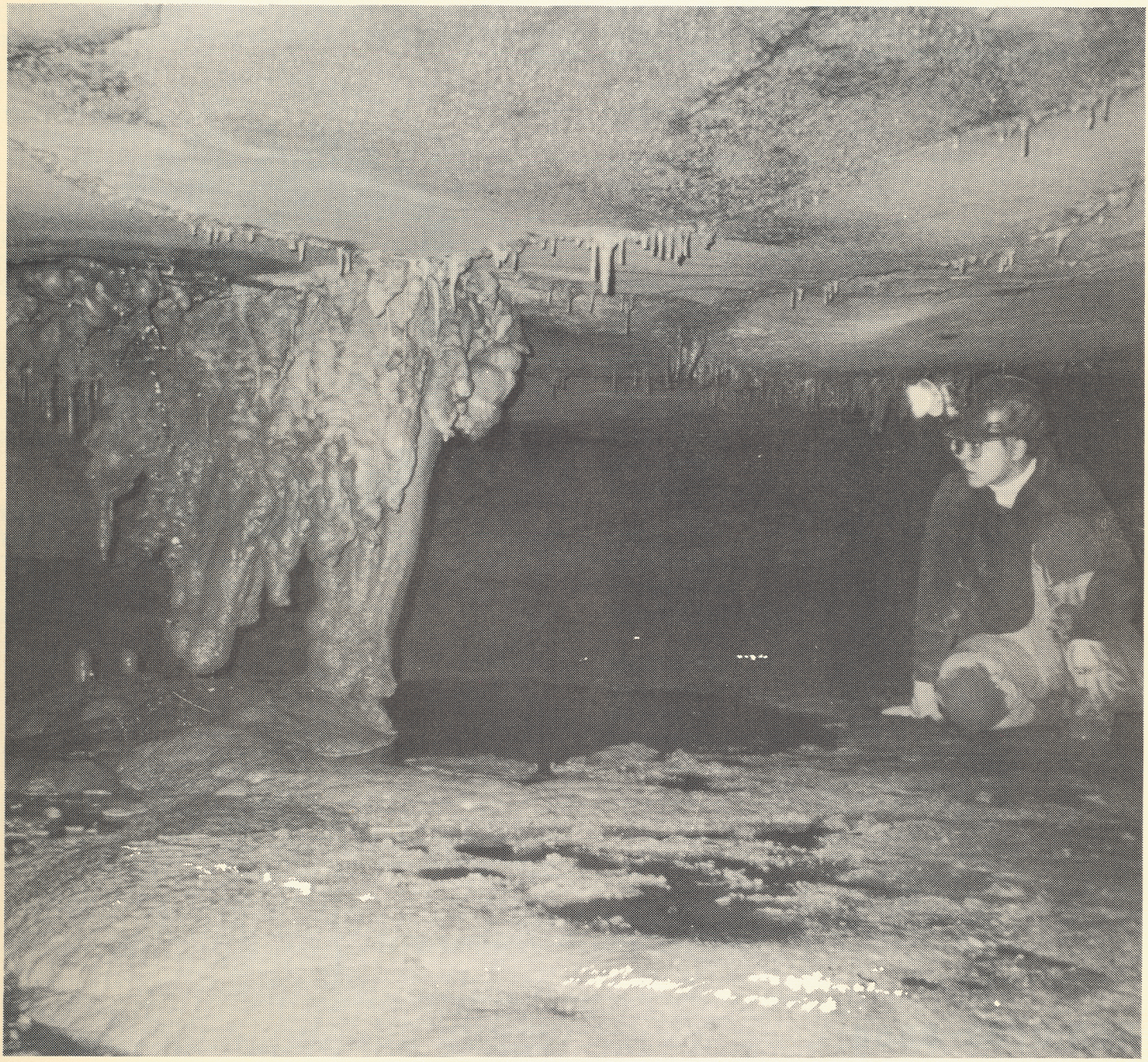
PHOLEOS

WITTENBERG UNIVERSITY SPELEOLOGICAL SOCIETY

Volume 8 (2) **1988**



The Wittenberg University Speleological Society

The Wittenberg University Sepeleological Society is a chartered internal organization of the National Speleological Society, Inc. The Grotto received its charter in April 1980 and is dedicated to the advancement of speleology, to cave conservation and preservation, and to the safety of all persons entering the spelean domain.

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PHOLEOS

THE WITTENBERG UNIVERSITY SPELEOLOGICAL SOCIETY NEWSLETTER

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GROTTO ADDRESS

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Springfield, Ohio 45501
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EXCHANGES

Exchanges with other grottoes
and caving groups are encouraged.
Please mail to Grotto address.

MEETINGS

Wedensday evening,
7:00 p.m., Room 206, Science
Building, Wittenberg University
Springfield, Ohio.

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Cover Photo:
The Fountain Room, Sloan's Valley Cave, Kentucky

EDITORIAL

To all our readers in America and around the world, welcome once again to PHOLEOS. This is the second issue of the term. As mentioned in the last issue, several club members had a successful trip to TAG over the winter break. Many stories and pictures were shared with those club members who were unable to go along.

The BOG meeting for the NSS, which was held at Wittenberg, was a great success. The meetings were held Saturday and were attended by a respectable number of cavers. On Sunday morning, after the now ritual post meeting parties, a trip to Ohio Caverns was taken. This trip concluded a very rewarding weekend for the club.

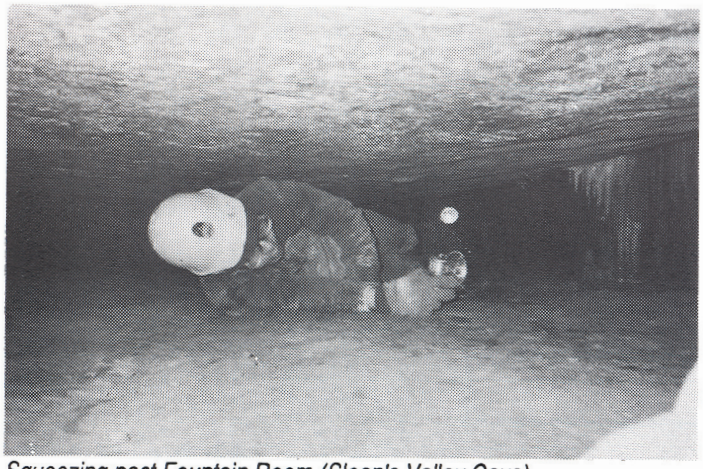
The Cave Bill was introduced back into the Senate but was placed aside. After much inquiry and letter writing, we have managed to get the Bill rolling again in the right direction. I strongly encourage everyone to write to their Ohio Senators asking for support for this important bill which will protect Ohio caves by law.

