DIVISION OF GEOLOGICAL SURVEY

GUIDEBOOK NO. 4

GEOLOGY OF THE HOCKING HILLS STATE PARK REGION

BY

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GEOLOGY SERVES OHIO

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INTRODUCTION

Geology is a discipline that requires firsthand viewing of rocks, in the field, to gain a full understanding of the principles and processes involved. No area of Ohio provides such a myriad of geologic features in a setting of magnificent scenery as does Hocking Hills State Park and surrounding areas. The effects of fundamental geologic processes such as weathering, erosion, and sedimentation are clearly visible to even the most inexperienced student. In addition, the rugged breathtaking scenery stimulates inquisitiveness and makes this an ideal area in which to learn and teach the field science of geology.

This field guide has been prepared in response to numerous requests received by the Division of Geological Survey for information on field trip localities. These requests are made by a diverse group, including teachers, students, weekend hikers, and vacationers. These individuals all have one thing in common: a profound interest in and curiosity about the natural environment of Ohio. It is with these individuals particularly in mind that this field guide has been written.

SAFETY

Safety procedures, no matter what the situation or the area, consist basically of an awareness of inherent dangers and the judicious use of common sense to minimize or neutralize these factors. The sheer cliffs formed by the Black Hand Sandstone in Hocking Hills State Park present an inherent danger; however, the likelihood of falling over one of these precipices is small when a few basic rules are observed. The vast majority of accidents are due to foolhardy stunts such as leaving the well-defined trails, climbing on steep moss-covered rocks or cliffs, or throwing rocks or other objects on some hapless passerby in the gorge below.

If an accident should occur, the park rangers should be contacted immediately. The rangers are trained in emergency first aid and have the equipment and expertise to remove an injured person from relatively inaccessible locations. These comments are not intended to discourage exploration of the park areas and for almost everyone who will use this guide are probably not even necessary. Those with an interest in various aspects of natural history are generally people well endowed with a respect for nature and, most importantly, with good judgment.

ORGANIZATION OF THE FIELD TRIP

The emphasis of the field trip is twofold. First, features of Mississippian-age sedimentary rocks exposed in the Hocking Hills State Park region are examined from the standpoint of basic stratigraphy, environment of deposition, and geologic processes that have been instrumental in development of scenic features. Second, the field trip examines deposits and features of glacial origin developed in proximity to the park area. The mode of formation of and recognition of glacial features is emphasized. Comments on physiography, culture, early history, flora, and fauna are added where appropriate.

Some stops are listed as optional. This designation is necessary for the expeditious completion of the trip in one day, especially when the group making the tour is large. Although salient features of the area are present at the optional stops, the stops can be omitted in the interest of time without destroying the continuity of the trip.

The Hocking Hills field trip can be easily divided into two segments, one segment on bedrock features of the park area and the other segment on glacial features. A twofold division of the trip should be especially useful to teachers who may wish to cover each segment of the trip in coincidence with separate sections of their curriculum or because of limitations of time. Geologic descriptions with roadlogs of other optional stops in the park area are given in the addendum.

LIST OF STOPS

The field trip stops are listed below with approximate time allocation at each stop (does not include travel time).

1. Logan Formation (optional) (½ hour)
2. Old Man's Cave (2 hours)
3. Rock House (1 hour)
4. Rock Bridge (1½ hours)
5. Gravel pit in Illinoian outwash (optional) (½ hour)
6. Salt Creek School (optional) (½ hour)
7. Adelphi Cemetery (½ hour)
8. Haynes kames (optional) (½ hour)
9. The Narrows (optional) (½ hour)

OTHER OPTIONAL STOPS

10. Ash Cave (1 hour)

11. Cedar Falls (¾ hour)
12. Conkles Hollow (1-2 hours)
13. Cantwell Cliffs (1 hour)

TOPOGRAPHIC MAPS

The road log may be followed on the following U.S. Geological Survey 7½-minute quadrangle topographic maps (fig. 1):

South Bloomingville (STOPS 1, 2, 3, 10, 11, 12)
Rockbridge (STOPS 4, 13)
Logan (STOP 5)
Clearport
Stoutsville (STOP 6)
Hallsville
Laurelville (STOPS 7, 8, 9)
Ratcliffburg

Quadrangle maps may be obtained from:

Ohio Division of Geological Survey
Building B, Fountain Square
Columbus, Ohio 43224

or

Distribution Section
U.S. Geological Survey
1200 South Eads Street
Arlington, Virginia 22202

A folder describing topographic maps and symbols is available upon request.

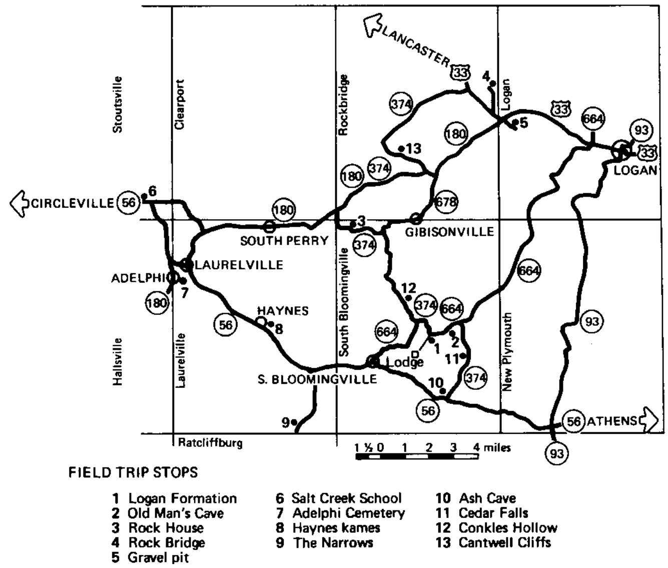

FIGURE 1.–Locations of U.S. Geological Survey 7½-minute quadrangles and field trip stops in the Hocking Hills State Park region.

HISTORY OF THE HOCKING HILLS STATE PARK REGION

When the first humans visited the area now called Hocking Hills State Park is unknown, but, speculatively, it may have been during the last phases of the Ice Age, when nomadic hunters of Ohio's earliest people, the Paleo-Indians, frequented part of the state. Fluted projectile points, almost the only artifacts known from Ohio Paleo-Indians, are relatively abundant in the glaciated terrain of nearby eastern Ross County, although none have been found in the park areas. The Paleo-Indians perhaps avoided the rugged hills of the unglaciated part of the state, but, considering the proximity of the park region to the glacial boundary, they may have wandered through the gorges and sought shelter in the shallow caves.

A long succession of distinct Indian cultural traditions prevailed in Ohio from the time of the Paleo-Indians until pioneer settlement; some of these peoples left direct evidence of their tenure in or close to the park areas. Burial mounds of the Adena culture not infrequently are encountered in the region; a prominent mound on the floodplain of Salt Creek is pointed out in this field guide. Archeological sites attributable to other Woodland cultures also are known in the area. The evidence available suggests that no permanent habitation existed in the numerous rock shelters in the park area; the protected overhangs probably provided temporary seasonal shelter for hunting parties.

During the Indian tenure in Ohio various peoples may have passed through the area on journeys to the extensive flint quarries at Flint Ridge in Licking and Muskingum Counties. The Shawnees traversed the area on treks to and from Chalahgawtha (Chillicothe) on the Scioto River. Apparently during the frontier wars white prisoners were marched through the region; a large beech tree that stood near South Bloomingville bore the inscription "This is the road to hell, 1782," recording the thoughts of a captive who had, at least temporarily, made good his escape.

Permanent habitation by pioneer settlers did not occur in the Hocking County area until the late 1790's. The abundant natural resources encouraged rapid settlement, so that by 1820 Hocking County had a population of 2,000.

The wealth of minerals in Hocking County was discovered, and by the middle of the 19th century many industries flourished, some to eventually fade with changing markets, others to survive until the present day. Hocking County lay on the edge of the great charcoal iron furnace district known as the Hanging Rock region. Two charcoal iron furnaces were established in Hocking County in the early 1850's, exploiting the thin bands of low-grade iron ore in rocks of Pennsylvanian age. The vast tracts of timber covering the hillsides provided wood from which charcoal was made to fuel the furnaces.

Beds of coal, also in rocks of Pennsylvanian age, provided an abundant and cheap source of energy for residents and industries. Additional iron furnaces were constructed and used coal as fuel. Coal remains an important mineral resource in eastern Hocking County.

Thick beds of clay and shale formed the base of a large ceramic industry that still prospers. In the late 19th and early 20th centuries the massive Black Hand Sandstone was quarried for building stone and as a source of silica for the glassmaking industry. In addition, petroleum and natural gas are produced in small quantities.

The rock shelters and gorges were popular hiking and picnicking areas for local residents throughout the 19th century; the numerous pre-1900 dates and names carved into the rocks bear witness to this fact. The ruggedness and inaccessibility of the gorges prevented cutting of the stands of virgin timber until the early 1900's, when lumbering operations became a threat. Fortunately, the passage of the state forest law in 1915 provided for the purchase of sites of scenic value, and in 1924 the first tract, encompassing Old Man's Cave, was acquired. The other park sites were purchased later in the 1920's.

During the 1930's various economic programs, including the Works Progress Administration (WPA), provided improvements in Hocking Hills State Park. Stone bridges, stairs, tunnels, and trails were constructed, permitting easy access to the gorges. Extensive reforestation of the denuded uplands was also carried out. Growth of these trees and natural succession of forest on adjacent long-abandoned farms has returned the Hocking Hills region to an approximation of its original primeval character. In 1972 a modern lodge and vacation cabins were opened at Hocking Hills State Park to provide gracious facilities for visitors to this unique scenic area.

GEOLOGY OF THE HOCKING HILLS STATE PARK REGION

Sedimentary rocks exposed at the surface in the Hocking Hills State Park region belong to the Mississippian System, deposited about 345 million years ago during the Mississippian Period, and to the Pennsylvanian System, deposited about 325 million years ago during the Pennsylvanian Period. Figure 2 shows the relationship of the rocks and the time periods they represent to the span of geologic time.

The strata exposed in the park area dip gently to the southeast at a rate of about 30 feet per mile. As a result of this slight tilt, rocks exposed in the western part of the park region are older than those exposed to the east. Rocks of the Cuyahoga Formation, of Mississippian age, through the Allegheny Group, of Pennsylvanian age, are encountered in a northwest-to-southeast traverse across the park region (fig. 3).

STRATIGRAPHY

The oldest rock unit exposed in the vicinity of Hocking Hills State Park is the Fairfield Member of the Cuyahoga Formation, of Mississippian age. Typically this member is a micaceous silty to sandy bluish-gray shale interbedded with a fine-grained gray to brown sandstone. Plant remains have been found in the shale. In the park region this unit averages about 70 feet in thickness; laterally to the northeast it grades into the overlying Black Hand Sandstone, the upper member of the Cuyahoga. Lithologically the Black Hand (known to drillers as the "Big Injun") is a well-sorted medium- to coarse-grained gray to buff sandstone ranging from 80 to 250 feet in thickness. Crossbedding and thin lenses of conglomerate are conspicuous. The Black Hand derives its name from a large soot-inscribed figure of a human hand placed by Indians on a cliff face of this sandstone in the gorge of the Licking River near Newark. It is thought that the hand served as a route marker to the flint quarries at Flint Ridge, east of Newark. Unfortunately, the

Years before present in millions of years	Eras and duration in years	Periods and duration in years	Presence in Ohio
	CENOZOIC 65 million	QUATERNARY 1.5-2 million	Pleistocene deposits cover over 2/3 of Ohio
2.5		TERTIARY 62.5 million	NOT PRESENT IN OHIO
65	MESOZOIC 160 million	CRETACEOUS 71 million	
136		JURASSIC 54 million	
190		TRIASSIC 35 million	
225	PALEOZOIC 345 million	PERMIAN 55 million	EXPOSED IN VARIOUS PARTS OF OHIO
280		PENNSYLVANIAN 45 million	exposed in Hocking Hills region
325		MISSISSIPPIAN 20 million	
345		DEVONIAN 50 million	
395		SILURIAN 35 million	
430		ORDOVICIAN 70 million	
500		CAMBRIAN 70 million	NOT EXPOSED IN OHIO; PRESENT IN SUBSURFACE
570	PRECAMBRIAN 3400 million		

FIGURE 2.—Geologic time chart (dates from Strahler, 1971; other time charts will differ somewhat from this one).

