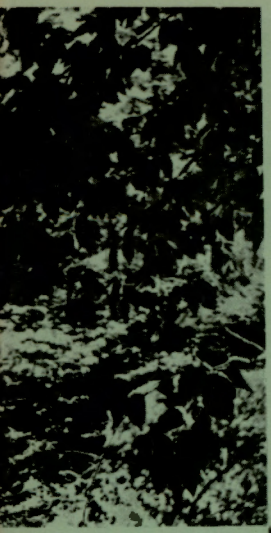
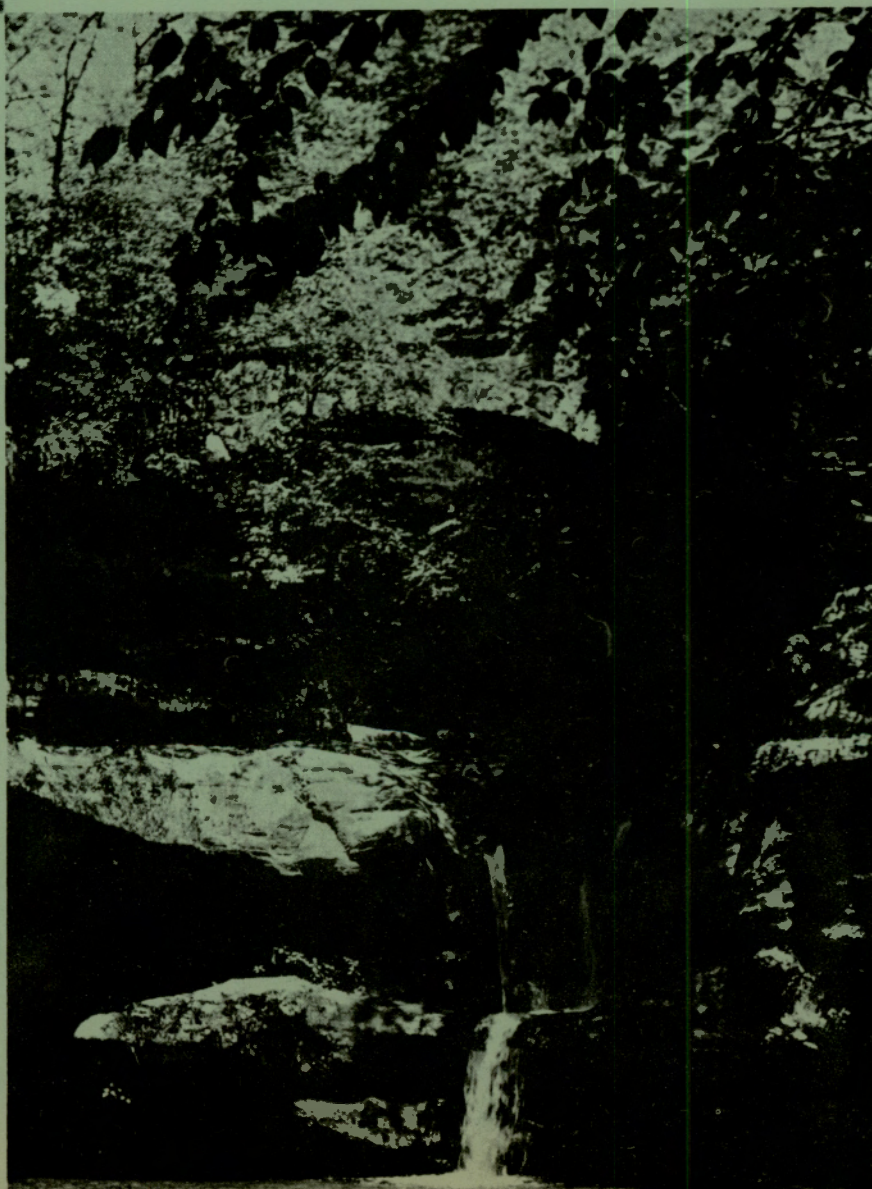


The Geology of Hocking State Park



By

John F. Hall

STATE OF OHIO

John J. Gilligan
Governor

DEPARTMENT OF NATURAL RESOURCES

William B. Nye
Director

DIVISION OF GEOLOGICAL SURVEY

Horace R. Collins
Chief

DIVISION OF PARKS AND RECREATION

Norville Hall
Chief

STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
Horace R. Collins, Chief

INFORMATION CIRCULAR No. 8

THE GEOLOGY OF HOCKING STATE PARK

By JOHN F. HALL

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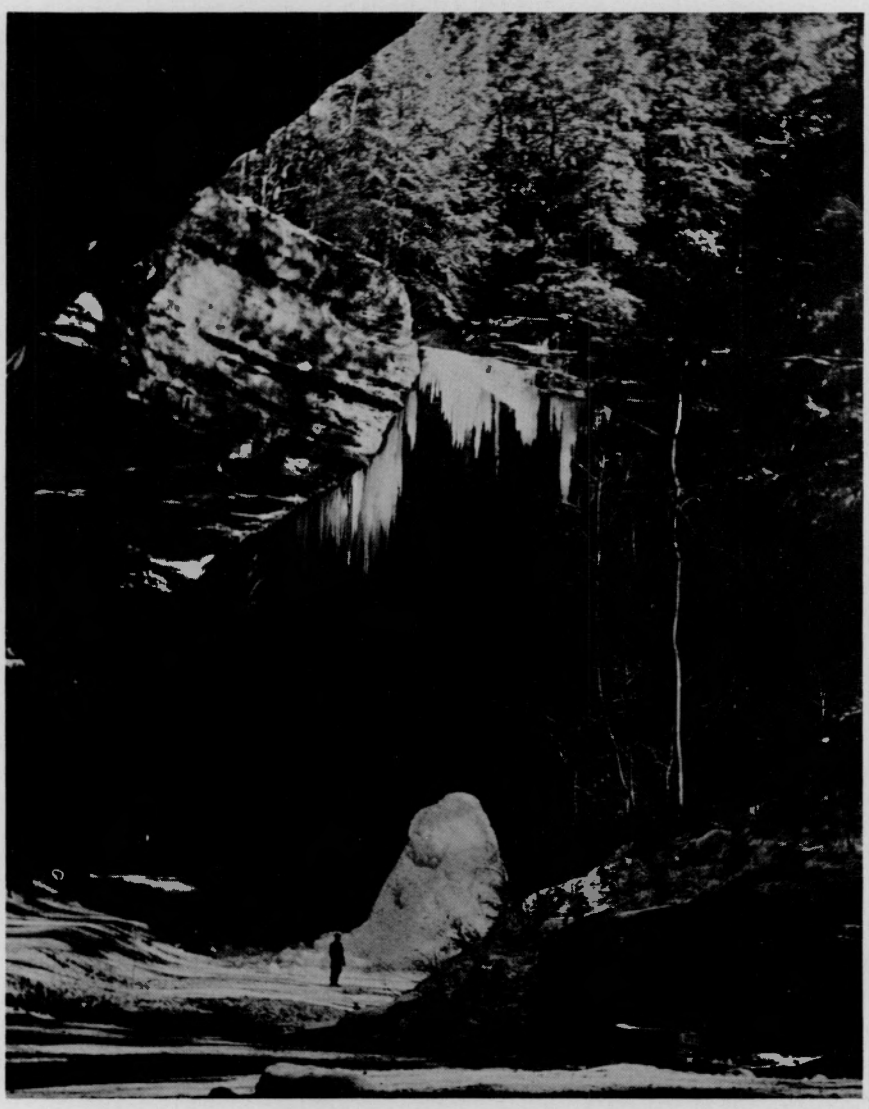

Frontispiece. View of Ash Cave. This cave, like others in the area, was formed by weathering of the middle zone of the Black Hand sandstone.

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INTRODUCTION

Every year more and more citizens are visiting and enjoying the unusual opportunities for relaxation, recreation, and scenic appreciation offered by Ohio State Parks. To obtain the fullest enjoyment of these areas, a greater understanding of natural history than the average person commands is often required. Hardly a visitor to any of our State Parks departs without some question or curiosity about either the flowers, trees, birds, or animals. In the case of the more scenic parks where gorges, caves and unusual rock formations are found, other questions arise, such as to the composition of the rock, its method of formation, the origin of the hills and valleys, relationship to rocks elsewhere in the State, and possible economic importance. The answers to this last group of questions are to be found in the science of the earth called geology.

Since the Hocking State Park, which is actually six individual areas, comprises what has been considered by many to be unequalled in Ohio for scenic beauty, this booklet has been prepared to provide some answers to questions concerning the geology of the Hocking State Park and the immediate vicinity. With this better understanding of these geologic features, the visitors will appreciate the beauty of these scenic hills and cliffs all the more.

PARK HISTORY AND REGIONAL SETTING

Nestled in the rugged and beautiful hills of western Hocking County are the six separate parks that make up Hocking State Park. They are Cantwell Cliffs, Rock House, Conkle's Hollow, Old Man's Cave, Cedar Falls, and Ash Cave. Each area possesses a somewhat distinctive feature; some are noted for their beautiful waterfalls and cool gorges, others display true caves or overhanging rock ledges,

and still others are noted for their steep cliffs and deep chasms. The individual parks are all located on or within short distances from State Routes 56, 374, and 664, and are not far from Logan, the county seat of Hocking County. Also this area is within easy driving range of all the major cities of the State (Fig. 1.)