I hope you find the articles on Limestone Caves In Eastern Ohio by Warren Luther and the report on Coon-in-the-Crack Cave interesting. I wish to all our readers a happy summer full of caving and excitement.

Tim Hopkin (Editor)

COURSE NOTES

A one day course entitiled "Speleology For Cavers" will be offerded on Friday, July 1, 1988 at the NSS Convention. Experts will lecture on each of the following topics: Geology, Hydrology, Formations and Sediments, Meteorology, Biology, and Archeology. Participants will receive printed course materials, and lunch will be provided. The cost for this course will be $25. Registration will be limited to 40 people. To register, send a check or money order to: NSS Educational Opportunities in Speleology Committtee (NSS EOSC), c/o J. C. Evans, Treasurer, 9 Pine Street, Maynard, Mass. 01754.



Squeezing past Fountain Room (Sloan's Valley Cave)

CAVE LAW
PROTECTION FOR OHIO'S CAVES

Senate Bill 177 was drafted by members of WUSS in spring, 87. The passage of this bill will help to preserve and protect one of Ohio's most under-rated natural resources. The bill will make the selling of speleothems illegal and will educate the general public about the importance of caves and the ground water associated with them. On the 18th of May, 1988, Senate Bill 177 was voted out of the Senate Energy, Natural Resources, and Enviromental Committee. It then went to the Senate, and on May 26 the Senate passed it by a vote of 31-0. It will now go to the House, which reconvenes in June. We urge all of you to take five minutes to write to your state reprsentative in support of Ohio's Cave Protection Bill. You may also want to call your state representative and ask for their support for this bill. Please help us get this bill through the House and into law. Thank you.

The following is a list of the senators in Ohio that should be contacted in regards to the Senate Bill 177 that aims to protect Ohio's caves. The senators can be called at the telephone numbers after their names or by writing using the following letter address:

The Honorable Senator (name of senator)
Ohio Senate
State House
Columbus, Ohio 43216

REPUBLICAN SENATORS	PHONE NO.
Aronoff, Stanley	466-8068
Cupp, Robert R.	466-7584
Drake, Grace L.	466-7505
Einan, Richard H.	466-9737
Gaeth, M. Ben	466-8150
Gillmor, Paul E.	466-8060
Gray, Theodore	466-8064
Hobson, David	466-3780
Horn, Charles E.	466-4538
Levey, Barry	466-8072
Ney, Robert W.	466-8076
Oelslager, W. Scott	466-0626
Pfeifer, Paul	466-8049
Ray, Roy	466-4823
Schafrath, Richard	466-8086
Snyder, H. Cooper	466-8082
Suhadolnik, Gary C.	466-8056
Watts, Eugene J.	466-5981

DEMOCRATIC SENATORS	PHONE NO.
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Bowen, William F.	466-5980
Branstool, Eugene	466-5838
Burch, Robert	466-6508
Butts, Charles L.	466-5123
Carney, Thomas	466-7182
Fisher, Lee I.	466-4583
Furney, Linda	466-5204
Long, Jan Michael	466-8156
Meshel, Harry	466-8285
Nattle, Robert	466-7041
Pfeiffer, Richard C. Jr.	466-5131
White, Michale R.	466-4857
Zaleski, Alan J.	644-7613
Zimmers, Neal	466-6247

WOODBURY WILDLIFE AREA NATURAL BRIDGE
MINI-KARST IN COSHOCTON COUNTY, OHIO

by T. A. Snyder

Karst in Ohio can pop up in the most unexpected places. While engaged in a survey of the natural bridges in the state, I visited one reported to exist in Woodbury Wildlife Area south of Warsaw in Coshocton County. I expected to find a bridge formed by the collapse of the roof of a sandstone recess cave, similar to the much larger Rockbridge of Hocking County. Instead, I found a limestone solution feature.

At first the situation seemed impossible. How could a pocket of karst barely 50 feet square exist in this sandstone region? The answer lay in the complexity of the bedrock underlying Coshocton county.

Most of the rock forming the hills of this area belongs to the Pottsville, Allegheny, or Conemaugh series of Pennsylvanian age. Each of these series is made of alternating layers of sandstone, clay, and coal. Scattered through them are several layers of limestone. Woodbury Natural Bridge has formed in one of these limestone layers—the Putnam Hill limestone of the Allegheny series.

The bridge is located near the head of an unnamed tributary of Simmons Run. In its descent, the little stream cuts across successively older strata of the Allegheny series. The Putnam Hill limestone, being more durable than the sandstones and coals above and below it, stands out as a ledge about 6 feet high across the stream. At this point it is made of a series of thin layers, each only one or two inches thick, and is capped by a more resistant layer about one foot thick. The upper layer has protected the weaker layers below from direct erosion by the stream, which evidently formed a waterfall here at one time. However, it could not protect these layers from the sapping action of the ancient waterfall. The result is a semi-circular recess cave about 4 feet deep, 5 feet high and 40 feet around the rim.

Recesses such as the one just described are common in eastern Ohio. What sets this one apart is the presence of a solution-enlarged crevice 12 feet behind the center of the recess and perpendicular to the stream. As the down-cutting stream broke through the sandstone overlying the limestone at this point, its waters began seeping into the crevice. Eventually, most of the stream was falling into it. The water could have exited by following the crevice to its outlet, provided there was one. Water presently covers its floor to a depth of several inches and has little if any current, and so it may never have provided an outlet.

There was another way out; the multiple bedding planes between the narrow layers of limestone could be readily, if slowly, traversed by the water. The distance involved between the downstream side of the crevice and the sloping back wall of the recess cave would have been made even more easily exploitable by the slight hydrostatic head provided by the weight of the water filling the crevice. Over time these thin openings would have been enlarged by solution and the intervening rock would have been carried away by freshets. The result is an irregular opening 26 inches high and 30 inches wide in its smallest dimensions through which the stream now flows.

A small but noticeable flow of water coming out of these same thin-bedded limestone layers in the upstream wall of the crevice, a few feet to the north of the waterfall, shows that the process is continuing. This water is evidently seeping down through cracks in the streambed farther upgrade.

