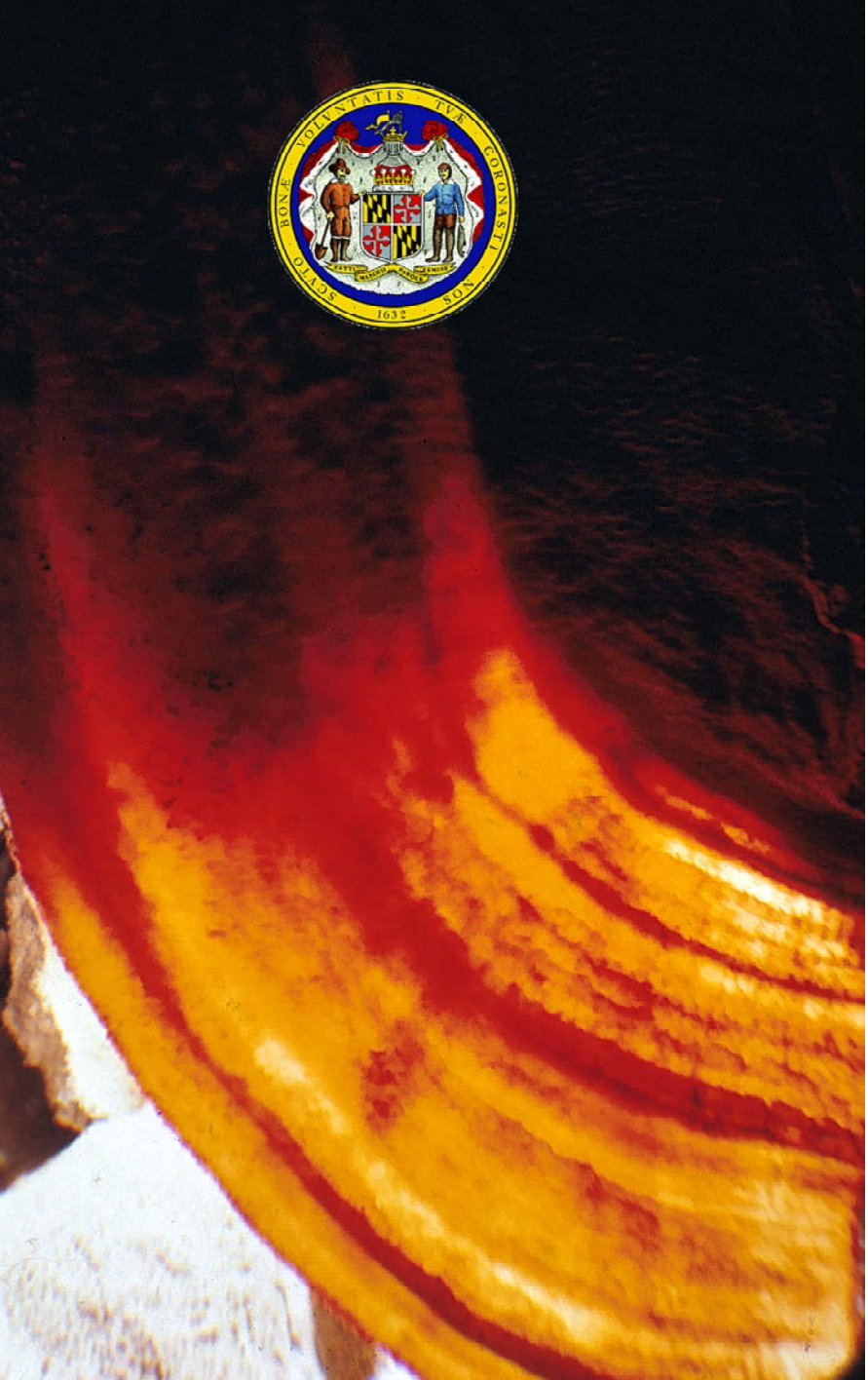


MARYLAND GEOLOGICAL SURVEY
EMERY T. CLEAVES, DIRECTOR
EDUCATIONAL SERIES NO. 3

Caves of Maryland

by

Richard Franz and Dennis Slifer



**COMMISSION OF
MARYLAND GEOLOGICAL SURVEY
(2000)**

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FOREWORD

Every once in awhile in caving circles I used to hear a caustic little joke which went like this:

“Have you ever been in a Maryland cave?”

“Yes, I've been in both of them, but my feet stuck out.”

In February, 1962, the following query, of questionable poetic virtue and entitled “Ode to the Maryland Cave Survey,” appeared in the newsletter of the Baltimore chapter of the National Speleological Society:

“the sinks has sunk
the ground has riz
wonder where the caverns is?”

Thus, a few merciless wags have from time to time besmirched the state of the speleological arts in Maryland.

While it's perfectly true that Maryland is not exactly vying for underground prominence with, say, our neighbor the Commonwealth of Virginia, with its 2,000-plus caves, or Alabama, with over 1,000 caves catalogued, the Maryland cave picture is not quite what the wits occasionally imply.

Cave studies here have come a long way since their inauspicious beginnings in the mid-18th Century, when Joseph Spangenberg made reference in Moravian Journals to a cave believed to have been the one now known as Busheys Cavern. This same cave, then called “Hughes’ Cave,” was one of two listed for Maryland in Dr. Louis Feuchtwanger's 1859 *Treatise on Gems*. A Maryland cave attained a considerable measure of scientific stature in the very early years of the 20th Century when the great American paleontologist, James William Gidley, began his extensive excavations in the Pleistocene deposits of the Bone Cave near Cumberland. It remains today one of the finest such fossil discoveries ever made.

By 1943 the number of caves on the state list had leaped to five, as recorded by Robert Morgan in his “Partial Index to All the Known Caves of the World,” published in *The American Caver*, the Bulletin of the National Speleological Society. Two years later Martin Muma, who had previously written about archaeological artifacts in Sand Cave in the Natural History Society of Maryland's journal, *Maryland*, and about John Friend's Cave, made the first attempt at a systematic state survey. Muma's descriptive list of 15 caves appeared in *The American Caver* in 1945.

A quantum leap in Free State speleology was made in 1950 with the publication of Bill Davies' *The Caves of Maryland*, Bulletin 7 of the Maryland Department of Geology, Mines and Water Resources. Davies' survey, reprinted with an appendix in 1952, contained general comments on cave science, and descriptions of some 54 caves as they were known at that time. A decade later, members of the Baltimore Grotto (chapter) of the National Speleological Society, responding to a need for up-to-date information on local caves, organized the Maryland Cave Survey. Several workers added considerably to our knowledge of the state's underground before this initial Survey became inactive. Periodic reports on their work appeared in publications of the National Speleological Society, notably the Baltimore Grotto News. In late 1965, Dick Franz and Dennis Slifer reactivated the Maryland Cave Survey, bringing to it both the spelunker's zeal and the investigative depth required to make a first-rate speleological study. Working with other members of the National Speleological Society, most of them Marylanders, their efforts have culminated in this extensive new book on the caves of Maryland.

Our caves are part of the natural heritage of America. In recent years we have become more and more aware of their aesthetic and scientific values to mankind. They are ancient phenomena. They have their own unique geological and mineralogical formations, and are inhabited by remarkable living things adapted to their very special environments. The evolutionary processes which have produced caves and their marvels required a great investment of the world's

time. Like any other aspect of our natural heritage, they should be treated with intelligence and responsibility. Unfortunately, though, as is the case with much of our environment we are both loving and vandalizing many of them to death.

Man had developed the questionable ability to destroy many of the inexorable works of eons. And so, it must be uppermost in the minds of those who read this book and use its information for whatever purposes, that all who enter the underground are privileged visitors. That caves, if they are to survive as living museums, laboratories, nature preserves, challenges, or just plain curiosities, must be treated with all the respect due their fragile grandeur and inestimable value.

John E. Cooper
Executive Vice-President
National Speleological Society

January 29, 1971

FOREWARD TO THIS NEW EDITION

Educational Series No. 3, *Caves of Maryland*, has always been one of Maryland Geological Survey's most popular publications. Although E.S.3 has been out of print for a number of years it is often requested. This reissue is not an exact replica of the original publication, although the original information and illustrations have not been changed.

Because the information in this publication has not been edited for content since 1971, it should be considered a historical document only. Some of the caves described here no doubt have been permanently closed or destroyed. Property ownership has also changed in many instances. Geologic interpretations have also undergone change. Therefore please treat this publication as a historical document and do not rely on the information contained herein as an accurate account of current conditions.

This edition was created by digitally scanning a clean, bound copy of the 1976 reprint of E.S.3. The scanned pages were processed with optical character recognition software and converted to Adobe Pagemaker format. The only changes made to the original text were corrected spelling, which was done by the software. Because we do not possess the original artwork for E.S.3, all the photographs and illustrations were reproduced from the scanned material. Unfortunately this process has caused a degradation in the quality of some of the photographs. This new reissue also does not exactly reproduce the original layout, but we have preserved the format as best as is digitally possible.

We wish to thank Sarah Conkwright for her assistance in piecing together the layout of this reissue and for proofreading the final copy.

Robert D. Conkwright
Geologist
Maryland Geological Survey
April 2, 2001

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INTRODUCTION AND ACKNOWLEDGMENTS

Systematic studies of Maryland caves were begun as early as 1942 by Martin H. Muma and his results published in a series of reports dating from 1942 to 1946. In these articles, 15 caves were described. In 1946, William E. Davies began surveying the state's caves, and this project continued until 1949. Both of these earlier attempts at cataloging the caves culminated in the publication of *Caves of Maryland* (Davies, 1950). In this report, a total of 53 caves from Allegany, Baltimore, Carroll, Frederick, Garrett, Howard and Washington Counties were discussed. Since this publication enjoyed considerable popularity, it was re-issued several times and appendices were added listing 10 additional caves, most in the Cumberland area.

Since the original survey proved incomplete, several interested cave groups endeavored to update it. In 1961, the Baltimore Grotto under the direction of Charles L. Smith inaugurated a short-lived but successful survey and discovered several new caves. In 1965, preliminary investigations were begun in Washington County by several Hagerstown cavers including Todd Merchant, Steve Bell, Mark Haymond and Dennis Slifer but again this new effort eventually lost momentum. In January, 1966, a new Maryland Cave Survey was initiated as an informal project initiated by Richard Franz upon the suggestion of John E. Cooper (Institute of Speleology, Dept. of Zoology, University of Kentucky and board member, National Speleological Society). In 1968, Dennis Slifer again became interested in Maryland caves and joined Richard Franz in directing the project. Later that year, the Maryland Geological Survey was approached with the idea of publishing the findings of the cave survey. Under the auspices of the Maryland Geological Survey, work was continued until early summer, 1970, at which time the information was compiled into the preliminary draft of the present publication. Without doubt as this publication is used by cavers in the future, more information will be made available and will necessitate a future "new Maryland Cave Survey" and subsequent publication of this new information.

Space limitations prevent expressing our gratitude to all those who helped to make this publication possible. The authors are particularly indebted to Don Eckarty, Greg Lehman and David Weaver for their constant companionship in the field. Other people who gave much of their valuable time to assist us in the

field are Frank Corliss, Dr. Del Fanning, Dennis Franz, Joe DeGiovanni, Pete Haver, Mark Haymond, Mike Houpt, David Kramer, Jim Kramer, Doug Rhodes, Dick Schroeder, Dr. Pete Stifel, Ted Wachter, Jim Wells and David Wilmoth. We wish to thank members of the Baltimore Grotto and those cavers who participated in the National Speleological Society Mid-Appalachian Region Spring Outing (1970) in Garrett County, particularly Gerry Forney (Philadelphia Grotto) who helped to organize this work weekend. We also wish to thank the many landowners, particularly Jerry Downs (Crystal Grottoes), Austin Flook (Snivelys Caves), Archie Hood (Rohrersville Caves) and Marshall H. Tewells (Devils Hole), who showed tremendous interest in our project. Several families, particularly Mrs. Fred Hoyer of Sang Run, Mr. and Mrs. Paul Robinette of Flintstone, and Mr. and Mrs. William Slifer of Boonsboro allowed us to use their homes while in their respective areas.

The authors are indebted to Dr. Del Fanning and Dr. Pete Stifel (both of the University of Maryland) for acting as geologic consultants, and to the following systematists for their identifications of the many biologic specimens collected in Maryland caves: Jerry Carpenter (University of Kentucky), planarians; Dr. Nell Causey (Louisiana State University), millipedes; Dr. Kenneth Christiansen (Grinnell College), collembolans; Martha R. Cooper (Yale University), crayfish; Dr. Benjamin Foote (Kent State University), helemyzid flies; Dr. G.E. Gates (Bangor, Maine), earthworms; Dr. Willis J. Gertsch (American Museum of Natural History), spiders and phalangids; Dr. Horton H. Hobbs (U.S. National Museum), crayfish; Dr. John R. Holsinger (Old Dominion College), amphipods, isopods, mites; David Lee (Natural History Society of Maryland), bats; Dr. William B. Muchmore (University of Rochester), pseudoscorpions and terrestrial isopods; William Robinson (Iowa State University), phorid flies; Dr. Harrison R. Steeves, III. (Virginia Polytechnic Institute), isopods; and Dr. Pete Stifel (University of Maryland), snails.

We want also to thank John E. Cooper, Dr. John R. Holsinger, Dr. Del Fanning, Dr. Benjamin Foote, David Lee, Joyce Kramer, Brother G. Nicholas, Rebecca Shockley and Dr. Pete Stifel for editing certain portions of the manuscript. We are indebted to our wives, Lea Franz and Elise Slifer, for reading and typ-

ing of the manuscript, and for the great amount of understanding that wives must show in order that a project of this sort be completed. Finally we wish to thank Dr.

Kenneth Weaver (Director, Maryland Geological Survey) and Mr. Tyler Bastian (State Archeologist) for their guidance and interest in the project.

ARRANGEMENT OF MATERIALS

Most of our accessible caves have suffered badly from the abuse of increased traffic by visitors who are not appreciative of the natural system into which they venture. The sport of spelunking is a rapidly growing one, and has brought about much concern by scientists and conservationists as to how best to control or limit damage to caves. The best method is, obviously, to withhold the location of caves worth protecting. This has already become common practice by some caving groups in this country. Another approach is in gating caves and limiting access to conscientious explorers. This often leads to the destruction of the gate in due course, as has often been the sad experience of the authors. We feel that locations should not be made readily available to the public at large; thus we have departed from the traditional method of geographic directions to caves which has been used in past surveys. Instead we have chosen to adopt the coordinate location system used in Caves of Virginia (Douglas, 1964), which requires having the proper topographic quadrangle and a plastic overlay for plotting. In so doing, we are assuming that the individual who is sufficiently interested to go to the trouble of following this procedure will be a conscientious and conservation-minded caver, whereas the individual who is not willing to do so is likely to be uninformed about caves and thus may be a potential vandal, and will be kept out of the cave. We hope that the advantages and knowledge gained by presenting this information about our State's caves will outweigh the vandalism and damage that may result from it.

For general use in locating caves, the coordinate grid system employed is relatively easy to use. This involves dividing a 7½ minute quadrangle into nine sections – NW, NC, NE, etc. in the same manner as in Figure 1. Each of these sections is then subdivided into nine smaller sections and each smaller section further subdivided until one arrives at a four-digit code such as C 1/4/4 and C 8/9/3 (see Fig. 1). By this method it is possible to give the location of a cave or any other surface feature, within 1000 feet or less, with no reference to latitude or longitude. Only rarely does more than one entrance occur within such a small area, and

where this does happen it is not difficult to differentiate them.

All caves are grouped alphabetically by county. In the heading of each description is the pertinent location information and the name of the quadrangle.

For determining the section location of any spot on a quadrangle it will be found useful to cut a piece of clear plastic the size of 1/9th of a 7 ½ minute quadrangle and measure off carefully into 81 rectangles. The final location within the smallest of these sections can be measured or estimated when the plastic is laid over the proper 1/9th of a quadrangle.

The Division of Archaeology of the Maryland Geological Survey maintains a permanent collection of quadrangles on which the authors have plotted all known cave locations accurately to provide a record should this information ever be needed.

The cave descriptions in the book have all been written by the authors with the exception of those borrowed directly from Davies' (1950) survey. These are marked with an asterisk. In every description we have included the following information, except where unavailable:

- 1) name
- 2) location and elevation
- 3) general setting
- 4) owner
- 5) items of historical or legendary interest
- 6) geologic horizon and cursory interpretation of geologic relations
- 7) physical description, including dimensions, map, and any unusual features.

The name given to each cave is always the best established local name. Caves named for property owners maintain the name of the owner which was either published first or most commonly used. These are not generally changed when the property changes hands. If a cave had not previously been named, it has

been given one indicating proximity to some prominent local geographic feature, as for example Rocky Gap Cave, Wolf Rock Fissures, or C & O Canal Cave. In most cases we have not resorted to numbering caves as these are confusing. Rather, it is preferable to differentiate several contiguous caves by prominent features of the caves themselves, as in the case of Rohrsersville Column Cave and Ground Hog Cave (Washington County). The stability of cave names is important for scientific work, and it is hoped that future authors of papers which refer to Maryland caves will employ the names used here.

Information of a geological nature concerning the occurrence of caves within a particular geologic formation has been obtained primarily from the County geologic maps or the 1968 State Geologic Map, all published by the Maryland Geological Survey.

The physical description of a cave includes the natural setting and dimensions of the entrance(s); the length and average size of the principal passages; and descriptions and dimensions of the larger chambers, bodies of water, and speleothems. Data of special historical, archaeological, paleontological, or biological interest are included in the description as well.

Recognition of the fact that certain mines in the state can be mistaken for natural caves has prompted the authors to include this information. The individual descriptions are included in Part II under the counties in which the particular mines are located. These mines are:

Dam No. 6 Mine, Round Top Mines (Washington County)
Pinto Mines (Allegany County)

Maps for all three have been included in the text.