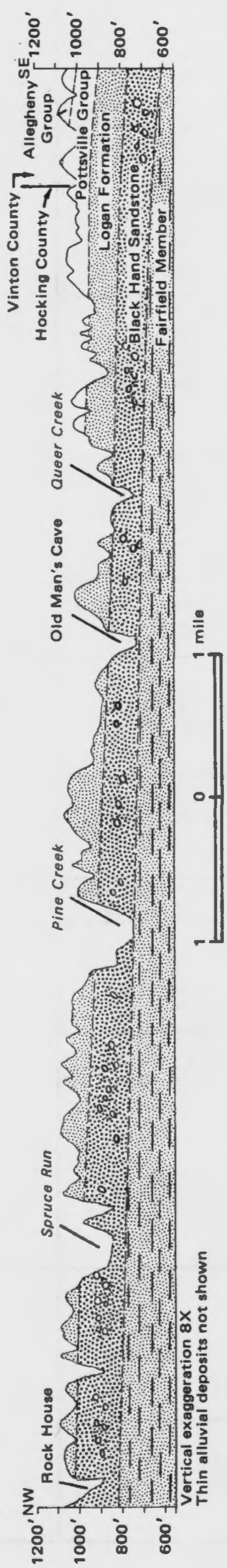

FIGURE 3.–Northwest-to-southeast cross section through the Hocking Hills State Park region, showing the slight dip to the southeast (DeLong, 1967).

figure of the hand was quarried away during construction of the Ohio Canal during the 1820's.

Overlying the Black Hand Sandstone is a rather thin (0-3 feet) bed of conglomerate composed of rounded quartz pebbles up to one inch in diameter enclosed in a matrix of coarse sand. This unit, the Berne, is the basal member of the Logan Formation, also of Mississippian age. The remaining members of the Logan Formation are the Byer, the Allensville, and the Vinton, in ascending order. These units are sandstone and shale.

The Byer Member is a fine-grained greenish-gray to orange-brown sandstone to siltstone interbedded with silty bluish-gray shale. Thickness of the Byer in the park region ranges from 17 to 50 feet. The Byer is characterized by abundant feeding trails and burrows of wormlike animals (fig. 8). Other marine fossils such as brachiopods and crinoids may be present in small numbers.

Overlying the Byer Member is the Allensville Member. The Allensville is a coarse-grained buff-colored sandstone interbedded with fine-grained sandstone and shale. Thickness of the Allensville ranges from 2 to 35 feet. Marine fossils are present at a few localities.

Uppermost in the marine sedimentary sequence of the Logan Formation is the Vinton Member. The Vinton is a fine-grained buff to gray sandstone interbedded with laminated siltstone and shale. Thickness of the Vinton in the park area ranges from 73 to 117 feet.

A distinct unconformity, representing a break in sedimentation and an interval of erosion, separates the Logan Formation, of Mississippian age, from the overlying Pottsville Group, of Pennsylvanian age. The Pottsville is composed of generally thin alternating beds of sandstone, shale, clay, and coal, with a few beds of marine shale or limestone.

The youngest bedrock exposed in the vicinity of Hocking Hills State Park belongs to the Allegheny Group, of Pennsylvanian age. These rocks are exposed on some of the higher ridges in the eastern part of the park area. The Allegheny rocks are similar to those of the underlying Pottsville in that they consist of alternating beds of sandstone, shale, limestone, clay, and coal. The sedimentary sequence exposed in the park region is presented diagrammatically in figure 4.

GEOLOGIC HISTORY

During the middle part of the Mississippian Period the region now occupied by Hocking Hills State Park was covered by a shallow sea. Streams with headwaters to the southeast carried their sediments into this seaway and built a series of deltaic complexes (fig. 5). Fine-grained sediments were carried out to sea and deposited in front of the advancing deltas.

The main part of the deltaic complex exposed in the park area is represented by the Black Hand Sandstone. The crossbeds and lenses of pebbles so characteristic of the Black Hand are typical of deltaic distributary deposits. Fine-grained sediments that later formed the Fairfield Member of the Cuyahoga Formation represent prodelta deposits (foreset beds) that settled in relatively quiet sea water offshore from the Black Hand delta. As the Black Hand delta built seaward, the coarse-grained sediments that formed the Black Hand covered the fine-grained sediments of the Fairfield (fig. 6A).

A rise in sea level or subsidence of the Black Hand delta caused transgression of the sea over the former delta. Winnowing of the upper few feet of fine-grained sand by the transgressing sea left a lag concentrate that became the Berne. Sedimentation began once more. Fine-grained sand that became the sandstone of the Logan Formation was

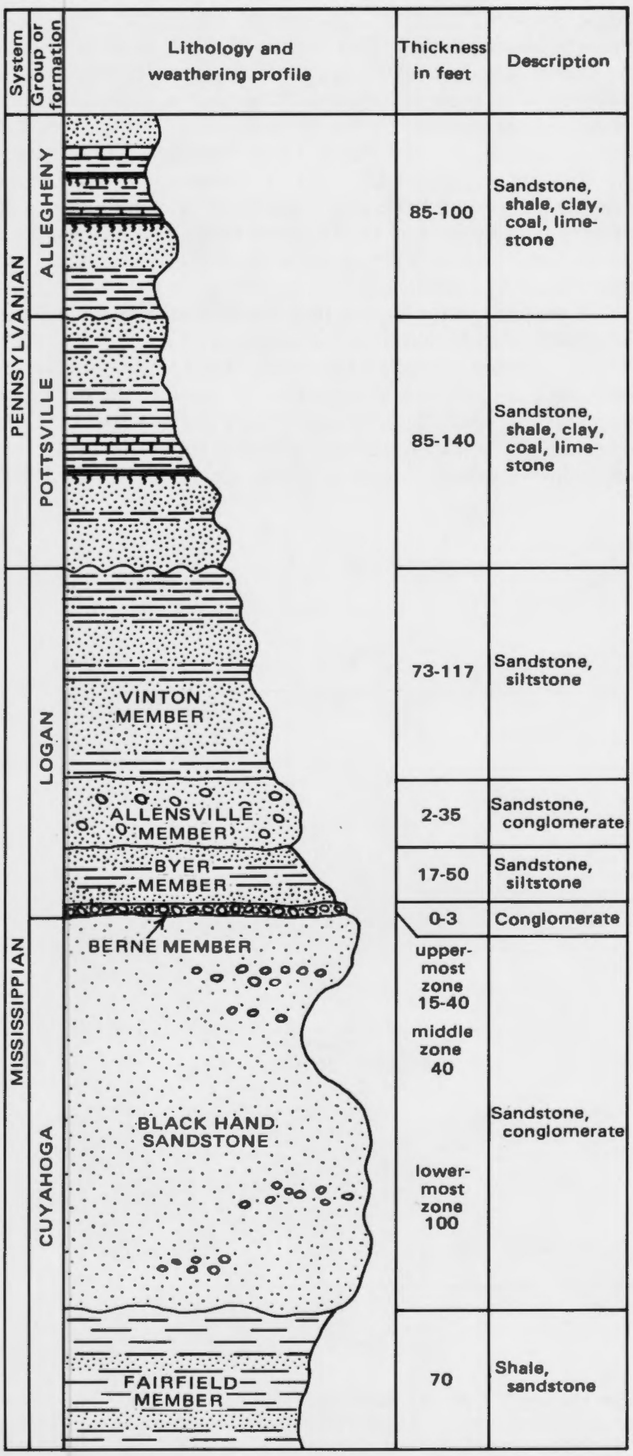

FIGURE 4.–Columnar section of rocks exposed in the Hocking Hills State Park region (modified from Hall, 1952).

deposited in the shallow sea (fig. 6B).

The geologic history of the park region during the remainder of the Paleozoic Era, the Mesozoic Era, and most of the Cenozoic Era is obscure. This was a time, in this area, of nondeposition and/or erosion. It can be surmised that in eastern Ohio previously deposited rocks were being stripped off by erosion (fig. 6C).

Not until late in the Tertiary Period, during the Pliocene Epoch, is any record available of events occurring in the region of Hocking Hills State Park. At this time a low-lying flat erosional surface known as the Lexington-Worthington peneplain was formed (fig. 6D).

Subsequent uplift of southeastern Ohio during the late Pliocene Epoch and early part of the Pleistocene Epoch renewed the erosional cycle, initiating dissection of the Lexington-Worthington peneplain. The accordant summit levels of many of the hills in the park region are all that remain of this once-flat surface (fig. 6E). Other peneplain remnants have been recognized in southeastern Ohio, indicating that more than one cycle of uplift and erosion may have occurred.

The spawning of great continental glaciers about 2 million years ago, during the Pleistocene Epoch, marked a time of erosion in southern Ohio. Although glacial ice came within 6 miles of the park area, it did no direct sculpturing of scenic features. Erosion of the magnificent gorges and unique scenic features of Hocking Hills State Park was accomplished by running water, the volume of which probably was increased greatly by the proximity of the ice sheets (fig. 6F).

FIGURE 5.–Extent of the Black Hand delta in Ohio (modified from Szmuc, 1970).

DEVELOPMENT OF SCENIC FEATURES IN THE PARK AREA

The rugged scenery of the six state park areas of Hocking Hills State Park is developed in one particular stratum, the Black Hand Sandstone of the Cuyahoga Formation. In comparison to other strata in the park region the Black Hand Sandstone is greatly resistant to erosion. Units such as the Logan Formation tend to form rather gentle vegetated slopes, but the Black Hand stands in vertical cliffs, in places over 100 feet high. The resistance to weathering of the Black Hand is due to its firm cementation by iron oxide. Sandstones of the Logan Formation lack this cementation and therefore crumble rather readily into individual sand grains.

The scenic beauty of the Black Hand Sandstone is accentuated further by differential cementation of sand grains within the unit. Based upon degree of cementation, and therefore resistance to weathering, the Black Hand is divisible into three zones (fig. 4). The lowermost zone is coarse grained, massive, and firmly cemented, and consequently resistant to erosion. The Lower Falls at Old Man's Cave is formed on this zone, which typically is about 100 feet thick.

The middle zone of the Black Hand is crossbedded and weakly cemented and therefore less resistant to erosion. As a result numerous recesses or rock shelters have developed in it. Old Man's Cave, Ash Cave, Rock House, Rock Bridge, and the reentrant at Cantwell Cliffs are all formed partly as a result of the weakness of this zone. The middle zone averages about 40 feet in thickness.

The uppermost zone of the Black Hand Sandstone is coarse grained, massive, and firmly cemented, making it resistant to weathering. This zone is as much as 40 feet thick and forms the rims of the gorges in the park region and the roofs of the rock shelters such as Ash Cave. Numerous waterfalls are present in the park where streams cross the uppermost zone of the Black Hand Sandstone. Cedar Falls and the Upper Falls at Old Man's Cave are examples. Degree of cementation, and therefore resistance to weathering, also differ within each zone of the Black Hand Sandstone, giving rise to intricate weathering patterns with firmly cemented layers standing in bold relief.