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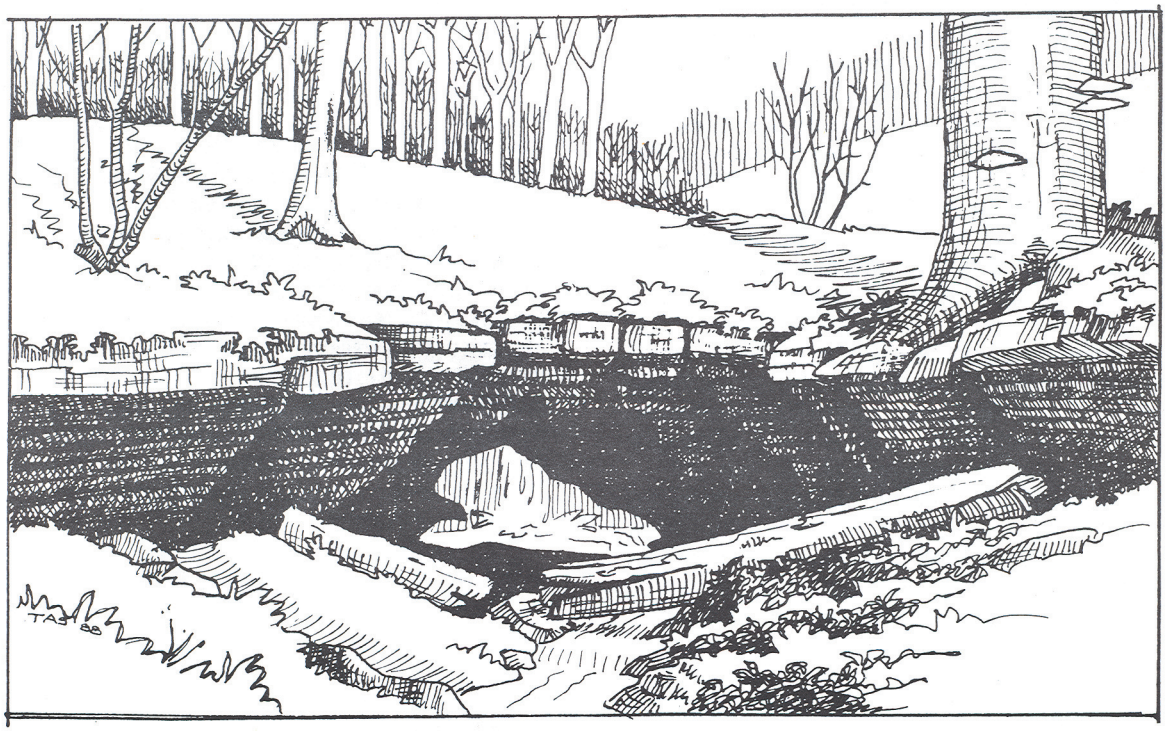

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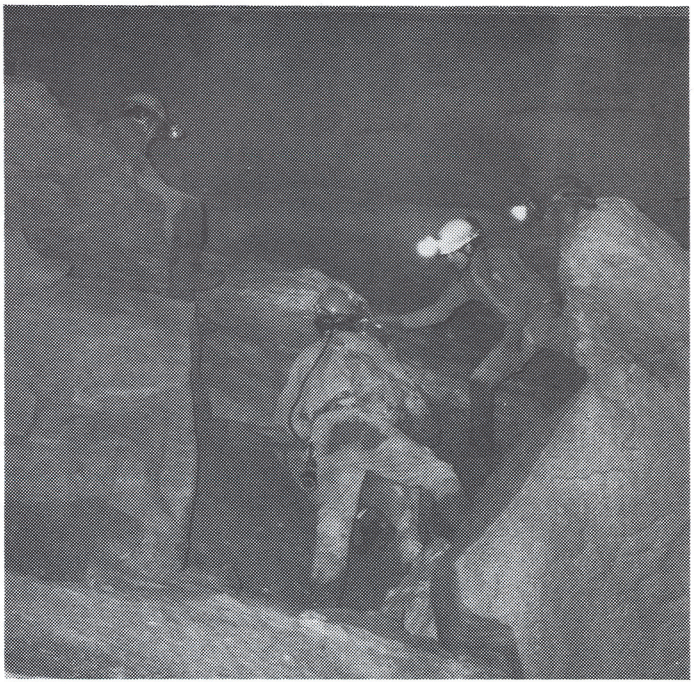
The window, or "swallow hole", opening into the crevice is about 10 feet long and 4 feet wide. The crevice itself is only half as wide, but much longer, extending south beneath the hill for at least another 15 feet. The extra width of the crevice at the window is due to headware erosion by the stream which falls 40 inches to the crevice floor. The back wall of the crevice beneath and to either side of the falls has been beautifully fluted.

Just upstream from the falls is a shallow sink 36 inches by 29 inches with water flowing through the bottom. Ten feet up the steep hillside, directly above the sink, is a circular depression 10 feet across which may be a filled sinkhole or a collapse feature in overlying strata caused by solution of the limestone below.

Although smaller than most of Ohio's generally small karst displays, this natural bridge is an important addition to the state's list of solution features. Its presence should also encourage the search for other caves and karst in the neglected eastern portion of Ohio. It can be reached by walking upstream to the south and west from the campground located at the end of Woodbury Lane in Woodbury Wildlife Area.



A helping hand on the boyscout trip (Sloan's Valley Cave)

COON-IN-THE-CRACK CAVES I AND II THC=212.01m (I) and 127.42m (II)

by Terence J. Madigan

Coon-in-the-crack Caves I and II are located in Carter Caves State Resort Park, Carter County, Kentucky. They were originally one cave, but due to collapse of the roof, two thirds of the cave forms the first segment and the remaining third forms the second segment of fracture controlled phreatic passage.

Cave (I), the longer of the two, forms the northwest limb and is entered via a small pit near the collapse zone. This zone forms a small depression in a flat area on the hillside in which the caves formed. Cave (II) forms the southeast limb and has two pit entrances—one near the collapse zone and one near the end of the cave. This second pit is named turtle pit because of the skeletons of several box turtles (Terrepene carolina) that had fallen in and died. A black salamander (Plethedon glutinotus) was also observed in this cave.

The pit entrances of both caves are about 3.5 meters deep. These were negotiated using a belayed etrier, although the entrance to cave (II) near the collapse zone has a slope that may be safely traversed unaided.

The entire system is very muddy, the mud being drier in some portions and muckier in others. Large breakdown blocks and speleothems that have detached from the ceiling litter the floor of both caves. Cave (I) has several kettles formed in the ceiling, which are indicated on the map.

Both caves drain via fractures in the floor near the respective centers of each segment, their lowest points in a system that has a generally level floor. Numerous side passages pinch out after only a few meters or less, although both segments contain small loops that may have originally served as overflow by-passes.

These caves were surveyed in August, 1987 by the following people who are deserving of thanks: Larry and Linda Bond; Charles, Howard, and Steven Kronk; Chris Cooke; Bill Stitzel; Horton H. Hobbs III; Nate Pfeffer; Bob Klapthor; and Terry Madigan.