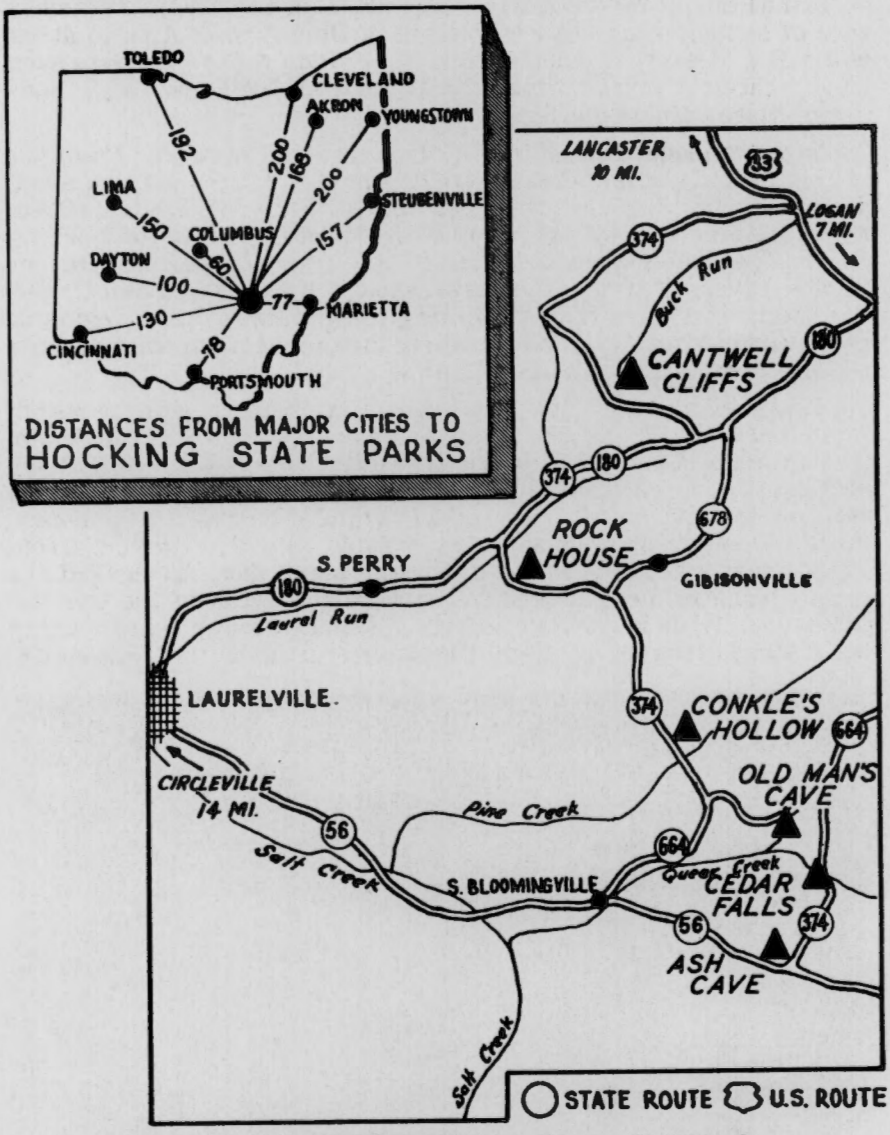

Figure 1. Map of Western Hocking County, Showing the Location of the State Parks

It is most appropriate that this area is a State Park, so that its wealth of natural beauty may be preserved in its original condition. The beauty of this rugged area is enhanced by the virgin forests of hemlocks, poplar, beech, and oak, and by the profusion of ferns,

shrubs, and wild flowers. The region is interesting not only to the geologist, but fascinating to the botanist and wildlife student as well.

Equally interesting is the history of this area, for it was once the rendezvous of numerous Indian tribes. The rock shelters and caves furnished homes for the ancient peoples from the Adena culture (a race of ancient Americans who lived in Ohio from 1 A.D. to about 800 A.D.) to the Fort Ancient man (1350-1660 A.D.). Perhaps even earlier races or tribes of man, back as far as 7000 years ago, made use of these natural dwellings.

In more modern time (post-Columbus) this area was the home of the Wyandot tribe which retreated to this rugged area to avoid their more savage neighbors. Their large village was located at Old-town, one mile south of the present day city of Logan, on the Hocking River. The Indians originally called this river the Hockhocking or "Bottle River." Through the parks, and along Queer and Salt Creeks ran the main Indian trail connecting the Kanawha River region of West Virginia with Chillicothe, where the great Indian chiefs, Logan the Mingo and Cornstalk the Shawnee, ruled.

This trail was used after the start of the frontier wars to march prisoners to the Indian towns on the upper headwaters of the Scioto. One hunter and trapper captured along the banks of the Ohio River was kept in the caves of the park region for several days while he was tortured. After being burned and branded he managed to escape during the night and ran as far as he could before he dropped, from sheer exhaustion, at the base of a large beech tree. As the Indians were closing in, he managed to carve on the trunk of the tree the following: "This is the road to hell, 1782." For many years this big beech stood in the valley of Salt Creek, several miles from Laurelville.

Plate I. Recess cave at Cantwell Cliffs. The sloping ceiling and differential weathering of the sandstone are well shown.

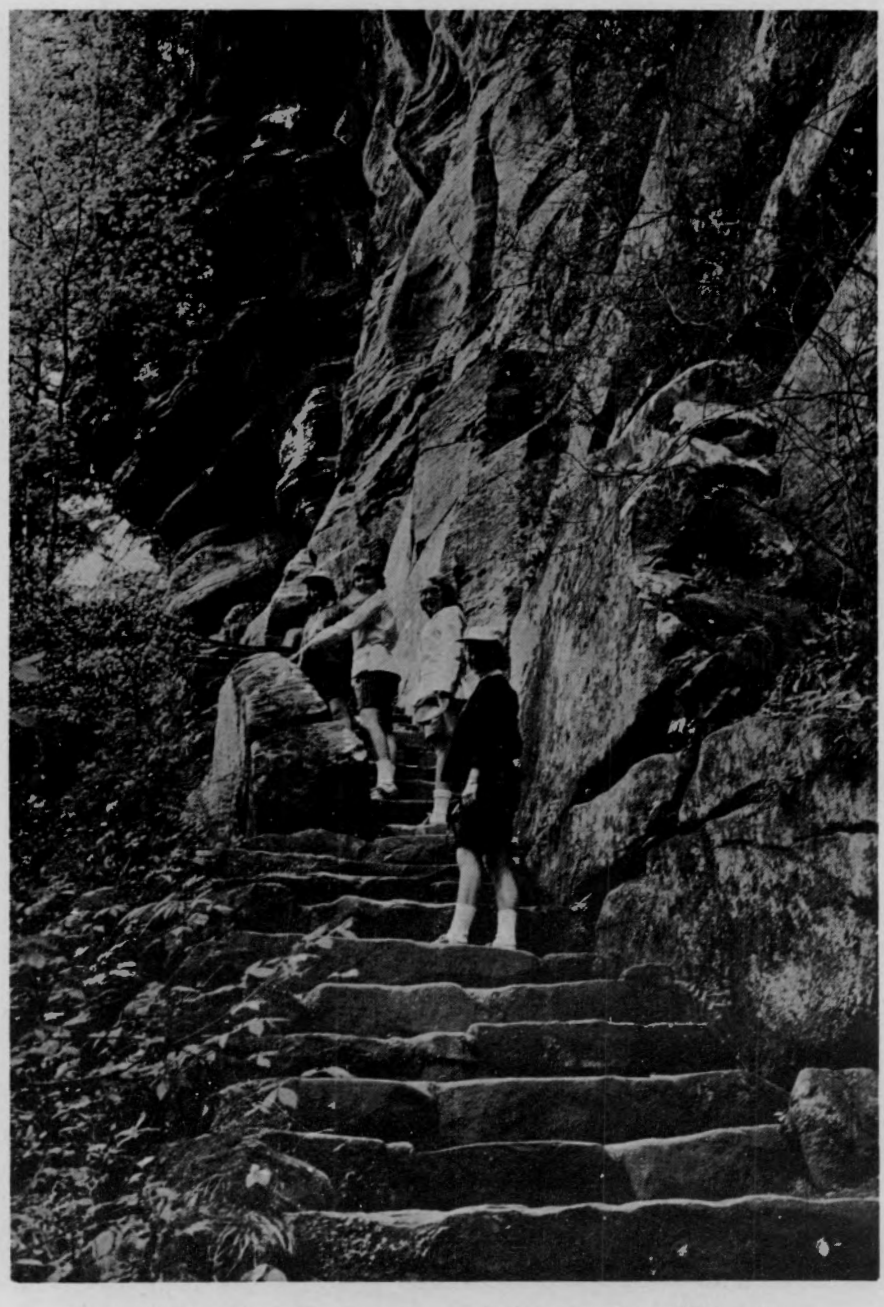

Plate II. The Black Hand sandstone cliff on the face of Rock House.

Though the park area, with its deep ravines and rugged cliffs, was considered a mysterious and dreary place by the Wyandots, it was one of their favorite and most productive hunting and trapping grounds. Legend also has it that they mined lead and silver from the near-by caves. However, this rumor has never been established as a fact, for to this day no deposits have been found. In the secluded regions of the cave area, Indian squaws baked corn bread in crude "hominy holes," which were round pits in the stone providing them with natural ovens. The smaller caves were used as workshops by the braves. Here they fashioned arrow and spear points. Today, in some of the more remote caves, excellent points can be found. Salt was also gathered from the near-by salt licks on Salt Creek and bagged in deer skins to be carried back to Oldtown in the fall.

Western Hocking County at this time was a veritable hunter's paradise abounding in deer, elk, wild turkey, bear and numerous small game. The cave region was a natural habitat for bears and many of the smaller caverns were used by them for hibernation during the winter. Occasionally wood bison wandered from the Western Plains into the broad flat valley bottoms. The last bison was reported killed along the banks of Queer Creek in 1799. After the coming of the white man the number of kinds of wildlife disappeared to the point that by the middle of the last century, no big game was to be found in the area. Today, however, deer are once again becoming plentiful and can be seen in the early morning browsing in the fields and woods around all the parks. Also in 1951, the tracks of a bear were reported in the northern part of the county.

In 1774, after repeated Indian attacks the armies of Lord Dunmore and General Lewis drove the Indians before them as the soldiers swept through the main trail and succeeded in pushing all the tribes, except for a few isolated bands, into northwestern Ohio. After this campaign, the Indian problem was never again a serious one for this area.

The first white settlers in Hocking County were deserters from Lord Dunmore's army. The first true pioneer settlers came into the area and established homesteads in the late 1790's. From then on the area blossomed with settlers and small farms. In 1818 Hocking County was organized and by 1820 the population of the county increased to more than 2000 people. In 1835 a powder mill was built at Gibisonville (near Rock House) to make gun powder from saltpeter deposits found in the near-by caves and gorges. About the same time grist mills were built at Cedar Falls and the area soon gathered the marks of civilization. In 1840 the canal along the Hocking River, connecting Logan with points north and south, was completed, thus rapidly encouraging further settlement. The first attempt to develop the county's mineral resources came in 1865 when shafts were sunk to mine coal and iron ore and wells drilled to obtain oil and gas. By the close of the 19th century the hilltops and flat stream valleys in western Hocking County had been cleared of their large stands of valuable timber and as this resource gradually disappeared, lumbermen slowly encroached upon the area now inclosed by the Park.

In 1915, through the leadership of State Forester Edmund Secrest, the State Forest law was passed by the legislature which enabled the State to acquire by purchase or gift such areas which were

deemed necessary to preserve sites and scenic value, virgin woodland, and areas suitable for recreation and reforestation.

The cave and park regions were well known by this time and since the 1870's they had been popular picnic and family gathering spots. However, poor roads kept many people away and as a result this scenic area remained almost an exclusive local attraction. In 1924, however, the State purchased its first block of land in Hocking County in order to preserve these natural beauty spots. This first purchase included the Old Man's Cave region, and consisted of 146 acres. Additional acreage was secured in later years (Table I) so that by 1951 over 8800 acres of timber and rugged scenic land were under state control in this part of Hocking County. As the acreage increased, so did the improvement of the roads, and by 1938 all the parks were readily accessible on either all-weather gravel or macadam roads.

The parks were under the supervision of the Department of Forestry as State Forest Parks until 1949, when the State legislature passed a bill forming the Department of Natural Resources with a special Division of Parks which then assumed control and management of the park areas. The acreage and the date of the first purchase of land for the individual parks are listed in Table I. Surrounding most of them are many hundreds of acres of state forest land still under the control of the Division of Forestry. Also in Table I is listed the total number of visitors to each of the separate parks in the year 1951. This shows well the popularity of this area, since the total visitors exceed the attendance of all other parks in Ohio which have neither fishing nor swimming facilities.

