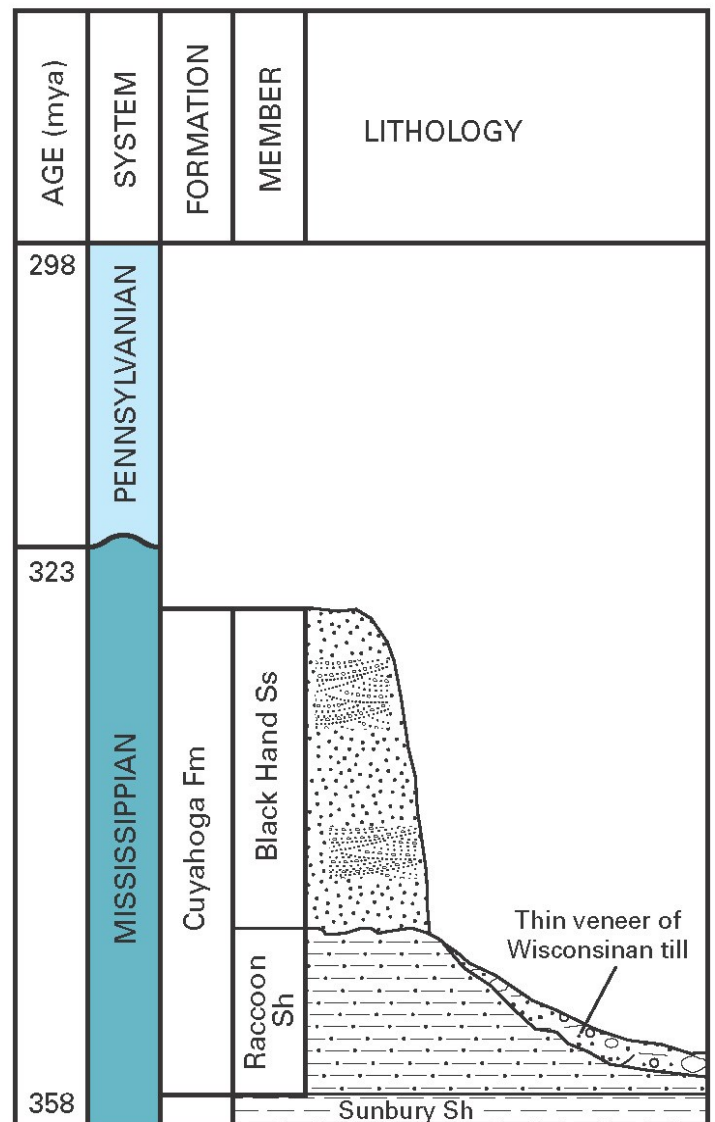


Figure 2. Generalized stratigraphic column of rocks and sediment near Shallenberger SNP. Abbreviations: mya = million years ago; Fm = Formation; Sh = Shale; Ss = Sandstone.

**Cover image:** Outcrop of Black Hand Sandstone exposed at Allen Knob in Shallenberger State Nature Preserve. Photo courtesy: Tom Arbour.

troughs, indicating a channel scouring of sediment, then refilling with sediment.

The large angular blocks of Black Hand Sandstone are referred to as “float” (fig. 3). The Black Hand Sandstone float at Shallenberger tends to be angular, indicating that it has not traveled far. The honeycomb weathering pattern, commonly observed on weathered faces of the Black Hand, is a type of differential weathering, the rock weathers at different rates (fig. 3). This pattern is caused by capillary action, the ability of water to be drawn into small spaces, drawing water into small pores within the rock. The water then dissolves the cement holding the sand grains together.



*Figure 3. Large float block of Black Hand Sandstone showing honeycomb weathering. The measuring rod is divided in 6 inch increments.*

The deposition of the Mississippian-age rocks in the area began with the Racoon Shale’s interbedded shale, siltstone, and thin, fine-grained sandstone. These rocks are indicative of low-energy environments, which feature slower-moving water and sediment falling slowly out of the water column. The Racoon Shale is interpreted as the distal, far-edge of a large delta. The sharp contact and change in grain size with the overlying Black Hand suggests a change from low-energy to high-energy (faster-moving water) environments.