GOOD CAVING PRACTICE AND CONSERVATION: A LETTER

Dear Caver,

There probably isn't a caver alive who at one time or another – maybe while crawling on his belly and hauling a survey tape, or stuck in the middle of a hairy climb, or maybe just exhausted and a long way from the entrance – hasn't said to himself: "What the hell am I doing here?" The answer is simple – he is having fun. This, incidentally, is why most anybody you'll ever meet in a cave is there in the first place. If the person you meet has three sets of bags under his eyes and a blank stare, and if he doesn't seem quite alive staggering along under a load of ropes and other paraphernalia, don't be deceived. He is happy.

Why? Well, that's too complex a question to handle here, and one that, once you've experienced the situation, you'll probably not be able to explain too well either. The feelings are too individualized, too personal. There are as many reasons for cavers as there are cavers and as many types of cavers as there are caves.

You'll discover this soon enough. You'll also discover that most cavers are interested in helping novices get acquainted with two big concepts: conservation and safety.

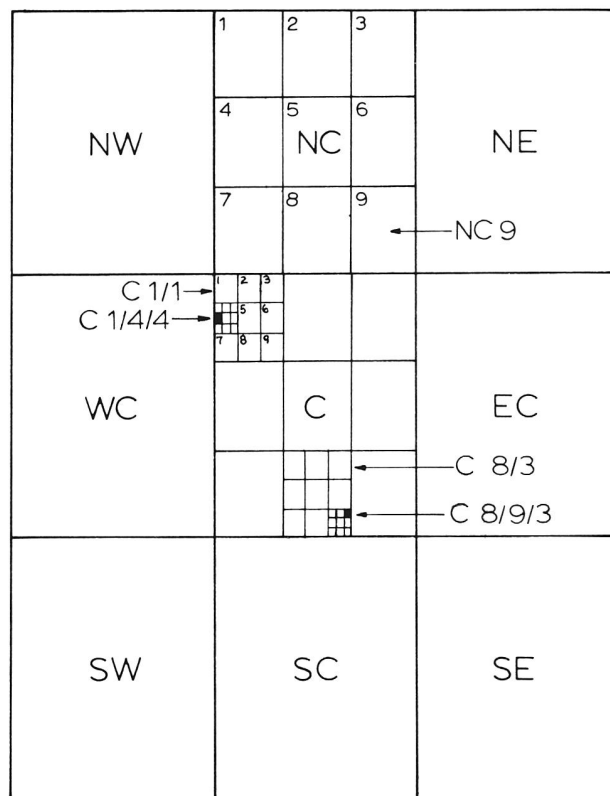


Figure 1. Cave location diagram. The method employed for stating cave locations is that of repeated ninefold divisions of the appropriate quadrangle

Our reasons are not unselfish. Conservation means that there will always be undamaged caves to visit and safety means that we and our children will be around to do our share of the visiting.

Let's consider safety first. This requires some familiarity with the cave environment.

When you enter a cave you face nature in a very consistent and uncompromising state. The temperature is generally a humid 55 degrees. The floor is as often of wet mud as it is of cold rock or stream bed. The walls, which may be impassably close together or invisibly beyond the penetration of your light source, are usually of solid bedrock, often covered with sharp snags. The ceiling, which you will frequently find pressed against your back as you squirm through a crawlway, is of the same composition. Sometimes pits and fissures of considerable depths are encountered. Frequently walls must be climbed, slippery slopes traversed, or streams waded. Sometimes cavers use specialized modifications of mountaineering techniques to descend pits. These techniques require considerable training.

It's easy to recognize the need for special adaptation to such an environment. As you become more enthused and proficient you will no doubt acquire an impressive array of equipment. Even for the casual beginner, however, certain things are essential.

First, you should carry two complete changes of clothes, one to wear to the cave and back and another for use underground. Beginners generally find jeans and a sweatshirt (worn over another shirt) most acceptable in a cave. Consider the clothes you choose for caving carefully; they will be ruined by brown mud stains. Tennis shoes, or leather hiking boots are the best footwear. Rubber boots would tend to be awkward, especially if you encounter deep water. Also, they do not support the ankles properly and your feet tend to slide around inside them, making critical footing somewhat precarious. Smooth soles require extra caution, as a slip can prove quite dangerous. Thin but sturdy gloves are strongly recommended.

A caver's most important piece of equipment is his combination hard hat-light source. An experienced caver's hard hat is scarred and battered. Your head could not absorb the bumps and scrapes encountered on most caving trips. A hard hat with a sturdy suspen-

sion provides some protection from falling objects, bumps against the ceiling and actual falls. A Mine Safety Appliances construction helmet is preferred by many cavers though a surfer-type helmet with a shock absorbing suspension is far superior. The light source, be it an electric lamp or a carbide powered miner's light, is best located on the hard hat itself. This leaves the hands free for climbing, crawling and scratching. Be familiar with your light source: without it you would be as helpless as a blind man in the middle of a busy freeway. An intelligent caver will carry at least one extra light for emergencies. Many carry a flashlight with NEW batteries, an extra bulb, and a candle or two. Don't forget dry matches. Should your light sources all fail, an extremely unlikely situation when you consider the additional lights of your companions, you should sit down and await a rescue party. But the best first aid here is prevention. Before you enter a cave make sure that everyone has at least two reliable light sources and enough carbide and water (in waterproof containers) or batteries for a much longer trip than you plan. Do not rely on your buddies for these things. They may just be relying on you.

Suitably attired and equipped, you are ready for a cave. It's strongly advised that you go with an experienced caver, preferably one affiliated with the National Speleological Society and one of the local NSS Chapters. Addresses of these organizations follow this text. Do not hesitate to write or phone; these people will be happy to hear from you and will probably invite you to a meeting. Here are some of the safety pointers they will give you.

1. Never cave alone. The dangers are compounded immeasurably.
2. Never cave if you have some illness that might render you temporarily helpless or irrational.
3. Caving is not a sport for recklessness; show-offs are seldom appreciated.
4. If height, darkness or tight, closed spaces disturb you, don't cave.
5. If you lack equipment, ask. You can probably borrow some.
6. Carry along some extra energy food in the cave. Hard candy, tootsie rolls, and such high sugar content foods are suggested.
7. Plastic baby bottles are ideal containers for carbide and water. Carry a lamp repair kit.
8. For obvious reasons, all vertical work on ladder or rope should be practiced and *perfected* outside of caves. Instruction is available.

9. When going caving, always leave word of where you are going, when you will return, and who to call in the event of an emergency. Local caving groups can supply you with necessary phone numbers of members. Remember that you are obligated to check out before the appointed time and plan accordingly.
10. You are the guest of the landowner. Always ask permission to use his property. Be courteous. Close all gates that you open; don't litter or dump spent carbide (it is poisonous to livestock). Remember, one inconsiderate caver can close a cave to all others.
11. Never overextend yourself or another person in a cave. Overtired or frightened people cause accidents. As you cave, consider the difficulties of removing an injured person from the cave.
12. As you travel through the cave, turn around and look behind you often. A cave looks entirely different from the opposite direction. If you fear getting lost, place objects at all junctions. Reflecting tape on ice cream sticks make ideal markers. Marks on the walls deface the cave.

Which brings us to the last and, in many ways, the most important segment of this letter. Caves are so unique and so slow to change that any mark of vandalism is virtually permanent. When you smoke your name on a wall with your carbide lamp you are defacing a great natural resource. Believe me, there is no glory in defacing a cave. Many an experienced caver has returned to his early caves just to remove such graffiti. There are several other conservation practices that you should consider strongly. Cave formations take centuries to develop. Broken formations are lost forever to

all other cavers. Trash is ugly. Dumped carbide is not only unsightly, but poisonous to cave fauna. The cave life is so delicate a balance that a few careless cavers can upset a whole ecology. A bat disturbed in hibernation may die. A piece of nutritious trash could cause an overpopulation in one species of cave life and this, in turn, could be detrimental to several others. The NSS "Caving Information Series – Number 1" paper sums it up nicely:

...Caves are unique natural wonders and must *not* be defaced. Writing names on the walls is against NSS policy. Removal of any cave formation is not condoned and in many cases unlawful. Cave life is not to be collected or disturbed in any way. A vandalized cave is ugly. Everything brought into a cave must be taken back out."

Obviously the policy is strong. It has to be. As I said at the beginning, we must always attempt to protect the caves we frequent and preserve our reputations as safe, careful, courteous people, if the sport is to continue. We must also be as careful of our own safety as possible. If you are a caver or intend to become one, safety and conservation are your chief interests.

Remember the old Baltimore Grotto Motto: Take nothing but pictures, leave nothing but footprints, kill nothing but time and . . . Good Caving.

Sincerely,



Jim Kramer
Baltimore Grotto

GEOLOGIC SETTING

INTRODUCTION

The average person has a good understanding of what a cave is, but, as with most subjects, there are numerous parameters involved in formulating a definition of the word. The authors of this report have used a working definition of a cave as *any natural cavity or opening in rock which is large enough for a human to enter*. Using this criterion we have included rock shelters and solution tubes which might not be considered worthy of listing by a researcher in a state

containing vast numbers of caves. Maryland is not such a state, so it has been possible to conduct a more detailed and intensive survey than many other states have accomplished. Although "a natural cavity" excludes man-made tunnels, mines, and quarries, we have in exceptional cases included descriptions of mines which are frequently visited mistakenly as caves. In other cases preexisting caves or fissures have been altered or extended by mining (e.g. Red Hill Cave, Dam No. 6 Mine, Round Top Mines).

Maryland has over 100 natural caves. Most of them are in the three western or mountain counties (Garrett, Allegany, Washington) and most are developed in the soluble carbonate rocks – limestone, dolomite, and marble. Indeed, this is universally the most common type of cave. Other kinds of caves do exist, however, and examples of some of these are found in Maryland.

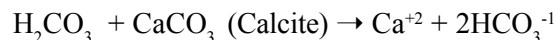
There are basically two different types of caves – solutional caves (limestone, dolomite, marble, gypsum) and non-solutional caves. Examples of non-solutional caves are: lava tubes; wave-formed sea caves; ice and glacier caves; and tectonically-formed caves in rocks such as sandstone, granite, and quartzite. The latter type occur in Maryland in several formations and are often referred to as fissure caves. They are typically high, narrow passages of even configuration and usually represent joints and fractures in the bedrock, although occasionally sedimentary rocks will have parted along bedding planes sufficiently to form a cave. In Maryland the Wolf Rock Fissures and Rocky Gap Cave are good examples of non-solutional caves produced by mechanical processes, as are various rock shelters listed in this report. This type of cave is neither extensive nor numerous, and consequently is of less interest to the speleologist concerned with cave origin than are solution-type caves.

Solution caves, however, are both numerous and extensive and are more complicated in their origin and development. They are important as integral and sometimes major parts of natural hydrologic regimes and groundwater systems. The biologist and ecologist have gathered much valuable information from the study of cave life forms, and, of course, caves often played important roles in the past as shelters for our ancestors whose remains are found in caves and studied by archaeologists. And certainly caves are to be prized for their aesthetic value and should be treated as natural resources.

Solution caves are formed by the dissolving action of ground water on soluble rock (limestone in most cases), and in later stages of development are decorated with flowstone speleothems deposited by ground water.

Ground water moving downward through the soil and rock column is converted into a weak solution of carbonic acid by the addition of dissolved carbon dioxide (a product of humus and plant decay). Calcite,

the principal mineral constituent of limestone, reacts with acids – including carbonic acid – and is converted into soluble calcium bicarbonate according to the following double reaction:



A cubic foot of water exposed, until reaction ceases, to limestone and air containing 10% CO₂ can dissolve about a quarter of an ounce of limestone (Moore and Nicholas, 1964). The fact that dilute acidic solutions and impure materials (limestone is rarely pure calcite) are involved in nature is compensated in geologic history by the enormous time spans over which nature has had to work with this process. Thus, as the slightly acidic ground water percolates down through fractures and along the bedding planes of the limestone, it dissolves small channels and solution tubes. Larger cavities or actual caves, however, are believed to form in a definite horizontal zone or layer below the water table (within the saturated zone). Such a process is called phreatic development, as opposed to earlier theories of vadose cave development (above the water table). Lateral movement and circulation of water in the phreatic zone is commonly less than 10 feet per year but this is adequate for solutional enlargement of passages, which are largely controlled in their development by structural features within the rock such as joints, faults, and bedding. Once the passage is large enough to permit turbulent flow to become established, the capacity for solution is greatly increased. When larger passages find points of discharge at springs or along streams, a hydraulic gradient is effective and mechanical abrasion of free flowing streams can serve to further enlarge and modify the passages (although this is thought in most cases to be a minor effect compared to solutional excavation). The problems of cave origin and development are discussed in greater detail in a later section.

CAVE-BEARING ROCKS ¹ AND THEIR DISTRIBUTION IN MARYLAND

The Coastal Plain, lying east of Baltimore and Washington and including the Eastern Shore, is an area of relatively low relief underlain by sands, gravels, silts, and marls. No solution caves have been reported in this area, although small shelter caves are found occasionally.

¹ Modified and expanded from Davies (1950)

The relatively uniform upland lying between the Coastal Plain and Catoctin Mountain is the Piedmont. It is an area of complex, folded rock, much of which is highly metamorphosed. Within this complex are two marbles, the Wakefield which crops out in Carroll County and the Cockeysville which is found in Baltimore and Howard Counties. These formations are similar in appearance and vary from fine-grained to sugary in texture. The Wakefield Marble is locally tinted pink, green, and blue, but in most areas both marbles are white. In Carroll County the Wakefield is at least 150 feet thick, and in Baltimore County a maximum of 400 feet of Cockeysville has been observed. Stose & Stose (1946) assign these formations to the Lower Cambrian and suggest they are equivalent to the lowest Cambrian carbonate rocks found in the Hagerstown Valley. Five caves are known in these marbles in Maryland. In addition numerous vertical shafts resulting from sinkhole collapse are developed near Westminster, Carroll County, but no extensive passages have been reported leading from the shafts.

Along the western edge of the Piedmont, in the vicinity of Frederick, Cambrian and Ordovician limestones crop out. The area underlain by these limestones is a rolling lowland known as the Frederick Valley. The Frederick Limestone, Upper Cambrian in age, is a laminated dark-blue limestone which weathers into thin-bedded slabs. It is about 480 feet thick. The Grove Limestone, Lower Ordovician in age, overlying the Frederick Limestone, is a thick-bedded dove or blue-gray limestone, 590 feet thick. Three caves have been reported in these limestones. A narrow band of Tomstown Dolomite extends along the east base of Catoctin Mountain, southwest of Frederick, but is covered by a deep mantle of wash except for isolated outcrops. No caves are reported along this band.

The limestone conglomerate portion of the New Oxford Formation (Triassic), which lies along the east side of Catoctin Mountain south of U.S. Highway 40, is composed of fragments of Paleozoic limestone cemented by fine-grained gray or red limestone. No caves are known in this formation.

West of the Piedmont is a mountainous belt of folded Paleozoic rocks. Near the eastern side of the belt is a broad lowland, the Hagerstown Valley, that is underlain by great expanses of limestone and shale. The oldest limestone formation here, the Tomstown, is Upper Cambrian in age and is composed of thin-bedded

to massive dolomites and limestones, light gray to pink in color, up to 1000 feet thick. Thirty-five caves are known from this formation, of which 14 are relatively large. The Tomstown tends to produce very attractive, well-decorated caves (e.g. Crystal Grottoes, Rohrerstown-Hog Maw Cave, Mt. Aetna Cave).

The Waynesboro Formation, consisting of sandstones, thin siliceous limestones, and some massive limestones, lies stratigraphically above the Tomstown. No caves have been reported in this formation. The Elbrook Limestone, a series of light blue to gray, shaly limestones and calcareous shales, with some massive limestones and dolomites in the middle of the formation, lies above the Waynesboro. It is 3000 feet thick and contains six known caves.

The highest Cambrian formation (often assigned as Cambro-Ordovician), the Conococheague Limestone, is massive, dark-blue, and banded with zones of oolites and stromatolite reefs at the base. The formation averages 1500 feet in thickness. Four caves and several small shelters are known in the Conococheague.

The Beekmantown, the lowest Ordovician formation (or the upper part of the Cambro-Ordovician) consists of laminated, fine-grained, blue to gray, relatively pure limestones averaging 2400 feet in thickness. Eight caves and several small shelters are known in the Beekmantown.

The Stones River Formation, which lies above the Beekmantown, consists of black to dove-colored, thin-bedded to massive, pure limestones and dolomites totaling 1000 feet of section. Nine caves are reported in these limestones.

The youngest limestones of the Ordovician are in the Black River Group (Chambersburg Limestone) which consists of a series of blue to gray argillaceous limestones up to 300 feet thick. Five caves are known in these limestones. The Upper Ordovician, above the Black River Group, is made up of shales and sandstones which underlie the Hagerstown Valley adjacent to the limestone areas.

The mountainous area lying between the Hagerstown Valley and Garrett County is underlain by a thick series of folded rocks which are Middle Paleozoic in age. The terrain is an alternation of long uniform ridges and narrow valleys with a general northeasterly trend.

In this area the oldest rocks are Silurian in age and directly overlie the shales and sandstones of the Ordovician. The lower portion of the Silurian contains mainly shales and sandstones. Thick limestones, suitable for cavern development, occur only in the Upper Silurian Cayugan Series. Impure limestones of local extent occur in the McKenzie Formation, the lowest formation of the Cayugan Series, but no caves are reported in them. The next higher formation, the Wills Creek Formation, consists of 600 feet of alternating calcareous shales, argillaceous limestones, sandstones, and thin zones of relatively pure limestone. Three caves are reported in the Wills Creek Formation.