TABLE I

Park	*Acreage*	*Date of Initial Purchase*	*Visitors*
Cantwell Cliffs	50	1929	4,500
Rock House	50	1925	95,000
Conkle's Hollow	100	1925	2,500
Old Man's Cave	250	1924	175,000
Cedar Falls	50	1929	4,000
Ash Cave	50	1925	75,000
TOTAL	550		356,000

Total attendance for 1960—822,425

GENERAL GEOLOGY

The Hocking State Park is unequalled in Ohio for scenic beauty. It possesses magnificent vertical cliffs, some over 200 feet high; deep gorges which terminate headward in large amphitheater-like coves; beautiful waterfalls musically cascading over vertical cliffs; and large overhanging caves or rock shelters, along with a few true caves. In order to understand the reason for these features, one must first become familiar with the different types of rocks present in this general region and the geological processes that caused them.

Geology is the science of the Earth. It includes the history of our planet starting with its origin and the history of the life which has for many, many centuries lived upon it. From a study of the rocks of the Earth, one can determine the reason for every feature of the

landscape, every rock structure below the surface, the possibility of economic rocks and minerals, and the processes resulting in these phenomena.

Everything visible on the surface of the Earth owes its origin directly or indirectly to some geologic process. These processes can be divided into two main classes: (1) external forces—the action of water, ice, and wind which wear away the Earth's surface; and (2) internal forces—those which affect the Earth's crust so as to lower, raise, bend, or break it.

The geologist divides all of the rocks of the world into three main classes: (1) *sedimentary*—those composed of material derived from other rocks; (2) *igneous*—which are formed by the solidification of melted earth materials; and (3) *metamorphic*—pre-existing rocks which have been altered by heat and/or pressure.

Approximately 80 per cent of the surface of the world is covered by rocks of sedimentary origin. Originally these rocks were deposited in roughly horizontal layers upon shallow sea bottoms or upon older land surfaces. After deposition and subsequent burial by other sediments, the materials were slowly consolidated, compacted, and cemented together to form true rocks. The outstanding characteristic of sedimentary rocks is their layered or bedded appearance. This layered effect is easy to recognize because the separate beds may differ from those either above or below, in color, type of rock, or texture (grain size of the sediments), or in all three.

The surface rocks of Ohio are all sedimentary in origin and the dominant rock types are shale, sandstone, limestone, coal, clay, and conglomerate. Representatives of all these types may be seen in or very near the Hocking State Park area. There are no surface outcrops of either igneous or metamorphic rocks in Ohio. However, if a well were to be drilled thousands of feet deep in Hocking County it would eventually reach metamorphic rocks and if drilled still deeper, it would probably reach true igneous rocks. The depth to which the well would have to be drilled is problematical, but it would be about 7,000 or 8,000 feet.

The general geological column for the Hocking State Park area is shown in Figure 2.

In the park region the most common type of rock is sandstone which is formed by the consolidation and cementation of layers of loose sand. The sand grains, usually of the mineral quartz, have been compacted by the weight of overlying sediments and cemented together either by silica or iron oxide. They are most resistant to weathering of all the rocks in the park. Weathering is a series of processes which eventually form soil from rock by the action of rainwater, frost action, and chemical action of weak natural acids.

The most outstanding rock formation in the area is the Black Hand sandstone (Figure 2). This rock unit was named from a cliff on the Licking River east of Newark, where the Indians had painted a large black hand on the face of an overhanging ledge. This painted hand guided the Indians to Flint Ridge, then a great source of flint for implements, such as arrowheads and spear points.

The Black Hand sandstone is the bedrock formation into which all of the scenic features of the park have been carved by natural

erosion and weathering. It is a medium-to-coarse-grained sandstone containing thin layers of small white quartz pebbles. These pebble layers are termed *conglomerate lenses* by the geologist. The cementing agent is usually iron oxide, which when weathered stains the sandstone in various shades of brown, while on the unweathered surface the sandstone is light buff in color.

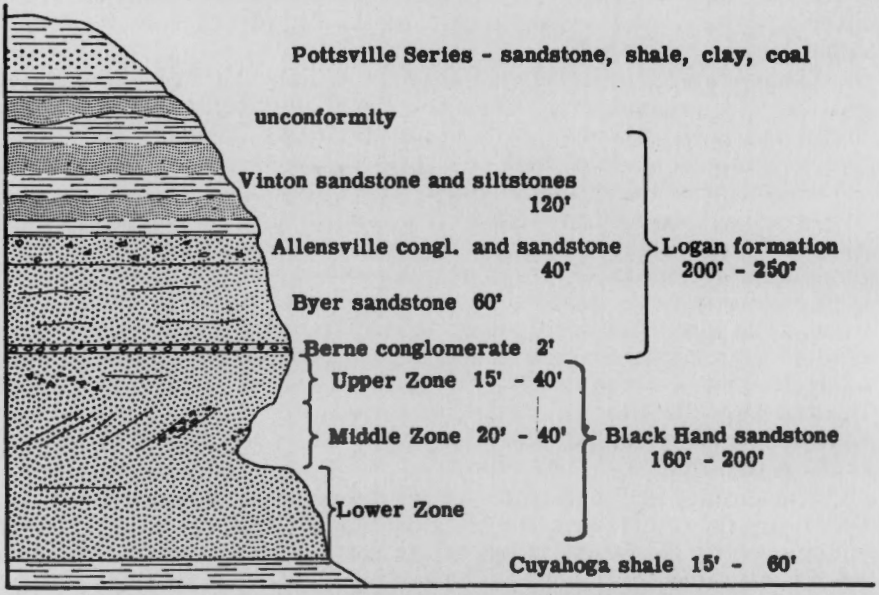

Figure 2. Columnar Section of Rocks in the Park Region

The Black Hand is extremely thick in the park region, being over 200 feet in several places and can be subdivided into three distinct layers called zones. The upper zone is very resistant to weathering, usually horizontally bedded, and firmly cemented. This zone occasionally displays slight cross bedding (described below). This part of the formation forms the top of all cliffs and projecting edges of the overhanging caves.

The middle zone, loosely cemented, contains some conglomerate lenses, and is extremely cross-bedded. This type of bedding differs from the normal or horizontal bedding in that the layers extended diagonally across or at an angle to the horizontal bedding. This feature is developed whenever sediment-laden water passes over the front edge of an embankment, such as a gravel bar or the edge of a delta. Due to the fact that this layer is loosely cemented, it is easily weathered and such scenic features as Rock House, Ash Cave, Old Man's Cave, and Cantwell Cliffs are formed in this particular zone.

The lower zone is similar to the upper one in that it is very resistant to weathering, tightly cemented, and has only slight crossbedding. The only scenic feature in this zone is the Lower Falls at Old Man's Cave.

Farther to the east, where the Black Hand rock is buried by many hundred feet of overlying sediments, drillers refer to it as "Big Injun

Sand" and it has supplied substantial amounts of both oil and gas.

Other sandstones besides the Black Hand are visible to the visitor of the park region. As shown in Figure 2, numerous sandstones are present in the Logan formation (named after the county seat of Hocking County) and in the Pottsville series (named from exposures in eastern Pennsylvania). The sandstones in the Logan are usually much finer grained than those in the Black Hand and show no cross-bedding. The relatively thin Pottsville sandstones are medium-grained, cross-bedded, and are associated with coals and clays. None of these rock units is connected with the scenic features of the Park but they are present on the hill tops along State Route 374 and 180.

Shales, compacted layers of clay and mud, are the next most common type of rock in the parks. The Cuyahoga shale, named from exposures along the Cuyahoga River, is exposed only under the overhanging cliff associated with the Lower Falls of Old Man's Cave. Here the shale is blue-gray, very sandy, and contains some thin sandstone layers. This exposure at Old Man's Cave is unique because it is the only recess or overhanging cave present in these soft, poorly resistant shales. Additional exposures of this shale are to be found along State Route 56 between Ash Cave and South Bloomingville. There the exposures are distinguished by the presence of alternating beds of thin sandstone and shales.

Plate III. View of the deep gorge at Conkle's Hollow.

Shales of the Logan formation and Pottsville series are to be found on the crests of the ridges between Old Man's Cave, Cedar Falls, and Ash Cave.

Other types of sedimentary rock present in the general park region are conglomerate, siltstone, and thin beds of clay and coal. Two conglomerate beds are present in the Logan formation and are com-

pacted and cemented layers of round, white quartz pebbles which represent old gravel deposits. One of these beds lies directly above the Black Hand and is visible along many of the small streams leading into the park area. The other bed lies approximately 60 feet above the Black Hand and is best exposed on State Route 374 near Ash Cave.

Siltstones, composed of silt—a sediment somewhat coarser than clay but finer than sand—comprise the rest of the Logan formation and may be seen on all the hills surrounding the parks.

Thin beds of coal and fire clay are present along the highway on the highest hills between Cedar Falls and Ash Cave. The coal, which represents compressed layers of decayed vegetation, appears as dark gray to black streaks in the exposure. The clays associated with the coals are easily recognized for they weather to an almost pure white color and it is presumed they represent the old soils which supported the coal-forming plants.

The geological processes of weathering and erosion are responsible for the scenic features of the Hocking State Park area. Weathering loosens the rock material while erosion carries it away.

Weathering is the process whereby rocks are broken up into fragments or decomposed by chemical means and this disintegration and decomposition are made easy by the presence of numerous cracks and crevices in nearly all rocks. These various size openings allow the entrance of water, wind, and other weathering agents. The main agent, however, is water which may be in the form of rain, dew, or ground water. It moistens the rocks, dissolves some of the minerals directly, takes part in many chemical reactions, and assists in breaking the rocks into small pieces. Weathering is vitally important to the human race because it results in building soils which form the basis of life on the lands.

Erosion is the loosening and removal of rock material by any process. The removal of material by running water is called *stream erosion* and that removed by wind is termed *wind erosion.* The action of sea waves and glaciers also help in removing the rock debris where these agents are present. The beautiful gorges in the parks are prime examples of stream erosion.

As the streams cut downward, they frequently encounter layers of varying hardness so that this cutting is slowed or accelerated depending upon the rock texture. This unequal cutting is called *differential weathering.* An excellent example of this type of weathering is the recess cave, where the soft materials have been removed by erosion, while the more hard materials remain as ledges.

In the Park area where waterfalls are present, a plunge pool or basin has been formed directly below the falls by the impact of the water falling from considerable heights. These pools tend to cut backward and to enlarge themselves by a process called *sapping* which may be defined as the natural process whereby cliffs are gradually undermined by the weathering of soft layers of rock. This sapping action not only enlarges the pool and starts to form the recess cave, but also the weathering behind the falls is speeded up due to the action of the water spray associated with the waterfalls. By this method the waterfall is continually retreating and leaves in its place a deep gorge.