LIMESTONE CAVES IN EASTERN OHIO (1987)

by W.P. Luther

INTRODUCTION

The sketchy list of caves accompanying this paper (see map) reflects what little the Ohio Cave Survey knows about limestone caves in the Upper Paleozoic strata (Late Mississippian, Pennsylvanian, and Early Permian) in the Appalachian Plateaus of eastern Ohio. One reason for the paucity of caves is (as will be seen) the comparative lack of carbonate rocks thick enough or pure enough to favor cave formation. Another reason is that no systematic exploration has been made for caves in eastern Ohio, since not much information is available to generate any interest. All but six of the several hundred known limestone caves are in the western half of the state, which is underlain largely by a thick sequence of Lower Paleozoic carbonates (limestones and dolomites), while the eastern half is underlain largely by clastic rocks (sandstones, shales, and clays) interbedded with coals and various thin limestones. A thin isolated limestone stratum in itself is capable of producing sizable caves; it is this writer's opinion, based on current research in caves of western Pennsylvania, that an extensive cave system could be found somewhere in the upper Ohio Valley, on the Ohio side, where certain important limestones are present. This could be proved, or disproved, mainly by field work in those areas. More will be said about this later.

As mentioned, thin limestones offer no obstacle to cave development; 20 feet of dense, pure limestone sandwiched between two clastic beds of varying permeability has a potential even for long caves, providing other conditions are right. McGrain and Bandy studied the problem with the Beech Creek limestone (Upper Mississippian) in southern Indiana, which has produced some large caves, notably Ray's Cave and American Bottoms Cave, the former having about 2 miles of mapped passages, and the latter still incompletely explored.[1] The

authors were quick to note the role of the overlying Cypress sandstone (now called Big Clifty) in supplying groundwater to the Beech Creek stratum, and the underlying, impermeable Elwren shale in trapping that water within the limestone. Furthermore, the Beech Creek consists of one or two massive beds of well-jointed dense limestone ranging in thickness from 8 to 24 feet—a condition found also in several of the eastern Ohio limestones. The newly-activated Kansas Speleological Society, working in parts of eastern Kansas where the Upper Paleozoic strata contain various thin limestones in a mixid sequence much like eastern Ohio, has found a number of caves in areas with little, if any, surface expression of groundwater solution—again like eastern Ohio, where not even a sinkhole has been verified. In western Pennsylvania, adjacent to Ohio, some caves have formed in one thin but persistent limestone, the Vanport, which extends well into Ohio and might also contain caves since otherwise the geological and topographical conditions are similar. The thick sequence of Mississippian limestones responsible for the "Central Kentucky Karst" extends into eastern Kentucky and crosses into Ohio near Portsmouth, where it is much thinner and already irregular in distribution, as in Greenup and Carter Counties, Kentucky—yet in certain places, notably at Carter Caves (which is a mere 23 miles south of the Ohio River), karst development has been intensive wherever this limestone is favorably exposed. Each of the above four areas have certain conditions in common with eastern Ohio: the bedrock is horizontal, or nearly so, and undeformed; the relief is generally moderate, between 200 and 600 feet; they lie at the glacial boundary or south of it, yet close enough to it to benefit from an ample supply of groundwater and the force of great volumes of meltwater; and the limestones, which are well-jointed, have an average thickness of about 20 feet. Forthermore, in all of these areas, including eastern Ohio, the limestones are Upper Paleozoic in age—a coincidence, of course, but several of these limestones cross into Ohio which are cavernous elsewhere. What sets eastern Ohio apart from the other areas is rather an unfavorable lithology of many of its limestones, and their usual lack of continuity.

Little research has been done on the presence, or lack, of caves in eastern Ohio. George White dismissed the likelihood of caves based on the thinness and impurity of most of the limestones; Campbell echoed this opinion; and Snyder pondered the interesting possibility that the great cave-forming epoch in the Maxville limestone of Ohio occurred during the Late Mississippian, before the widespread delta sandstones, conglomerates, and siltstones of earliest Pennsylvanian time were laid down on top of the limestone, with the simultaneous destruction of hypothetical cave systems by erosion and filling. One paper deserves special attention here, because it is so far apparently the only study made of the effects of solution on some of these thin limestones in Ohio. Caswell worked in an area with limestones so thin (under 5 feet), an area in which nobody, not even the present writer, would have considered searching for caves, and what Caswell found is a cave, apparently a fairly long one, though perhaps not negotiable by humans. It is at least an integrated network of solution passages; a description of it will be found in later paragraphs.

THE CAVES AND THEIR GEOLOGICAL SETTING

The oldest limestone in consideration here is the Maxville, of Upper Mississippian age. It is roughly correlative with the rock responsible (though under a different name) for Carter Caves in eastern Kentucky. Its occurrence in eastern Ohio is patchy, as it already has become in Greenup County, Kentucky, and its expected horizon on the outcrop is often occupied by a nonconformity where the lowest Pennsylvanian strata rest on an ancient erosion surface. Much of the Maxville, then, was removed, and the basal Pennsylvanian clastics fill old valleys cut into the Maxville and sometimes through it into older rock. In addition, the limestone in Ohio is approaching the northern and western limits of its original deposition, thinning out in those directions. These two circumstances give it today an erratic, unpredictable presence on the outcrop, where it usually appears as pockets or inliers.[2] However, to the southeast, beneath drainage, the Maxville is persistent and thickens along the regional dip towards the Appalachian Basin. Most of its limited outcrop areas are already at or near drainage, where it is quarried extensively, thus further removing the stone along with whatever rare solution features or caves it may have contained. The Maxville limestone attains a maximum thickness of about 60 feet on the outcrop, though for the most part it is much thinner. It appears along a sinuous, discontinuous line from Scioto County on the south into Coshocton County on the north, and its best development is confined to several localities in Perry and Muskingum Counties. It is also known in Vinton, Jackson, and Hocking Counties. Like its exposures at Carter Caves and elsewhere in northeastern Kentucky, the Maxville shows several distinct facies and a highly variable lithology; it can be siliceous and crossbedded, massive and dolomitic, brecciated and cherty, or thinly bedded and shaly.