The Tonoloway Formation is a series of inter-bedded limestones and calcareous shales totaling 600 feet. The limestones are mainly thin-bedded, banded, and weather into plates. Some massive beds occur in the lower part of the formation. Fifteen caves are recorded from the Tonoloway, six of which are relatively large and deep. Though the Tonoloway Formation marks the top of the Silurian in Maryland, limestone formations continue uninterrupted into the Devonian. The Helderberg Formation, consisting of four limestone members, lies at the base of the Devonian. The Keyser Limestone, the lowest member, is massive and nodular in the lower part and thin-bedded and shaly above. It averages 280 feet thick and contains four caves. The caves, all relatively large, occur near the top of the formation and extend into the overlying New Creek Limestone.

The New Creek Limestone is thin, averaging 8 to 13 feet thick, and by itself is of little significance in cavern development. However, in conjunction with the underlying Keyser it contains one of the largest caves in the State (Twiggs). The New Creek is a massive, blue, crystalline, at times crinoidal limestone.

The limestones forming the upper part of the Helderberg Formation, the Corriganville and Licking Creek Members, are arenaceous and contain a large amount of chert. Three caves are known to exist in them (Fort Hill Fissures).

The Devonian system, above the Helderberg Formation, consists of clastic rocks, and no limestones are encountered below the Greenbrier formation in the Mississippian system. The Greenbrier Formation crops out in Garrett County where the rocks lie relatively flat. The Allegheny Plateau, of which Garrett County is a part, is a rolling upland cut by deep rounded val-

leys. Several distinct ridges, formed by broad gentle anticlines, cross the area with a north-east-southwest trend. The Greenbrier Formation is exposed at the surface along the flanks of these ridges and on the sides of deep valleys cut into the upland. It is an argillaceous to pure, gray to pink, massive, crossbedded limestone, 65 feet thick. It is underlain by about 90 feet of shale and sandstone. Along the eastern edge of the plateau a lower, arenaceous limestone member, 46 feet thick, lies below the shale and sandstone. Three relatively large caves and one small cave are developed in the upper limestone member of the Greenbrier Formation. Crabtree Cave, the largest in the State, occurs in the Greenbrier.

In Garrett County the Pottsville Series at the base of the Pennsylvanian System contains several calcareous sandstone members in which one large (Sand Cave) and numerous small shelter caves are developed. These are the youngest rocks in Maryland that contain caves worthy of notice.

Several non-carbonate formations contain "fissure caves" in Maryland. The Tuscarora Sandstone, at the base of the Silurian, is 400 feet thick. It contains three caves, one of which has over 100 feet of passage (Rocky Gap). The Cambrian Weverton Formation (quartzite) contains fissure caves at Wolf Rock and Shockeyes Cave, and several fissures and rock shelters are developed in the Sugarloaf Mountain Quartzite (late Pre-Cambrian). One small cave (Friends Creek Cave) is known from the Catoctin Metabasalt in Frederick County.

Caves occur in the seven Maryland counties indicated below.

<u>County</u>	<u>No. of Caves</u>	<u>%</u>
Baltimore County	2	1.3
Carroll County	2	1.3
Harford County	1	0.7
Howard County	1	0.7
Frederick County	10	7.0
Washington County	89	60.0
Allegany County	30	20.2
Garrett County	<u>13</u>	<u>8.8</u>
Total	148	100.0

The counties of Baltimore, Carroll and Howard contain very few small caves which are restricted to

areas of outcrop of the two Piedmont marbles. In Frederick County is the greatest variety of caves developed in different rock types. These include marble (McKinstry Mill Cave), limestone (Buckeystown, Monocacy, and Grove Quarry Caves), quartzite (Wolf Rock Fissures), and metabasalt (Friends Creek Cave). Washington County contains over 60% of Maryland's caves, mostly because it is underlain by more exposed carbonate strata than the other counties. The most noticeable pattern of cave distribution in Washington County is in the northeast-southwest trending band of Tomstown Dolomite which lies at the western foot of South Mountain. Here 35 caves are developed, 14 of which are relatively large and many of which are quite beautifully decorated with speleothems. Within this band of Tomstown Dolomite one can further distinguish three clearly defined clusters of caves, which occur at Rohrsersville, Keedysville, and north of Beaver Creek. These centers of high frequency are separated by areas of low cave frequency or absence. The reasons for this distribution are yet to be determined.

The majority of the remaining caves in Washington County appear to fall into discreet but less well defined patterns of occurrence. These are along stream valleys where incision has exposed the bedrock and increased drainage has been able to clean caves of their fill material. The most conspicuous examples occur along the Antietam Creek (9 caves), Licking Creek (3 caves), Conococheague Creek (4 caves), and the Potomac River (20 caves). Another high density cluster occurs along the prominent loop in the Potomac River south of Downsville (Whitings Neck).

In Allegany County most of the caves occur in the Tonoloway and Helderberg Limestones east of Cum-

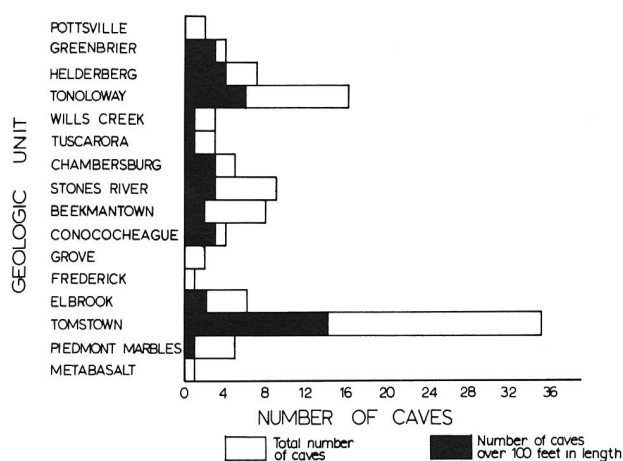


Figure 2. Distribution of caves by geologic unit.

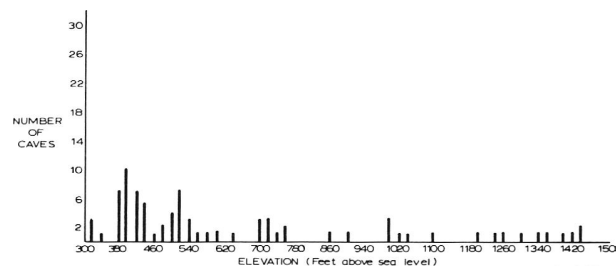


Figure 3. Distribution of caves in Washington and Allegany Counties by elevation above sea level.

berland. The distribution patterns form lines which are parallel to the large folds in the regional structure of the Ridge and Valley province. The most noticeable pattern is that containing Horse, Twiggs, Devils Hole, and Tewell Caves, all of which align on the strike of the same fold. The inferred hydrological connections between such caves also follows the strike in most cases. Rocky Gap, Lovers Leap, and Haystack Mountain Caves are developed in Tuscarora Sandstone near the edges of steep water gaps which are cut through the ridges. A band of Greenbrier Limestone crops out along the eastern flank of Dans Mountain west of Cumberland. Although it should contain caves, none have yet been reported, probably due in large part to the remote and rugged terrain.

Although only a few caves are known from Garrett County, many more certainly exist. Relatively little field work has been done in this area for this report. The existence of the two large caves, Crabtree and John Friends, in the Greenbrier Limestone indicates that the area probably has many more large caves. The sparsity of population and roads is primarily responsible for our ignorance of caves in this area.

Another distribution pattern exists when the number of caves in an area (e.g. Ridge and Valley province) are plotted against their entrance elevations (Fig. 3). Certain peaks are obtained which apparently correspond to past erosional levels, perhaps peneplains or terrace surfaces. Several investigators have reported the observation that such surfaces have an effect on the shallow phreatic origin of caves in low to medium relief terrains (Davies, 1950, 1960; White, 1960; Wolfe, 1964). It is thought that development of these caves is a function of local base level and is a result of water table stabilization over a period of time sufficient for solutional processes to be effective.

Davies (1949) was able to associate a real distribution of West Virginia caves with their relative positions within a drainage basin. A definite increase in the number and size of caves was noted as the headwaters of the major drainage basins are approached, a pattern which cannot be ascribed to changes in stratigraphy or extent of outcrop, as these factors are relatively constant. The reason for such a distribution is not obvious but may be due to the upper reaches of the drainage basin being less subject to geomorphic fluctuations than the lower parts of the streams, thus allowing more uniform subterranean solution.

PATTERNS AND FEATURES OF MARYLAND CAVES

With the exception of rock shelters, the caves of Maryland show a tendency to develop along joints. Faults, cleavages, or fractures other than joints are apparently not significant in controlling the direction of passages in solution-type caves. In most caves one set of joints exerts major control over the pattern with the larger passages developed along them, and subordinate side passages follow the secondary joints.

In flat-lying limestones in Garrett County, caves are simple in pattern. Generally, one main passage is developed that follows a major set of joints with occasional offsets along subordinate joints. Multiple levels are confined to local sections of caves and are connected by vertical cliffs or shafts. Passages slope uniformly but show no consistent relation to the dip of the rocks.

In folded strata, where caves lie on the flanks of folds, passages develop as fissure-like openings along steeply inclined joint planes. The passages vary from a few feet to over 100 feet high and consist of several parallel openings. Except in Twiggs Cave, the passages are offset along the dip where they occur in more than one level. In Twiggs Cave the joint control is so dominant that levels are not offset but are developed one above the other.

Caves lying near the crests of anticlines, like Revells Cave and Crystal Grottoes, have a maze of interlacing passages equally developed along two or more sets of joints. This results in a plan resembling city blocks.

With the exception of Sand Cave and Devils Den,

bedding exerts little control in cavern development in Maryland except to modify the cross-sectional shape of some passages. In Sand Cave the bedding determines the extent of the cave, and joints tend to modify the shape of the walls, but are otherwise unimportant in controlling the pattern. In Devils Den the bedding determines the direction of the major passages.

It has been observed that a predominance of Maryland caves exhibit a marked horizontal nature and extent. Very few have more than 100 feet of vertical relief. Many have sloping passages but for the most part remain on one plane. The control of pattern by the strike of the rocks is not constant. At high dip, however, strike-oriented patterns are common but by no means the rule. In flatter limestones, there is no preferred pattern (e.g. Crabtree Cave).

These views are further substantiated by Barr (1961), who classified Tennessee caves into two major types according to inclination of the beds. He proposed the terms Allegheny and Appalachian to designate these types. Allegheny type caves are developed in strata of relatively low dip (e.g. Garrett County). The floors and ceilings tend to be horizontal except where secondarily modified by fill, breakdown, and dome pit. Major passages tend to follow the dip, with patterns often being complex and different levels super-imposed.

Appalachian type caves appear in steeply or moderately inclined beds and are the predominant pattern in the Appalachian Valley (Washington and Allegany Counties). The floors and ceiling of different levels are not superimposed, as a rule, but tend to occur down-dip from, and usually parallel to, other levels. Devils Hole Cave in Allegany County is a good example of this.

In summary it may be said that the caves of the Appalachian Ridge and Valley province are typically single conduit type passages parallel to the ridges, with large lateral extents being rare. The limestones do not have protective cap rocks, so the caves are subject to relatively easy truncation and collapse processes. The limestones of the interior plateaus, in contrast, are nearly flat-lying and occur often under sandstone or shale-capped ridges. These caves are related to much larger drainage basins, often by as much as a factor of 10 (Poulson and White, 1969), than those caves in the Appalachians and have a relatively larger lateral extent.

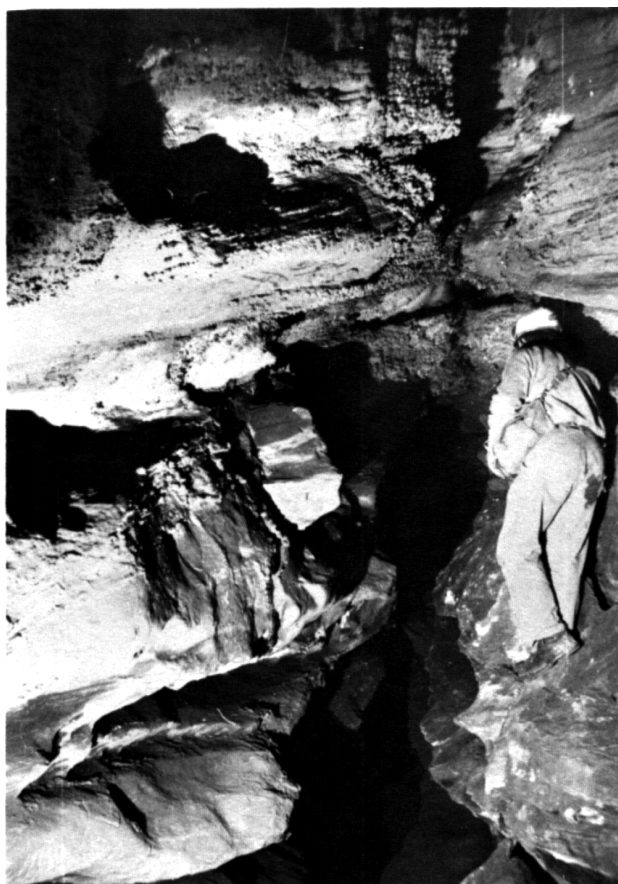


Figure 4. Typical fissure passage in Crabtree Cave, Garrett County. Traverse is often along irregular ledges which may form false floors over deep crevices. Note "cave coral" on walls in upper part of passage.

Cave features can be classified as solutional (passage shapes, fluting and scalloping, etc.), mechanical (breakdown, streams), and depositional (speleothems, minerals, sediments). Features which are not considered in this discussion are biological factors and any man-made items, including artifacts.

The shape of passages in Maryland caves is relatively simple. Practically all are rectangular in cross section with the height greater than the width. Some low, narrow passages, referred to as crawlway, are circular or elliptical in outline. Others are narrow vertical fissures (Fig. 4) that require considerable squeezing to traverse. The most complicated type, consisting of a low broad opening with a fissure at the base, is known as a "keyhole" because of its characteristic shape.

Cave walls and ceilings are generally bare limestone with fluted or pitted surfaces. In Twiggs Cave, however, bare rock is seldom seen as it is covered with

a thick deposit of laminated clay and silt. Floors of bare limestone are seldom seen except in stream channels, such as in Jugtown and Devils Hole Caves. Clay fills or piles of fallen rock form the floors of all caves in the State except Atheys Cave where bare pitted limestone does form the bottom of passages.

Cave passages terminate in various ways. Termination of strike passages, in particular, usually takes one of the following forms: silt or mud choke, breakdown, travertine chokes, intersection with the surface, siphon (water), and by narrowing to a thin fissure too small to traverse. In Maryland caves the last category is particularly common. The passage may either become too small due to narrowing of the rock walls or may be caused by the fill being too near to the ceiling. In view of this, it is with qualification that we refer to a passage as "ending". In many cases it very likely extends beyond the barrier, or may exist but is filled with sediment or water.

Solutional "sculpture" is common on the rock walls and ceilings of many Maryland caves. Fluting usually refers to vertical grooves and is best expressed on the sides of domepits, such as in Crabtree, Twiggs, Atheys, and John Friends Caves. Scallops are small pockets or indentations in limestone and are a result of solution from a freely flowing stream (Moore and Nicholas, 1964). Consequently, they occur almost entirely on cave floors and seldom on the walls which are often smooth or gently undulating. It should be further understood that not all Maryland caves have streams. Of those that do, Jugtown Cave displays the most well developed scallops. The orientation of scallops can often be used to infer the direction of stream flow in caves which no longer contain a stream. The absence of small scallops in the greater part of most limestone caves supports the idea that caves were formed by slowly moving water, like that below the water table rather than by fast-flowing water.

Bretz (1942, 1956) compiled a list of solutional features which he considered to be formed under phreatic (sub-water table) conditions and a list of secondary features which are later superposed by free-surface cave streams on existing phreatic type caves. Phreatic solutional features he describes as:

- 1) Spongework – a complex pattern of minor cavities and partitions ("honeycomb" effect), due to differential solubility of rock. This feature

has not been observed in any Maryland cave.

- 2) Wall and ceiling – roughly circular, rounded pockets, larger than spongework, separated by stretches of unaffected wall or ceiling. These are not uncommon in Maryland caves.
- 3) Bedding and joint plane anastomoses – these are systems of minor, curvilinear, tubelike, solution cavities lying in a plane and making an intricate pattern with their crooked courses and repeated intersections. They record an incomplete development of what would have become low ceilinged, tabular cave openings along planar features in the rock. Since joint-plane anastomoses stand on edge, the idea of a free-surface cave stream making them is purely fanciful. Anastomoses are well developed on the ceiling of Winders No. 1 Cave, below the entrance shaft.
- 4) Joint-determined wall and ceiling cavities – differential solution guided by joint cracks result in narrow vertical slots tapering upward. These features may be observed in many Maryland caves.
- 5) Continuous rock spans across cave chambers – such spans are either natural bridges or vertical partitions and pillars. Less soluble beds and joint planes are the determining structures. Dam No. 4, Indorse, and Atheys Caves, and Crystal Grottoes have both types of rock spans developed.
- 6) Network patterns – caves with passage patterns such as Revells and Crystal Grottoes can be referred without doubt to solution along controlling joints below the water table.