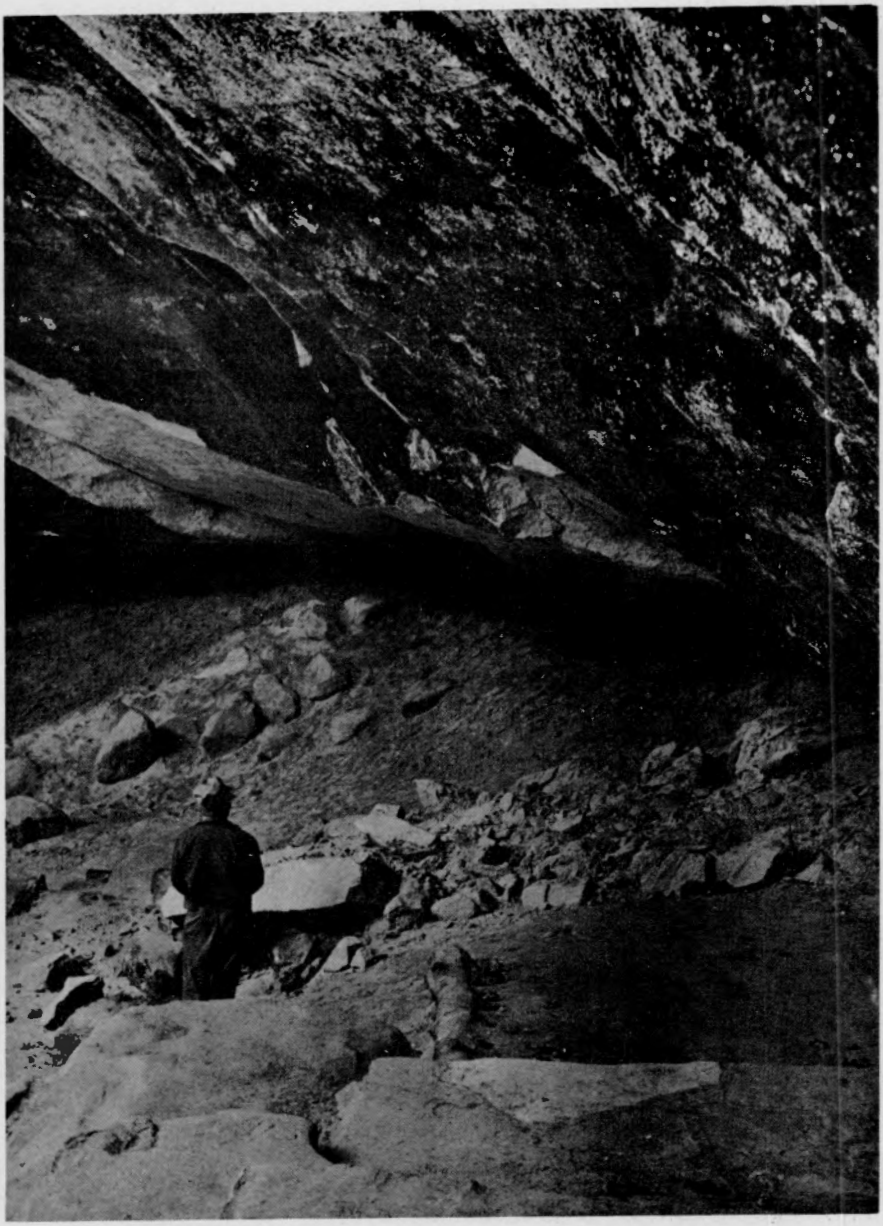

Plate IV. Rock fall in Old Man's Cave. The recess represents undercutting in the middle zone of the Black Hand sandstone, when the level of the nearby stream was higher.

In the past, forces within the earth have compressed the rocks of this area and fractured them, creating a condition called *rock joints*. In many places two or more sets of joints will intersect, usually at wide angles and combined with the natural bedding, the joints tend to divide the rocks into a series of large blocks. These blocks are very susceptible to weathering and when they have fallen away from the cliffs are termed *slump blocks*. Slump blocks found in most of the valleys in the park area have broken away from their original position due to these joint patterns.

GEOLOGIC HISTORY OF THE PARK AREA

In order to present the geologic history of the Park area as recorded by the rock layers, it is necessary to understand the principles used by the geologists to divide a vertical sequence of rocks into separate time intervals. The time involved since the formation of the earth is estimated to be over two billion years. All of geologic time is divided into major divisions called eras. These eras are in turn broken down into smaller time divisions called periods, epochs, ages, and stages.

Examples of these subdivisions are given in the table below, using terms that apply to the rocks of the Park.

Time	*Examples of Rock Nomenclature*
Era	Paleozoic
Period	Mississippian system
Epoch	Kinderhookian
Age	Cuyahoga formation
Stage	Black Hand sandstone

Figure 3 is a chart of geologic time which shows the major subdivisions of geologic time and their estimated duration. The oldest beds are listed at the bottom and the most recent at the top just as the layers were deposited.

At the beginning of the Paleozoic era, some 600 million years ago, a broad, shallow trough (called a geosyncline) was formed by the settling or sinking of the land from New England to southern Georgia. This area slowly sank below the sea level and was subsequently covered by a wide shallow arm of the sea. Streams flowing into this trough area carried along fragments of weathered rocks from the nearby landmasses and this material sinking to the sea floor was buried by later sediments of like origin and all of the debris was gradually compacted and cemented into various types of sedimentary rocks.

Occasionally this sequence of deposition was stopped by some internal force which pushed the deposits above sea level and once exposed, they were acted upon by both weathering and erosion. The weathering processes broke the rocks into fragments and erosion cut the hills and valleys into the raised surface. Where this cutting effect was long lasting considerable relief was formed on the old surface. If this surface was covered by later sediments, the uneven or irregular contact line between the two rock units is called an *unconformity*.

During the Cambrian, Ordovician, Silurian, and Devonian periods thick deposits of sandstones, shales, and limestone (rocks formed by cementation of limy shells or by being chemically precipitated out of our marine waters) were deposited in Ohio. Later, these

beds were covered by rocks of Mississippian, Pennsylvanian, and Permian ages in eastern Ohio, but in the western part of the State, these older rocks, with the exception of the Cambrian, were left exposed at the surface.

In the middle of the Mississippian period (about 330 million years ago), the Hocking Park area was covered by a shallow sea in which the Cuyahoga shale was deposited. This sea has been designated marine in origin because fossilized clams and other forms of marine life have been found within the shale.

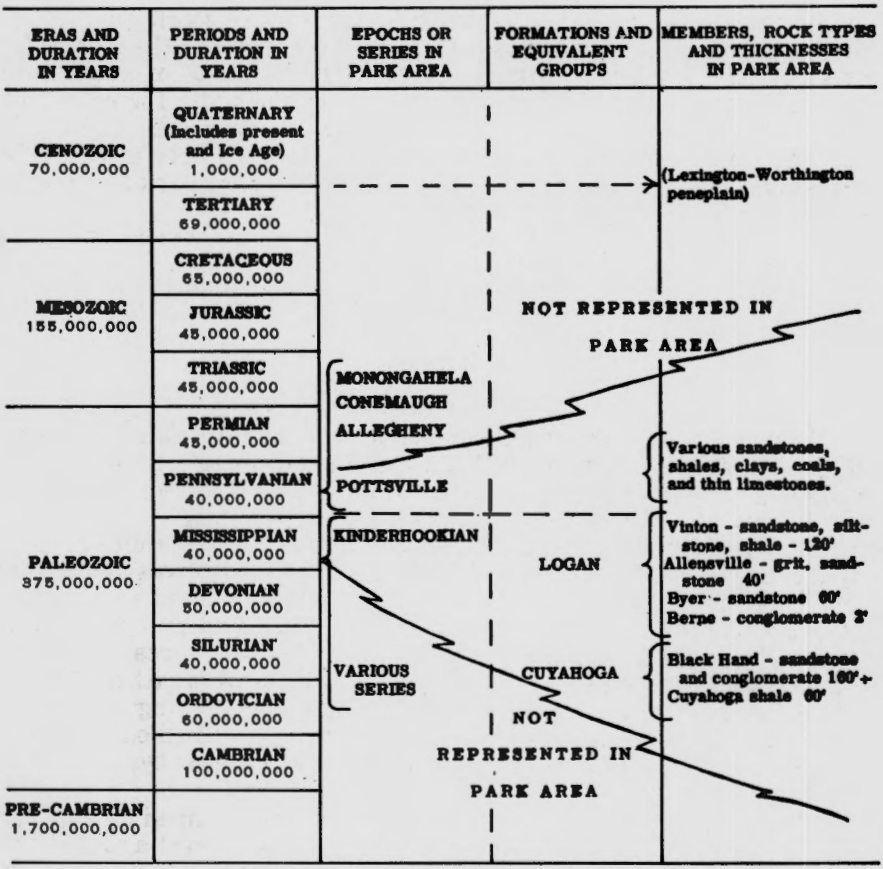

Figure 8. Geologic Time Chart

As the Mississippian period progressed, internal forces elevated a previously low-lying landmass in the eastern part of the United States. As a result, weathering and erosion became more active on the rising landmass and the streams draining this area carried away literally ton upon ton of coarse sand and gravel from this highland to the southeast and into the park region. The coarseness of material and the abundance of cross-bedding indicate that this debris was deposited in the form of a large delta, which built itself out into the

shallow sea (Fig. 4A). As this delta was being formed the sea basin was gradually sinking, but the rate of deposition exceeded the sinking rate, so that in many places the delta rose above sea level.

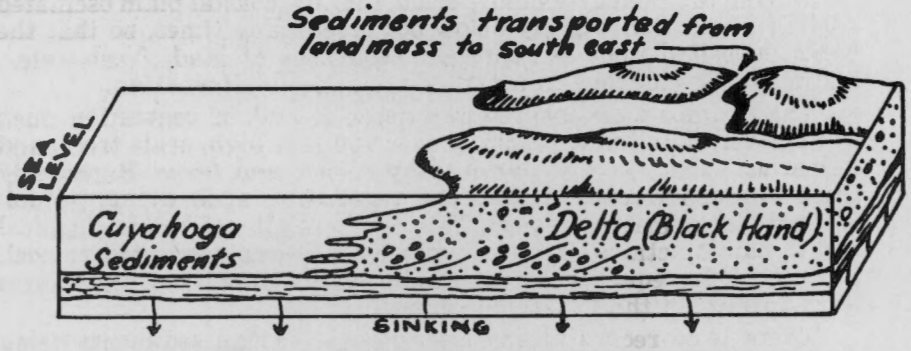

Figure 4A. Conditions near the middle of the Mississippian time showing deposition of Cuyahoga and Black Hand sediments

These delta deposits when consolidated became the Black Hand sandstone rock unit, extending over one hundred miles north and south, and to the east probably extending another several hundred miles under the cover of younger rocks. This imposing size does not seem excessive, since the present day Mississippi River delta, which makes up most of the State of Louisiana, is roughly the same in area.

After many thousands of years, this eastern landmass was worn down to such a degree that only fine-grained sediments were derived from it. At the same time, the rate of sinking in the trough area exceeded that of deposition so the sea once again covered the area. This is shown by the fact that the Logan formation is composed of fine-grained sediments and is marine in origin (Fig. 4B). The coarse-grained sandstone or conglomerate in the middle of the formation indicates a mild recurrence of uplift in the landmass to the southeast. (Fig. 4B).