Geologists have offered two possible interpretations of the Black Hand Sandstone’s depositional environment. Wolfe and others (1962) noted a laterally gradational contact with the Racoon Shale. This type of contact indicates a gradual shift from low-energy to high-energy depositional environments, followed by lateral reworking of the sediment. Wolfe and others (1962) interpreted the Black Hand Sandstone as a coarse-grained sand deposited at the mouths of deltaic channels then reworked along shoreline currents. A second interpretation was presented by Matchen and Kammer (2006). They suggested that a rapid drop in

sea level led to an incised valley and a fluvial (river) depositional environment of the Black Hand Sandstone. Either way, the source of the coarse clastic sediment was the Acadian Highlands—pre-Appalachian Mountains—to the present-day east of Ohio.

## Glacial Geology

Shallenberger is located within the glaciated Allegheny Plateau. The area shares characteristics of both the till plain to the north and the unglaciated Allegheny Plateau to the south, meaning the slopes around the knobs are covered with material left by glaciers, while the tops of the knobs are unglaciated.

The trails in Shallenberger are primarily composed of glacial till, a mixture of silt, sand, gravel, clay, and erratics (fig. 2; see map on back page). The erratics range in size from pebbles to boulders (0.16 to greater than 10 inches). The erratics were transported from Canada by glaciers which covered much of Ohio during the Wisconsinan Glaciation—70 to 13 thousand years ago. Uniform silt and clay form the lacustrine (lake) deposits at the northern edge of Shallenberger. The silt and clay were deposited when glacial meltwater was trapped and formed lakes.

Two primary episodes of glaciation are documented in Ohio: Illinoian and Wisconsinan (fig. 1). Between 300 and 120 thousand years ago, Illinoian glaciers advanced and retreated. This was followed by the Wisconsinan Glaciation, 50 thousand years later. The Illinoian glaciers advanced farther south than the Wisconsinan glaciers.