Vadose solutional features, or those formed by a free flowing cave stream, include the following:

- 1) Incised meanders in cave walls – The cause is believed to be a vadose cave stream meandering on a cave floor. Crude examples of this feature may be seen in the active stream passage of Devils Hole Cave.
- 2) Horizontal grooves in cave walls – This feature has not been observed in Maryland caves.
- 3) Domepits – Circular vertical openings up to 100 feet high are developed in the ceilings of many caves (Fig. 5). These shafts, known as domepits or chimneys, often have water falling or

running down them. Their walls are usually ribbed or fluted and sometimes covered with flowstone. In some cases they may connect with higher passages. They are best displayed in Twiggs, Atheys, Crabtree, John Friends, and Devils Hole Caves. Shafts of similar size, developed in cave floors, are known as pits or wells. These are rare in Maryland caves, being found only in Twiggs Cave where they range up to 50 feet deep. Domepits are formed by descending vadose water which flows from an older phreatic system to a new, lower discharge point by direct descent.

- 4) Pendants – These are bedrock remnants which hang from ceilings or flat bottoms of overhanging ledges. They are often found in groups and represent solutional remnants of once lower and more uniform ceiling surfaces. No good examples are known from Maryland caves.
- 5) Ceiling channels – These rare, winding, channel-like deep grooves incised into cave ceilings have not been observed in Maryland caves.

Rockfalls, known as breakdown, are a common feature of caverns, and serve to alter the shape and size of passages and to develop large rooms. The passages of Maryland caves are not generally large enough to permit extensive falls of this nature, however. The general problems of the mechanics of this process have been treated in detail by Davies (1951), by applying principles of mining engineering to caves. The most spectacular breakdown in the state can be found in Twiggs, Devils Hole, Crabtree, and Sand Caves. In Twiggs Cave large blocks, up to 50 feet on a side, bounded by joints, have pulled loose and dropped, with some rotation, to lower levels. The upper level passages, therefore, represent openings that are not entirely solutional in origin. Isolated chunks of breakdown can be found in most Maryland caves. In some caves slab breakdown (Fig. 6) is common (Greises and Buckeystown Caves are good examples). Flat slabs of rock several inches thick, which result from breakage along bedding planes, are scattered throughout. They are most common near the entrance. This type of breakdown is the most hazardous, and caution should be utilized when exploring low passages beneath it.

During certain stages of their development caves are filled to a varying extent by sediments, commonly clay, silt, sand, and gravel. Bretz (1942) was one of

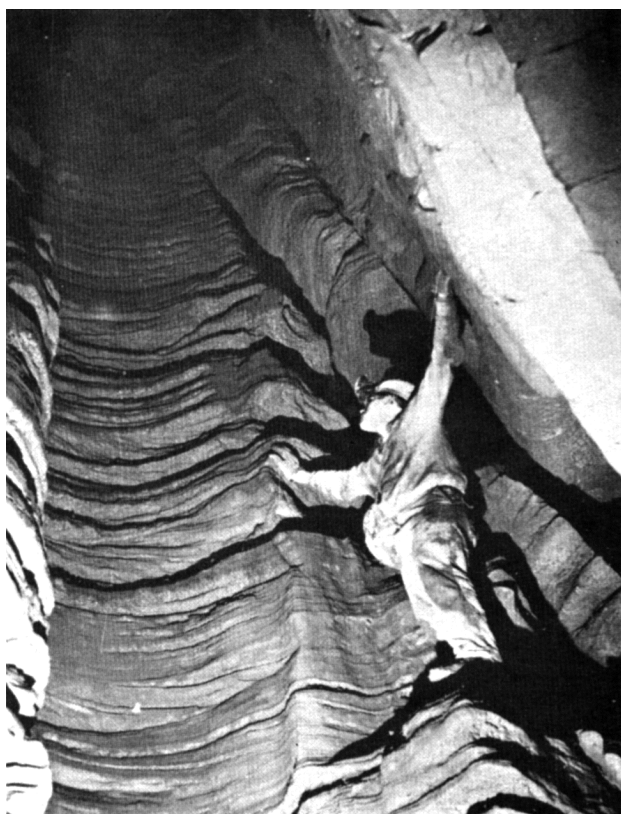


Figure 5. A typical dome-pit developed in the ceiling of Crabtree Cave, Garrett County. Such features are shaped by descending water and sometimes contain waterfalls. Dome-pits may extend through the floor as pits to connect various levels in a cave.

the first investigators to draw attention to this phenomenon in his studies on caves of the Ozark Plateau in Missouri. There, where large amounts of red clay are present, the sediments were believed to have been deposited at the close of the phreatic cycle. Barr (1961) cites evidence that filling may occur during the earlier part of the phreatic stage, plugging the cavity with insoluble material and thereby forcing deeper solution. He also suggests that cave fills are both terrace deposits laid down by free surface streams and that some are the result of seasonal flooding. Examples of both types are found in Maryland caves. The sediment in Wilson, Fairview, Devils Hole, and McKinstry Mill Caves is present largely because of seasonal flooding of nearby streams and, in the case of Devils Hole (Fig. 7), storm runoff. In these caves, organic debris such as leaf litter and pieces of wood are found within the more recent sediment and also adhering to the walls and ceiling. Darby Cave, situated downstream from a lumber mill and located in a wooded area, is completely clogged (at its furthest traversable extent) by massive log and wood jams, a result of spring flooding of the cave.

The caves along the Potomac River (Two Locks, Pinesburg, Snyders Landing, Dellingers, and Dam No. 4 Caves) contain thick deposits of river gravel mixed with clays and silts. The gravel was deposited simultaneously with gravel-covered terraces in the vicinity. Jugtown Cave, in Washington County, has clay fill in the old, or dry, section, and gravels in the first half of the stream passage. The last half of the stream changes gradient and the floor is bare pitted limestone with pools of water and small cascades. Nearby Winders No. 1 Cave is interesting because a portion of the ceiling in the main room is covered with a conglomerate quite similar to the gravel in the streambed in Jugtown Cave. The floor of Winders No. 1 is covered with typical fine silt and clay fill. One Maryland cave, Atheys, shows no evidence of clay fill. The floor and walls are bare rock, and shelves and niches lack clay cover. Red Hill Cave in Washington County was at one time completely filled with an interesting series of iron-rich sediments. The cave was mined out to its present extent in the nineteenth century. X-ray analysis showed some of this sediment, which occurs as yellow-orange clay bands, to be almost 50% goethite. A source for such an accumulation has not yet been determined.

Earth fills, in general, are firm though damp. In Twiggs and Stegmaier No. 3 Caves, however, they are saturated with water and have the consistency of thick mud. Such conditions make traverse of the cave rather difficult, but amusing. At present, cavern streams are removing rather than depositing fills in most Maryland caves. Only in the two caves mentioned above is there evidence of recent clay accumulation. Davies (1950) reported two large mud flows near the entrance of Twiggs Cave, originating from the base of sinkholes and gradually pushing into the passage and filling it. They were over 6 feet thick and covered an area 50 feet long and 15 feet wide. The supply has apparently ceased or been diverted, as the mud flows were dormant and drying in 1969.

In addition to the more common clastic sediments, some caves in the state contain autochthonous fills such as breakdown and weathering detritus; organic debris (guano, etc.); and chemical deposits such as travertine, manganese and iron hydrate deposits, and ice (White, 1964).

Two cave features that are rarely mentioned in speleological literature are fossils and roots. Roots are found in many caves, and Maryland is no exception. Their presence is, of course, limited to caves



Figure 6. Slab breakdown in thin-bedded Frederick Limestone, Buckeystown Cave, Frederick County.

relatively close to the surface, although they have been observed underground at estimated depths of 35 feet. Normally small rootlets and tips are found, but roots as large as three inches in diameter have been observed in Rohrsersville-Hogmaw Cave and Jugtown Cave (Fig. 8). Dense masses of root hairs are growing in pools in the streambed of Jugtown Cave and provide a rare habitat for aquatic life forms such as isopods. Roots grow through the rock and into caves along joint and bedding planes and occasionally along lithologic contacts. Small root hairs have even been observed growing out of the tips of stalactites (Douglas, 1964, p. 406). This, along with direct observation of occurrence is evidence of structural control of the presence of speleothems as well as roots. Roots have been observed growing from speleothems in Holmes and Howell Caves in Washington County, and are present in caves of three physiographic provinces of the state.

Fossils are a relatively rare feature to be found in caves. There are two types – those within the cave or the sediment, and those in the bedrock through which the cave is cut. A good example of the first type are the Pleistocene vertebrate remains which have been excavated from the sediment in Cumberland Bone Cave (Nicholas, 1954). The second type are much older invertebrate fossils which represent the fauna of the environment of deposition of the bedrock, usually marine. The walls of the Fort Hill Fissure Caves, developed in the New Scotland Member of the Helderberg Formation, are encrusted with a typical Lower Silurian fauna of brachiopods, crinoid stems, and tabulate and rugose corals. Due to silicification the fossils are more resistant to solution than limestone, and hence are preserved while the more soluble limestone is re-

moved by solution. In places they are covered with a thin veneer or "frosting" of calcite where water has trickled down the walls and deposited flowstone. The "honey comb" coral *Favosites* is found in the walls of Horse and Devils Hole Caves in Allegany County. The flat bedding plane ceiling of Rocky Gap Cave, in the Tuscarora Sandstone, is covered with an interwoven mass of infilled burrows of *Arthroporycus*, a probable Silurian marine worm (Fig. 9).

Following excavation, cave passages are modified by deposition of carbonate collectively referred to as speleothems. Speleothems were formerly called formations, but as this term is used by geologists to describe stratigraphic units, this dual usage led to confusion. The most common speleothems are stalactites, stalagmites, and their related forms. Although their development is far from being completely understood, speleothems are known to form primarily as a result of a loss of dissolved CO_2 from dripping water as it enters the cave, rather than by evaporation of the water itself – a difficult process in view of the nearly 100%



Figure 7. Unsorted stream deposits in Devils Hole Cave, Allegany County, consisting of large pieces of sandstone in a mud matrix.

relative humidity of most caves. As ground water leaves the overlying soil and rock and enters a cave, it encounters air which contains less CO_2 . The CO_2 is given off in accordance with partial pressure relations, and the water becomes supersaturated with calcium carbonate some of which is deposited according to the following reactions:



This process is the reverse of that by which limestone is dissolved to produce caves.

Several factors thus operate to control the growth and distribution of speleothems. The rate of supply of water and its chemical composition are essential controls in the formation of speleothems, but ventilation of the cave plays an undetermined role in that it affects the CO_2 concentration of the cave atmosphere. Geologic structures such as joints and bedding planes control the distribution of certain speleothems within a cave by channeling descending ground water along preferred paths.

Stalactites originate as a tiny ring of calcite (or aragonite in some rare cases) on the cave ceiling where the water emerges as a drop. Each subsequent drop precipitates a minute amount of material, which grows downward in a series of rings as a tubular "soda straw" stalactite, in the form of a hollow cylinder. Soda straw stalactites are relatively common in caves. They average about a quarter of an inch in diameter and are commonly several inches long, although their fragile walls are only about one sixty-fourth of an inch thick. They are so fragile that they sometimes break under their own weight.

The common "carrot-shaped" or conical stalactites originate as soda straws. When water flows down along the outside of the tube (due in part to clogging of the tube) it precipitates calcite on the surface, most abundantly at the top. It thus not only enlarges the stalactite but gives it a conical shape, tapering downward. The deposits precipitate in relatively parallel layers (Fig. 10) which appear as rings when the stalactite is viewed in cross section. These rings are made visible by differing amounts of impurities (such as iron oxides) in the various layers. It has been suggested that these rings may be annual, reflecting seasonal fluctuations of the ground water parameters involved. Soda straw stalactites show vertical growth increments which may



Figure 8. Large tree root growing into Jugtown Cave, Washington County. Roots generally enter caves through joints and along bedding planes.

reflect similar changes. Fanning (1970) has studied the problem by observing drip rates in some Washington County caves, and notes that many stalactites dry up for certain parts of the year. No investigators, however, have yet completely demonstrated an absolute seasonal or annual basis for explaining these rings and growth increments. The reader is referred to Moore and Nicholas (1964) for a detailed treatment of the composition and structure of stalactites and other speleothems.

A stalagmite is the counterpart of the stalactite. It grows upward from the floor, being formed by the water dripping from the ceiling. The two may sometimes meet to form a column.

When water flows down the walls of caves, sheets of calcite called flowstone are deposited. Draperies are thin translucent sheets which hang from the ceiling and walls of caves. During certain growth periods impurities may be collected and produce a banded structure resembling fried bacon. Draperies often have

serrated edges along their bottom sides, much like the edge of a saw. Each tooth, or point, is controlled by crystal growth on the edge of the speleothem. Excellent draperies are developed in Crystal Grottoes, Rohrsersville-Hogmaw, Schetromph, and Winders No. 1 Caves.

Rimstone dams are formed on the floors of caves and consist of narrow, interconnected ridges bounding pools of water resembling terraces. Water usually flows over them from one crescent-shaped pool to another. A hypothesis is offered by Moore and Nicholas (1964) to explain rimstone dams. As water flows over an obstruction it is slightly agitated, causing CO_2 to be given off and calcite to be precipitated on the lip of the dam. As more water flows over low parts of the dam than elsewhere, more calcite is deposited on them and the top of the dam therefore keeps nearly level. They are not very abundant in Maryland caves, although good examples occur in Howell and McMahon's Mill No. 2 Caves.



Figure 9. Casts of *Arthropycus* borings on bedding plane surface in ceiling of Rocky Gap Cave, Allegany County.

Although speleothems formed on the surfaces of cave pools are relatively scarce in caves, and unknown from Maryland caves, they are quite interesting and merit some brief mention. One of these is the calcite raft, or calcite ice – a very thin and fragile film of calcite which is supported by surface tension. They sink and break up readily when the pool is disturbed. In some caves natural deposits of rafts almost a foot thick have been found in areas once covered by cave pools.

At the margins of some pools, deposits called shelves attach to the wall and extend out over the water. These features have been observed in a few Maryland caves, although never well developed. Calcite bubbles first recognized underground in a limestone mine in England, are very rare cave features. They have thin walls and are never more than a quarter of an inch in diameter. They are formed at the surface of the water by calcite crystallizing around bubbles.

Calcite crystals are not uncommon in the interiors of cave pools, where they have formed underwater. In Maryland caves they are usually quite small. Cave pearls, another speleothem which occurs in association with pools, have not been found in Maryland caves. They range from sand size particles to irregular bodies as large as six inches in diameter, but are typically small and spherical. They generally have a nucleus and consist of concentric layers of calcite. Many are formed in nests below dripping water, which agitates and rotates the body at the same time as the calcite is being deposited on it, thus a spherical body is formed much like an oolite or a pearl in an oyster.

Cave coral, helictites, and anthodites are other varieties of carbonate deposits occurring in caves. Anthodites, flowerlike clusters of crystals (often aragonite) have not been observed in a Maryland cave. Cave coral, on the other hand, is quite abundant in some Maryland caves, in particular Round Top Summit, Crabtree, Atheys, and John Friends Caves. Cave coral consists of nodular encrustations and is quite similar in appearance to some marine corals. It is often called "popcorn" by the spelunker. In crawlways and narrow fissures it can make a traverse not only difficult but painful. Cave coral displays a laminar cross-section but never has a central canal. This fact, along with the areas of occurrence in caves suggests that it is formed by seeping water, although some types are more explainable by the action of splashing or dripping water.



Figure 10. Soda straw or tubular stalactite showing vertical growth increments and terminal crystals. Growth increments may be annual. Interior view of split specimen on right.

Helictites are thought to form as a result of seeping water as well. These are delicate twisting structures which project from ceilings, walls, and floors of caves at all angles and are sometimes called eccentric stalactites. Many investigators have studied the growth of these grotesque but beautiful phenomena. Moore and Nicholas (1964) give perhaps the most reasonable explanation. Helictites have a narrow central canal extending along their axis. This canal, less than a hundredth of an inch in diameter, conducts water under hydrostatic pressure from a minute opening in the cave wall through the helictite to its tip. The flow is so slow that a drop of water cannot form and gravity cannot affect the shape, which is controlled by the systematic tilting of the single crystal "cone" deposited at the tip. Helictites are very well developed in the Stegmaier No. 3 Cave, and occur in less profusion in the Rohrserville King Quarry Cave, Winders No. 1, and McMaho's Mill No. 2 Caves.

The term "cave flower" usually is applied to the petallike crystals of gypsum or selenite ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) which occur in incredibly beautiful displays along with gypsum needles and "angle hair" in some caves. No gypsum deposits or speleothems are known from Maryland caves, however.

The matter of growth rates of speleothems is a subject not yet completely understood. It is obviously a function of the rate of flow of the water and its degree of supersaturation with respect to calcite. As would be expected, observation has shown that the rate varies greatly from place to place, even within a particular cave. Moore (1968 b) reports that micrometer measurements of soda straw or tubular stalactites indicate an average net rate of elongation of about 0.2 mm. per year. Apparently stalagmite growth rates appear to be about the same as those for stalactites. A maximum rate would be about one tenth of an inch per year, but a probable average would be a hundredth of an inch per year (Moore and Nicholas, 1964). Radiocarbon dating has been used successfully to a limited extent in dating carbonate speleothems.

Went (1969) presents some exciting data which may shed new light on the study of the growth of stalactites. He found that a fungus (*Cephalosporium lamellaecoela*) was regularly associated with the active tips of stalactites in eastern Nevada caves. Crystallization of calcite occurred on hyphae suspended from the stalactite wall in the terminal drop.