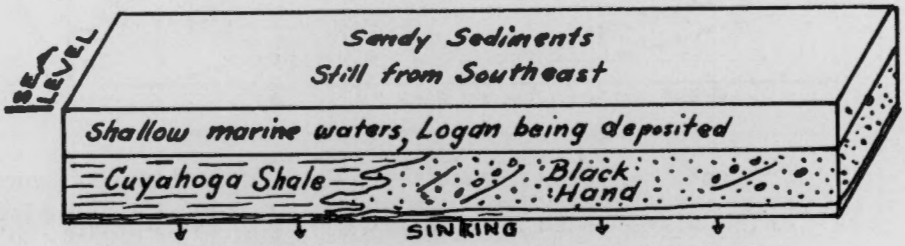

Figure 4B. Conditions near the end of the Mississippian time

Before the end of the Mississippian period the Park area was uplifted, above sea level, and pronounced erosion took place, leaving valleys as deep as one hundred feet or more cut into the raised Mississippian surface. This produced a major unconformity between the

Mississippian sediments and the Pennsylvanian rocks.

By the beginning of the Pennsylvanian period, the seas readvanced and much of eastern Ohio and surrounding states was transformed into a coastal plain, covered by swamps, cut by numerous streams, and bordered by deltas.

During the Pennsylvanian period, this low coastal plain oscillated slightly above and slightly below sea level many times, so that the rocks deposited upon it represent sequences of land, fresh-water, and marine conditions in a rather remarkable alternation.

The swamps were covered by a dense growth of vegetation, such as huge fern-like trees, reaching over 100 feet high, scale trees, and numerous other types of large pithy rushes and ferns. Repeatedly these swamps were filled and the vegetation, upon dying, accumulated in large masses as peat. This peat was altered by bio-chemical and dynamic actions and after many years was converted to coal. Through this sequence of repeated swamps numerous coal seams were formed in the Pottsville series.

There is no record of any later Pennsylvanian sediments being deposited in this area, but it is assumed that at least Allegheny and Conemaugh deposits were here at one time.

The materials composing the Cuyahoga shale, Black Hand sandstone, Logan formation, and Pottsville series were originally deposited essentially in horizontal layers. At the end of the Paleozoic era, horizontal pressures were directed from the southeast on the sediments and caused the rocks to fold and bend. In Pennsylvania and West Virginia these folds are very steep, with the rocks being vertical in some places. In Hocking County, however, this pressure only tilted the beds so that they now slope (dip) about 30 feet per mile to the east. For example the Black Hand, at the surface in Hocking County, is 600 feet below the surface twenty miles to the east. (Fig. 4C).

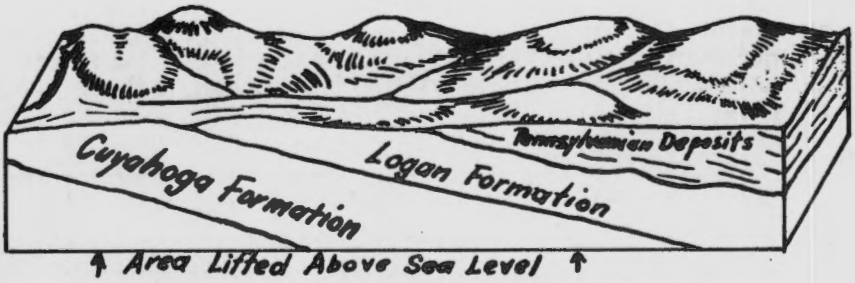

Figure 4C. Conditions at the close of the Paleozoic

At the end of the Paleozoic era this folding lifted these sediments several hundred feet above sea level and once exposed, streams were formed and the newly elevated landmass began to be eroded. Extended erosion eventually reduced the land area to a rather even surface which slopes gently toward the sea. This resulting surface is known as a "peneplain" (meaning almost a plain). After a peneplain has been formed, renewed vertical uplift may take place, and the erosion cycle of wearing highlands down to flat even surfaces may start all over again.

The Hocking Park region, which has remained above sea level from the beginning of the Mesozoic era to the present time, had at least one and possibly two of these peneplain surfaces formed upon it before the middle of the Cenozoic era (35 million years ago). (Fig. 4D).

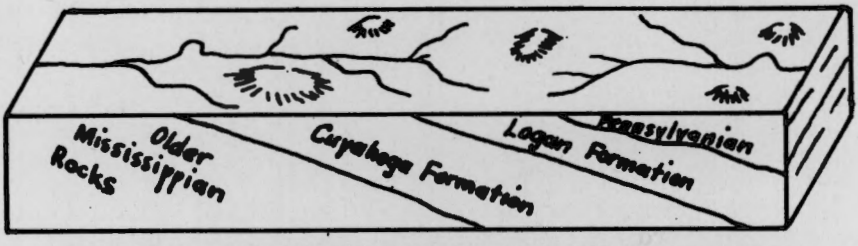

Figure 4D. End of Pliocene; Lexington-Worthington Peneplain

About 1 to 3 million years ago during the Pliocene epoch (a Tertiary time subdivision) another peneplain was formed and this is known as the Lexington-Worthington surface. As one looks out over the hills from the fire tower at Rock House, it is noticeable that all the summits or hilltops have the same elevation. This accordance of hilltops at 1020 to 1100 feet above sea level is all that remains of this old flat surface.

Approximately one million years ago, at the start of the Pleistocene epoch (a lower subdivision of the Quaternary), the area was again uplifted and a new cycle of erosion started. All of the cliffs, gorges, and other scenic features of the Hocking Park area have been carved since the start of this last erosion cycle. This present-day dissected upland is commonly known as the Allegheny Plateau. (Fig. 4E).

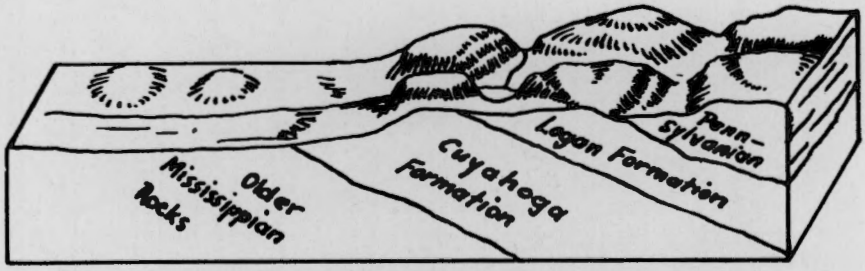

Figure 4E. Southeastern Ohio at the present time

The Pleistocene epoch was also the time of the great continental glaciers which moved down from Canada and covered much of North America. Almost all of Ohio, north of Hocking County, was glaciated and though the glaciers never reached the Park area, their effects upon the rate of weathering and erosion were probably very great.

The deep ravines and caves in the Black Hand sandstone have been cut by the action of both weathering and erosion which in this area are dependent upon great amounts of water. The present-day

streams in the parks are not large enough to do all of this cutting. However, during glaciation, the air was more moist, causing more rapid weathering by both chemical and mechanical means. Also erosion was more active due to the increased power.

At the present time the area is being eroded at a rather rapid rate and in several millions of years, Hocking County will once again become a flat surface or peneplain.

CANTWELL CLIFFS

Cantwell Cliffs, the farthest north of all the parks, is located on State Route 374 and has been acclaimed by many to be one of the most picturesque spots in Hocking County. It is primarily a gigantic precipice, 150 feet high and in the shape of a horseshoe. Associated with this cliff is a rock shelter or recess cave.

The headward erosion of Buck Run has been the direct cause of this scenic spot. As the valley eroded back, the Black Hand sandstone formed one steep escarpment after another, each having been destroyed by the undermining of the resistant cap rock (upper zone) through weathering and erosion of the weak middle zone.

Approaching the rock shelter and main cliff, the trail winds its way through narrow passageways between large slump blocks of Black Hand and the main cliff. The narrowest of these passageways has been aptly called "Fat Woman's Squeeze." These blocks have fallen away from the cliffs due to splitting and honey-comb weathering is visible. The name "honey-comb" is applied because this type of differential weathering resembles the honey-comb of bees.

The projecting lip or rim of the recess cave is composed of the upper zone of the Black Hand sandstone which is very tough, extremely massive, and about 30 feet thick. The recess beneath it has been carved into the weak middle zone which is fine-grained and only slightly cross-bedded. This is one of the few localities where this zone is not extremely cross-bedded. The bottom zone is very poorly exposed and is essentially of the same type of sandstone as the upper zone.

On the face of the cliff there are several places where the cementing material, iron oxide, has been concentrated to such an extent that long elliptical bodies of dark, reddish-brown sandstone are to be seen in contrast to the more usual buff-brown shales. These masses of concentrated iron oxide and sandstone are called *concretions*.

Foot trails follow the valley floor for several miles along the base of this cliff and on top additional trails lead both east and west along the rim of the precipice. Near the end of the East Rim Trail is Lookout Point from which the cave and most of the escarpment can be seen. Due to the deep woods in the valley, the best time to view the many scenic features at Cantwell Cliffs is in the winter or in the early spring before the trees have much foliage.

ROCK HOUSE

Rock House is located on State Route 374, one mile south of Route 180, and is unique among the Hocking Park areas because it contains the only true cavern in the region.

Here at the head of a valley, a sheer cliff of Black Hand sandstone, 150 feet high, rises from the deep valley floor. The formation displays an array of attractive colorings: bright buff where freshly exposed,

deep red and brown on the weathered surfaces, and pale green where it is covered by moss and lichens.

Halfway up the face of the cliff is a row of seven "windows" separated by five massive columns of solid stone. Steps have been cut into the cliff and these lead up and through the windows. Inside is a tunnel-like passageway, about 200 feet long, 20 to 30 feet wide, and 20 to 25 feet high, and is open at both ends.

The very existence and location of this cavern is due to the presence of a major joint fracture, which runs parallel to the long corridor. The cliff face is parallel to this corridor and probably is located on another joint fracture of the same system.