A second major factor that has had an integral part in the development of the park's scenic features is the system of joints running through the Black Hand Sandstone. Joints are cracks or fractures along which no movement has taken place. In the park region the joints are nearly vertical and in many places can be traced laterally for some distance. Two major intersecting systems of joints are visible in the Black

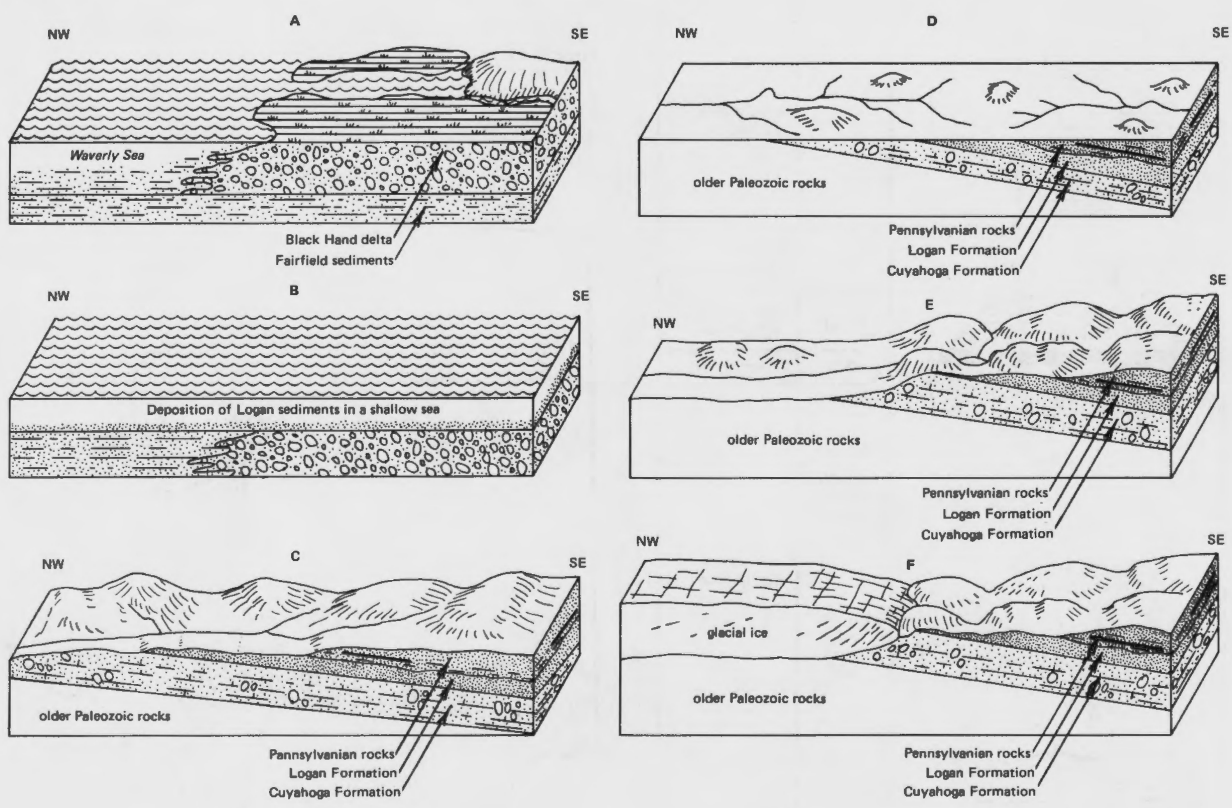

FIGURE 6.–Geologic history of the Hocking Hills region (modified from Hall, 1952). *A*, The Black Hand delta advanced into the shallow Waverly Sea during the middle of the Mississippian Period. *B*, The sediments which are now the Logan Formation were deposited in a shallow sea that advanced over the Black Hand delta in later Mississippian time. *C*, Near the end of the Paleozoic Era the region was uplifted and dissected by erosion. *D*, At the end of the Tertiary Period the region was reduced to a flat surface, called the Lexington-Worthington peneplain. *E*, Uplift of the land at the end of the Tertiary Period initiated dissection of southeastern Ohio by streams. *F*, During the Pleistocene Epoch of the Quaternary Period great ice sheets advanced to the northern border of the Hocking Hills region. Moisture related to these glaciers caused further dissection of the region by erosion, leaving the landscape largely as it appears today.

Hand Sandstone in Hocking Hills State Park. These systems generally run north-south and east-west.

Joints are zones of weakness where water can easily penetrate, dissolving cement and enlarging the joint by expansion due to freezing. In addition, streams in the park region tend to follow the joint patterns, which are paths of least resistance. The effect of erosion along joint patterns is most pronounced at Rock House, but all of the park areas exhibit joint-controlled weathering and erosion, which produce the angularity and vertical walls in the outcrops of Black Hand Sandstone.

The agent of erosion that has created the unique geologic beauty of the park area is water. Ground water percolating through the porous sandstone dissolves the cement binding the sand grains together. Expansion due to freezing of moisture between the grains pries the sand grains loose from their matrix so they fall to the ground and are eventually carried away by running water. Streams cut downward, deepening the chasms and carrying away the sediment. In terms of a human lifespan the erosional process is exceedingly slow, but, given a million years or so, the great gorges of Hocking Hills State Park have had ample time in which to form.

ROAD LOG – BEDROCK GEOLOGY, HOCKING HILLS STATE PARK DINING LODGE TO ROCK BRIDGE

Mileage

Cumulative	*Between points*	
South Bloomingville quadrangle		
0	0	Dining lodge at Hocking Hills State Park. Proceed in vehicles north along the lodge road toward the junction with Ohio Rtes. 374 and 664.
0.8	0.8	Fine-grained sandstone of the Byer Member is exposed along the left (west) side of the road (fig. 7).
1.2	0.4	Junction of Ohio Rtes. 374 and 664 and dining lodge road. Park vehicles in the wide pullover on the right side of the road. **STOP 1** (optional). Outcrop of Black Hand Sandstone and Logan Formation (SW¼SW¼ sec. 11, Benton Township, Hocking County, Ohio).

The top of the Black Hand Sandstone is exposed in the ditch along the south side of Ohio Rtes. 664 and 374 uphill (west) from the road junction. Overlying the Black Hand is about 2 feet of Berne conglomerate, the basal member of the Logan Formation. The Berne is characterized by pebbles, up to one inch in diameter, of milky quartz.

Overlying the Berne in rather sharp contact is the Byer Member, which is distinctive because of the presence of burrows and feeding trails (trace fossils) of wormlike creatures of the ichnogenera *Scalarituba* (fig. 8) and *Zoophycus.* These burrows are quite abundant at this locality and in the outcrops of Byer sandstone exposed on the west

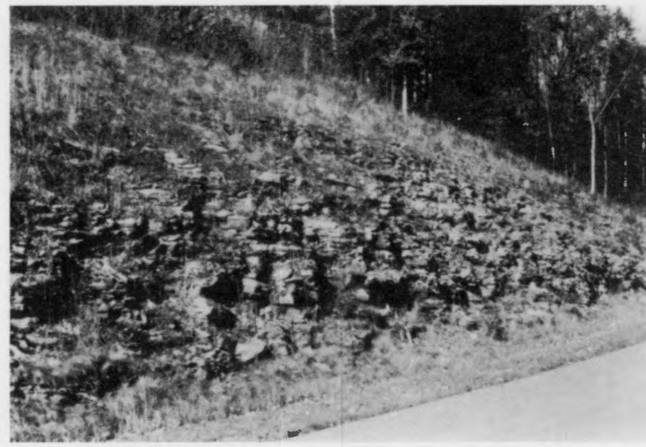

FIGURE 7.—Sandstone of the Byer Member of the Logan Formation exposed along the dining lodge road.

side of the lodge road.

		Return to vehicles and turn right (east) on Ohio Rtes. 664 and 374.
1.6	0.4	Park vehicles in parking lot to the left (north). **STOP 2.** Old Man's Cave (SW¼ sec. 11, Benton Township, Hocking County, Ohio). The trip down the gorge begins at the upper end where Old Man's Creek (this stream has no formal name, but has been called Old Man's Creek informally for some time) crosses the entrance road to the campground.

GEOLOGY OF OLD MAN'S CAVE

Old Man's Cave, the most popular of the parks in Hocking Hills State Park, exhibits some of the most diverse and unique geologic features of the area. The scenic features of Old Man's Cave are developed in the gorge of Old Man's Creek where the stream plunges spectacularly more than 100

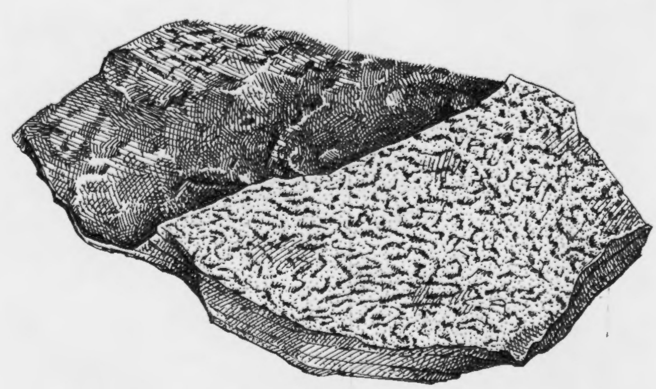

FIGURE 8.—Feeding trails of a wormlike trace fossil, *Scalarituba missouriensis.* These branching tubular burrows are common in the Byer Member of the Logan Formation in the Hocking Hills region.

FIGURE 9.–Small waterfalls developed in the resistant uppermost zone of the Black Hand Sandstone.

feet in a distance of just over half a mile. The entire thickness of the Black Hand Sandstone is traversed in this distance between the Upper Falls and the Lower Falls.

The waterfalls, rock shelter caves, and rugged cliffs are a result of the erosive action of running water on the jointed differentially resistant Black Hand Sandstone. In most areas staining of the rock surface by iron compounds and by lichens and algae has created a veritable rainbow of colors on the steep walls of the gorge.

Old Man's Creek flows in a broad valley cut into the soft sandstones of the Logan Formation to the vicinity of the road into the camping area at the upper end of the gorge. Here the stream flows across a wide flat area of resistant bedrock, which marks the position of the Berne conglomerate, and then begins a steep plunge over a series of small waterfalls, cascading into the gorge in a 30-foot waterfall known as the Upper Falls (fig. 9). The Upper Falls marks the position of the firmly cemented resistant uppermost zone of the Black Hand Sandstone. Old Man's Creek follows a northeast-trending master joint.

Below the Upper Falls is a well-developed plunge pool.

FIGURE 10.–The Devil's Bathtub, a pothole developed by the swirling action of Old Man's Creek.

From the Upper Falls the stream descends the steep-walled valley in a more gentle gradient to the Devil's Bathtub (fig. 10). Geologically, the Devil's Bathtub is a pothole, formed by sand grains and pebbles swirling around and around in a hollow cut by the stream. Probably most of the cutting of the pothole is accomplished during times of high water. The Devil's Bathtub and the narrow overhanging walls of the stream channel just below it are formed in a resistant layer in the middle zone of the Black Hand.

Exhibited at many places on the steep walls of the gorge is a type of weathering called honeycomb weathering; the term refers to the pattern developed on the face of the rock. The intricately etched patterns are caused by a process known as case hardening–differential cementation of the sand grains by iron oxide. Where ground water has deposited iron oxide in the pore spaces between the sand grains a very resistant layer is formed. The firmly cemented sand grains have left the case-hardened layers standing in relief in honeycomb or riblike patterns.

Old Man's Cave, a large rock shelter in the northwest valley wall of Old Man's Creek, is formed in the weakly cemented crossbedded middle zone of the Black Hand Sandstone. This rock shelter cave is about 200 feet long, 50 feet high, and 75 feet deep. Enlargement of the cave is accomplished primarily by the spalling of individual sand grains, although occasionally large blocks fall from the ceiling. The cave floor is covered with the results of both these processes. The resistant uppermost zone of the Black Hand forms the roof of the cave. A large joint paralleling the trend of the valley forms the margin of the ceiling. This joint can be seen entering the bedrock at the east (on the left facing out) end of the rock shelter. Honeycomb-weathering patterns are well developed on the ceiling. Old Man's Cave derives its name from a fugitive from West Virginia named Rowe, who lived here as a recluse after the Civil War. After his death he was reputedly buried beneath the rocks on the cave floor.

Downstream from Old Man's Cave, Old Man's Creek encounters the resistant lowermost zone of the Black Hand Sandstone and cascades into a broad plunge pool as a scenic waterfall known as the Lower Falls. A large rock shelter is developed behind the waterfall. At the base of the rock shelter the contact between the Fairfield shale member of the Cuyahoga Formation and the Black Hand sandstone member can be seen. Downstream from the Lower Falls is the lower gorge, which can be followed along a trail to Cedar Falls, a distance of about 2 miles. The floor of the lower gorge is developed in the Fairfield shale; the vertical walls are composed of the Black Hand Sandstone.

In addition to the unique and often spectacular geological features found in the gorge at Old Man's Cave, there is an abundance of plant and animal life. Many of the plants are relict species and as such record former climatic and geological conditions. A relict species commonly found growing in the gorge at Old Man's Cave is *Sullivantia sullivanti* (fig. 11), a small shrublike plant with round scalloped leaves. This plant had its origins in the southern United States and was brought to Ohio by the preglacial Teays River. The ameliorated climatic conditions along the steep walls of the gorge apparently have perpetuated the survival of this species. *Sullivantia sullivanti* is especially common on the cliffs surrounding the plunge pool below the Upper Falls. The towering hemlock trees that line the gorge are glacial relicts that flourished in this area during the

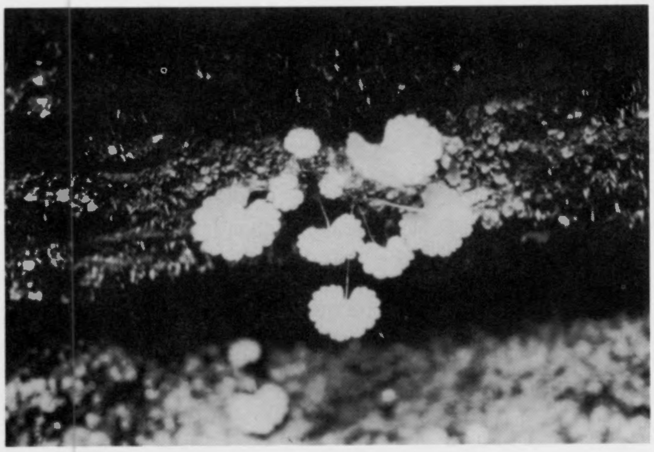

FIGURE 11.–*Sullivantia sullivanti,* a relict plant that has survived since preglacial times owing to the ameliorated climatic conditions on the sandstone walls of the gorge of Old Man's Creek.