MINERALOGY OF MARYLAND CAVES

More than sixty different minerals, some found elsewhere, are known from limestone caves. Most caves, however, contain only a few species. Calcite is, of course, the most commonly observed mineral in caves, as it constitutes almost all dripstone and flowstone (travertine) speleothems. Typical rhombohedral crystals of calcite are readily seen when stalactites are broken and sometimes line the interiors of pools or vugs as dogtooth spar. Aragonite is occasionally found, but in comparison to calcite it is rare. Aragonite has been verified (by X-ray) from only two Maryland caves – Stegmaier No. 3 and Buckeystown. In both instances the occurrence is in the form of small white nodular clusters of "flowers" growing on the walls and ceiling (Fig. 11). The occurrence of aragonite in caves is a function of the level of supersaturation of the water with respect to calcite. Curl (1962) and Moore and

Nicholas (1964) shed some light on this very complex problem of the aragonite-calcite relation in caves. It should be noted that caves with the highest levels of supersaturation are warm southern caves because bacterial production of CO_2 in the overlying soil is very rapid. Aragonite is relatively common in southern caves and is never found in cold northern caves or in caves at high altitudes. It is therefore rather likely that Maryland caves occupy an intermediate position in terms of aragonite formation. It is also possible that Maryland caves may contain deposits of fossil aragonite – aragonite formed in the past during a warmer period but now being covered by calcite.

Minerals which have not been reported from Maryland caves, but are found in other caves are: gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$), usually in the form of selenite; primary dolomite (CaMgCO_3); and "moonmilk" or hydromagnesite ($\text{MgCO}_3 \cdot \text{Mg}(\text{OH})_2 \cdot 3\text{H}_2\text{O}$). Moonmilk is a peculiar, soft cottage cheese-like assemblage of carbonate minerals and is usually associated with certain bacteria which are believed to be instrumental in its production.

Ice is often considered to be a mineral, and as such bears listing here. Ice deposits occur in cave entrances and into the twilight zone of caves during the winter months. No perennial ice is known to exist in any Maryland caves, however.

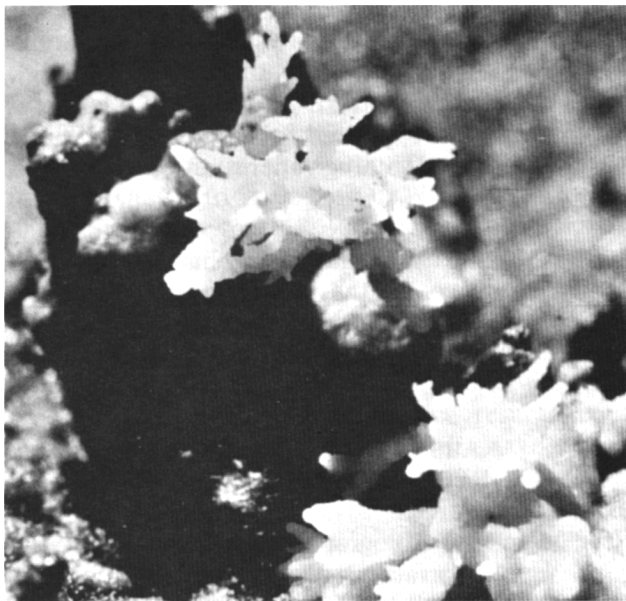


Figure 11. Aragonite "cave flowers" in Buckeystown Cave, Frederick County. Individual "flowers" are 3-5 mm in diameter.

The iron mineral goethite ($\text{FeO}(\text{OH})$) has been identified from Red Hill Cave (Franz and Slifer, 1969) and probably exists in others, as either sediments or impurities in flowstone.

Several caves in the state contain black soot-like deposits of manganese dioxide or heavy metal manganates (White, 1962). Very little is known about the origin and nature of such minerals in caves.

Some small crystals of secondary quartz are present in Maryland caves, notably Rohrer'sville Hogmaw, Snyders Landing No. 2, and Devils Hole Caves. They usually occur as linear features presumably along joints and fractures, similar to the siliceous boxwork of South Dakota's Wind Cave. Chert is also found in some caves, but is residual from the bedrock. The Fort Hill Fissure Caves are good examples of this feature.

Saltpeter deposits in caves were once of considerable economic importance. The saltpeter, in the form of niter (potassium nitrate) and nitrocalcites, is scattered through the clay and silt fills. Distinct large crystals are seldom found. Some question still exists as to the origin of such deposits. Bushey's Cavern is the only Maryland cave to have been exploited for saltpeter, and had a rather extensive leaching operation in the 19th century.

Bat guano accumulations have also been mined from caves in the past, for use as fertilizer and for phosphate minerals. No appreciable guano deposits are known, however, from any Maryland caves.

KARST FEATURES AND KARST HYDROLOGY OF MARYLAND

The unique topographic development of limestone areas, characterized by sinkholes, subterranean drainage, and thin argillaceous soil interrupted by limestone outcrops, is known as karst topography. In Maryland, karst features are developed in various ways. The limestones of the plateau in Garrett County seldom shows karst characteristics as they crop out on the sides of hills and do not form the surface over extended areas. Springs and bare ledges of limestone are common, but sinkholes are rare.

In the vicinity of Twiggstown, the surface is composed of broad shallow sinks, several hundred feet in diameter but only 20 to 40 feet deep. The soil is shal-

low and full of slabs of weathered limestone. In cleared areas, on the sides of hills, soil slumps are common and expose bare rock. Lapiez (bare bands of limestone) are not found in this area.

In the Hagerstown and Frederick Valleys karst features are more spectacular. The rolling surface is pitted by numerous sinkholes, ranging from 10 to 20 feet wide and 10 feet deep up to over 100 feet wide and 100 feet deep. The sides of the sinks attain steep slopes but are seldom vertical. Locally several sinks are united to form shallow uvala. Lapiez are common over much of the valley, varying from isolated, interrupted bands of limestone to areas in which the surface is composed of nothing but low outcrops of limestone along the strike. Lapiez are developed to a maximum along outcrops of the Beekmantown, Conococheague, Chambersburg, and Upper Stones River Limestones.

Karst features are generally lacking in areas of marble in the Piedmont. Valleys are broad with gentle slopes, and only occasional shallow sinkholes are encountered. Surface exposures of the marble are infrequent and lapiez are absent.

Subterranean drainage, characteristic of karst areas, is developed to a small extent in Maryland. In the Twiggstown area, drainage is all subterranean. The large doline at Twiggstown, which contains several caves, is drained by a sizable stream flowing in Twiggs Cave. The stream is fed by the large sinkhole pond at Twiggstown which, in turn, is fed by several small springs in the vicinity. The point of resurgence of this stream is a matter of speculation. A large stream emerges at Rush as Murley Branch Spring, three miles northeast of Twiggstown, and local residents report that chaff put in the pond at Twiggstown emerged there. The stream is also said to resurge at Blue Hole, a large spring adjacent to the Potomac, one half mile west of Spring Gap. The rock structures make the later assumption highly improbable. A third possible point of emergence is at the head of Frog Hollow. Dye placed at Twiggstown in 1948 was not observed in any of these assumed points of resurgence so the question is still unsettled.

A portion, of Flintstone Creek follows a subterranean course from Flintstone southwest for a mile. In low water the entire creek flows underground, but in normal seasons its flow is divided. The stream disappears at the rear of the high school in Flintstone and passes under a hill to resurge in a large spring at the

west end of the gap one mile to the southwest.

In the Hagerstown Valley, major streams remain on the surface, but smaller tributaries are subterranean except in wet seasons. The subterranean drainage network in this area is extremely complex, and much study will be needed to unravel it.

Several hydrologically interesting areas in Washington County have been observed in the course of conducting this survey. It seems rather likely that Hepburn Cave, near Hancock, is directly related to the subterranean water course which emerges less than a mile to the south as the large spring which supplies water to Hancock. North of Indian Springs is Darby Cave, which receives the entire flow of Rattle Run Creek and carries it underground for over 100 feet to a siphon (Fig. 12). This is Maryland's best example of a classic sinking stream or swallow hole. The exact point (s) of resurgence are not yet known but one is suspected in the gravel seep near Revells Cave. Local residents call it a "blowhole" and report that it spurts water into the air during spring floods. This projected route would involve subterranean piracy from the old surface drainage course to a new channel through Moore Knob for at least a mile, to Licking Creek.

Much of the drainage in the vicinity of Downsville is underground to the nearby Potomac River. A projected system involves several caves in the area. Natural Well, a sinkhole containing a small stream which siphons, is at the upstream end of this "system". It almost certainly contributes to the watercourse which includes Cave-in-the-Field, one-half mile to the south. Cave-in-the-Field receives surface runoff from a considerable watershed during storms and contains permanent water in the form of a well or siphon all year. From here it is about one-half mile to the McMahon's Mill Caves (No. 2 has a stream in it) to the south, which are definitely related to Howell Cave. Howell Cave is situated at the base of a cliff by the Potomac, and is the point of resurgence for the system. In wet periods a stream flows from the cave, blocking the entrance. During dryer times this does not occur and the water probably follows a lower, hidden course to its outlet at the river. The area containing nearby Dellingers Cave has several major springs which very probably serve as points of resurgence for similar chains of yet unknown caves constituting subterranean drainage networks.



Figure 12. Rattle Run Creek flows into the mouth of Darby Cave, Washington County, and is the best example of a sinking stream in Maryland.

The area surrounding Schetromphs Cave, near Conococheague Creek, displays some of the most impressive karst features in the state, in the form of karren, grikes (or cutters), and chains of large deep sinkholes. Schetromphs Cave contains a sizeable permanent stream which siphons quite near to the large spring which feeds several watercress ponds below the entrance. The two streams are almost surely one and the same. Collection of hypogean amphipods from the spring seems to substantiate this idea. The cave, no doubt, serves as the outlet for the drainage system underlying the adjacent well-developed karst area.

Jugtown Cave carries a permanent stream which originates from the direction of the metamorphic rocks on the west side of South Mountain, and flows through the cave to several siphon points in the direction of the carbonates in the Hagerstown Valley (to the west). Winders Caves are one-fourth mile to the south but have no flowing water in them. A sinkhole several hundred yards west of Jugtown Cave's entrance has a vertical fissure too narrow to enter, but from which issues the sound of water splashing when rocks are rolled down. More cave is indicated by this as well as the geology here, although no surface resurgence or outlets are suspected yet for this drainage system.

The Rohrersville caves display a promising degree of indicated hydrological interconnection, despite the presence of well-developed local surface drainage. The stream which flows through the length of Hogmaw Cave forms a pond in the sinkhole containing the entrance. The water from this pond flows into the bank on the opposite side of the sinkhole (from the cave en-

trance) and in a direction towards the King Quarry Cave and several springs to the north.

A high density cluster of caves is located at Keedysville, just three miles northwest of the Rohrersville area. Although most of them have no cave streams at present, they may indicate a truncated, formerly continuous paleodrainage system involving these two groups of caves at one time.

The water flowing through caverns is close to neutral in pH and contains only relatively small amounts of dissolved solids. Samples of water from the stream in Twigg's Cave contained 187 parts per million of dissolved substances. Similar results were obtained from Murley Branch Spring. The cave waters in Maryland are generally slightly alkaline as indicated by the following pH values (from Davies, 1960, p. 11):

Twigg's Cave – stream	7.25-7.7
Twigg's Cave – water on wall	6.0
Murley Branch Spring	7.0-8.3
Atheys Cave – drip pool	6.0-7.0
John Friends Cave – stream	7.0-7.5
Dam No. 4 Cave – stream	7.0-8.0

ORIGIN, DEVELOPMENT, AND AGE OF MARYLAND CAVES

The solutional processes instrumental in the formation of limestone caves has been discussed previously. The life history of such caves begins with movement of slightly acidic ground water through joints and fractures in the bedrock. The fractures, or in some cases partings between beds, are solutionally enlarged by the dissolving action of the ground water. In this early stage, the water moves quite slowly through the rock. Davis and Moore (1965) have observed semidiurnal movement along a bedrock joint in a California cave, with a magnitude of about half a micron, which they propose coincided in time with the theoretical earth tides. This effect may very well serve to provide a "pumping" action which would initiate and maintain circulation of ground water through joints prior to enlargement and integration of channels. Once the openings are of sufficient size for turbulent flow to be established (about a quarter of an inch in diameter),

solution is greatly enhanced since the rate of solution is proportional to the velocity of the solvent (Kaye, 1957). The velocity within the system of open joints and bedding planes can result from either hydrostatic pressures or from steep stream or drainage gradients within the system

Because the formation of cavernous channels requires the continuous addition and removal of ground water, caves represent a continuous conduit leading from a source to an exit. No one theory of cave development can be applied to all caves, as each cave has a unique history. Nevertheless, there are certain broad principles valid for the development of all solution caves, which appear to fall into two classes, according to Howard (1963); those that arise through solution and abrasion by groundwater or free surface groundwater streams flowing with a definite gradient, and those that result from solution by groundwater flowing under artesian pressure. Some caves have records of both processes having acted at different times during their development.

Until the present century people generally assumed that caves had been made by underground streams. Compelling arguments against this idea were first proposed by the Austrian geologist Alfred Grund and by the American geomorphologist William Morris Davis, who in 1930 published his classic paper on the origin of caves.

According to Davis' theory, "cavern development takes place in two distinct cycles. The first occurs in the phreatic zone where the pattern of the cave is established and passages and rooms are excavated to maximum size. When passages are elevated above the phreatic zone by regional uplift, the second cycle is inaugurated. This cycle, in the vadose zone, is characterized by the development of flowstone and dripstone and the modification of existing passages by subterranean streams or rock falls. Davis related the first cycle to regional peneplanation and keyed the entire development of caverns to the peneplain cycle as follows:

1. Solutional development of deep-seated network of fissures, galleries, and shafts in the phreatic zone beneath a peneplain surface.
2. Enlargement of openings to mature proportions.

3. Regional uplift with change from phreatic to vadose conditions in cavern passages.
4. Depositional replenishment by dripstone and flowstone.
5. Degradation of cavern roof and walls by erosion and final peneplanation.

J. Harlen Bretz (1942) modified Davis' theory by introducing a third stage in the cavern cycle. This stage, occurring in the transition from phreatic to vadose conditions, is characterized by deposition of clay fills in cavern openings. The clay is derived from the surface and transported to phreatic reservoirs where it forms deposits that may completely fill cavern passages. The structures and texture of fills indicate that they were deposited in quiet water. Upon uplift vadose streams flowing along the cavern passages excavate channels in the clay and may ultimately remove it.

Theories opposing the two cycle development of caverns have been proposed by several authorities. Swinnerton (1932) postulates a single vadose stage for cavern development in which both excavation and replenishment take place. In this theory cavern systems are developed by "near surface water which flows laterally in the fluctuating top of the water table towards the principal surface streams."

Malott's (1938) theory of cavern origin agrees with Davis in that the patterns of caves evolve below the water table. However, Malott postulates that vadose streams develop underground courses along selected passages of primitive cavern systems and enlarge them, ultimately producing a mature, integrated system of passages.

A one cycle theory proposed by Gardner (1935) postulates that the initial pattern and cavern openings are developed in porous horizons where water is under hydrostatic pressure. As valleys cut these aquifers, vadose water actively circulates and enlarges the passages to mature size. As the valley is cut down, successively lower aquifers are tapped, and multiple cave levels develop. As relief increases, the vadose streams drop to lower levels, and the upper passages are dry. Dripstone and flowstone are formed at the same time that vadose waters are enlarging the primitive cavern openings to mature size. Gardner applied his theory to areas of thick limestones with gentle dips, a

condition that is lacking in Maryland.

The cavern features observed in Maryland are best explained by the theories proposed by Davis and Bretz. However, certain modifications are necessary to explain more fully specific conditions. Though both Bretz and Davis related the phreatic cycle in cavern development to regional peneplanation, more specific correlations appear possible in caves in areas of folded rock. The caverns of Maryland are developed at uniform levels that are closely related to Pleistocene river terraces. Where a cave is composed of more than one level, the various levels are developed with uniform vertical spacing that coincides with terrace intervals. It is more appropriate, therefore, to relate the stage in which maximum development of cavern passages occurs to a zone directly beneath the water table during a period when straths or local base levels are formed rather than to random development below a peneplain as Davis and Bretz proposed. Another modification in Bretz's theory is necessary in the case of clay fills. Those observed in Maryland caves contain crossbedded deposits of gravel, sand, and silt as well as thick unstratified clays. Bretz's proposal that the fills were formed in phreatic reservoirs apparently does not apply here. The fills are a result of alternate vadose and phreatic conditions in which active subterranean streams deposit sand and gravel when the water table is low and fine silt and clay when the water table is high and phreatic conditions exist. Such alternations would occur as the phreatic stage of excavation drew to a close and uplift of the cavern passages began." (Davies, 1950, pp. 8-9)

A vast amount of speleological data has been accumulated since 1950 in this country, some of which indicates that certain cavern features were not adequately accounted for by any of the previously accepted theories. The development of horizontal passages across inclined strata and parallel to the strike as well as the presence of large quantities of variable clastic material in cave fills were in need of explanation. In England, Sweeting (1950) concluded that cavern levels are closely related to erosion levels. In the U. S., Davies (1960) also concluded that Appalachian caves are closely related to river terraces and other erosional surfaces, and the horizontal development of passages in folded rock is a result of maximum solution in a small vertical zone directly beneath the water table during periods when the water table is relatively stable. White (1960), Deike (1960), Moore and Nicholas

(1964), and Wolfe (1964) have all substantiated this with similar observations of their own.

The reason that most caves develop just below the top of the saturated zone, rather than at random depths within this zone, is believed to be due to a nonlinear relation between calcite solubility and the partial pressure of carbon dioxide. As a consequence, the mixing of any two waters, either saturated or undersaturated with respect to calcite, will always produce an undersaturated solution capable of further solution. Solution would therefore occur continuously in the zone just below the top of the water table, where downward-percolating water constantly mixes with slowly moving ground water (Moore, 1968).

Four stages of limestone cave evolution have been proposed (Davies, 1960, and Moore and Nicholas, 1964) and are generally agreed upon. They are applicable to the majority of the caves in Maryland.