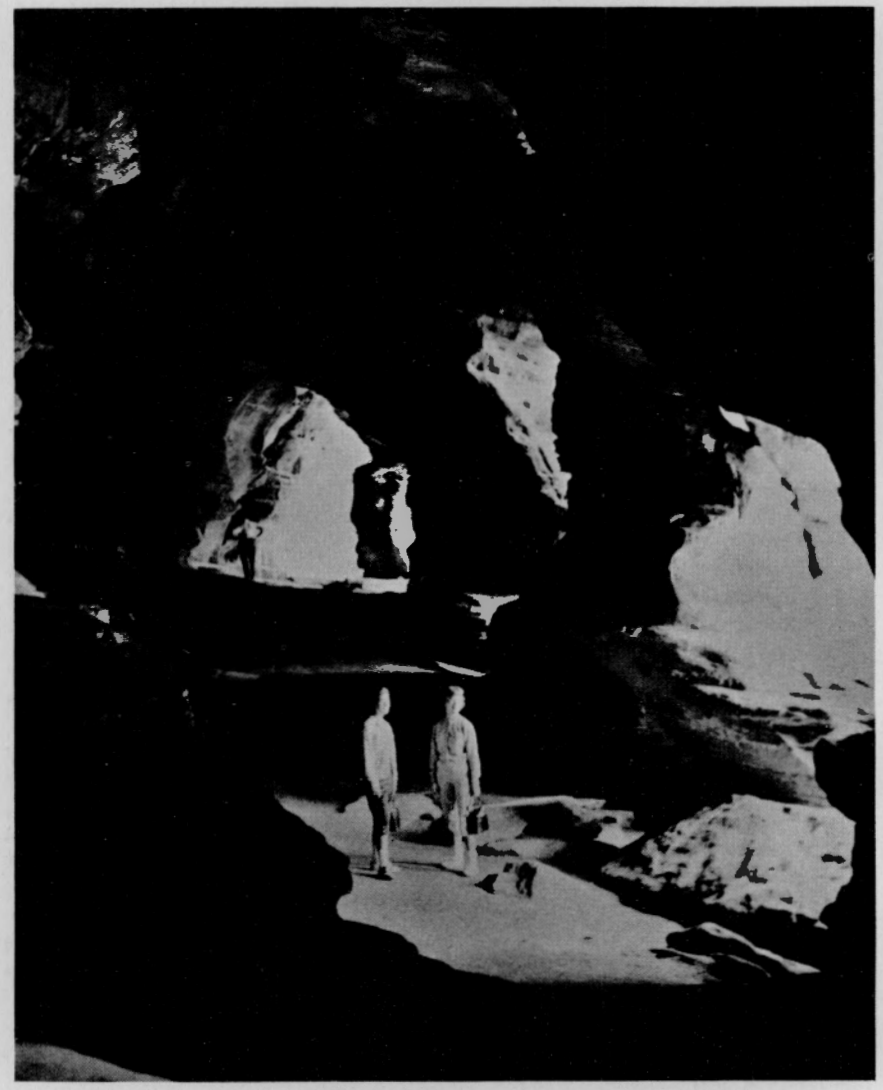

Plate V. Interior of Rock House showing the passageway along the main joint pattern.

A second set of joints, unequally spaced, cuts the cliff face and major joint at roughly right angles. Enlargement of both sets of joints by weathering has produced the passageway and window-like openings. The two large end windows are located on the master joint, while the side windows are cut along the second set of joints. This latter set of joints can be traced across the cavern floor into the rear wall where weathered out niches are visible. The window-like openings have the form of Gothic arches and the columns between the windows hold up the massive room. These columns are widest at the top and are very irregular in shape due to differential weathering.

The cavern is located in the middle zone of the Black Hand and greater weathering along the two joint systems in this zone is responsible for the "House." If one considers the processes of weathering as an inadequate method of forming Rock House, it may be noted that if the 100,000 cubic feet of sand needed to fill the cavern was removed in the last 1,000,000 years (since the beginning of the Pleistocene epoch), the rate of removal would be about one-half ounce of sand per day.[1] The actual removal seems to have been done mostly by wind, with stream erosion having little effect on the cliff.

Rock House has had a very colorful history and has been a mecca for thousands of visitors for many years. A 16-room hotel, complete with ball room and livery stable, was built there in 1835 and was used until 1925. It stood where the park shelter is today. At one time a United States Post Office was located in the hotel.

Besides the usual tourists, the region has been occupied by a variety of not-so-welcome guests. Early Indians were the first visitors, while robbers, horse-thieves, murderers, and even bootleggers in later years used Rock House as a "Robbers Roost."

The park area also offers numerous trails that wind through acres of deeply wooded countryside. A view from the fire-tower, located not far from the parking lot, offers an excellent panorama of the region. From this tower the uniformity of the hilltops which represents the old Lexington-Worthington peneplain may be seen.

CONKLE'S HOLLOW

Conkle's Hollow is situated between Rock House and Old Man's Cave just a short distance from State Route 374. It is a deep, rocky gorge (considered to be the deepest in Ohio) almost totally unimproved and is closer to its original condition than some of the other areas. The valley floor is a veritable wilderness with hemlocks, birches, other hardwoods, ferns, and many scrubs found growing in profusion. In places, the growth is so thick that little or no sunlight ever reaches the deep valley floor.

The trail leading up the gorge (over one mile long) is picturesque and extremely rugged. The small stream, easily forded, must be crossed several times, without the aid of bridges, as the path winds its way over and around large slump blocks of sandstone.

Towering cliffs of Black Hand, almost 250 feet high, rise majestically on both sides of the valley. In some places the cliffs over-

[1] Carman, J. E., "Geology of the Scenic Features of Ohio," Ohio Journal Science, vol. XLVI, p. 279, 1946.

hang to form small caves, and the gorge becomes so narrow that the distance at the top from cliff to cliff is less than 300 feet.

Numerous small side valleys enter the gorge and in the spring or after a heavy rainfall, they are turned into spectacular waterfalls with the water plunging and cascading over sheer cliffs, 60 to 70 feet high.

Near the upper end of the hollow, the cliffs become almost vertical and are practically inaccessible. In places, however, by strenuous climbing, the top of the cliff can be reached. In climbing this steep wall of very coarse sandstone, three distinct levels are reached; each becoming progressively more difficult to scale. These levels correspond to the three zones in the Black Hand.

At the back end of the gorge a series of waterfalls distantly cascade over moss-covered rocks into a small plunge pool. In the back of this pool is found a recess cave, 50 feet long, 30 feet wide, and 25 feet high. Due to this overhang and cave it is impossible to follow the stream up the valley any farther.

In a cleft in the rock on the west wall of the gorge is a large block of sandstone with the following carved upon it:

W. J. CONKLE 1797
A O-COW. 1898

Beyond all doubt the first date, though somewhat indistinct, is one of the earliest records of a white man having explored the area.

Trails can be followed completely around the rim of the hollow and the paths follow the edge of the cliff. From these vantage points the depth and magnitude of the area can be more quickly appreciated. The towering trees on the valley floor far below seem to be only small bushes from this height, and the steep cliffs of variously colored sandstone on the opposite walls seem to be un-ending.

Conkle's Hollow has been carved into the Black Hand sandstone through the action of stream erosion. The tough upper zone forms the rim and the middle zone is represented by the numerous small caves and recesses. From the trail an almost complete section of this rock unit can be seen.

OLD MAN'S CAVE

The most popular of all the Hocking areas is Old Man's Cave which is located on State Route 374, two miles from Conkle's Hollow. This park has been voted by the Ohio Federation of Women's Clubs as the outstanding beauty spot of Ohio.

The area derives its name from the fact that a fugitive from West Virginia by the name of Rowe lived as a hermit in the main cave for many years after the Civil War. After his death, he was buried in Old Man's Cave beneath the rocks he loved so well.

There are many more scenic features in the Park, such as the Upper and Lower Old Man's caves, picturesque waterfalls, and three miles of heavily wooded gorge.

Perhaps the best way to view the caves and gorges is to start at the top and continue on downstream. At the head of the gorge, Old Man's Creek cascades over a series of ledges which are composed of the resistant upper layers of the Black Hand sandstone. This cascade terminates in a waterfall, 30 to 40 feet high, called The Upper Falls. The undercut ledges associated with this falls are due to undermining by older streams that once flowed at these various

levels. Continual erosion has worn the stream down to its present level.

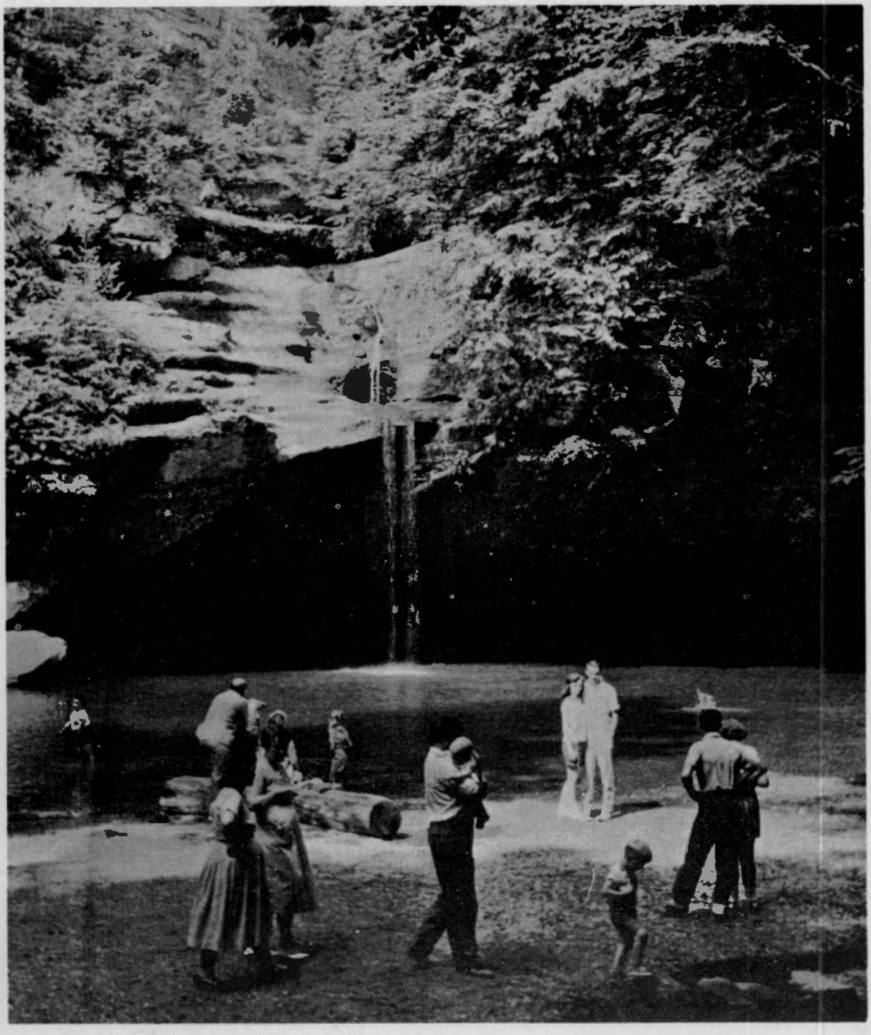

Plate VI. The Lower Falls at Old Man's Cave. The falls are in the lower zone of the Black Hand, and the plunge pool is in Cuyahoga shale.

The Upper Gorge starts below the Falls and continues downstream for more than one-half mile, through a deep woods which blots out most of the sunlight. The Upper Gorge is cut into the middle zone of the Black Hand and varies from 30 to 50 feet and increases in depth downstream from 30 to 100 feet. The walls of the gorge are vertical in most places and cut by deep clefts. These niches are due to undercutting when the stream level was higher than it is today. About halfway down the gorge there is a series of

rapids and small waterfalls and they have been named the Middle Falls. A noteworthy feature of erosion is the presence in the valley floor of numerous potholes. These can best be seen beneath the first two bridges crossing Old Man's Creek and also on the smooth surfaces of the lower part of the gorge near the Middle Falls.

A pothole is formed by the constant swirl of the water which carries pebbles and sand around and around in one spot, gradually boring a hole downward into the rock. Sand and pebbles serving as cutting tools may often be found in the bottom of the pothole.

In the north wall, near the lower end of the Upper Gorge, is Upper Old Man's Cave (the main cave) and it was here that the hermit lived out his life. The cave is located on a vertical cliff, 75 feet above the stream and is about 200 feet long, 50 feet high, and its greatest depth or overhang is about 75 feet. This cave, like the floor of the Upper Gorge, has been cut into the weak middle zone of the Black Hand. Though much larger, its origin is similar to clefts farther upstream.