Pleistocene ice age, when cooler climates prevailed. The cool moist gorges of Hocking Hills State Park have provided favorable environmental conditions for the survival of these trees.

		Return to vehicles and turn right (west) on Ohio Rtes. 664 and 374. Continue west to junction of Ohio Rte. 664 and Ohio Rte. 374.
3.7	2.1	Junction of Ohio Rte. 664 and Ohio Rte. 374. Turn right (northwest) on Ohio Rte. 374.
4.1	0.4	Black Hand Sandstone outcrop on the left (west).
4.7	0.6	Road to parking lot at Conkles Hollow on the right (northeast). Proceed straight ahead (northwest).
5.2	0.5	Headquarters of the Hocking State Forest and the Hocking Honor Camp on the left (southwest).
8.0	2.8	Junction of Ohio Rte. 374 and Ohio Rte. 678. Continue on Ohio Rte. 374 to the left (west).
9.9	1.9	Parking lot of Rock House on the right (north). Turn in and park vehicles. **STOP 3.** Rock House (NW¼SE¼ sec. 19, Laurel Township, Hocking County, Ohio). Lunch in the picnic area at Rock House.

GEOLOGY OF ROCK HOUSE

As are many other geologic features in Hocking Hills State Park, Rock House is a product of differential weathering along joints in the Black Hand Sandstone. Rock House, however, is a more striking example than any other area: a tunnel-like cave about 25 feet high and 200 feet long, open at both ends, runs parallel to the cliff face. The passageway follows a major joint trending northeast. Five windows opening from the main tunnel onto the cliff face are formed along a second set of joints trending northwest. The joints are visible as large cracks running along the ceiling and into the walls of the passageway. Figure 12 illustrates the configuration of the passageway and windows and the joint patterns that have controlled development of these features.

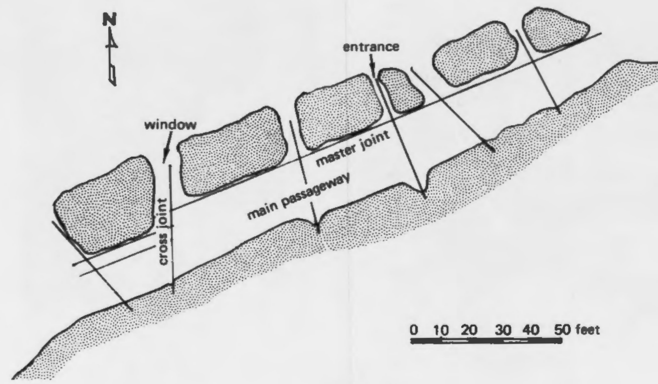

FIGURE 12.–Map of Rock House showing the tunnel-like main passageway and the windows (after Carman, 1946). Note that these openings are developed along joints.

The passageway of Rock House is formed in the middle zone of the Black Hand Sandstone. The more resistant uppermost zone forms the roof, and the lowermost zone forms the floor; ground water percolating along the joints has caused enlargement in the middle zone. Excavation of the loose sand grains has been accomplished by running water, mostly during the Pleistocene Epoch, when climatic conditions were moist owing to glacial influence. Even today, when rainfall is abundant, springs of water issue from the sandstone in the lower part of the tunnel and flow in rivulets across the floor and out the windows.

The beauty of Rock House is enhanced by an intricate pattern of colors on the walls. Shades of brown, red, and orange are due to staining by iron compounds. Shades of green are caused by algae and lichens growing on the damp sandstone.

Rock House has long been a popular attraction for tourists (fig. 13). In 1835 a 16-room hotel was built at the present site of the picnic shelter. It stood until 1925. The numerous carvings of initials and dates in the walls of Rock House bear testimony to its long period of popularity. Many of the visible dates are over 100 years old. It is reported that a carving in the form of a book with the letters I.T.F.B.R.B.A.R: - I.T.F.F.A.W.M.T.A.W. is inscribed in the rock over one of the doors. The letters stand for: "In the fall Buck Run bananas are ripe: - in the frosty fall a wise man takes a wife." Buck Run banana is the local name for the fruit of the pawpaw tree.

Return to Ohio Rte. 374; turn left (east) on Ohio Rte. 374 and retrace route to the junction of Ohio Rte. 374 and Ohio Rte.

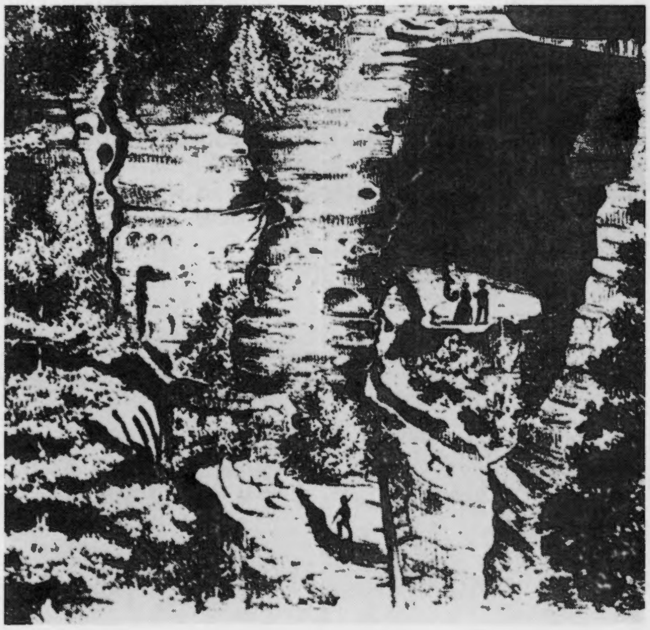

FIGURE 13.–Early lithograph of Rock House (from Andrews, 1871).

678.

11.8 1.9 Junction of Ohio Rte. 374 and Ohio Rte. 678. Turn left (north) on Ohio Rte. 678 toward Gibisonville.

13.0 1.2 Enter the village of Gibisonville. A mill was built here in 1835 to manufacture gunpowder from saltpeter (niter, potassium nitrate) found in nearby caves and gorges.

Rockbridge quadrangle

15.7 2.7 Junction of Ohio Rte. 678 and Ohio Rte. 180. Go straight ahead (north) on Ohio Rte. 180.

17.5 1.8 The Byer Member of the Logan Formation is exposed in the roadcut on the right (southeast). The Black Hand Sandstone of the Cuyahoga Formation is exposed in the ditch on the right and in the gorge on the left.

Logan quadrangle

19.5 2.0 Junction of Ohio Rte. 180 and U.S. 33. Turn left (west) on U.S. 33. *Caution:* Four-lane divided highway.

Rockbridge quadrangle

20.0 0.5 Turn right (north) onto access road (not shown on quadrangle map) immediately south of the roadside park. Turn right (east) again on access road and proceed straight ahead (east).

20.1 0.1 Turn left (north) at the red brick house on the north side of the road onto Good Hope

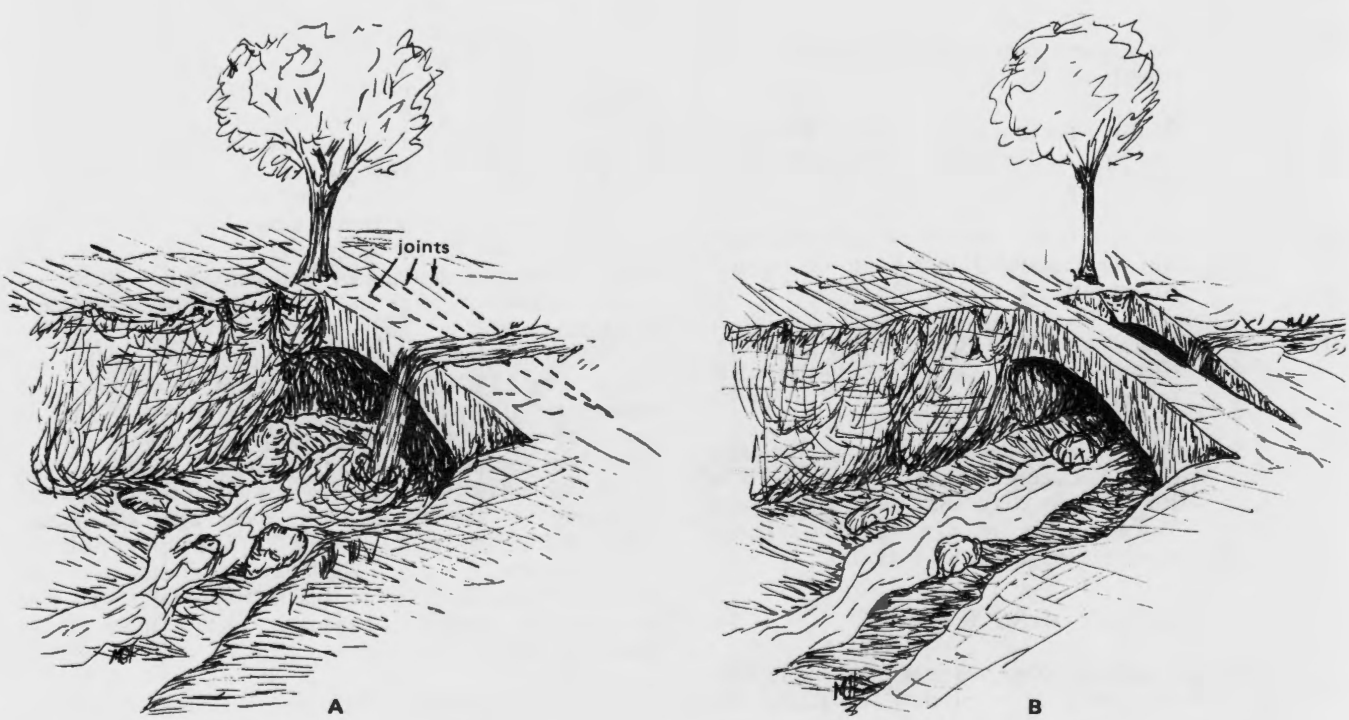

FIGURE 14.–Development of Rock Bridge. *A*, Rock shelter reentrant formed in middle zone of the Black Hand Sandstone. *B*, Collapse of a joint-bounded roof block left a portion of the roof intact as a natural bridge.

Township Rd. 504. Cross outwash material from the Illinoian ice. Note the gravel exposed in the field to the left (west).

20.6 0.5 Turn right (east) into lane at the white house on the right (east). Park vehicles and walk (about 0.6 mile) to Rock Bridge. **STOP 4.** Rock Bridge (NW¼SE¼ sec. 24, Good Hope Township, Hocking County, Ohio).

The natural bridge and access routes to it are on the farm of Mr. and Mrs. Zoara Crawford. Mr. Crawford is extremely generous in granting permission to visit this unique feature to anyone who asks. Please observe courtesies pertaining to litter, farm gates, livestock, and crops.

GEOLOGY OF ROCK BRIDGE

Rock Bridge, a natural arch or bridge, spans more than 100 feet and stands about 40 feet above stream level. The bridge is about 5 feet thick and more than 20 feet wide at its widest point, narrowing to 4½ feet. Like many other geologic features developed in the Black Hand Sandstone, Rock Bridge owes its existence to joint patterns and to zones of differential resistance to weathering.

Rock Bridge is located at the head of the valley of a small unnamed tributary to the Hocking River. At this point the resistant Black Hand Sandstone outcrops. Because of its resistance the sandstone formed a small waterfall in the stream valley. The weakly cemented crossbedded middle zone of the Black Hand was eroded to form a reentrant or rock shelter; the resistant uppermost zone formed the roof and the lowermost zone formed the floor. Three closely spaced joints trending northwest cut the Black Hand Sandstone at right angles to the trend of the stream valley. Collapse of a roof block bounded by the two innermost joints has left a long narrow span of the roof standing as a natural arch known as Rock Bridge (fig. 14).

Rock Bridge has long been a favorite spot for picnicking and visitation, especially during the late 1800's (fig. 15), when the Columbus, Hocking Valley, and Toledo Railroad ran nearby.