- 1) initial enlargement of joints and partings at depth in the saturated zone, to produce nonintegrated tubes and pockets.
- 2) development of master channels (mature caverns) directly below the water table during a period when the altitude of the water table was relatively stable, the flow was constant for a long period of time (direction of flow was toward major valleys), and a high partial pressure of CO₂ existed at the top of the saturated zone.
- 3) a transitional stage, in which local streams have cut down to a point where their seasonal fluctuations affect the level of the water table in the cave and clastic fill is deposited under alternating conditions of saturation and aeration.
- 4) relative uplift (most often by further lowering of the water table) of the cave above the zone of saturation, with modification of passages by deposition of speleothems, erosion of fill material, and breakdown formation.

It can be seen that the formation of limestone caves is directly related to erosion of the modern topography. The age of a cave bears little relation to the age of the

rocks that enclose it. Most caves are very much younger than the rocks in which they are formed. In fact, all the major limestone caves in the world, including some in rocks hundreds of millions of years old, are considered to be less than 10 million years old (Moore and Nicholas, 1964). In his studies of Tennessee caves, Barr (1961) cites reasons for believing that the majority of those caves are no older than Pliocene (10-12 million) and some are perhaps wholly Pleistocene (2-3 million). Davies' studies of Maryland (1950) and West Virginia (1949) caves illustrate the relation of Pleistocene river terraces to cave levels. If the maximum development of passages is related to the water table at the time terraces or erosion levels develop (and most evidence indicates that it is) then the age of the cave should be the same as that of the terrace. The largest group of Appalachian caves seems to be of this nature. Less common are those that lie near the top of high ridges, and are thereby presumably related to the Schooley peneplain of Cretaceous age. Other caves lying at the summit of subordinate ridges are probably related to the Harrisburg level which is early Tertiary.

The majority of the caves of Maryland are probably



Figure 13. Fresh sinkholes in the bed of a farm pond near Boonsboro, Washington County.

late Tertiary or early Pleistocene. The Cumberland Bone Cave is a helpful indicator in that it contained Pleistocene bone deposits, which means that the cave has to be older than Pleistocene. At the same time it must be younger than the age of the tectonic events that turned the strata here to a nearly vertical position, which is most likely Permian (c. 250 million years).

CAVE BIOLOGY

THE CAVE ENVIRONMENT

Three major environmental subdivisions may be recognized in caves; a twilight zone, a middle zone, and a deep interior zone (Poulson and White, 1969). Except for the naturally illuminated twilight zone, total darkness prevails throughout the cave system. Light penetration will vary slightly depending on the amount of vegetation near the entrance and on the size, shape and orientation of the entrance. Temperatures and humidities in the lighted area approximate those of the surface. The dark middle zone has fluctuating temperatures and humidities due to air currents, while the deep interior is characterized by total darkness, constant high relative humidity, and constant low temperature (Holsinger, 1964).

Within the deep interior, relative humidity may vary from 80 to 100 percent (Poulson and White, 1969). Humidity data is available from only two Maryland caves, Schetromph Cave in Washington County and Crabtree Cave in Garrett County. In the Drapery Room of Schetromph, the humidity was 100 percent in October and May (1969, 1970). In the first room of Crabtree, approximately 120 feet inside, the humidity was checked monthly over a two year period (1961, 1962). The lowest reading (60 percent) occurred in December of both years, saturation during September and November and 90 percent in the other months (Miller and Parsons, 1963). In the Bat Room deep within the cave, the relative humidity varies slightly from 95 to 100 percent.

Temperature in the deep interior is approximately the mean annual temperature of the region (Poulson and White, 1969). Close proximity to the surface and air currents, which are activated by the chimney effect or by changes in barometric pressure, influence temperatures. Except for outflowing and inflowing streams, cave water is nearly the temperature of the rock through which it flows.

In Garrett County caves, air and water temperatures varied from 10° to 11.5°C. In the Bat Room at Crabtree Cave, the temperature during October and December (1967, 1969) was 11.5°C. In some of the higher grottoes beyond this area, it was somewhat cooler. Air temperatures of the first room, approx-

imately 120 feet inside, varied from 3° to 9.5°C. (1961, 1962) (Miller and Parsons, 1963), indicating that this area is part of the middle zone. A small weep which issues slowly from the right passage and flows into the first room was consistently 11.5°C. The other cave stream which flows out of the left passage into the "sewer" and then onto an enclosed spring on the adjoining hillside was 12°C. At John Friends Cave the air temperature in the rear of the cave was 11°C and the stream was somewhat cooler (March, 1970). Davies (1950) found that temperatures in Allegany County caves varied from 10.5° to 12°C. In Washington County caves, temperatures were erratic, varying from 8.5° to 13°C. Possibly this phenomenon could be explained by the "shallowness" of the caves in this area. In Snively Cave No. 2, the floor at the rear of the cave was 8.5°C, while higher in the fissure the temperature was 11.5°C (December and March, 1969). Apparently the heavier air settles to the floor, forcing the lighter warmer air to rise. At Jugtown, the entrance also acts as a cold air trap. The floor temperature was 11°C; the high dome at the rear of the entrance passage, 13°C; and the stream temperature, 9.5°C (March, 1970). In the rear of Hogmaw and Column Caves (both of the Rohrsersville System) the air temperature was 11°C (1968). At Hogmaw, the stream flowing into the entrance pool from the side passage was the same temperature as the creek outside the cave suggesting that this water represents a short subterranean side channel of the Little Antietam Creek. Deeper in the cave the water temperature was 12°C. This water probably reflects the local water table.

The greatest number of species occurs within the naturally illuminated twilight zone, rapidly decreasing with a reduction in light. Many organisms attempting to escape less tolerable conditions outside of the caves may use the cool, moist cave entrances as refugia. Many of these species will venture deeper into the cave system but most periodically return to the surface for food. These organisms, which cannot complete their life cycle underground, have been termed *trogloxenes* or cave visitors. In Maryland, cave crickets, cave moths, red-backed and slimy salamanders, wood rats and bats conform to this ecological classification. Other species will penetrate beyond the twilight zone and become permanent residents in the deeper recesses of the cave; usually they are



Figure 14. Luxuriant growth of fungi on cave rat scat in Buckeystown Cave, Frederick County.

preadapted to habitats on the surface which are similar to the cave environment. These *troglophiles* or "cave lovers" are capable of completing their life cycle in caves. Examples are planarians, cave spiders, collembolans, and long-tailed salamanders. A third group of organisms, known as *troglobites* or obligate cave dwellers, inhabit the deep interior. These obligatory cave species are characterized by degeneration of eye structure, little or no pigmentation, and usually attenuation of appendages. In Maryland caves, a few spiders and millipedes, a collembolan and several crustaceans show these specializations.

According to Holsinger (1964), if other conditions are constant the distribution of cavernicoles within a cave will be controlled by the amount of food available in the cave ecosystem. Food sources include vegetative matter, dead animals, fecal material, and live organisms.

Probably the most important food source for organisms associated with Maryland caves is vegetative matter that has been washed, blown or carried into the cave. Small temporary streams transport leaves and organic debris through fissures in the permeable limestone from the surface. Accumulations of organic matter from these sinking rivulets are commonly observed in the ceilings of fissure passages and domes. Larger streams flow into the mouths of some caves, floating logs and planks into them and often washing in tremendous quantities of debris during floods.

Wind-blown leaves frequently choke the entrance passages of many Maryland caves. With the advent of the spring rains and fair weather cavers, much of this organic material will be washed or carried into the cave proper.

The eastern wood rat, *Neotoma floridana*, a common cave inhabitant, usually forages outside the cave dragging fresh vegetation into its underground shelter for nest building and food. Squirrels and chipmunks store various food items under large rocks on the surface and much of this material finds its way through small holes into caves. This appears to be an important source of organic debris in the shallow Washington County caves. Man, in his attempts to protect his domesticated livestock from falling into sinkholes, may either cover or fill these cave entrances with logs, boards and rocks. Much of this material finds its way deep into the cave. Hikers and inexperienced cave explorers carry planks and logs into caves to aid them in climbing small pits or crossing water-filled depressions. Smaller particles are carried into the caves on the boots or in the pockets of cavers.

Other important food sources for cave organisms include dead animals and fecal material. Remains of raccoons have been found in several caves. In several instances skeletons and feathers of chickens along with raccoon scat were found, indicating that raccoons had used passages as lairs for a number of years. Occasionally dead bats and rats have been observed in streams and on the clay floors of caves. Many farmers use the sinkhole entrances of caves as dumps for dead livestock. Fecal material of cave rats, mice, bats, raccoons and cave crickets has been seen. Usually fungi (Fig. 14), collembolans, and millipedes are associated with this excrement. Since there are no large summer colonies of bats known to exist in any Maryland caves, there is little accumulation of bat guano.

Live prey must also be included as a food source in the cave environment. We have noted the house centipede feeding on phorid flies, the cave spider capturing young slimy salamanders, and larval salamanders consuming tubificid worms and mayfly naiads. Mushrooms and other fungi grow on rotten wood; the spores may provide a food source for the larvae of some common flies. The roots of trees commonly invade the shallow Washington County caves and may represent an additional food source.

Autotrophic bacteria, especially iron bacteria which are found in cave soils and on cave walls, are known to manufacture food in the absence of light. At this time biologists are not sure what role this microflora plays. One possibility is that troglobites, particularly amphipods, may be dependent on something which is produced by the bacteria. Since deep-cave bacteria are known to produce antibiotics which exclude many molds and higher fungi (Caumartin, 1963), it is suggested that this may be the "something" (Poulson and White, 1969).

FAUNA OF MARYLAND CAVES

The cave fauna of Maryland is limited but varied. More than 128 species belonging to 105 genera, 67 families, 12 classes and 5 phyla have been identified. Of these, only nine aquatic and five terrestrial species of troglobites (= obligatory cavernicoles) are known. All belong to the phylum Arthropoda. These 14 troglobites are concentrated in the caves of the Great Valley (Valley and Ridge Province) in Washington County and on the Allegheny Plateau of Garrett County; only one, a terrestrial species, is known from Allegany County.

The flora is restricted to fungi and bacteria except near the entrance where numerous photosynthetic species flourish in the available light.

Flatworms

The troglophilic planarian, *Phagocata morgani* (family Planariidae), is extremely abundant on rocks and organic material in isolated pools and in shallow interstices in Crabtree Cave, Garrett County. According to Carpenter (*in litt.*), this whitish species also occurs in surface streams and springs.

Earthworms

Three genera of earthworms (family Lumbricidae) are known. *Dendrobaena rubida* and *Octolasion tyrtaeum* have been collected in several Washington and Allegany County caves and appear to prefer pulpy wood as retreats. Their castings are usually abundant under the wood. *Allolobophora turgida* is known only from Devils Hole Cave, Allegany County, where it is found under rocks in a saturated, gravelly stream bed. Holsinger (1964) listed these species plus three other genera of lumbricid worms from Virginia caves. Due

to their subterranean habits, earthworms are difficult to classify ecologically. More information must be gathered before the biologist can begin to accurately access their role in the cave ecosystem.

Snails

Nine terrestrial gastropods belonging to five families make up the molluscan fauna associated with Maryland caves. No aquatic or troglotic species are known. In Washington County caves, *Triodopsis albolabris* and *T. tridentata juxtidens* (family Polygyridae) are regularly encountered; other species which are occasionally collected in this county include *Anguispira alternata angulata* and *Helicodiscus parallelus* (both in family Endodontidae), *Haplotrema concavum* (family Haplotrematidae), *Helisoma anceps* (family Planorbidae), *Stenotrema hirsutum* (family Polygyridae) and *Gastrocopta armifera* (family Pupillidae). *Mesomphix inornatus* (family Zonitidae) apparently replaces *Triodopsis* in Garrett County caves.

Crustaceans

Fourteen species of crustaceans have been reported from Maryland caves. Of these, only two, *Haplophthalmus danicus* (family Trichoniscidae) and *Cylisticus convexus* (family Oniscidae), are typical

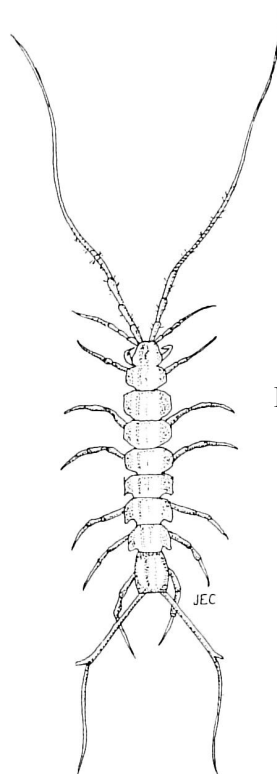


Figure 15. Isopod (10 mm).

surface dwelling terrestrial isopods (Fig. 15). These "sowbugs" are abundant in several Washington County caves in decaying logs, on damp clay, and under rocks.

One epigeal and two troglobitic species of fresh water isopods have also been recorded. *Asellus pricei* (family Asellidae), a common inhabitant of subterranean waters in the Great Valley of Pennsylvania, Maryland and Virginia, is commonly seen in caves but apparently is not restricted to them. The ability of this troglobite to use regional subterranean water courses as dispersal routes may account for its extensive distribution (Steeves, 1969; Holsinger and Steeves, in prep.). A second subterranean asellid, *Asellus franzi*, has been found in Crabtree Cave in Garrett County. This species is also known from Millers Cave, Centre County, Pennsylvania, and resembles certain species observed in caves of the Interior Low Plateau area farther west (Steeves, (1969; Holsinger and Steeves, in prep.). An epigeal species of *Asellus* has been collected in several small limestone springs in Washington County which open onto the Chesapeake and Ohio Canal.

One epigeal and seven troglobitic species of amphipods (Fig. 16) (family Gammaridae) are known. These crustaceans can be readily distinguished from isopods by their laterally flattened bodies. Isopods are flattened dorso-ventrally. *Crangonyx dearolfi*, *Stygonectes gracilipes* and an undescribed species of *Stygobromus* are known from caves in Washington County (east of Conococheague Creek). Both *Crangonyx* and *Stygonectes* are represented by large species, while the species of *Stygobromus* is a diminutive form. *C. dearolfi* which also occurs in caves in Berks and Dauphin Counties, Pennsylvania (Holsinger, pers. comm.) has been reported from Hogmaw, Cave-in-the-Field and Natural Well. It occurs sympatrically with *Stygobromus* sp. only at

Hogmaw. *S. gracilipes* is known from Dam No. 4 and Jughtown; this species has also been reported by Holsinger (1967, 1969) from caves in Pennsylvania, Virginia and West Virginia. The undescribed species of *Stygobromus* also occurs sympatrically with *S. gracilipes* in Dam No. 4 Cave. At no point do the two largest species occur together. Only the epigeal amphipod, *Grammarus minus*, has been found in western Washington County caves (west of Conococheague Creek). Possibly the Martinsburg Shale prevents the troglobitic species from penetrating into the western Valley and Ridge limestone.

The genus, *Stygonectes* is represented in the subterranean waters of the Allegheny Plateau in Garrett County. Two species, *Stygonectes allegheniensis* and *S. emarginatus* occur syntopically in John Friends Cave. Water from this cave and from the surrounding countryside flows into the Youghiogheny River, a tributary of the Ohio River. In this cave, *S. emarginatus* is much less abundant than *S. allegheniensis* (Holsinger, 1967). An undescribed species of *Stygonectes*, apparently closely related to *S. emarginatus*, is known from Crabtree and Sand Caves (Holsinger, in litt.). The waters from both of these caves eventually flow into the Potomac River. At Sand Cave, the species is confined to shallow, silty-bottomed pools in the rear of the cave; specimens from Crabtree Cave are known from deeper drip pools. A specimen of an undescribed species of *Stygobromus* was collected in a small, muddy-bottomed stream in Crabtree Cave. Apparently this species is very rare in this cave. The crayfish, *Cambarus bartonii* (family Astacidae), is known from several caves in eastern Washington County. A specimen of this pigmented crayfish was found feeding on a large larva of the northern dusky salamander, *Desmognathus fuscus fuscus* in the rear of Hogmaw Cave.

Insects

Collembolans

Five species of "springtails" or collembolans (Fig. 17) have been collected in Maryland caves. *Tomocerus flavescens* and *T. bidentatus* (both in family Entomobryidae) are abundant in wet caves of both Allegany and Washington Counties. *Sinella cavernarum* (family Entomobryidae) is known only from Hogmaw Cave. A species of *Ceratophysella* (family Entomobryidae), apparently belonging to the *communis*

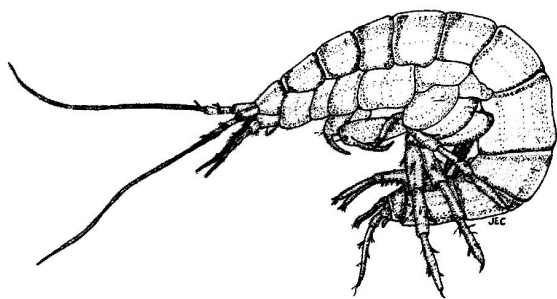


Figure 16. Amphipod (6 mm).

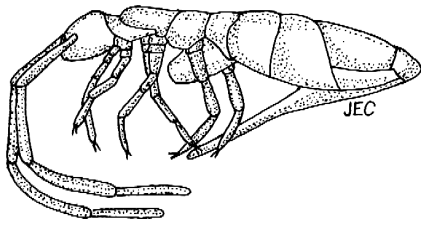


Figure 17. Collembolan (½ mm).

complex, has been collected in McMahoins Mill No. 2 Cave. The only troglobitic species which has been recorded is an undescribed form belonging to the genus *Arrhopalites* (family Sminthuridae). Specimens of this species were gathered from a wet stream passage in Crabtree Cave. Collembolans possess a unique structure called a furcula, used in jumping. This forked jumping apparatus is folded forward under the abdomen until it is needed to help the "springtail" to elude a potential predator. At this time the insect releases the clasp-like tenaculum which holds the furcula to the abdomen and the collembolan "springs" away. Usually these insects are abundant on damp clay and in dead leaves or rotten logs, but occasionally they are found on the surface of drip pools.

