

GEOLOGY OF CHESTNUT RIDGE METROPARK

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Introduction

Chestnut Ridge, in northern Bloom Township, Fairfield County, is a unique scenic area that owes its existence to a long and complex geologic history. The ridge, which reaches an elevation of 1,110 feet, is part of the area that marks the boundary between the glaciated Till Plains to the north and west and the unglaciated Appalachian Plateaus province to the south and east. Chestnut Ridge is considered by some to be the westernmost foothill of the Appalachian Mountains. This leaflet provides background knowledge to better interpret the geologic history of Chestnut Ridge MetroPark and highlights locations in the park where geologic features can be viewed.

Bedrock Depositional History

The backbone of Chestnut Ridge is formed by a knob or outlier of Black Hand Sandstone that was once part of a more extensive deposit that has been subsequently eroded. The sandstone, and the beds of shale beneath it, were deposited in an ancient sea that covered Ohio during the early part of the Mississippian Period about 345 million years ago (fig. 1).



Figure 1. Paleogeographic reconstruction of North America during the Early Mississippian Period (modified from Blakey, 2013). Present-day Ohio is outlined in red.

Cover image: View of Chestnut Ridge from the Metro Park's fishing pond, Fairfield County, Ohio

At this time, the Appalachian Mountains were making their initial rise to the east as North America collided with the European continent. The sediments eroded from these rising mountains were carried westward by streams into the Ohio sea and deposited as portions of deltas, similar in many ways to the delta of the modern Mississippi River (fig. 2). The shales and siltstones underlying the Black Hand Sandstone represent stream or beach deposits associated with the nearshore portion of the delta.

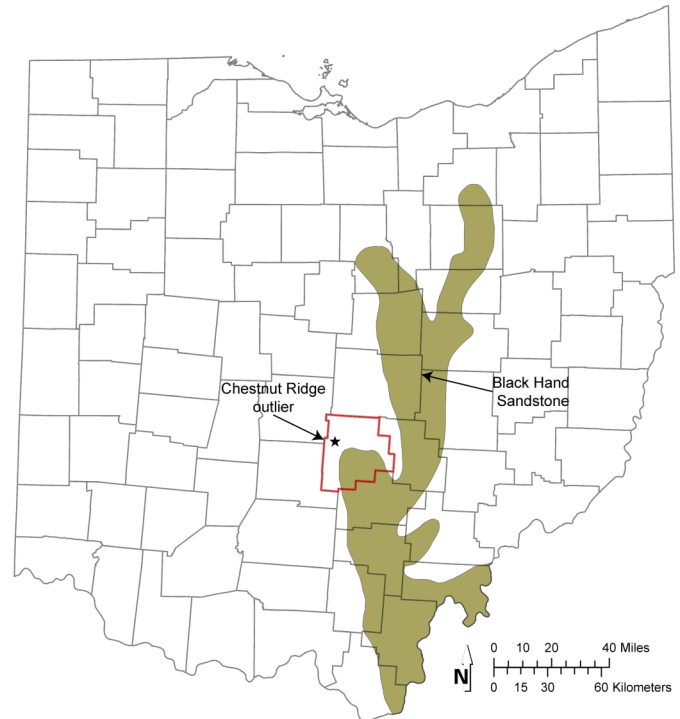


Figure 2. Extent of the Black Hand delta in Ohio (modified from Hansen, 1975). Fairfield County is outlined in red.

Black Hand Sandstone

The Black Hand Sandstone received its name from a large, soot-inscribed outline of a human hand on a cliff of this rock in Black Hand Gorge in Licking County. The hand, which was created by Native Americans to show the trail to Flint Ridge, was quarried away during building of the Ohio & Erie Canal in the 1820s.

The Black Hand Sandstone is a medium- to coarse-grained conglomeratic sandstone composed almost entirely of quartz grains, and it can be up to 300 feet thick. This stone was quarried extensively in the Hocking Valley and other areas during the 1800s, including Chestnut Ridge (fig. 3). Mined areas are still visible today along the ridge trail. Principal uses for the stone included bridge abutments, foundations, and as dimension stone for buildings. Today, the Black Hand Sandstone is an important groundwater resource because of its excellent aquifer properties, such as its porosity and

permeability. It is also quarried for glass production on an intermittent basis, as market conditions permit.