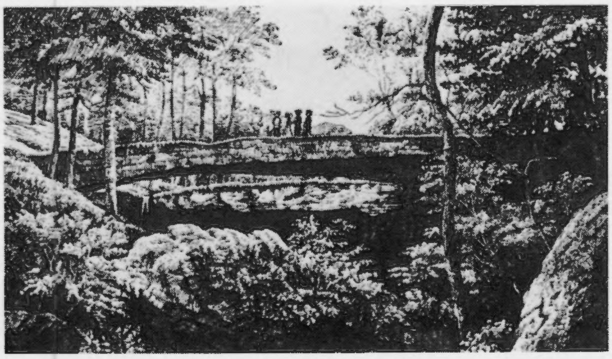

FIGURE 15.–Rock Bridge as it appeared in 1889 (from Howe, 1907).

ROAD LOG – GLACIAL GEOLOGY, ROCK BRIDGE TO HOCKING HILLS STATE PARK DINING LODGE

On the return walk from Rock Bridge to the vehicles, proceed to the summit of the hill, which is the site of a small family cemetery. From this vantage point certain drainage features of this portion of the Hocking River valley can be viewed.

DRAINAGE CHANGES OF THE HOCKING RIVER VALLEY

Prior to glaciation, during Teays-stage drainage, the ancestral Hocking River was a northwest-flowing stream known as the Logan-Lancaster River (fig. 16). This tributary of the Teays River had its headwaters in the vicinity of Haydenville, in southeastern Hocking County. The drainage divide separating the northwest-flowing Logan-Lancaster River from the southeast-flowing Luhrig-Stewart Creek was located just southeast of Haydenville.

Advance of the (Kansan?) ice into the present-day Hocking River drainage basin blocked the northwest-flowing Logan-Lancaster River and created a large lake that extended southeast to the drainage divide near Haydenville. After dissipation of the early ice sheet northwestward drainage was resumed.

The Illinoian ice advanced down the Hocking River valley to the vicinity of Horns Mill (Clark's Crossing), just north of Sugar Grove, in Fairfield County, and created an ice dam across the valley. Sediment-laden meltwaters were discharged down the valley in a southeasterly direction. The divide near Haydenville was soon bridged, establishing a southeastward drainage to the Ohio River.

At this time the river occupied the broad Teays-stage valley between Logan and Rockbridge. This valley can be seen clearly to the southeast from the hilltop on the Crawford farm. Outwash from the Illinoian ice filled the valley with more than 200 feet of sand and gravel. The outwash deposits were of sufficient thickness that only scattered bedrock knobs projected through the Illinoian valley train. (The hill upon which the Crawford family cemetery and Rock Bridge are located is one of these bedrock knobs.) The river wandered back and forth across this aggraded surface. Upon cessation of meltwater deposition after melting of the Illinoian ice the river cut into its own debris. Fortuitously the river followed a course on the aggraded valley train north of the main buried valley and eventually entrenched itself in the narrow bedrock valley it occupies today. Figure 17 illustrates the drainage changes between Rockbridge and Logan during late Illinoian time. The abandoned valley segment between the two towns retains the most extensive Illinoian outwash deposits of the entire Hocking River valley. Buck Run and Clear Fork (via Scott Creek) removed only minor amounts of outwash from the valley.

Return to U.S. 33.

21.1 0.5 Junction of U.S. 33 and access road. Turn left (east) on U.S. 33.

Logan quadrangle

21.7 0.6 Junction of U.S. 33 and Ohio Rte. 180.

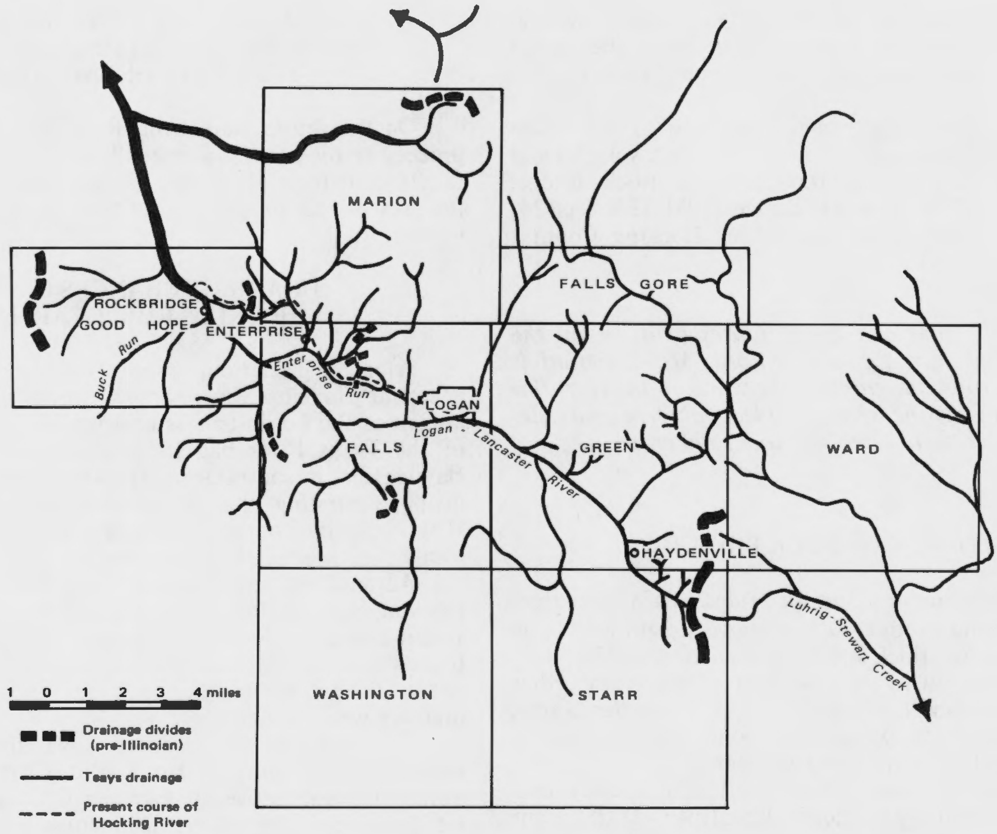

FIGURE 16.–Teays-stage drainage in the Hocking River valley area of Hocking County. The northwest-flowing Logan-Lancaster River joined the Groveport River, a major tributary of the Teays River, in Fairfield County (from Merrill, 1953).

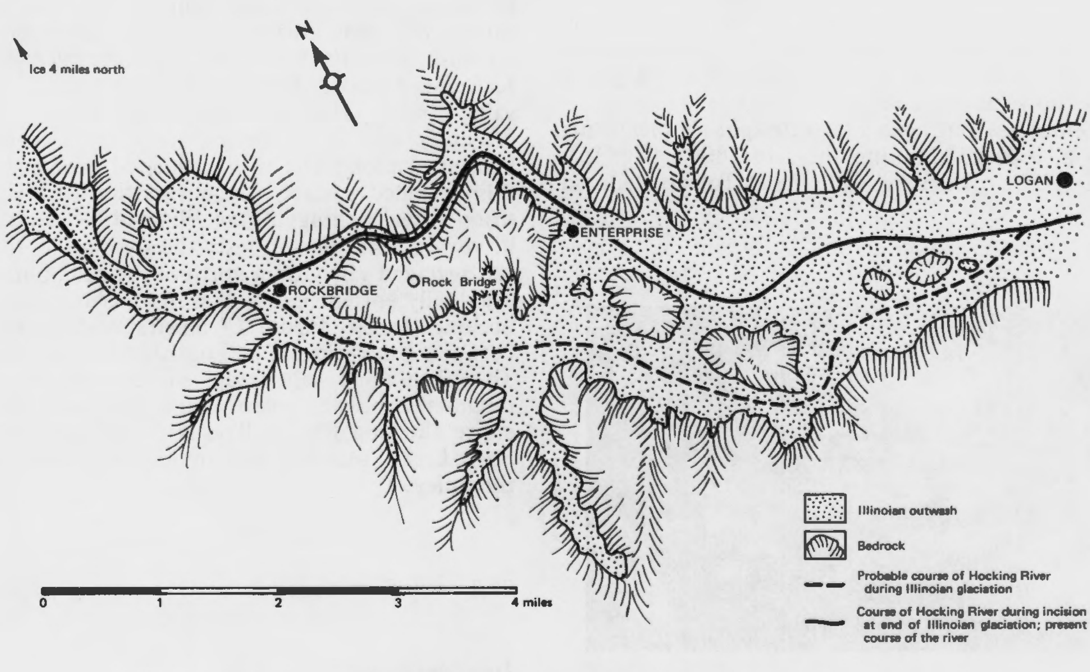

FIGURE 17.–Drainage changes in the Hocking River between Rockbridge and Logan during late Illinoian time (from Merrill, 1953, and Kempton, 1956).

Turn right (south) on Ohio Rte. 180 and then left (southeast) less than 100 yards onto Hocking County Rd. 3, Lake Logan Rd.

22.1 0.4 Gravel pit on the left (north). Park vehicles in the pit. **STOP 5** (optional). Gravel pit in Illinoian outwash (SE¼SW¼ sec. 6, Falls Township, Hocking County, Ohio).

The sand and gravel (fig. 18) exposed in this pit are Illinoian outwash deposited in the abandoned ancestral Hocking River channel, which was visible from the hilltop on the Crawford farm. The sand and gravel are crossbedded and relatively well sorted. A 2- to 5-foot-thick cap of loess, composed of silt and fine sand, overlies the sand and gravel at this locality.

FIGURE 18.–Illinoian outwash exposed in a sand and gravel pit at Stop 5.

Depth of weathering is generally great in outwash materials of Illinoian age, reflecting the great span of time since deposition. Depth of leaching at this locality averages 10 feet. Pebble counts from this locality average 42 percent carbonates, 40 percent clastics, and 18 percent crystallines. Younger Wisconsinan outwash materials from the Hocking River valley generally have a higher percentage of carbonates than do older Illinoian outwash deposits. This is probably a reflection of the greater amount of time available for leaching of carbonates from the Illinoian deposits.

Return to vehicles and proceed back to Ohio Rte. 180.

22.5 0.4 Turn left (southeast) on Ohio Rte. 180.

Rockbridge quadrangle

26.2 3.7 Junction of Ohio Rte. 180 and Ohio Rte. 678. Turn right (west) on Ohio Rte. 180.

26.7 0.5 Ohio Rte. 374 joins Ohio Rte. 180. Continue on Ohio Rte. 180.

27.1 0.4 Black Hand Sandstone outcrops on the right (north).

Clearport quadrangle

31.2 4.1 Ohio Rte. 180 and Ohio Rte. 374 split. Continue straight ahead on Ohio Rte. 180.

31.4 0.2 The bedrock knob in the field to the left is composed of Black Hand Sandstone. The field trip route is following the valley of Laurel Run, which flows across the Fairfield Member of the Cuyahoga Formation.

Laurelville quadrangle

33.4 2.0 Enter village of South Perry. This community is located at the boundary of the Illinoian ice sheet. The ice margin was oriented north-south in this immediate area, and the ice overrode the bedrock hills west to east. Continue west on Ohio Rte. 180.

36.1 2.7 The boundary of the Wisconsinan ice sheet is crossed at this point (valley of Dry Run).

36.5 0.4 Junction of Ohio Rte. 180 and Moccasin Rd.

At this mileage the field trip route proceeds to an optional stop, STOP 6, Salt Creek School. This route traverses a narrow unpaved road that crosses a narrow bridge. Travel conditions could be difficult, especially for large vehicles such as buses, during wet or icy weather. If this stop is to be omitted, proceed on Ohio Rte. 180 to Laurelville, where Ohio Rte. 56 joins Ohio Rte. 180 (1.8 miles). Turn right (west) on Ohio Rtes. 180 and 56. Proceed 0.6 mile to junction where Ohio Rte. 180 splits from Ohio Rte. 56 at mileage 38.9 (p. 14).

ROAD LOG – OPTIONAL ROUTE (STOP 6)

0.0 0.0 Turn right (north) on Moccasin Rd. The road follows Moccasin Creek, a small tributary of Laurel Run.

Clearport quadrangle

1.5 1.5 Turn left (west) on South Perry Rd. (Salt Creek Township Rd. 205) and enter Pickaway County.

1.6 0.1 Cross Moccasin Creek.

Stoutsville quadrangle

Illinoian and Wisconsinan ice covered the area now being crossed.

2.5 0.9 Cross Pumpkin Ridge, a bedrock ridge covered by glacial sediments.

3.2 0.7 Cross Salt Creek. This valley served as a drainage channel for meltwater from the receding ice sheet.

3.5 0.3 Junction of South Perry Rd. and Tarlton-Adelphi Rd. (Pickaway County Rd. 64). Proceed straight ahead (west) on South Perry Rd.

4.1 0.6 Junction of South Perry Rd. and Ohio Rte. 56. Continue straight ahead (west) on Ohio Rte. 56.