One cave is presumably in the Maxville limestone in Muskingum County, north of Zanesville in the Licking River valley. Walden, who visited it, describes it as "decorated" but "damaged by highway construction." About 10 feet of Maxville is exposed in this area, capped as usual by the Sharon conglomerate. Caves are frequent in the Sharon, though (hence the caution in assigning this cave to the Maxville), and may even resemble limestone caves in general appearance, with eroded passages along joint planes, bedding-plane crawlways, and limonite stalactites and flowstone. The present writer, who could not find this cave (referred to as Dillon Park Cave in the Survey files), did notice that its assumed location, when transferred to the geological map of Muskingum County accompanying Stout (1918), falls precisely on the Maxville horizon. Walden also reports a "sinkhole" in Hocking County, in the vicinity of some good exposures of the Maxville, though in an area where the first Pennsylvanian coals are mined and where one would expect many holes, pits, and excavations; the present writer has not investigated this. Morse mentions conspicuous solution along bedding-planes in the Maxville limestone in Perry County where it is exposed along drainage level in small creeks. This may be surficial weathering, since thin shale partings have also been removed between single ledges of limestone. He also mentions a "small pit opening" in Perry County in which he observed several feet of Maxville; again, like Walden's "sinkhole," this is an active quarrying area wherein such openings would be suspicious.

(A cave in Lawrence County, erroneously assumed by the present writer to be in the Maxville limestone, was mentioned as an afterthought in his article on Adams County caves, and later cited by Snyder in his interesting discussion of the Maxville. The Mississippian limestone is nowhere exposed in that area, and the cave is likely in the Vanport limestone. The author wishes hereby to correct his mistake.)

The next important limestone in eastern Ohio is the Mercer, of Lower Pennsylvanian (Pottsville) age, divided into an upper and lower member separated by shales and other clastics. These two beds are thin but persistent, reaching a maximum thickness of about 10 feet for each member. The Mercer enters Ohio in Mahoning County in the north and disappears in northern Jackson County; each member is usually much thinner than its known maximum, and will consist of a single stratum, or "ledge," of limestone, well-jointed and without bedding-planes. It is in this formation that Caswell conducted much

continued on page 8

COON-IN-THE-CRACK CAVES I

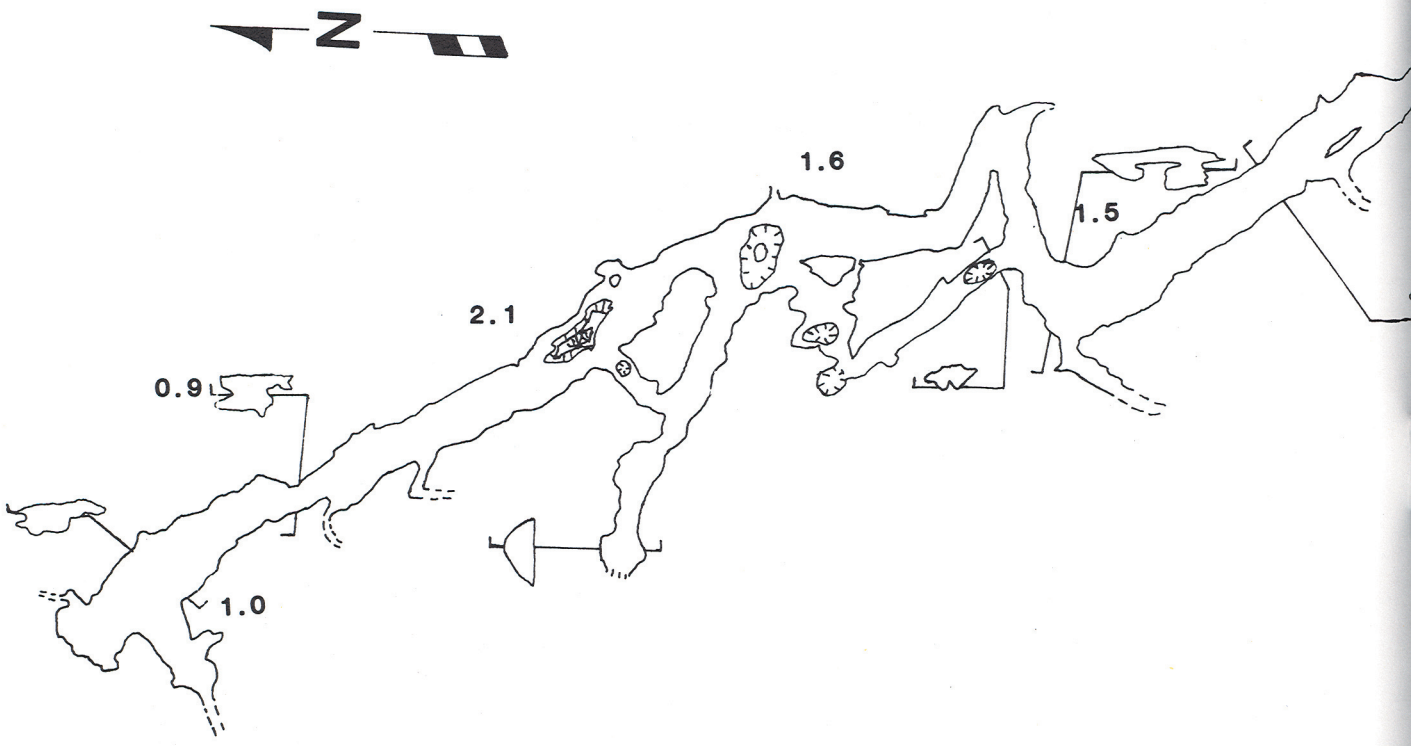
CARTER CAVES STATE RESORT PAR

CARTER COUNTY, KENTUCKY

THC 212.01m (I) 127.42m (II)

Surveyed 7-87 by W.U.S.S.