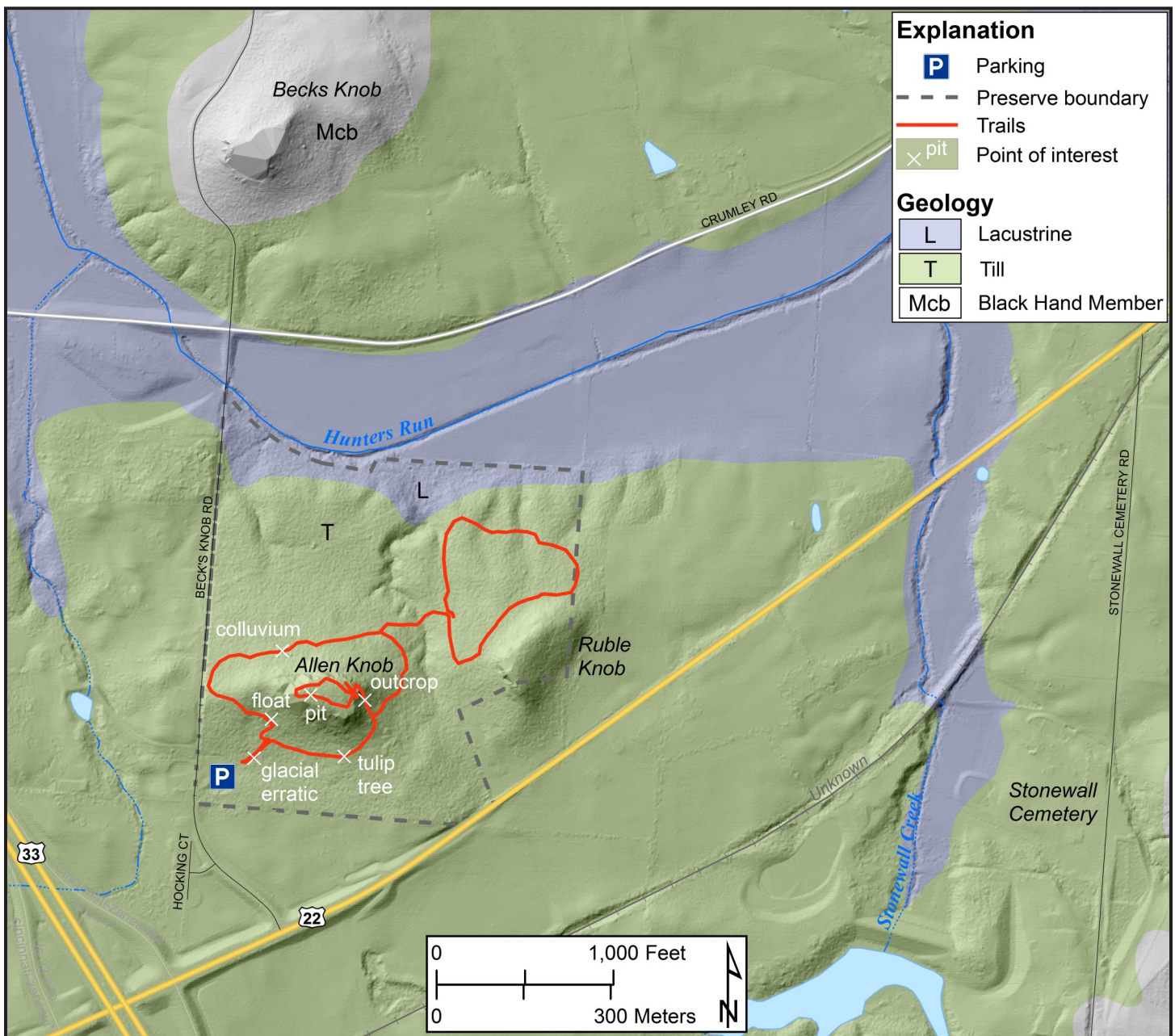
## Quarrying

Most of the early quarries in Fairfield County were located east of Lancaster. The Black Hand Sandstone was often commercially quarried for building stone during the late nineteenth and early twentieth centuries. However, little is known about quarrying of the Black Hand Sandstone at Shallenberger. The earliest known reference of quarrying at Allen Knob is from Hyde (1953). Relatively fresh exposures and the pit on top of Allen Knob suggest that the Black Hand Sandstone was quarried for use as dimension stone. Blocks extracted from Allen Knob may have been used for nearby building foundations or for the walls of Stonewall Cemetery, 2 miles directly east (see map on back page).

Shallenberger is conveniently located and easily accessible for Ohioans of all ages. Shallenberger is a great place to view a small portion of Ohio’s long geological history with its Black Hand Sandstone exposures, glacial terrain, and crystalline rocks transported from Canada. It is certain to educate, fascinate, and inspire the explorer in anyone.

## References Cited & Further Reading

- Division of Water, 1996, Ground water pollution potential of Fairfield County, Ohio: Columbus, Ohio Department of Natural Resources, Division of Water, Report No. 41, p. 174
- Ebbert, E.S., 1901 Lancaster's sons and daughters, past and present, in Lancaster and Fairfield County, Ohio: Cincinnati, Ohio, Kraemer, G.A., p. 88–148.
- Hyde, J.E., 1953, Mississippian Formations of Central and Southern Ohio: Columbus, Ohio Department of Natural Resources, Division of Geological Survey, Bulletin 51.
- Matchen, D.L., and Kammer, T.W., 2006, Incised valley fill interpretation for Mississippian Black Hand sandstone, Appalachian Basin USA: Implications for glacial eustacy at Kinderhookian–Osagean (Tn2–TN3) boundary: *Sedimentary Geology*, v. 191, no. 1–2, p. 89–113.
- Pavey, R.R., Goldthwait, R.P., Brockman, C.S., Hull, D.N., Swinford, E.M., and Van Horn, R.G., 1999, Quaternary geology of Ohio: Columbus, Ohio Department of Natural Resources Division of Geological Survey Map SG-1, scale 1:500,000.
- Wolfe, E.W., Forsyth, J.L., and Dove, G.D., 1962, Geology of Fairfield County: Columbus, Ohio Department of Natural Resources Division of Geological Survey, Bulletin 60.



Geologic map of Shallenberger State Nature Preserve showing topography of the area, hiking trails, and sites discussed in the text.