4.2 0.1 Salt Creek School. Turn into parking lot. **STOP 6** (optional). Salt Creek School (SW¼SE¼SW¼ sec. 15, Salt Creek Township, Pickaway County, Ohio).

FIGURE 19.–View of the bedrock hills marking the Appalachian escarpment. Topography in the foreground is developed on Illinoian glacial sediments.

The vantage point of Salt Creek School gives an excellent view of the bedrock hills (fig. 19) of the Appalachian escarpment rising against the skyline to the south and southeast. The rolling topography of the area between Salt Creek School and the forested hills of the escarpment is end moraine deposited by the Wisconsinan ice. Ice retreated from this area about 16,000 years ago. The relief of the glaciated topography is due in part to bedrock dissected in preglacial time. Drift deposits in this area are generally thin.

Return to vehicles and turn left (southeast) on Ohio Rte. 56.

Hallsville quadrangle

5.9 1.7 Cross Salt Creek.

Restrooms available in small park on left.

6.4 0.5 The extensive flat area now being crossed is known as The Prairie. This was the site of an early postglacial lake. Pollen from marl deposits in the lake bed show that the dominant tree in this area was spruce, with lesser numbers of pine, fir, larch, and oak. Several incomplete skeletons of mastodons have been recovered from the lake deposits; one skeleton found near Hallsville was dated by radiocarbon at 13,695 ± 520 years before present. Fluted projectile points used by Paleo-Indians have been found along the shores of this former lake, although none have been found in association with mastodons.

Note the numerous conical kames in the immediate area. In the background the bedrock hills of the Appalachian Plateaus Province rise above the glaciated topography in the foreground. Just ahead is the beginning of the Cuba Moraine, which probably marks the farthest advance of the Wisconsinan ice in this area. A radiocarbon date on spruce wood from till of the Cuba Moraine indicates that the Wisconsinan ice advanced into this area about 17,000 years ago.

7.6 1.2 Junction of Ohio Rte. 56 and Ohio Rte. 180.

End of optional route.

Hallsville quadrangle

38.9 2.4 Junction of Ohio Rte. 56 and Ohio Rte. 180 west of Laurelville. Turn left (south) onto Ohio Rte. 180 and proceed on Concord St. into the town of Adelphi.

Laurelville quadrangle

39.4 0.5 Turn left (east) at the second cross street (Market St.) in Adelphi and proceed up the hill to the cemetery at the corner of Market St. and High St.

39.6 0.2 Park vehicles and walk to the crest of the hill in the cemetery. **STOP 7.** Adelphi Cemetery (NE¼NE¼ sec. 1, Colerain Township, Ross County, Ohio).

The town of Adelphi is built on the Cuba Moraine. From this vantage point on the cemetery hill the striking contrast between the glaciated Central Lowlands Province to the west and northwest and the unglaciated Appalachian Plateaus Province to the east can be seen. The glaciated countryside abounds in productive farms utilizing the gentle topography and fertile soils; the unglaciated bedrock hills remain in forest because the steep slopes and shallow soils make farming marginal at best.

The Illinoian ice extended about 4 miles down the valley of Salt Creek to the village of Haynes. Note the wide flat valley of Salt Creek to the southeast. Erratics (igneous and metamorphic rocks) of Canadian origin have been found on the tops of hills bordering the valley of Salt Creek, indicating that at its maximum extent the Illinoian ice covered the highlands. Melting of the ice exposed the ridge

FIGURE 20.–View of Salt Creek valley southwest from Adelphi Cemetery (Stop 7). Note the kame terrace along the north valley wall.

tops and left a tongue of ice in the valley of Salt Creek (see fig. 23). Classic kame terraces formed along the valley walls of Salt Creek in association with the ice tongue. These terraces (fig. 20) are particularly well developed along the north valley wall southeast of Laurelville, directly east of the cemetery at Adelphi. The terraces are best developed on the north valley wall because the warm summer sun in the southern sky cast more radiation on that wall, causing greater melting of the ice and therefore more meltwater along the north side of the valley.

Low outwash terraces of Wisconsinan age are visible at the base of the Illinoian-age kame terraces. Figure 21 illustrates the relationship of the kame terraces and outwash terraces to the valley walls of Salt Creek near Laurelville.

Another classic feature of glacial origin in this area is the drainage reversal of Salt Creek. Before glaciation, during Teays-stage drainage (fig. 22), ancestral Salt Creek flowed northwest to Laurelville. This stream, known as Laurelville Creek, flowed north-northwest until it joined the Groveport River, a tributary of the Teays River, just south of Columbus, in Franklin County.

The advance of an early ice sheet, possibly the Nebraskan or Kansan, blocked the Teays River and created a reversal of the master stream and many of its tributaries. The upstream portion of ancestral Salt Creek, in Hocking County, remained unaffected by this ice sheet; however, the downstream portion was drastically disrupted and joined the south-flowing Newark River near Chillicothe. The stream is known at this stage as Adelphi Creek.

Illinoian ice, which advanced south in the valley of Salt Creek to the present site of Haynes, dammed the stream, forming a large lake in the valley (fig. 23). Eventually the lake waters rose high enough to bridge a low divide on the south side of the valley. The divide eventually was eroded, the lake was drained, and the present southward drainage of Salt Creek into the Scioto River was established (fig. 24).

Visible evidence of the drainage reversal of Salt Creek includes: (1) The presence of barbed tributaries such as Blue Creek, Sams Creek, Pine Creek, and Queer Creek. All of these streams flow in an upstream direction instead of in a downstream direction as would be characteristic of an undisrupted dendritic drainage pattern. (For a short distance upstream from their mouths, these tributaries have acquired, in recent times, a downstream direction to their courses.) (2) The valley of Salt Creek narrows downstream between

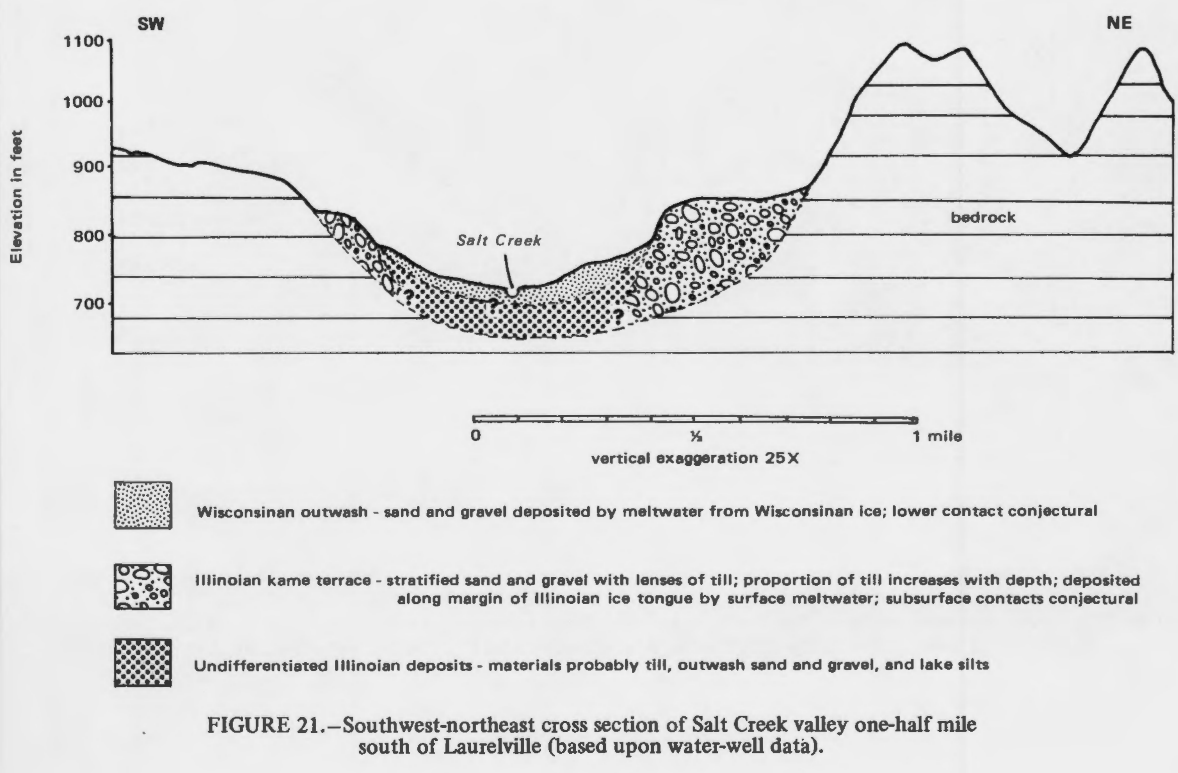

FIGURE 21.–Southwest-northeast cross section of Salt Creek valley one-half mile south of Laurelville (based upon water-well data).

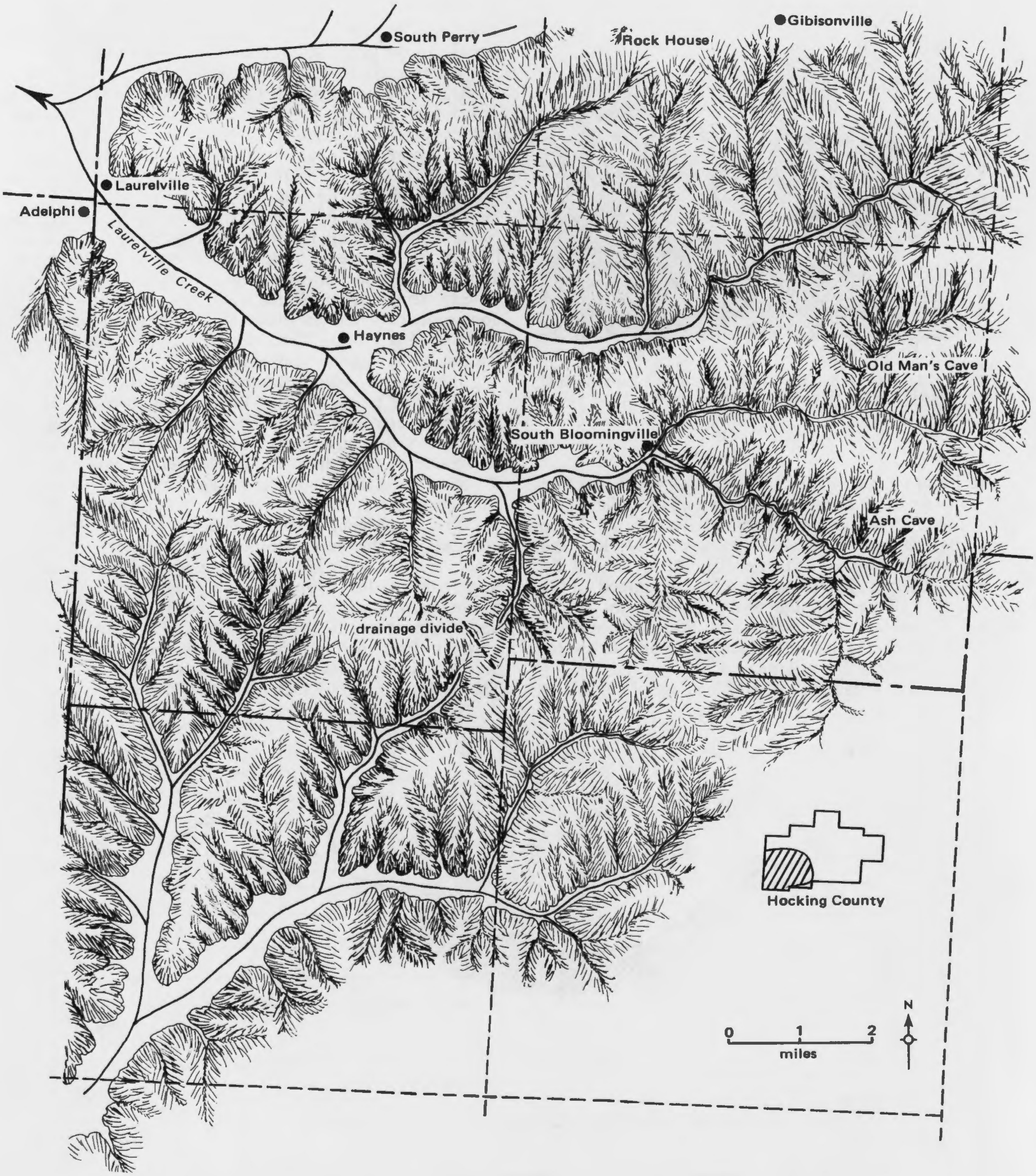

FIGURE 22.–Teays-stage drainage in the Salt Creek valley area, Hocking County, Ohio (topography from U.S. Geological Survey Laurelville 15-minute quadrangle topographic map; drainage data from Stout, Ver Steeg, and Lamb, 1943).