A hundred yards below this cave is the Lower Falls and Lower Old Man's Cave. Here the water leaps a distance of 30 to 40 feet down into a plunge pool below. The Cave lies to the right of the pool and is 200 feet long, 50 feet wide, and 40 to 50 feet high. Here the resistant lower zone of Black Hand holds up the Falls while the recess cave has been cut back into the soft Cuyahoga shale. The contact of the two formations can be seen beneath the large overhang. During times of heavy rainfall the pool and associated moisture accomplish much of the undercutting.

On the face of the Lower Falls and easily visible from above is a profile of an old man. This feature has not been the cause of the Park's name but is only an erosional feature first discovered by early tourists.

The combination of the waterfall, towering precipitous cliffs that expose the entire section of the Black Hand, the mirror-like pool, and cavern, make this spot the most scenic in the area.

CEDAR FALLS

Downstream from the Lower Falls is another gorge greater in both width and depth than the first and is called the Lower Gorge. Trails leading through this gorge lead to Queer Creek and eventually to Cedar Falls.

Cedar Falls is located at the head of a gorge approximately one mile west of State Route 664 and halfway between Old Man's Cave and Ash Cave. Of all the Park areas, Cedar Falls has retained more of its natural, unspoiled beauty than any of the others. This is largely due to its remoteness and inaccessibility. In order to preserve this picturesque, rugged area in its natural state, the Division of Parks has provided only the most essential accommodations for visitors.

Cedar Falls is a characteristic semi-circular cliff over which Cedar Creek flows to form a waterfall, 50 feet or more in height. Behind the falls is a small recess cave formed by the sapping action of the plunge pool. The face of the waterfall is crossed by two deep grooves in which the water flows in normal times and these grooves have been formed by the abrasive action of small sand particles as

they have been carried along by the stream. This is a striking example of the effects of stream erosion. To the right of the waterfall is a hollowed-out pocket which represents an old pothole formed when the stream was much higher than at present.

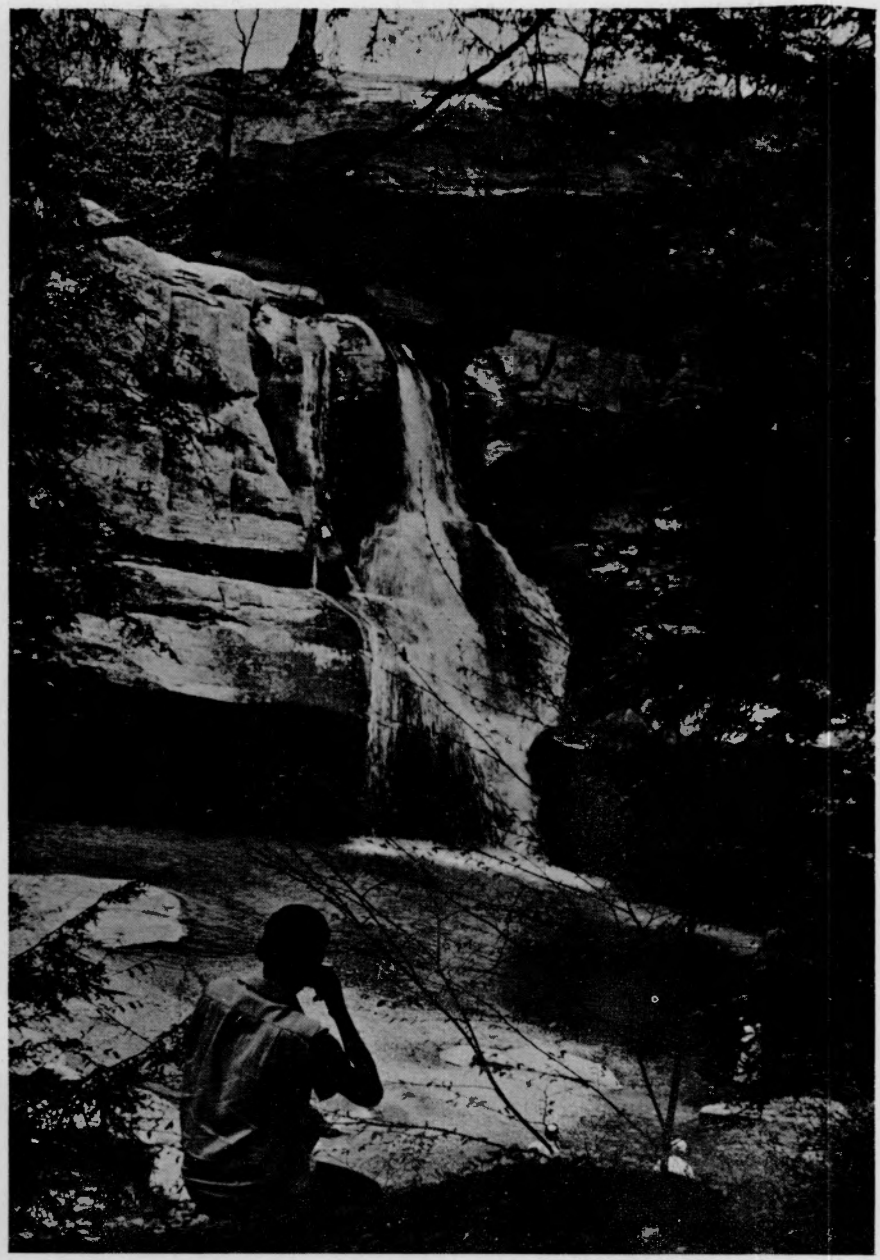

Plate VII. The face of Cedar Falls.

The lip, or rim, of Cedar Falls, once the site of an old grist mill, is composed of the hard, massive upper layer of the Black Hand, while the plunge pool, recess cave, and gorge are all cut into the less resistant middle zone.

Below the Falls, Cedar Creek and Queer Creek join and flow through a deeply wooded gorge with large slump blocks choking the valley floor in many places. This gorge is very similar to the one at Old Man's Cave and is connected to it by several trails. In this valley stands the largest tree in Ohio, a giant towering hemlock, 149 feet high and 46 inches in diameter. Also within the gorge is "Saltpeter Cave" named for its valuable deposits of saltpeter, used in colonial times to make gun powder. Here also are numerous small potholes and caves once used by the Indians for natural ovens.

ASH CAVE

Two miles south of Cedar Falls on State Route 56 in the southernmost part of the Park areas, is Ash Cave, which though not the most beautiful of the Hocking Parks is beyond doubt the most spectacular. It has the largest overhanging ledge in the entire region.

The approach to Ash Cave is through a narrow gorge, heavily wooded with hemlocks, pines, and various kinds of hardwoods. With astonishing suddenness the deep forest gives way, and a tremendous overhanging ledge and cave are present.

Shaped like a gigantic horseshoe this projecting rock is 700 feet around the bend from one end to the other, 100 feet from the front edge to the back wall of the recess, and over 90 feet high. A small stream gracefully plunges over this cliff into a small pool at the front of the cave.

The origin of this cave is like the others in the area: the more resistant upper zone of the Black Hand forming the roof and the easily weathered middle zone causing the recess. During periods of heavy rainfall, sapping action, due to the moisture from the spray of the plunge pool, is the most important factor in undermining the ledge.

This cave received its name from a huge pile of ashes found by the first settlers when they came into the area. These ashes have been considered the remnants of countless Indian campfires. As late as 1890, large quantities of these ashes were still present. The largest pile on record was 100 feet long, 30 feet wide, and 3 feet high.

This tremendous overhang has been used repeatedly for camp meetings, having a natural "pulpit rock" in front, shelter for hundreds, and remarkable acoustical qualities. Two spots in fact, under the rock, have the qualities of a "whispering gallery."

CONCLUSION

In publication of the Geological History of Hocking State Park the Division of Parks of the Department of Natural Resources has two prime objectives in mind.

First, for those who have already visited and enjoyed observing the natural scenic beauty of the park itself, together with the age-old and ever-changing geological formations, this booklet will be of

value and interest in explaining when, how and why these many geological transformations were created.

Secondly, for those who have not yet visited the widely-known and historic area, the foregoing information should be of material assistance in aiding the observer and visitor to better understand the important historic background of this State Park.

True, the awesome and unique rock formations found in Hocking State Park stand out in utter silence in their picturesque settings, but those same rocks tell the observer an interesting story—a story which began 600 million years ago.

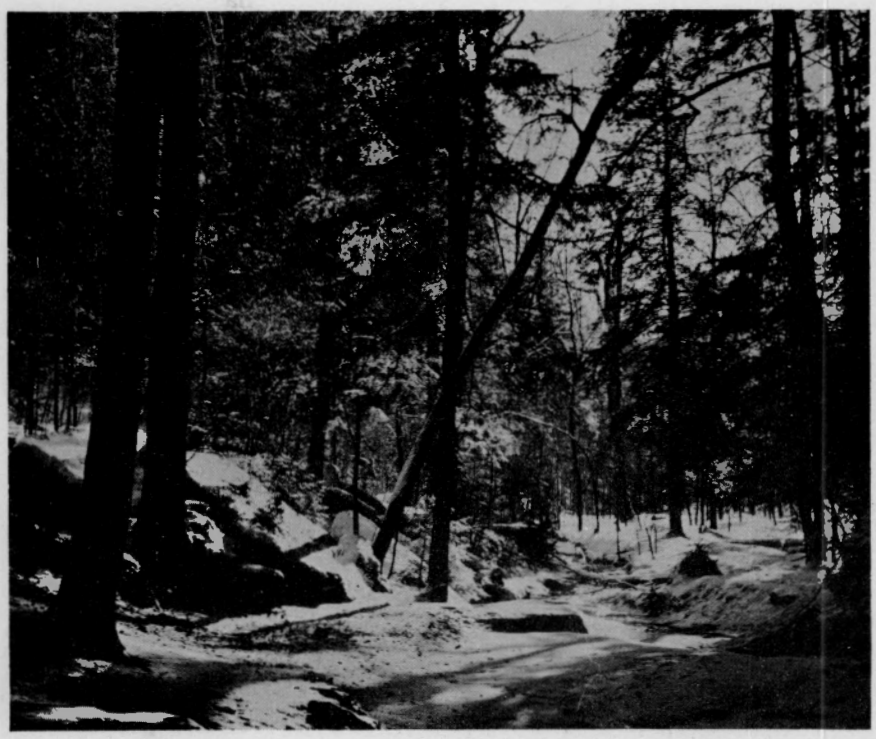

Plate VIII. View of gorge at Ash Cave.