The Black Hand Sandstone generally is resistant to weathering and consequently forms scenic ridges, cliffs, waterfalls, natural arches, and rock-shelter caves in many areas of Fairfield and Hocking Counties. The processes of weathering and erosion have carved these scenic features over a long period of time, perhaps tens of millions of years. Weathering and erosion likely accelerated during the last 2 million years as glaciers advanced and physically scoured the landscape.

Glacial Influences

The latest chapter in the geological development of Chestnut Ridge began about two million years ago when great continental glaciers moved southward from Canada, eventually covering about two-thirds of Ohio. At least three, and perhaps four or more, separate glaciers covered portions of the state during the Pleistocene Epoch, commonly referred to as the Ice Age. The most recent glacial advance, known as the Wisconsinan Glaciation, reached its maximum extent at modern-day Lancaster about 24,000 years ago. Glaciers advanced across Ohio, depositing vast amounts of sediment which filled pre-glacial bedrock valleys. These *buried valleys* had the effect of smoothing over the landscape and creating vast, flat plains. Glacial *drift* is any unconsolidated sediment that has been transported and deposited by glacial processes. Glacial *till* is a type of glacial drift that is poorly sorted and usually composed of a clay and/or silt matrix surrounding pebbles of many different rock types. This glacial till is the material that forms the flat plain surrounding Chestnut Ridge today. By 14,000 years ago, the glacier was gone from Ohio,

but its effect on Chestnut Ridge is still visible.

Near the height of the glaciation, around 25,000 years ago, ice was advancing over the region from the northwest towards Lancaster, where it reached its maximum extent. Ice likely overran the pre-existing bedrock knob and sheared off or rounded the hill. The shape of Chestnut Ridge shows a generally smoother, sloping hillside against the direction of glacial flow and a steeper, more irregular hillside with the direction of glacial flow, which is indicative of a *roche moutonnee* landform (fig. 4). *Roche Moutonnee* is a French phrase that literally translates to “sheep rock.” This landform resembles the back of a sheep that is lying down. Look for the presence of glacial erratics on top of the ridge, which are also evidence for ice overrunning the bedrock ridge.

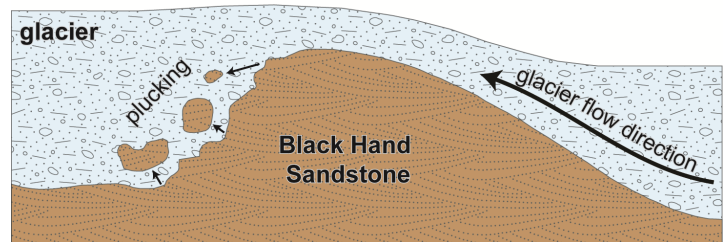


Figure 4. Conceptual diagram showing the development of a *roche moutonnee* as a glacier overrides a bedrock knob. Glacial plucking occurs on the down-gradient hillside, leading to a more irregular, steeper slope.

Summary

Chestnut Ridge Metro Park has a long and complex geologic history. The ridge is composed of Black Hand Sandstone, a Mississippian-age rock unit composed of medium-grained quartz sandstone. Sediments that eventually became lithified into the Black Hand Sandstone were originally deposited in a shallow deltaic environment. Historically this rock unit has been mined as dimension stone for buildings, bridge abutments, and foundations. Today the Black Hand Sandstone is an important groundwater aquifer because of its high porosity and permeability. The Black Hand Sandstone is generally resistant to weathering and erosion, but Wisconsinan-age continental glaciers drastically changed the landscape surrounding Chestnut Ridge. These glaciers advanced over the ridge, abrading the up-glacier hillside giving it a smoother slope. The glacier then plucked away rock on the down-glacier hillside giving it a steeper, more irregular slope. This makes Chestnut Ridge a glacial landform known as a *roche moutonnee*, or sheep rock. The geologic history of Chestnut Ridge is sure to fascinate those visitors who take the time to wander and observe the natural splendor of the park.