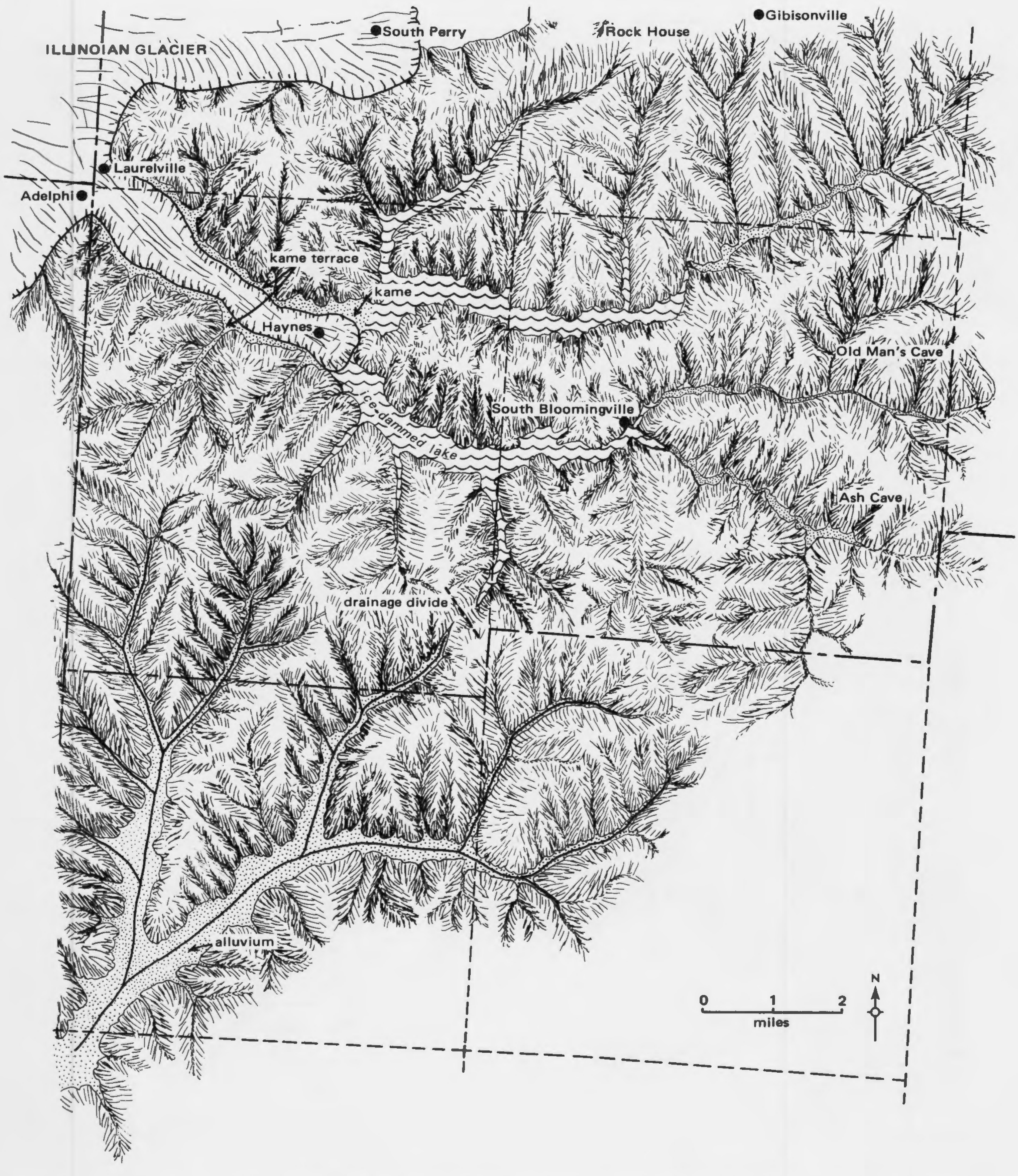

FIGURE 23.–Salt Creek valley area during Illinoian glaciation, showing the extent of the ice and the lake created by damming of north-flowing drainage (drainage data from White, 1939; Stout, Ver Steeg, and Lamb, 1943; Hall, 1951).

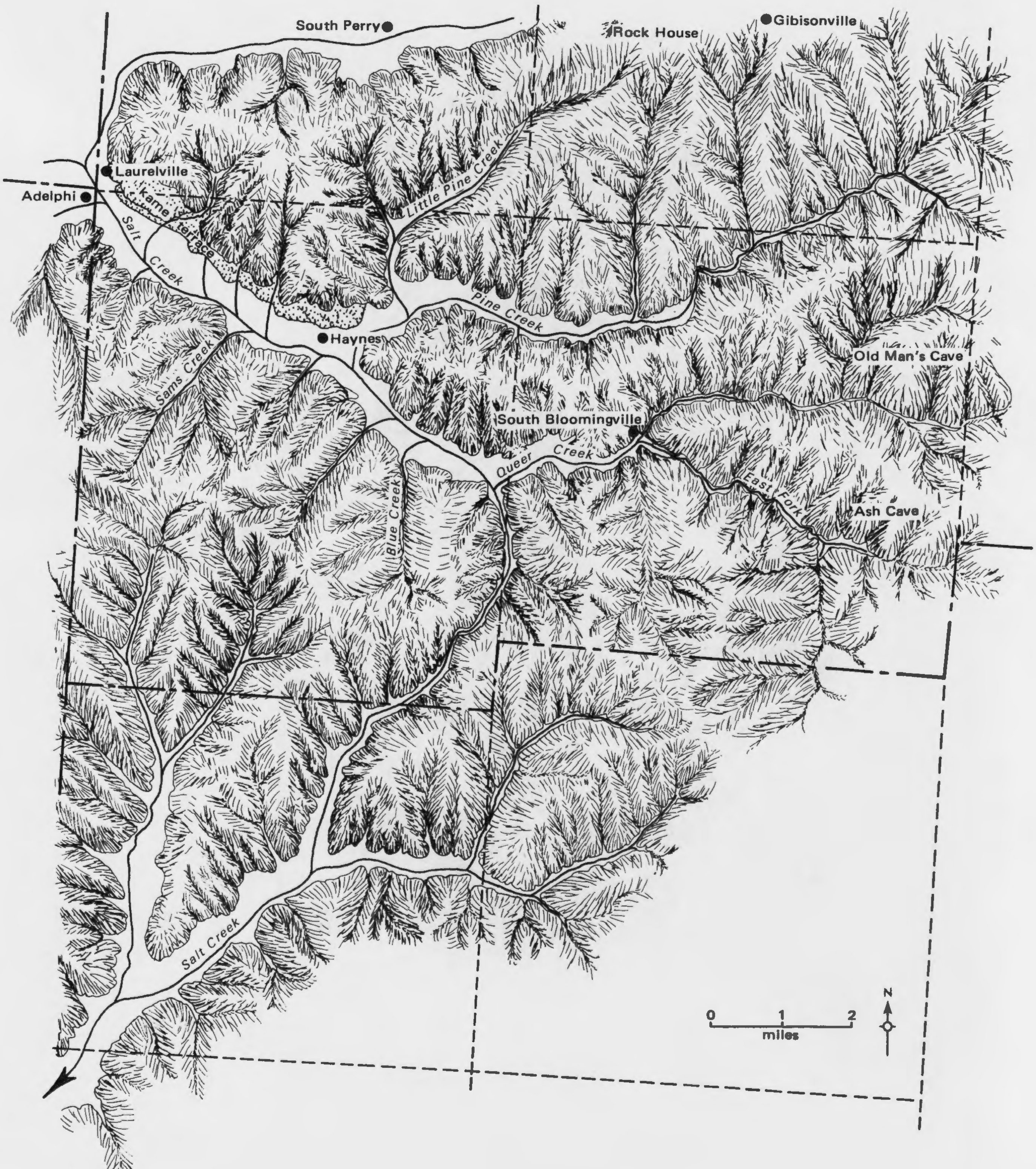

FIGURE 24.–Present drainage of Salt Creek.

Laurelville and the junction of Salt Creek and Queer Creek. (3) Salt Creek enters a narrow bedrock-walled valley at a near-90° angle just south of the junction of Salt Creek and Queer Creek. (4) The bedrock valley of Salt Creek south of its junction with Queer Creek narrows toward the site of the old drainage divide (SW¼ sec. 36, Salt Creek Township, Hocking County, Ohio) and then widens south of the divide. These features are illustrated in figure 24.

Hallsville quadrangle

40.5 0.9 Return to junction of Ohio Rte. 56 and Ohio Rte. 180. Turn right (east) on Ohio Rtes. 56 and 180 to Laurelville.

Laurelville quadrangle

41.0 0.5 Cross Salt Creek and enter the town of Laurelville. Enter Hocking County.

41.1 0.1 Proceed straight ahead (southeast) on Ohio Rte. 56 (Ohio Rte. 180 veers northeast).

42.1 1.0 The classic flat-topped kame terraces viewed from Adelphi are visible to the left (northeast). Note also the width of the valley of Salt Creek here for comparison with the valley farther downstream.

42.6 0.5 To the right (southwest), on the floodplain of Salt Creek, is an Adena Indian burial mound.

43.1 0.5 At this point the road crosses a kame, visible on the right (southwest). To the left (northeast) is a continuation of the kame terrace. Just ahead to the left (east) is an inactive gravel pit (not visible from road) in Illinoian kame terrace deposits. Most of this gravel was removed for local use as road metal.

44.1 1.0 More of the Illinoian kame terrace is present on the valley wall to the left (northeast). Note the hummocky surface of the terrace here in contrast to the flat-topped terrace at Laurelville.

45.0 0.9 Enter village of Haynes. **STOP 8** (optional). Illinoian kames at Haynes (N½ sec. 15, Salt Creek Township, Hocking County, Ohio). These kames are as much as 160 feet high (fig. 25). This point marks the southernmost known advance of Illinoian ice in the valley of Salt Creek.

45.4 0.4 Cross Salt Creek.

47.8 2.4 Junction of Ohio Rte. 56 and Hocking County Rd. 184, The Narrows Rd.

At this mileage the field trip route proceeds to an optional stop, STOP 9, The Narrows. If this stop is to be omitted, proceed straight ahead on Ohio Rte. 56 and continue road log at mileage 49.8 (p. 20).

FIGURE 25.–Kames at Haynes (Stop 8).

ROAD LOG – OPTIONAL ROUTE (STOP 9)

0.0 0.0 Turn right (southeast) on The Narrows Rd.

2.6 2.6 White frame house on the left (southeast) side of the road is the former Pine Cottage School. Park vehicles on the right (northwest) side of the road opposite the house. **STOP 9** (optional). The Narrows (SW¼SE¼ sec. 36, Salt Creek Township, Hocking County, Ohio).

For the last 2½ miles the route has been following a narrow bedrock-walled valley. Note that Salt Creek flows in a wide flat-bottomed valley from Laurelville to the junction of Ohio Rte. 56 and The Narrows Rd.; at this point Salt Creek enters a narrow steep-walled valley. This stop is at the approximate site of the former drainage divide that was bridged by ice-dammed lake waters when the reversal of Salt Creek occurred (see figs. 22, 23, 24).

Return to vehicles and continue south on The Narrows Rd. to the turnaround at the Hocking-Vinton County line.

2.9 0.3 Shale of the Cuyahoga Formation is exposed on the right (west).

Ratcliffburg quadrangle

4.2 1.3 Hocking-Vinton County line. Turn vehicles around in the space to the left of the road and proceed north along The Narrows Rd. to the junction with Ohio Rte. 56.

Laurelville quadrangle

8.4 4.2 Junction of Ohio Rte. 56 and The Narrows Rd. Turn right (east) on Ohio Rte. 56 and cross Salt Creek.

End of optional route.

South Bloomingville quadrangle

49.8 2.0 The Benton Compressor Station of Columbia Gas of Ohio, Inc., is on the right (southeast). During the summer months natural gas is stored underground in the "Clinton" sandstone, of Silurian age, and is pumped out in winter when the demand is high. Depth to the "Clinton" in this area is about 2,100 feet.

50.2 0.4 Enter the town of South Bloomingville. Junction of Ohio Rte. 56 and Ohio Rte. 664. Proceed straight ahead (northeast) on Ohio Rte. 664.

50.8 0.6 South Bloomingville School on the left (north). Note the blocks of massive Black Hand Sandstone.

51.6 0.8 Fairfield Member of the Cuyahoga Formation outcrops on the left (north).