Flies

Thirteen families of flies have been collected but only five (Heleomyzidae, Phoridae, Mycetophilidae, Sciaridae, Culicidae) appear with any regularity. The heleomyzid flies are the most abundant and have been recorded in caves throughout the major limestone areas in the state. Members of this family can easily be recognized by their gray to brown coloration and by the heavy spines occurring along the anterior margins of the wings. The housefly-sized *Amoebaleria defessa* is probably the most common and widespread species of cave-associated Diptera. It has been collected from seventeen caves in Washington, Allegany and Garrett Counties. Specimens are especially abundant during the warm months but a few have been seen in winter. In January, several sluggish individuals were collected under a large rock in the rear of Howell Cave. *Heleomyza brachypterna*, *H. serrata* and *Aecothea specus* are abundant in the shallow Washington County caves but are not known from the deeper caves farther west. Evidence indicates that the heleomyzid flies (Fig. 18) may be able to complete their life cycles in caves, but until the larval stages are collected in caves and reared through to adults this will remain questionable.

Magasela cavernicola (family Phoridae) has been

found in three Washington County caves. On one occasion, specimens blackened the walls and ceiling above the remains of a squirrel in Snively No. 1 Cave. No larvae or pupal cases were observed in the carcass, however. They may have been congregating in this small alcove to deposit eggs on the remains. The flies of the family Phoridae are small, quick-running dipterans which characteristically have a hump-backed appearance and a distinctive wing venation.

The larvae and adults of the fungus gnat, families Mycetophilidae and Sciaridae, are abundant in caves which contain large quantities of organic material. The larvae, which spin mucus webs on the damp clay floor and over rotten wood, are elongate, white and usually translucent bodies. Most feed on fungus spores. The adults appear to be less abundant but this may be due to their small size. Unfortunately, the taxonomy of most Nearctic fungus gnat genera is confused (Laffoon, *in. litt.*) and none of the Maryland material has been identified.

Mosquitoes (family Culicidae) are particularly common in caves which open upon streams and rivers. Usually they do not feed while roosting in caves or at least they never attempted to bite us while we were investigating infested caves.

Besides the four listed above, several other families of Diptera were occasionally noted. These were Anthomyiidae, Calliphoridae, Dolichopodidae, Drosophilidae, Sacrophagidae, Spaeroceridae,

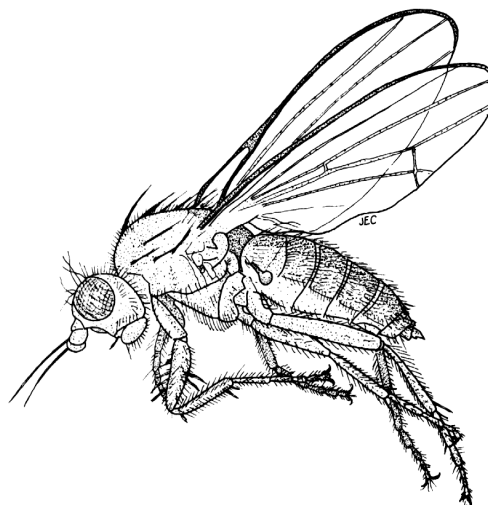


Figure 18. Heliomyzid fly (9 mm).

Syrphidae, Tipulidae and Trichoceridae.

Miscellaneous Insects

Banded cave crickets, *Ceuthophilus gracilipes* (family Gryllacrididae), are seen in caves throughout the limestone areas of the state. Since this species must return to the surface for food, the cricket could be used as a surface proximity indicator. Crabtree Cave, which is the state's longest and deepest cave, has cricket populations in two areas (at the entrance and the rear of the right passage) indicating closeness to an epigeal food source. Humus soils, terrestrial snails and flies also occur in these areas and help to substantiate this hypothesis.

The cave moth, *Scoliopteryx libatrix* (Fig. 19) (family Noctuidae), was found in eight Washington County caves but was not seen in the deeper caves farther west. During the winter months these brightly colored, two inch long moths retreat deep into caves. However, by the end of March, they are found congregating near the entrances. These moths which hibernate in areas where the relative humidity is near saturation are usually covered with droplets of moisture.

Beetles belonging to five families are occasionally seen. Dung beetles (family Scarabaeidae) and larval rove beetles (family Staphylinidae) are associated with fecal material; ground beetles (family Carabidae) and

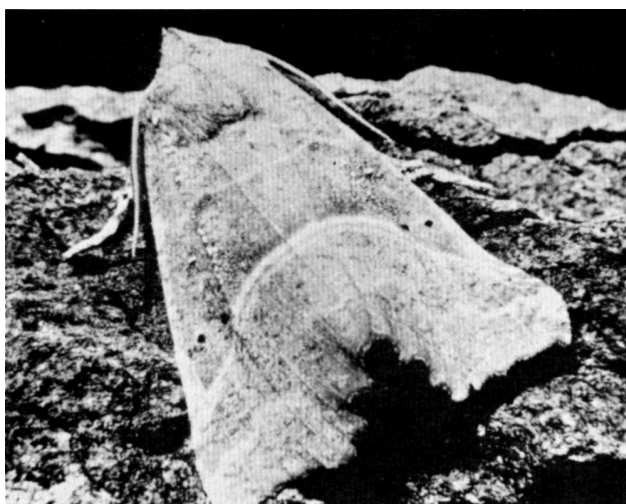


Figure 19. The cave moth *Scoliopteryx libatrix* is relatively common in Washington County caves during the winter months.



Figure 20. Spider (3 mm).

click beetles (family Elateridae), in organic material or wandering on the walls or floors; and long-horned beetles (family Cerambycidae), in fresh clippings from cave rat nests. Even though extensive trapping and Berlese techniques were employed, no troglobitic beetles were discovered. *Pseudanophthalmus* might be expected in western Maryland caves, as it occurs in nearby West Virginia and in one rare instance in a cave in southwestern Pennsylvania (Holsinger, *in litt.*).

Spiders and Harvestmen

Of the twenty species of spiders (Fig. 20) belonging to nine families, only five are found with regularity in Maryland caves. The cave orb weaver, *Meta menardii* (family Argiopidae), and the American house spider, *Achaearanea tepidariorum* (family Theridiidae), are the most obvious cave inhabiting species. The slightly larger *M. menardii* is abundant in Baltimore (Muma, 1946), Washington, Allegany and Garrett County caves whereas *A. tepidariorum* appears to be restricted to shallow Washington County caves. Both species are abundant near cave entrances but they also occur in the deeper portions of some caves and densities appear to be greatest in winter. In January, 1970, at Snivelys No. 2 Cave in Washington County, cave orb weavers were extremely abundant. At that time, a particular vertical rock face, ten feet square, housed 52 specimens. On a return visit in March this area contained only 16 individuals indicating a tremendous decrease in the spider population of this cave.

In early March, 1970, several silky egg sacs, approximately one half inch in diameter, of the cave orb weaver were observed in the rear of Sand Cave in Garrett County; one of them contained 162 spiderlings. A week later at Snivelys Caves in Washington County

other egg sacs were in the process of hatching; one of these contained 211 young spiders. By the last week in March, all sacs were empty at both locations.

Both *M. menardii* and *A. tepidariorum* are known to feed on the dipterans, *Amoebaleria defessa* and *Culex* sp.; in addition, webs of *M. menardii* are found to contain millipedes, *Ophiulus pilosus* and *Nopoiulus* sp., and juvenile slimy salamanders, *Plethodon glutinosus glutinosus*.

Six species of sheet web weavers and dwarf spiders (family Linyphiidae) have been collected. *Porrhomma cavernicolum*, a troglobitic species, was obtained from leaf litter in Snivelys No. 2 Cave, Washington County; additional specimens were gathered from under bark of decaying logs in Devils Hole and Fort Hill Fissure No. 2 Caves, Allegany County. Holsinger (1963), suggested that this species may be predacious on collembolans. At both Allegany County localities, this spider was associated with two species of the springtail genus, *Tomocerus*. Two female specimens of an apparently undescribed species of *Oreonetides* (Gertsch, *in litt.*), were collected from leaf litter in the Snivelys No. 2 Cave. Both specimens had no pigment and reduced eyes and they may be troglaphiles or possibly even troglobites (Gertsch, *in litt.*). Leaf litter collections from three other Washington County caves revealed specimens of *Ceratatinopsis interpres*, *Eperigone tridentata*, *Lepthyphantes sabulosus* and *Sciastes terrestris*.

The troglaphilic cave spider, *Nesticus pallidus* (family Nesticidae), has been collected in five Washington County caves and in Fort Hill Fissure No. 3 in Allegany County. These rather small spiders, which occasionally have a greatly reduced eye structure (Holsinger, 1964), are abundant in and around

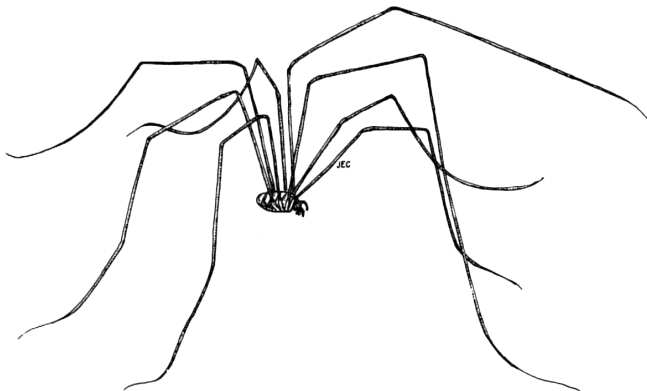


Figure 21. Phalangid (harvestman).

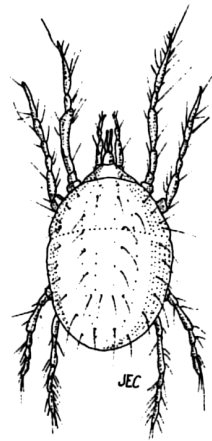


Figure 22. Mite (1/4 mm).

decaying wood and corn cobs. These spiders also may prey on collembolans. Other families of spiders which occasionally are found in Maryland caves include Agelenidae, Amaurobiidae, Anyphaenidae, Clubionidae, Pisauridae, Salticidae, and Thomisidae.

Phalangids, harvestmen or daddy-long-legs (Fig. 21) are names that apply to a "spider-like" arthropod which occasionally wanders into Maryland caves. These creatures are characterized by a short oval body which is divided into cephalothorax and abdomen, very long and delicate legs, two eyes situated on a tubercle near the center of the cephalothorax and a pair of scent glands. Two species are found in the state's caves. *Phalangodes acanthina* (family Phalangodidae), a troglaphilic species, was collected from decaying walnut shells in Hogmaw Cave, Washington County, and three sub adults of the troglaphenic *Leiobunum bicolor* were recorded from the twilight zone of John Friends Cave, Garrett County by Muma (1944b). On numerous occasions, dozens of daddy-long-legs have been observed on the wet walls in the rear of Sand Cave which is also in Garrett County.

Mites and Pseudoscorpions

Several undetermined species of mites, family Parasitidae, are known from Mt. Aetna Cave in Washington County (Muma, 1946), Crabtree and Old Salamander Caves in Garrett County. Several tiny mesostigmatid mites were obtained from leaf litter collections in Bowmans Addition Cave, Allegany County. Mites are small, eight-legged creatures (Fig. 22) with a membranous or leathery integument. Sometimes hard plates or shields may be present. One specimen of the pseudoscorpion, *Apochthonius* probably *moestus* (family Chthoniidae), was collected in leaf litter from Rocky Gap Cave in Allegany County.

Pseudoscorpions (Fig. 23) are like miniature scorpions except they lack the tail and the stinger. Since Berlese apparatus has been used frequently on Maryland cave litter and since very few mites or pseudoscorpions have been obtained, it must be assumed that these small but fascinating arthropods are extremely scarce in caves in this area.

Centipedes and Millipedes

Centipedes are uncommon in the state's caves. Only one genus, *Scutigera*, (family Scutigeridae), is found with any regularity. Specimens are usually seen on walls in association with the cave fly, *Amoebaleria defessa*; possibly these chilopods are predacious on the dipterans.

Millipedes (Fig. 24) form a conspicuous portion of Maryland's cave fauna. These arthropods differ from centipedes by having two pairs of legs on most body segments; centipedes, have only one pair. Seventeen species belonging to nine families have been collected, and of these only two – an undetermined species of *Pseudotremia* (family Cleidogonidae) and an apparently undescribed species of *Nopoiulus* (family Nemasomidae), appear to be troglobites. Specimens of *Pseudotremia* (females only) were collected in baited traps at Hogmaw and Schetromph Caves, Washington County. Apparently this genus which is widely distributed in caves in eastern North America reaches its northern limit here. According to Causey (*in litt.*), population densities of this group of millipedes are extremely low on the periphery of their range. Specimens of the new species of *Nopoiulus* were found on rotten wood in Fairview and Bowmans Caves, Washington County. Two other members of



Figure 24. Millipede (45 mm).

this genus were also obtained. A huge colony of *N. venustus* exists in Red Hill Cave, Washington County, where they are abundant on the organic remains of an old whiskey still – barrel staves and corn cobs. Two hundred and twenty-six millipedes were seen with the greatest concentrations occurring approximately sixty feet inside the cave. At this point the soil and the organic debris were saturated with water. Small populations of this species, along with *N. minutus*, were found in Hogmaw Cave, Washington County. Both of these troglaphiles were introduced from Europe.

According to Causey (*in litt.*), western Maryland is the distributional center for the genus *Conotyla* (family Conotylidae). In Maryland the troglaphilic *C. vaga* has only been collected in the Great Valley caves of Washington County. *C. gracilis*, *C. venetia tertia* and *C. villosus* are known from caves around Flintstone and Cumberland in Allegany County. A related family, Trichopetalidae, is represented by *Flagellopetalum appropinquo* in Hogmaw Cave where it is associated with *N. minutus*, *N. venustus* and *Pseudotremia* sp.

The troglaxene, *Ophiulus pilosus* (family Julidae), was obtained from leaf litter and rotten wood in five Washington County caves. Other species which are known include: *Dixidesmus* sp., *Pseudopolydesmus serratus*, *Scytonotus granulatus* (all members of the family Polydesmidae), *Narceus annularis* (family Spirobolidae), *Oriulus delus* (family Paraiulidae) from Washington County caves; *Dixidesmus branneri* from Allegany County caves; and *Nemasoma* sp. (family Nemasomidae) and *Abacion magnum highlandense* (family Lysiopetalidae) from Garrett County caves.

Fishes

The northern mottled sculpin, *Cottus bairdii* (family Cottidae), is an occasional cave visitor and has been frequently seen in Hogmaw and Houpt Caves. Sculpins are easily identified by their enlarged heads, slimy bodies and large pectoral fins. Large rainbow trout, *Salmo gairdneri* (family Salmonidae),

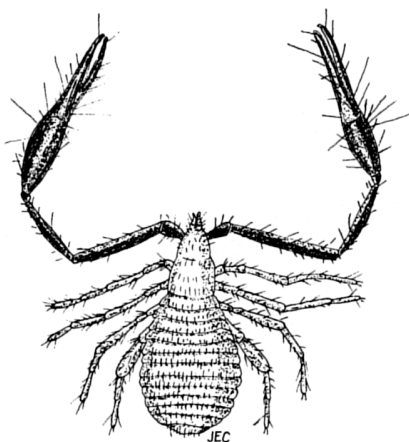


Figure 23. Pseudoscorpion (3 mm).

are known to use Murley Branch Spring Cave and are protected by the cave owner. Several yearlings were seined from mats of floating watercress near the cave entrance indicating that this may represent a reproductive colony.

Salamanders and Frogs

Of the ten species of salamanders and six species of frogs that have been observed, only the long-tailed salamander, *Eurycea longicauda longicauda* (fig. 25) (family Plethodontidae), may be troglophilous. The other species may either wander into caves accidentally or seek them as temporary shelters. Amphibians, which use cracks and fissures for aestivation or hibernation, particularly the red-backed salamander, *Plethodon cinereus cinereus* (family Plethodontidae) and the slimy salamander, *Plethodon glutinosus glutinosus* (family Plethodontidae), occasionally penetrate into shallow caves.

Some populations of long-tailed salamanders are known to retreat into certain Maryland caves during August and September where they mate and lay their eggs. Eggs have been collected in late November in Dam No. 4 Cave (Franz, 1964), but the egg-laying period probably extends from September through January (Franz, 1967). Larvae which measure 18 or 19 mm at hatching are found in caves as early as December. Adults apparently leave their subterranean retreats in April. The yellow color, long tail and dark vertical bars on the tail will serve to distinguish this

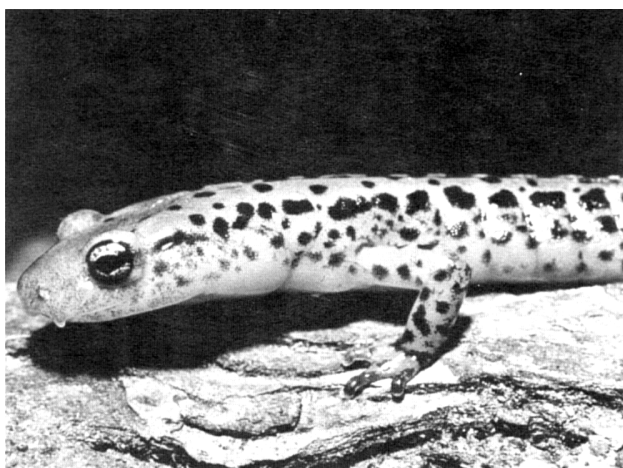


Figure 25. The Long-Tailed Salamander (*Eurycea longicauda*) is the only troglophilous salamander in Maryland caves.

species from other Maryland salamanders. The gilled larva has a light dorsal stripe and dark sides. On two occasions aberrant adult specimens were seen. Four individuals from Schetromph Cave showed a reduction in the normal amount of dark pigment (Franz, 1967); one specimen from Dam No. 4 Cave revealed excessive melanophore concentrations and may represent an example of pattern neoteny.