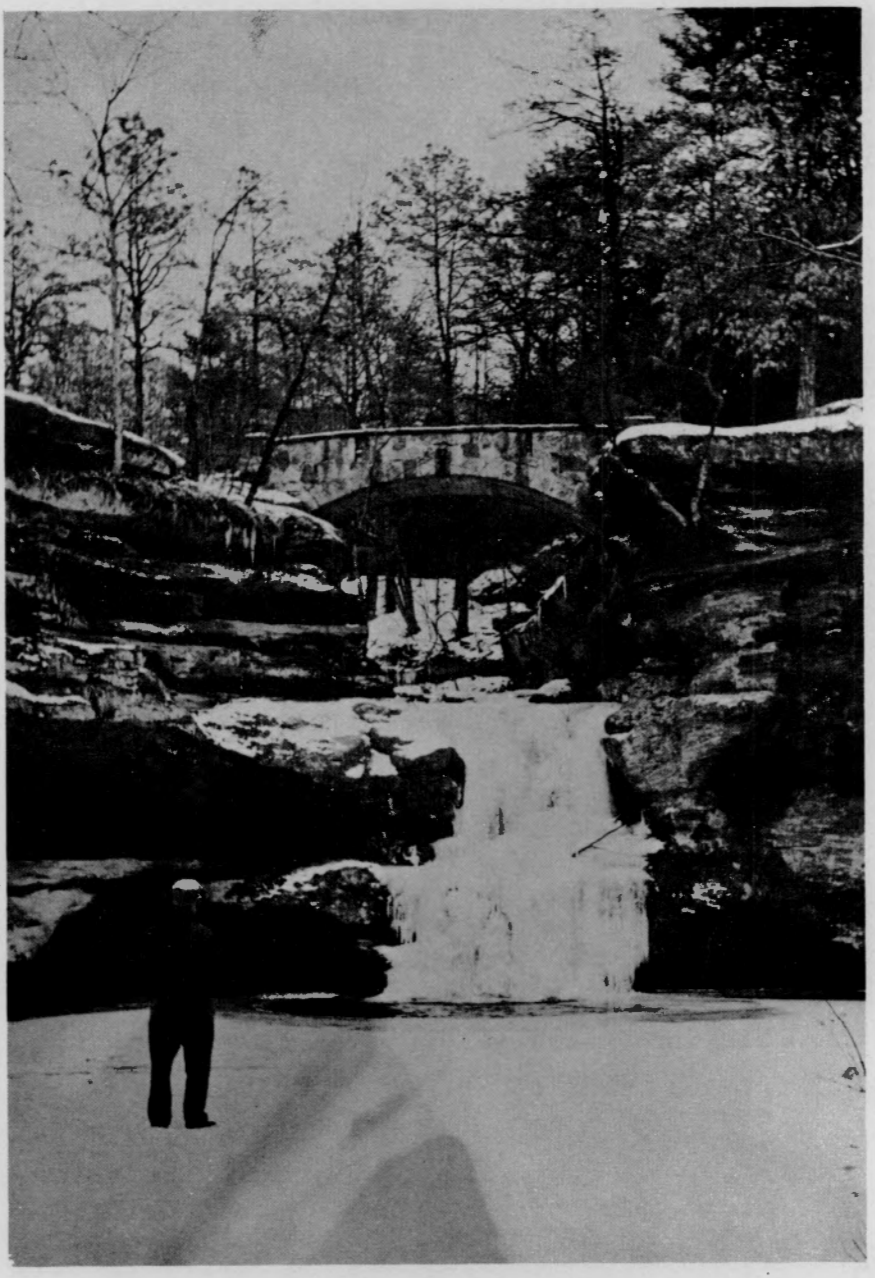

Plate IX. The Upper Falls at Old Man's Cave in winter. This same view in summer is shown on the cover plate.

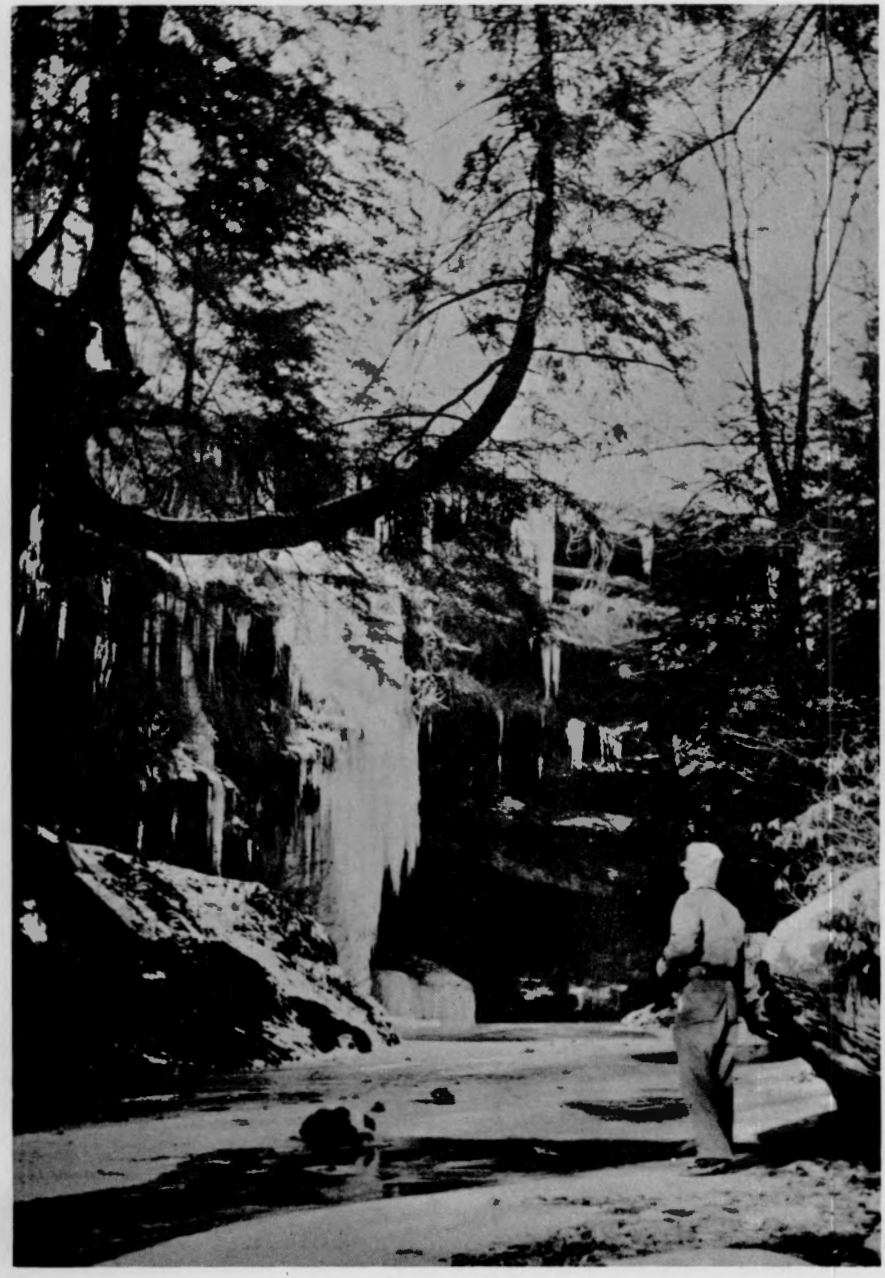

Plate X. The Upper Gorge at Old Man's Cave.

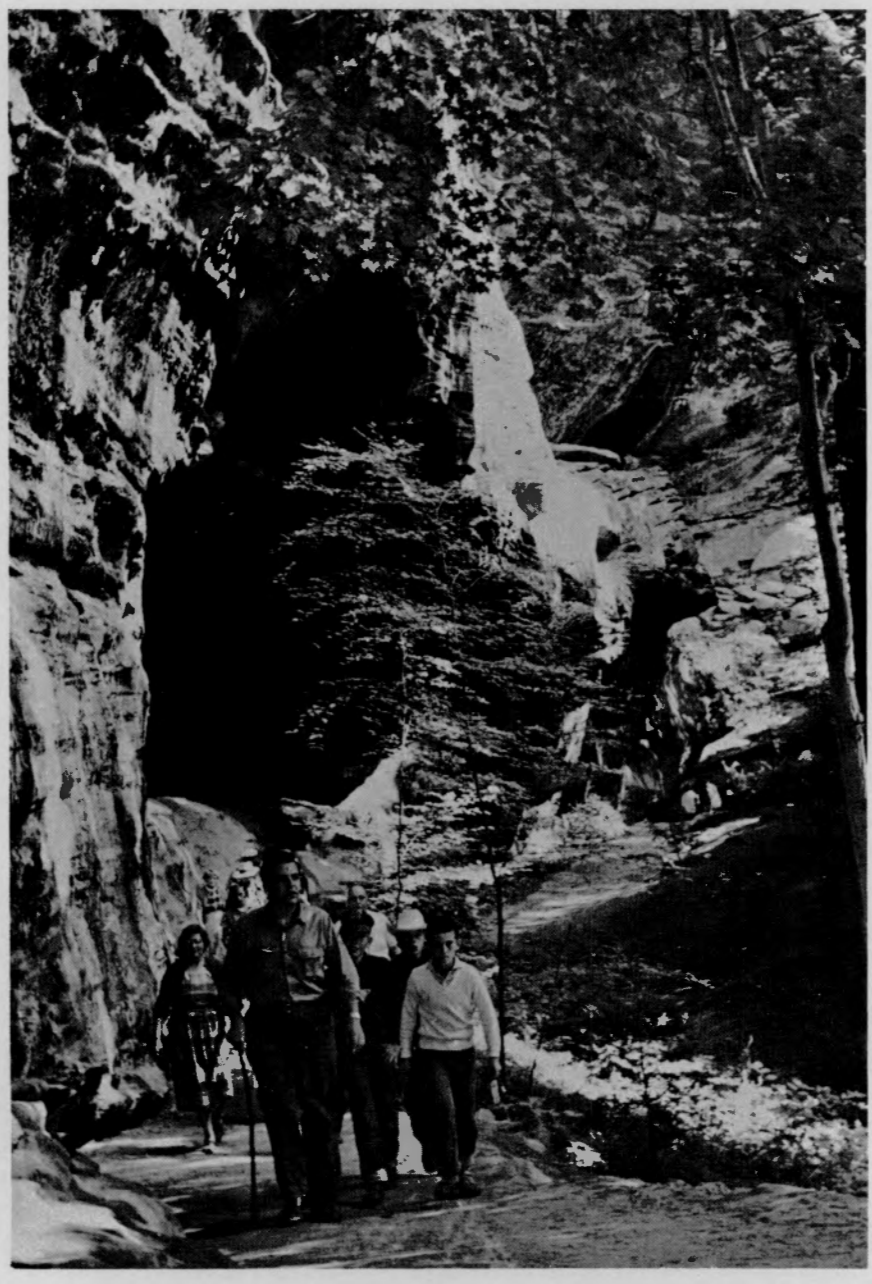

Plate XI. A guided tour on the trail above the top of the Lower Falls in the vicinity of Old Man's Cave.

Also available on the HOCKING STATE PARKS

Division of Geological Survey
Report of Investigations No. 63

Geology of the South Bloomingville Quadrangle, Hocking and Vinton Counties, Ohio

This report consists of a colored geologic map of the quadrangle, on which five of the six parks are located. A cross section and stratigraphic column are included and hiking trails and bridle paths are clearly marked. The reverse side contains full-color photographs of Ash Cave, Cantwell Cliffs, Cedar Falls, Conkle's Hollow, Old Man's Cave, and Rock House, with brief descriptions of the geologic processes that have shaped the rocks.

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