COON-IN-THE-CRACK (I



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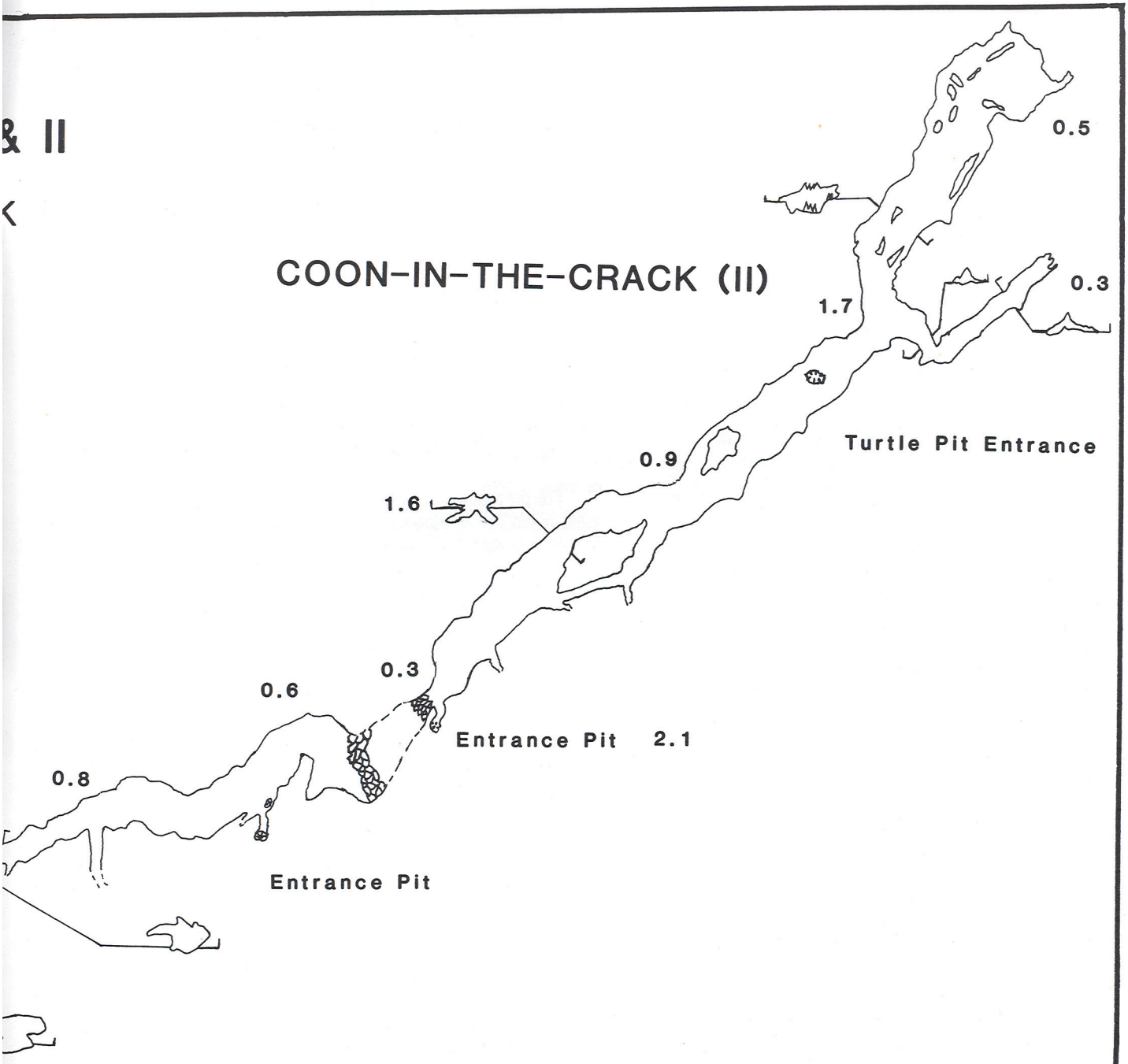

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SCALE

Map by

Howard Kronk

and

Terence Madigan

continued from page 5

of his research, finding numerous opened solution channels on exposed surfaces—joints from which the clay fill had been removed. He also examined well records, finding that the Mercer limestones, along with the associated Putnam Hill limestone, are important aquifers, since they trap water between impermeable strata. He concluded that the frequency and amount of solution in the opened joints depends on several conditions: the thickness of the overburden; the presence of synclinal folds, which trap groundwater; the presence of intersecting joint systems; and the thickness of the limestone. The average "openness" of joint-plane solution is greater along outcrops (natural or otherwise), especially if the outcrop is in the trough of a syncline. This groundwater action is sufficient to have a measurable influence on the hydrology of a small watershed. The "cave" Caswell reported in Coshocton County is perhaps not a curious anomoly, but rather an indication that more and larger such features might be discovered in other areas as well. He says:

> "Plugged joints in a thin limestone can also be unplugged by a change in flow regime, as is demonstrated by the following example. A pond was constructed about 20 years ago in the area ... at a site that appeared to be suitable, that is, 'leak proof' ... The pond held water, with no excessive leakage, for some time, but later, when the depth of the water in the pond was increased, the water suddenly drained away exposing a hole in the pond floor ... This hole showed that the Upper Mercer Limestone occurs a few feet below the pond floor. Water that had flowed into and filled the pond, now drains into the limestone beneath the pond and reappears about 1000 feet downstream where the Upper Mercer crops out in the stream channel ... That portion of the stream channel between the pond and this outcrop is now relatively dry. Several observation wells, drilled after the pond failed, revealed the synclinal structure of the limestone in the area of the pond. Because the pond held water for a time, the now open joints must have been plugged with clay, making the limestone relatively impermeable. The water must have slowly removed the clay from the joints and washed it down dip to where it was discharged in the stream. Finally, when the water level in the pond was raised, the remainder of the clay was washed away, reopening the old solution channels in the limestone."

Whether or not passages such as these will be enterable and explorable remains to be seen. Caswell gives no thickness for the limestone at this site, but even if it were only 5 feet, and the solution channels wide enough to enter, there could be sizable networks in this and other limestones scattered throughout eastern Ohio.

Some dozens of feet above the Mercer limestones is the Putnam Hill limestone which can reach 13 feet in thickness but is generally much thinner. Caswell noted identical solution openings in this limestone in the Coshocton County area, and his conclusions regarding the Mercer would be valid here.

Above the Putnam Hill and separated from it by a fairly thick sandstone is the Vanport limestone of Middle Pennsylvanian (Allegheny) age. Because of its potential as a cave-producer in Ohio, more space will be devoted to it, and if the reader will indulge the writer's stepping across state lines to describe caves in Pennsylvania, this potential may readily be seen. The Vanport is a persistent formation, outcropping across eastern Ohio from Mahoning County through Lawrence County, though it is often represented by sandstone, shale, or flint in the middle part of the area; the prominent quarry beds of Flint Ridge, Licking County, are in the Vanport, where it is entirely siliceous. As a limestone it is best developed in Mahoning County, adjacent to Pennsylvania, where it maintains a thickness of 20 feet or a little less, and is generally a dense, crystalline limestone; in the southern area it is about 10 feet thick. The Ohio Cave Survey has two caves likely in the Vanport. One, Edmundson's Cave in Lawrence County (mentioned above in conjunction with the Maxville limestone), is best described by its owner, since the Survey has yet to investigate it:

> "There might be a few crawlway caves in this region but they have not been explored. The hollows around the Vesuvius Lake region end in rock houses which sometimes have openings farther back into the hills. We have a farm ... with several of these rock houses in the hollows ... Also there is a spring house ... blasted out of solid limestone which has the spring running into (sic) it. The spring comes out of a hole in the lime large enough for a man to crawl into, but no turning space ... Legend has it that there is an underground lake farther back in the hill ..."