51.9 0.3 Enter Hocking State Forest.

52.0 0.1 The massive sandstone outcropping on the left (north) is the Black Hand Sandstone.

53.1 1.1 Junction of Ohio Rte. 664 and Ohio Rte. 374. Proceed northeast (curving to the southeast) on Ohio Rtes. 664 and 374.

54.3 1.2 Junction of entrance road to Hocking Hills State Park dining lodge and cabins and Ohio Rtes. 664 and 374. Turn right (south) on lodge road.

55.5 1.2 Hocking Hills State Park dining lodge. End of trip.

REFERENCES

Specific references have not been cited in the text but are listed here with brief annotations. Much of the literature listed below, especially publications of the Division of Geological Survey, is readily obtainable; other works, particularly theses and dissertations, are limited in their availability. Publications available from the Division of Geological Survey are marked with an asterisk.

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Pages 82-83 contain an early description of Rock House and Cedar Falls.

Baker, Jack, 1965, Drainage history of a part of the Hocking River valley: Ohio Acad. Sci., field trip guide, April 24, 1965.
Discussion of the drainage changes, including those between Rockbridge and Logan, in the Hocking River valley.

*Carman, J. E., 1946, The geologic interpretation of scenic features in Ohio: Ohio Jour. Sci., v. 46, p. 241-283. Reprinted as Reprint Ser. 3, Ohio Geol. Survey, 42 p.
Includes an excellent description of the geology of many of the park areas.

*DeLong, R. M., 1967, Geology of the South Bloomingville quadrangle, Ohio: Ohio Geol. Survey, Rept. Inv. 63, map with text.
Colored geologic map of the Hocking Hills State Park region with a brief description of stratigraphy and mineral resources. Reverse of the map includes color photographs and an explanation of the geology of the scenic features of the parks.

Fagadau, S., 1952, Paleontology and stratigraphy of the Logan Formation of central and southern Ohio: Ohio State Univ., Ph.D. dissert. (unpub.), 425 p.
Includes localities of occurrence and illustrations of fossils found in the Logan Formation in Hocking County.

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ADDENDUM

This field trip does not include stops at Ash Cave, Cedar Falls, Cantwell Cliffs, or Conkles Hollow, the other parks within the Hocking Hills State Park system. These areas have been omitted from the list of scheduled stops because of time, not because of lack of features of scenic and geologic interest. Included on the following pages are brief descriptions of these areas, including road logs, so that individuals may include them on future trips. All road logs start from the parking lot of Old Man's Cave.

ASH CAVE

Ash Cave (NW¼ sec. 26, Benton Township, Hocking County, Ohio) is at the head of a short valley cut by a small tributary of the East Fork of Queer Creek. The valley follows a major joint.

Lying only a short walk from the parking lot along a level path, Ash Cave is the most accessible of the major geologic features of Hocking Hills State Park. In sheer magnitude Ash Cave is the most impressive of the many rock shelter caves in the area. The reentrant is 100 feet deep and over 500 feet long. The rim is about 90 feet above the valley floor. A small waterfall (fig. 26) plunges spectacularly over the rim into a well-developed plunge pool. In winter, the waterfall often freezes in an impressive pillar-shaped ice formation. The waterfall is developed along a small joint along the rim of the rock shelter.

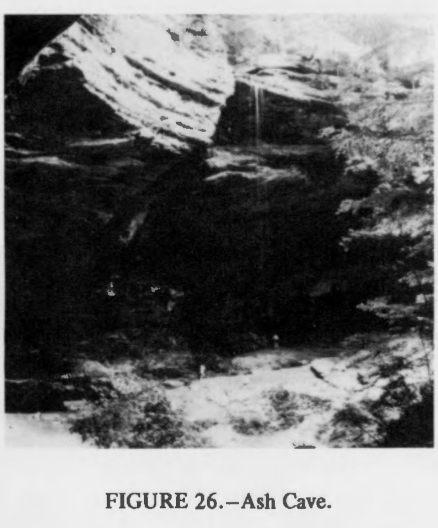

FIGURE 26.–Ash Cave.

A large joint which the stream valley follows forms much of the margin of Ash Cave. The rim is composed of the more resistant uppermost zone of the Black Hand Sandstone, and the major reentrant is developed in the weakly cemented middle zone.

Dissolution of cement in the middle zone of the Black Hand Sandstone at Ash Cave is due in part to the spray from the waterfall and in part to ground water percolating through the porous sandstone. The thick layer of loose quartz-sand grains covering the floor of Ash Cave bears witness to the removal of cement by solution. Large blocks of sandstone may break loose from the roof, but this method of enlargement is insignificant in comparison with the less spectacular spalling of individual sand grains.

Removal of sand grains from the floor of Ash Cave is accomplished during periods of heavy precipitation, when the stream may overflow its banks and wash sand from the margin of the reentrant, and by the action of small rivulets of water from springs flowing across the cave floor. Wind has not contributed to enlargement of the rock shelter at Ash Cave nor to any of the other features in the park.

Ash Cave derives its name from the great quantity of ashes that littered the floor of a nearby rock shelter until as late as 1886. Speculation is that the ashes were the remains of Indian campfires and accumulated over a period of many centuries. Another proposal suggests the ashes are remnants of gunpowder-manufacturing operations conducted by early settlers in the region. Although no satisfactory settlement of this question may be reached, it should be noted that excavations of the rock shelter floor have revealed arrows, flint artifacts, pottery, and numerous bones of animals consumed for food by Indian occupants of the cave.

Mileage

Cumulative	*Between points*	
South Bloomingville quadrangle		
0.0	0.0	Old Man's Cave parking lot. Turn left (east) on Ohio Rtes. 374 and 664.
0.5	0.5	Ohio Rtes. 374 and 664 split. Turn right (south) on Ohio Rte. 374 to Ash Cave.
2.3	1.8	Cedar Falls Park on the right. Proceed south on Ohio Rte. 374.
4.3	2.0	Junction of Ohio Rte. 374 and Ohio Rte. 56. Turn right (west) on Ohio Rte. 56. Note the outcrops of massive Black Hand Sandstone on the right (north).
4.7	0.4	Turn right (north) into parking lot at Ash Cave.

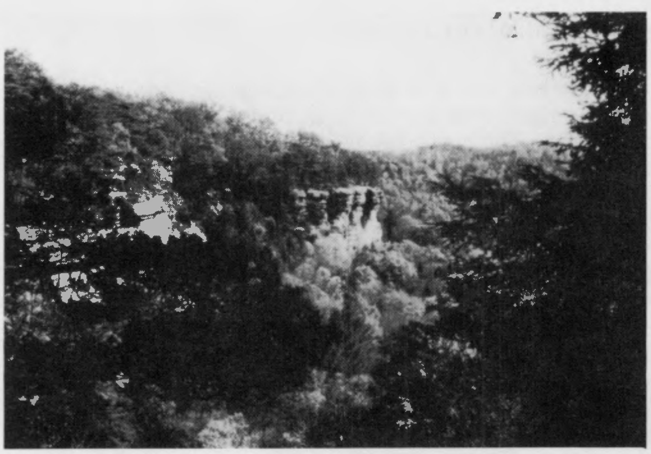

FIGURE 27.–Conkles Hollow viewed from the west rim.

CONKLES HOLLOW

Conkles Hollow (NE¼ sec. 4, Benton Township, Hocking County, Ohio) is one of the most spectacular parks within the Hocking Hills State Park system because of the unequaled sheer cliffs (fig. 27) of Black Hand Sandstone rising nearly 200 feet above the valley floor.

Two trails are available at Conkles Hollow: (1) a gorge trail just over ½ mile in length, and (2) a rim trail about 2 miles in length. The gorge trail is easily navigated along the flat valley floor. All three zones of the Black Hand Sandstone are visible in the steep cliffs of the valley walls. Crossbedding and honeycomb weathering are well displayed on the fretted surface of the Black Hand. During periods of heavy rainfall numerous waterfalls cascade from hanging valleys along the canyon rim, adding to the beauty of the rugged narrow canyon, which is only 300 feet wide at some places. The gorge at Conkles Hollow follows a major joint trending N. 60° W. The head of the gorge ends in a rock shelter over which plunges a waterfall.

The rim trail gives an unsurpassed overview of the pristine gorge. Features are best seen from the rim trail during winter and early spring when foliage is not present. Conkles Hollow derives its name from an early visitor to the area who recorded his presence with the inscription on the west wall of the gorge: W. J. Conkle 1797.

Mileage

Cumulative	*Between points*	
South Bloomingville quadrangle		
0.0	0.0	Old Man's Cave parking lot. Turn right (west) on Ohio Rtes. 374 and 664.
2.0	2.0	Junction of Ohio Rtes. 374 and 664. Turn right (northwest) on Ohio Rte. 374.
2.7	0.7	Junction of Ohio Rte. 374 and Conkles Hollow parking lot road. Turn right (northeast) and proceed to parking lot.

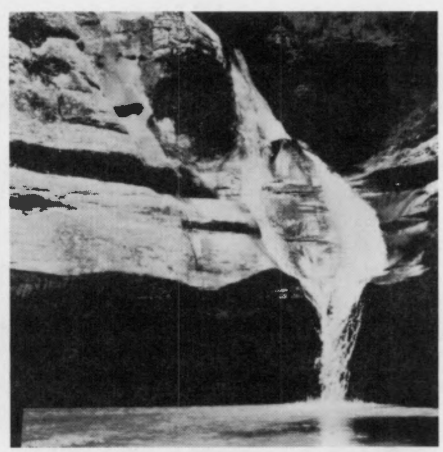

FIGURE 28.–Cedar Falls.

CEDAR FALLS

Cedar Falls (NE¼SW¼ sec. 13, Benton Township, Hocking County, Ohio) is outstanding among the many picturesque spots in Hocking Hills State Park. Queer Creek flows in a broad gently sloping valley to just west of Ohio Rte. 374, where the stream encounters the resistant Black Hand Sandstone. The stream then races through a narrow gorge in the uppermost zone of the Black Hand and cascades in a 50-foot waterfall (fig. 28) into a large plunge pool. Queer Creek follows a joint trending N. 80° W. in the uppermost zone of the Black Hand above the falls.

The gorge of Queer Creek can be followed from Cedar Falls to Old Man's Cave along a trail just under 2 miles in length. The scenery is outstanding along this route.

Mileage

Cumulative	*Between points*	
South Bloomingville quadrangle		
0.0	0.0	Old Man's Cave parking lot. Turn left (east) on Ohio Rtes. 374 and 664.
0.5	0.5	Ohio Rtes. 374 and 664 split. Turn right (south) on Ohio Rte. 374 to Cedar Falls.
2.3	1.8	Cedar Falls on right (west). Turn into parking lot.

CANTWELL CLIFFS

The park at Cantwell Cliffs (NW¼ sec. 4, NE¼ sec. 5, Laurel Township, Hocking County, Ohio) encompasses a short valley bounded by steep cliffs of Black Hand Sandstone. The valley heads abruptly in a relatively large rock shelter over which flows a small waterfall. As with other rock shelter caves in Hocking Hills State Park, the one at Cantwell Cliffs is a product of differential weathering in the Black Hand. The roof of the rock shelter is formed by the resistant uppermost zone of the Black Hand; the reentrant is in the weakly cemented middle zone. Joints in the Black Hand are abundantly evident at Cantwell Cliffs and are especially visible along the face of the rock shelter at the valley head. Numerous massive blocks of Black Hand have become detached, along joint planes, from the main body of sandstone and have moved short distances downhill. "Fat Woman's Squeeze," along the valley wall near the rock shelter at the valley head, was created in this manner.

Mileage

Cumulative	*Between points*	
South Bloomingville quadrangle		
0.0	0.0	Old Man's Cave parking lot. Turn right (west) on Ohio Rtes. 374 and 664.
2.0	2.0	Junction of Ohio Rtes. 374 and 664. Turn right (northwest) on Ohio Rte. 374.
6.4	4.4	Junction of Ohio Rte. 374 and Ohio Rte. 678. Proceed straight (north) on Ohio Rte. 678.
7.6	1.2	Enter the village of Gibisonville. Continue east-northeast on Ohio Rte. 678.
Rockbridge quadrangle		
10.4	2.8	Junction of Ohio Rte. 678 and Ohio Rtes. 374 and 180. Turn left (west) on Ohio Rtes. 374 and 180.
10.9	0.5	Ohio Rtes. 374 and 180 split. Turn right (northwest) on Ohio Rte. 374.
13.2	2.3	Junction of Ohio Rte. 374 and Cantwell Cliffs parking lot road. Turn right (northeast) into parking lot road.