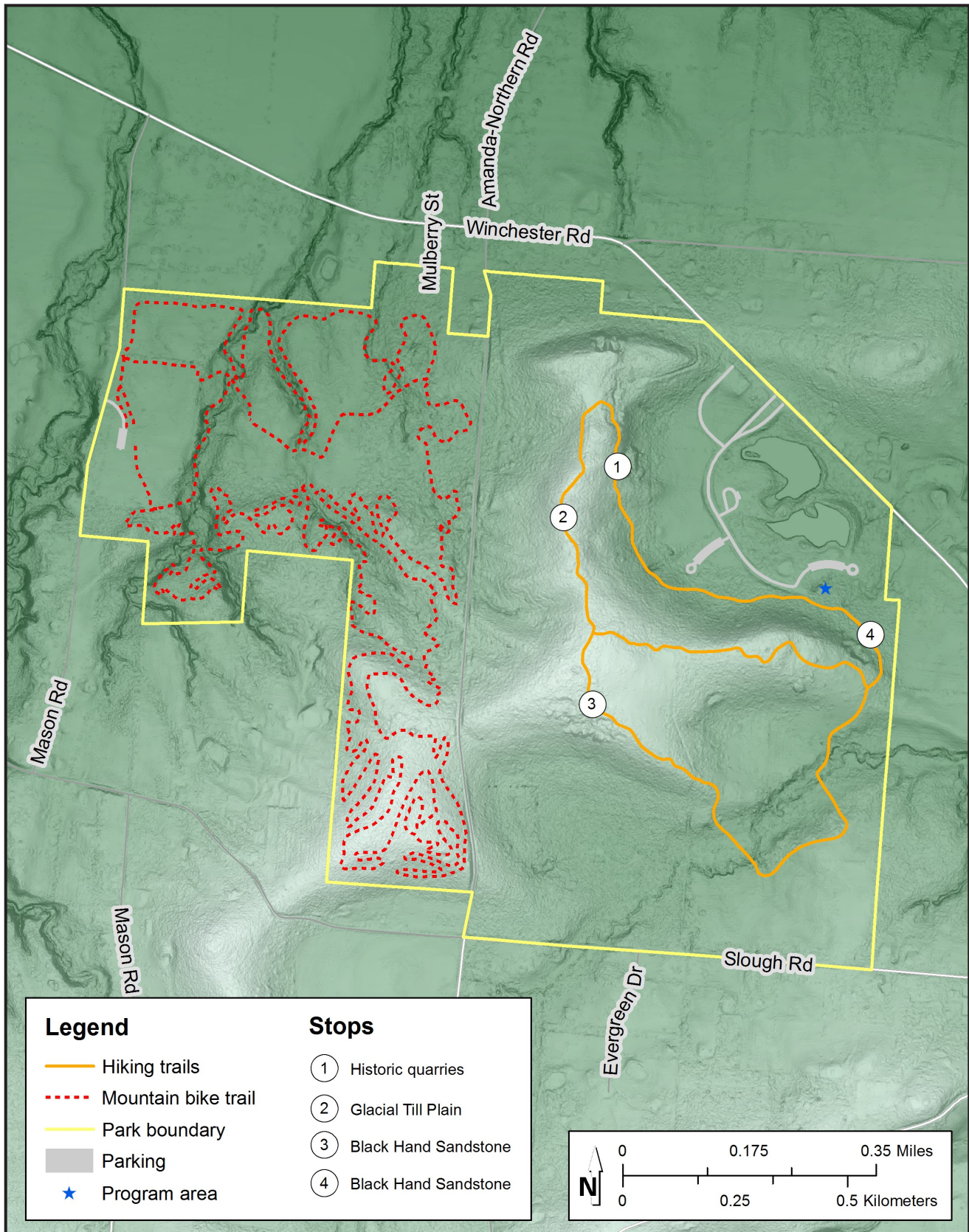
Figure 3. Historic photograph of Sharp Quarry, Sugar Grove, Ohio (J.E. Hyde, 1904–1905). The quarries at Chestnut Ridge would have looked similar to this at the height of production. The lowermost unit is the Black Hand Sandstone.

Further Reading

Blakey, R.C., 2013, Key time slices of North American geologic history—Early Mississippian Period: Colorado Plateau Geosystems, Inc.

Hansen, M.C., 1975, Geology of the Hocking Hills State Park region: Ohio Department of Natural Resources, Division of Geological Survey Guidebook 4, 23 p.

Wolfe, E.W., Forsyth, J.L., and Dove, G.D., 1962, Geology of Fairfield County: Ohio Department of Natural Resources, Division of Geological Survey Bulletin 60, 230 p.



Chestnut Ridge trail map showing topography of the area, stops along the hike, and features discussed in the text.