The present writer, while searching for this and other caves in the area, noted the abundance of "rock houses," which, of course, are formed in several of the massive sandstones which crop out everywhere in eastern Ohio; sometimes crawlway caves can be found at the base of a sandstone bluff, often with springs issuing from them. However, aside from the possible confusion over rock types (sandstone or limestone), such a feature as she describes could very well be in the Vanport limestone, which does crop out in the area around her farm. The Vanport has been an important commodity throughout the region, especially during the nineteenth century, when it was mined together with several iron ores, providing the proper flux for a thriving (but now defunct) iron smelting industry in Lawrence County. Caves in the Vanport, other than spring resurgences along its natural outcrop, could be uncovered during quarrying or stripping, in which case there might be no clue to their existence on the surface. The other cave known to the Survey in this area has indeed been breached, or exposed, in a Vanport limestone quarry in Vinton County; this "Unnamed Cave" (for want of a better name) boasts of about 100 feet of passageway, but has not yet been examined by the Survey.

In western Pennsylvania the Vanport is a well-known producer of caves; the closest one to Ohio—Harlansburg Cave—would easily rival the longest surveyed cave in Ohio, if not surpass it. For these reasons the present writer will draw upon some recent research on caves of western Pennsylvania, on the assumption that the proximity of such large network-caves to Ohio might encourage research and field work on this side, where such caves are entirely possible. William White has given the Vanport special attention as a speleogenic limestone in several counties north of Pittsburgh, where it is about 20 feet thick, as it is also in the Youngstown area. He describes or locates about a dozen caves, several of which are intricate mazes confined to the upper portion of the limestone, and can have up to a mile or more of passages. Since the Vanport is quarried expensively in western Pennsylvania, many caves were uncovered which would otherwise have no natural entrances. One of these, Harlansburg Cave, was breached during highway construction along a hillside about 17 miles east of the Ohio-Pennsylvania boundary. White explains,

> "Like the other Vanport caves, Harlansburg Cave is a complex two-dimensional network maze. Passages trend mainly north-south with east-west cross passages. Connecting passages are generally 3 to 5 feet wide and 3 to 6 feet high.

In the western part of the cave, passages up to 10 feet high may be found. To the south and east the passages are filled with breakdown presumably the result of encroachment of the cave toward the hillside. Passages also become smaller in cross section toward the south and east. Aproximately 2500 feet of passage have been explored. ...

"The floor fill consists of approximately two feet of laterite clay covered with six inches of water. Some dry passages occur in the eastern part of the cave. The clay covers the walls and ceilings as well as the floor. Eyewitness accounts say that water gushed from the cave in flood quantities when the entrances were originally opened. The cave also contains more breakdown than the other Vanport caves. Active collapse is taking place now and a number of rockfalls have been reported. Much of the breakdown is from the Kittanning sandstone which makes up the roof of the passage in some locations. The breakdown activity may relate to the draining of the cave and subsequent drying after opening of the entrances."

Aside from these larger maze caves, a few of the others seem to be single short passages at the base of the Vanport with running water in them. Two caves in Armstrong County, Pennsylvania, so much resemble the second-hand description of Edmundson's Cave in Ohio that their brief description is warranted here. Buffalo Creek Cave is entered through a low spring resurgence and opens into a short section of larger passage floored with water, and a crawlway extends 200 feet from a point 15 feet within the cave, interrupted by occasional domes 10 feet high. Cove Run Cave is entered likewise through a resurgence, in this case bricked up, and the cave is essentially a short low crawlway through mud and water, with very little headroom. Rumors indicate that the cave, which had been used as a "reservoir," was once "extensive," but no longer penetrable.

White offers the following conditions and conclusions regarding cave development in the Vanport limestone: 1) the Vanport crops out generally along the Allegheny River and its major tributaries at an altitude of about 1200 feet, considerably above present pool elevations; 2) the caves were formed between the Kansan and Illinoian glacial epochs, as deduced from river terraces, and are the result of base-level back-flooding from the then higher Allegheny River bed; 3) the caves are confined to the upper 10 or 15 feet of the limestone, which is purer; 4) the Vanport is contained between impervious rocks, making direct vertical recharge of groundwater difficult, if not impossible; 5) the caves are networks of joint- controlled parallel passages with many cross-passages, these networks tending to maintain uniform dimensions throughout; and 6) the caves do not exhibit solutional features, nor are sinkholes present which would betray the existence of caves.[3]

The Vanport limestone continues without interruption into Mahoning County, Ohio, where it appears near or at the top of the hills and plateau bordering the Mahoning River. Some quarries in it, both active and abandoned, ought to be investigated, as well as its outcrop along the valleys. Unfortunately, south of the Youngstown area the limestone begins to thin out or become replaced by other facies, as noted in earlier paragraphs. The carbonate rocks above the Vanport are numerous, widespread, and highly variable in their lithology. Since no other caves in eastern Ohio are known to occur in a specific limestone, these strata will not be discussed here except in passing, and the reader would best refer to the detailed geological column reproduced in Fig. 2 to get an overview of their vertical distribution and nature, and consult Lamborn for a more thorough account of their occurrence and lithologies, bearing in mind that an undertaking as comprehensive as his must necessarily be incomplete, or even at times misleading.[4] Among the remaining limestones, several are well enough developed in certain localities, and will be mentioned briefly. In the Conemaugh formation (Middle Pennsylvaninan) the Brush Creek, Cambridge, Ames, and Pittsburgh limestones attain economic importance, the middle two are especially prominent east of Zanesville, when they occur as single massive beds less than 10 feet thick. The other two are apt to be interstratified with shale over much of their outcrop areas, hence less favorable for cave development. The Monongahela formation (Upper Pennsylvanian) has some thick carbonates, especially in the Ohio River valley; of these the Redstone, Fishpot, Benwood, Arnoldsburg, and Uniontown limestones are worth mentioning, since they reach thicknesses greater than those in the Lower Pennsylvanian, but are on the whole more shaly than massive. The Permian limestones continue in the same manner, with three members (the Lower, Middle, and Upper all separated by clastics) of the Washington limestone exposed in the region around Wheeling. A few other scattered caves and rumors of caves will bring to a conclusion all the information the Ohio Cave Survey has on these elusive features.

Walden reports three caves in Perry County. As mentioned above, the Maxville limestone has its most spectacular outcrops in this area, but these caves seem to be too far east to exist in Maxville, which ought to be below drainage in their vicinity. Therefore, until otherwise known it is safe to assume they are in an unknown Lower Pennsylvanian limestone - if in limestone at all. Strip Mine Cave, entered in the face of a cliff (perhaps a strip mine highwall), has a passage leading down to the west, parallel to the cliff; 50 feet within the cave a left-hand passage also descends, apparently. Both passages are narrow but continue, and the main passage is 12 feet high. In the same general vicinity he reports two other caves, one which is in a sandy limestone, and the other, which is a "big" cave, more likely a mine. Since the Survey has no clear locations for these caves they have not been investigated; likewise it is not possible to rule out the chance they may be sandstone fractures, or as in latter case, not caves at all.

A feature in Wayne County known locally as "Carmany Cave" has been given an elaborate description in the Survey files. A more sober, if not laconic, postscript by a second person explains that "Carmany Cave" is an abandoned coal mine. Eastern Ohio has perhaps thousands of abandoned coal mines and pits, which so often resemble natural caves, especially when in a state of collapse, that to the untrained they may as well be caves. It is entirely possible, though, that coal mining operations could disclose a natural cave in limestone, so a thorough search of any kind of excavation would not be necessarily purposeless.

A final limestone cave has been reported from eastern Ohio. This one, which has no name, is in the Ohio River valley across from Wheeling, West Virginia, in Belmont County. Baturla relates that

"... it is a small cave ... Wheeling Steel used to mine limestone from. The mine part consists of two levels, but the natural cave is in the rear of the bottom level. Both the mine and cave have bats and insects. I do not know how well the natural part is explored, but I have been to a section that is around 100 yards from the mine section.

" A subject of argument is the cause and identification of a gas that appears once in a while at the division of the cave and mine ..."

A quick search for this mine was made by the present writer, who could not find it. At Wheeling, and up and down the valley, numerous limestones are exposed because of the abundance of carbonates in these Upper Pennsylvanian and Lower Permian strata, and because of the greater that usual vertical relief (in excess of 700 feet) along the Ohio River. About 1100 feet of rock are at the surface in Belmont County,

of which perhaps 200 feet are various impure limestones interbedded with calcareous shales. Some of these "limestones" attain an aggregate thickness of 60 feet, but are often arenaceous, nodular, brittle, and generally unsuited for cave formation. These strata are mainly in the higher elevations, where they are stripped, quarried, or mined frequently. Streib reports that these limestones are well jointed, and Eberle's petrographic studies show that at least a few of the limestones, though thin, are massive and dense enough to favor cave development in them.

CONCLUSIONS

In spite of the meager evidence for limestone caves in eastern Ohio, the present writer feels that more and larger ones can be found, especially in light of the research undertaken by William While and Caswell. Natural entrances to these caves will be extremely rare, and even rarer will be sinkhole or any other surface clues to the presence of caves, that what is now the present state of Ohio, unlike most surrounding areas, because of certain coincidences and peculiar circumstances, lies in time and space between the optimum or favorable epochs for speleogenesis. For example, it would seem obvious that the several Pleistocene glacial advances over western Ohio obliterated certain cavernous areas, and that the rejuvenation of some of these (presumably) preglacial caves is still in a youthful stage. Many caves may have been destryed completely, or lie deeply buried, only to be uncovered in some distant era of the future. The special case of the Maxville limestone has been discussed at length, and Snyder's hypothesis regarding ancient cave systems in it; again, another "optimum time" may lie ahead, since the Maxville limestone thickens greatly under cover and beneath drainage, attaining well over 100 feet in thickness below the valley floors. If and when Ohio River base-level ever reaches that horizon, we can expect a situation not unlike present-day eastern Kentucky, where the same limestones are as persistently thick and favorably exposed. Where the topography at Carter Caves ha nearly its exact counterpart in Ohio, that is, in the gorges and valleys around Old Man's Cave in Hocking County, the Maxville limestone, which is due on the outcrop roughly 100 feet (with wide fluctuations) above the Black Hand sandstone—in which the many scenic features of the Hocking Hills State Parks are formed—is completely absent. A well-developed, continuous limestone even only 20 fee thick, exposed in those gorges, would no doubt give the Ohio Cave Survey plenty to work with. Of course, such things are futile to discuss, since they do not exist, but the situation in Pennsylvania is quite real and ought to be given serious consideration. Enough preliminary research has been accomplished by the Ohio Cave Survey to give field workers clear indications of where and how to look for caves in the eastern area. Besides the usual local inquiries and examinations of limestone outcrops, springs, solution cavities in roadcuts, and so forth, attention should be directed towards excavations of all kinds—deep mines as well as shallow quarries—no matter what rock is removed from them, because even a sandstone quarry can breach a limestone cave, above or below the worked stratum. A cave encountered in a quarry or mine is at best always a nuisance to a mining engineer or quarry operator, and if not, it will be destroyed eventually anyway; finding caves in such circumstances will be a matter of chance, but a prolonged search is bound to yield something interesting— and perhaps completely unsuspected.

Endnotes

[1] Peters, in an unpublished essay, points out that the action of glacial meltwaters may have had considerable effect in the enlargement and integration of the glacial boundary. Some analogous situations exist in Ohio in the outcrop areas of both the Maxville and Vanport limestones but these have not been studied for their possible relation to cave formation. The Rocky Fork Caves, or Seven Caves, in Highland County, which also lie athwart the glacial boundary, have been examined carefully by George White and later by Hobbs. Though it is outside the area covered in this paper, and in Lower Paleozoic dolomites, the reader is urged to consult these authors for further clues to speleogenesis in eastern Ohio.

[2] There is also some evidence that any surviving exposures of the Maxville in extreme southern Ohio were removed along the preglacial Teays River valley, which cuts a wide swath across Scioto County; near Portsmouth, on the Kentucky side of the present Ohio River, the Maxville is exposed high on the steep hillsides with a thickness of close to 50 feet, and on the opposite side the high hills themselves, which would show the limestone, are missing.

[3] Karst in itself does not necessarily denote the existence of caves, since it is often the result of a process independent of deeper groundwater solution. This condition—a lack of karst—is the general condition in western Pennsylvania and eastern Ohio. An absence of visible karst is even common in the limestone cave regions of western Ohio, where comparatively large caves are found where nobody would expect them, such as beneath glacial drift..

[4] The Maxville limestone is omitted entirly from Lamborn's account of Coshocton County, even though Lamb, 35 years earlier, published the results of his field work. In the former, nothing was mentioned about 10 feet of the Maxville limestone in the Walhonding River valley.

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Resting (Sloan's Valley Cave)

Approximate locations of eastern Ohio limestone caves.

1. Carter Caves, Carter Co. (Ky.)
2. Edmundson's Cave, Lawrence Co.
3. Unnamed Cave, Vinton Co.
4. Sinkhole (?), Hocking Co.
5. Strip Mine Cave, Perry Co.
6. Pit (?), -do-
7. Cave, -do-
8. Cave (or mine?), -do-
9. Dillon Park Cave, Muskingum Co.
10. Solution Channels, Coshocton Co.
11. Cave, Belmont Co.
12. Harlansburg Cave, Lawrence Co. (Pa.)