In the southern part of its range, the slimy salamander frequently invades caves for egg-laying and aestivation (Cooper, *in litt.*), but apparently this is not the case in Maryland. Adults are occasionally encountered during the fall and winter months. In April and May juveniles are abundant near the entrance to Hogmaw Cave. Frequently they fall prey to several types of twilight zone predators, particularly the cave spider, *Meta menardii*. The slimy salamander is a large black species with numerous white spots or flecks scattered over its dorsum. Occasionally the flecks may be concentrated on the sides.

Specimens of the red-back salamander have been observed in caves from October through March. This small plethodontid salamander has two major color patterns, a red striped phase and a lead-gray phase. The species appears to be absent from Allegany County (east of Cumberland) and western Washington County (west of Licking Creek), where it is replaced by the ravine salamander, *Plethodon richmondi richmondi* (family Plethodontidae) (Harris, 1969). The ravine salamander, which is similar to the lead-gray phase of *P. c. cinereus* except for a higher costal groove count, should be encountered in caves near Flintstone and Twigtown.

The larvae of the northern spring salamander, *Gyrinophilus porphyriticus porphyriticus* (family Plethodontidae), and the northern dusky salamander, *Desmognathus fuscus fuscus* (family Plethodontidae), are often seen in Hogmaw and Jugtown Caves. Adults of the latter species are known from Darbys, Fairview and Houpt Caves. The Allegheny Mountain salamander, *Desmognathus ochrophaeus ochrophaeus* (family Plethodontidae), is restricted to streams on the Allegheny Plateau (Harris, 1969), and should occur in Garrett County caves. Specimens from Sand Cave were collected under rocks in the twilight zone and also in the small stream in the rear of the cave. The adult red-spotted newt, *Notophthalmus viridescens viridescens* (family Salamandridae), has been found in Devils Hole twice. Since this species occurs abun-

dantly in ponds above the cave, these newts were probably washed into the sinkhole entrance. The northern two-lined salamander, *Eurycea bislineata bislineata* (family Plethodontidae), and the northern red salamander, *Pseudotriton ruber ruber* (family Plethodontidae), have both been collected in two Washington County caves. Spotted salamanders, *Ambystoma maculatum* (family Ambystomidae), were obtained from two Garrett County caves, John Friends Cave and Muddy Creek Falls Shelter (Nicholas, *in litt.*).

Certain frogs and toads have been encountered at the entrances of caves; a few species occasionally venture deeper. Small populations of pickerel frogs (Fig. 26), *Rana palustris palustris* (family Ranidae), are known to invade subterranean retreats during the fall months. In each instance the cave entrance opens onto a large stream or river. Groups of 20 or more individuals have been observed in the rear of Dam No. 4 Cave. Smaller aggregations have been seen in Snyders Landing and Fairview Caves. The pickerel frog can easily be recognized by the two rows of "square" spots on its back and by the bright yellow or orange coloration on the concealed surfaces of the hind legs.

Green frogs, *Rana clamitans melanota* (family Ranidae), are known to invade Hogmaw Cave in the early spring. On several occasions, specimens had positioned themselves around the entrance pool and when disturbed they retreated to its silty bottom. Once a large frog was captured from the lake in the rear of the cave. Green frogs have also been retrieved from the rear of Devils Hole, but probably were carried in by flood water. The dorso-lateral folds and the drab,



Figure 26. Small populations of the Pickerel Frog inhabit some Maryland caves during the fall months.

greenish-brown dorsum of this species will serve to distinguish it from other Maryland frogs.

Spring peepers, *Hyla crucifer crucifer* (family Hylidae), and american toads, *Bufo americanus americanus* (family Bufonidae), were twice taken in Devils Hole. They may have fallen into the steep-walled sink during spring breeding migrations to nearby ponds. Specimens of the leopard frog, *Rana pipiens pipiens* (family Ranidae), and the wood frog, *Rana sylvatica sylvatica* (family Ranidae), have been found on two occasions; each time they appeared to be emaciated.

Snakes and Turtles

Reptiles sometimes wander into caves but their presence there is usually accidental. On one occasion, however, this may not have been the case. Several black rat snakes, *Elaphe obsoleta obsoleta* (family Colubridae), were observed among speleothems on the ceiling of a room in the rear of Dellingers Cave. When one of the larger individuals was captured, it immediately regurgitated a pipistrelle bat, *Pipistrellus subflavus*. Since there is access to this room through a small hole from the outside, the rat snake may be intentionally entering the cave to feed. Several *Elaphe* were also observed in Sand Cave but at this time no bats were found. This species was seen in Stegmaier's Orchard Cave but had probably wandered into the cave accidentally (Nicholas, pers. comm.).

The northern water snake, *Natrix sipedon sipedon* (family Colubridae), has been seen in Murley Branch (Muma, 1946), Grove and Dellingers Caves, but it is probable that the snakes had accidentally wandered in. In December, a dead specimen of the eastern garter snake, *Thamnophis sirtalis sirtalis* (family Colubridae), was discovered inside Allegany High School Cave. No poisonous species have been recorded in Maryland caves, but the copperhead, *Agkistrodon contortrix mokasen* (family Crotalidae), is occasionally encountered around the rocky ledges near cave entrances. Particular caution should be taken near Crabtree, Fort Hill and Round Top Caves.

An adult wood turtle, *Clemmys insculpta* (family Testudinidae), was found in a side passage of Revells Cave, approximately 35 feet inside. Apparently it wandered in and then became lost. The specimen was near death. In August several eggs of this species were col-

lected among some flood debris in the rear of Darbys Cave. The embryos were fully developed. Cooper (1960) reported finding an eastern box turtle, *Terrapene carolina carolina* (family Testudinidae), in the same cave.

Mammals

Raccoons, eastern wood rats and six species of bats are known to frequent the caves of the state. The raccoon, *Procyon lotor* (family Procyonidae), apparently uses caves as temporary shelters. Occasionally individuals may wander too far into the blackness and become lost. Foot prints, claw marks and the decomposed bodies of these animals have been found in Stegmaier, Wilson and Winders Caves.

The eastern wood rat, *Neotoma floridana magister* (family Cricetidae), is often encountered in caves. Although "cave rats" are seldom seen by cavers, their presence may be conspicuous, particularly in the fall when they are busily storing rations for the winter and building nests. Tremendous quantities of grasses, sumac fruits and leaves, apples, mushrooms, various composites, and shiny objects are hauled into the cave. On one occasion a pair of eyeglasses was carried off while the owner slept in the mine at Crabtree. During the next day the glasses were recovered on a shelf, high in a fissure in the adjoining cave, several hundred feet from the closest possible connection to the mine. Populations of these large, docile rodents have declined considerably during the last ten years due to vandalism and systematic poisoning. Since these rodents forage over large areas surrounding their subterranean retreats, nearby orchards may suffer slightly. Some "orchardmen" are beginning to use chemical sprays to curb this foraging. Since one apple may be shared by several individuals, mass poisoning might occur and bring about final extinction to those populations.

The most numerous cave mammals in Maryland are bats (family Vespertilionidae), of which six cave-dwelling species have been reported. These are the big brown bat, *Eptesicus fuscus fuscus*; Keen's bat, *Myotis keeni septentrionalis*; little brown bat, *M. lucifugus lucifugus*; social or Indiana bat, *M. sodalis*; small footed bat, *M. subulatus leibbii*; and eastern pipistrelle, *Pipistrellus subflavus subflavus*. The pipistrelle is the most frequently encountered and is widespread throughout Maryland. This species can readily be distinguished from all other Maryland bats

by its pink forearms. Dew droplets which often accumulate on the fur will also aid in its identification. Big brown bats, which are the largest cave bats in the state, and little brown bats are both abundant only during the winter months. Apparently the big brown bats can tolerate less humidity and cooler hibernating temperatures and select roosts near entrances of caves. Other species tend to congregate deeper in caves where climatic conditions are more stable. Keen's bat and the small footed bat are apparently rare and have only been reported from the Round Top area (Paradiso, 1969). The social bat is known from Round Top Mines and from John Friends Cave.

During the summer, bats may use caves as daylight retreats and forage at night in the surrounding countryside. The ability of bats to navigate by echolocation in total darkness enables them to find their way through intricate cave passages and to capture nightflying insects outside the cave. Recent investigations revealed that after a route has been established in a cave, bats will tend to rely on memory. During the warm months, bats may utilize several caves within a given area. Although bats may not be in a particular cave when it is visited, they usually leave obvious signs of their presence. Guano deposits under summer roosts and reddened areas on the ceiling indicate the position and size of roosts. In winter, bats may seek caves which are different from those utilized in the summer and nursery colonies may utilize still other caves. The caves must be cold enough to produce and maintain proper hibernating temperatures. This requires a cave of moderate size with downward sloping entrance passages to capture and retain the heavy, cold, night air.

Since bats are both unique mammals and superior insect exterminators they should be protected. Recent population studies indicate that many species are rapidly decreasing in numbers. The indiscriminate use of insecticides may be the primary reason for such significant drops. Another major cause could be the purges on colonies roosting or hibernating in caves. People, misguided by over-publicized rabies scares, have burned, stoned or clubbed many dormant bats. Other causes may be the entering of bat caves by cave explorers or the sealing of cave entrances by land owners, which may prohibit the bats' access to the only hibernating cave in the area. If hibernating bats are frequently disturbed they will rapidly use up stored fat supplies and starve before emerging in the spring.

Constant harassment will cause summer colonies to temporarily or permanently vacate a particular cavern. Bats thus displaced will be forced to compete with other resident colonies for roosting sites and feeding areas. The disturbance of a summer maternity colony often results in the accidental death of a large percentage

of the year's young. Keeping clear of roosts, not making loud noises in "bat rooms", and avoiding prolonged illumination of bat clusters are simple courtesies which will help to insure survival of these unique flying mammals.

CAVE DESCRIPTIONS

ALLEGANY COUNTY

Allegheny High School Cave

Allegheny County, Cumberland Quadrangle

Location: SE 2/7/3

Elevation: 770

On the south side of Wills Creek approximately 150 feet above the stream, there is a small crawlway about 20 feet long. This cave is in the Wills Creek Shale.

Atheys Cave

Allegheny County, Flintstone Quadrangle

Location: SW 3/2/2

Elevation: 1230

This cave is located near the town of Rush and is on the property of Ronald Bluebaker. The entrance is on a wooded hillside approximately 150 yards east of an old barn.

History: ²

Little concerning the history of the cave could be ascertained except that it has been open for exploration for at least a generation. The oldest date within the cave is 1943, but reports indicate that thorough investigations were made about 40 years ago.

Geology: ²

The cave is developed in the lower part of the Tonoloway Formation, approximately 100 feet above the base. The Tonoloway is a massive to blocky, blue-black, pure limestone with a gentle dip of 20° to the southeast and a strike of N 30° E. The cave is developed along sets of vertical joints. The major set trends N 20° E to due north. Minor joints are developed along the trend N 70° W. The cave is located on a series of subordinate folds on the east limb of the larger Tussey Mountain anticline.

Description: ²

The entrance to the cave is inconspicuous and very small, consisting of a sloping pit about 6 feet deep and 4 feet in diameter. The walls of the pit are platy

² reproduced from Davies (1950).

CONVENTIONAL SYMBOLS FOR CAVE MAPS

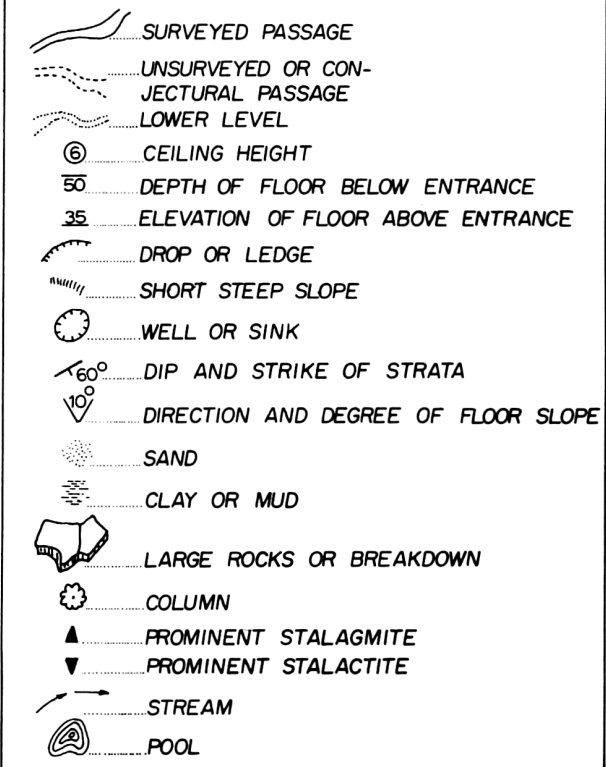


Figure 27. Symbols for cave maps.

weathered limestone, that, though loose, is not dangerous as the plates are interlocked. The base of the pit is covered with orange-brown clay and leaves.

The passage connecting the entrance and the first room is difficult to traverse. It consists of a narrow crevice, 25 feet long, averaging one foot in width and with a height rising from two feet near the entrance to 10 feet at the first room. The walls of the passage are lined intermittently with coral and flowstone, and the floor is covered with leaves near the entrance and by broken rock towards the first room.

The first room is roughly triangular in plan with a gently sloping floor. The walls are vertical, and a gently sloping arch forms the ceiling 20 feet above the floor. The eastern wall is covered with heavy flowstone and intricate cave-coral formations. The room is 30 feet long, 11 feet wide at its widest part, and 25 feet below the entrance. Connecting the first room with the Cathedral Room is a narrow crawlway at floor level. The tunnel, five feet long, one or two feet wide, and less than two feet high, is typical of the connecting passages in the cave.

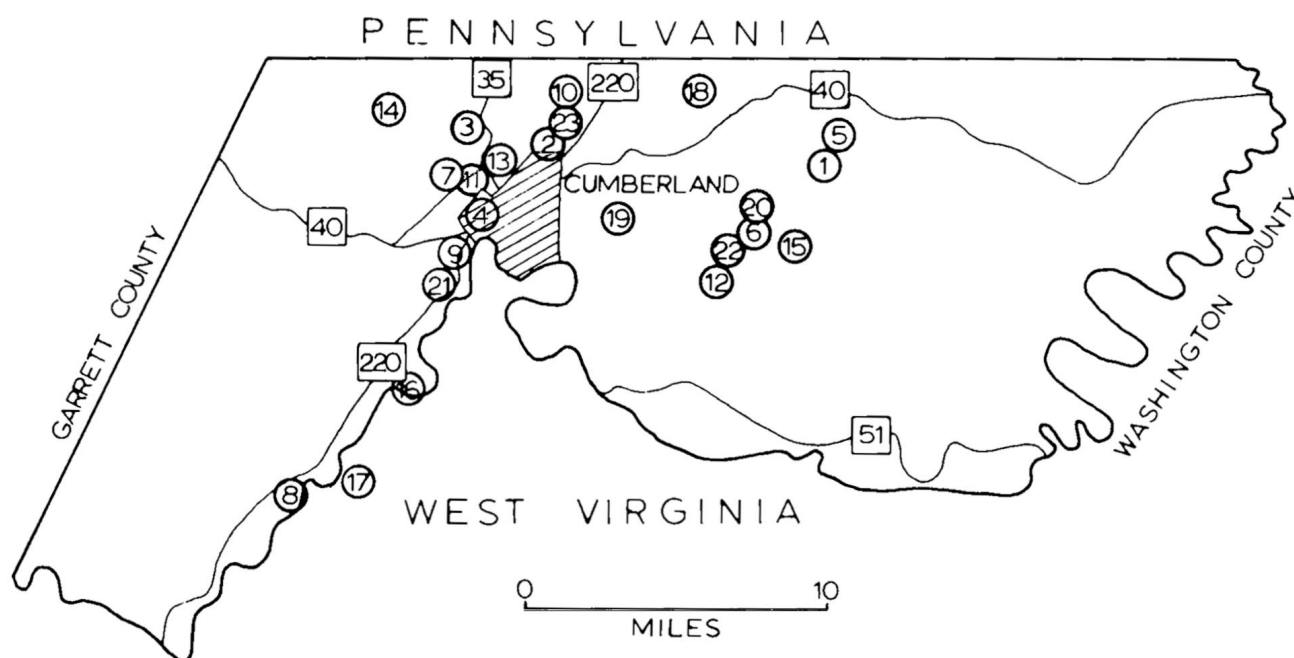


Figure 28. Distribution of caves in Allegheny County: 1)Atheys 2)Bowmans Addition 3)Cumberland Bone 4)Cumberland Quarry 5)Devils Den 6)Devils Hole 7)Dressmans 8)Fort Hill Fissures 9)Goat 10)Greises 11)Haystack Mountain 12)Horse 13)Lovers Leap 14)Mt. Savage Road 15)Murley Branch Spring 16)Pinto Mines 17)Rhodes 18) Rocky Gap 19)Stegmaier Orchard 20)Tewell 21)Trash Pile Pit 22)Twiggs 23)Valley Road Quarry.

The Cathedral Room is similar in plan to the first room, being triangular in shape, 12 feet long and 9 feet wide. The ceiling is over 30 feet high and caps a lofty chimney. On the east side of the room is a small alcove a few feet above the floor that merges with the chimney at a height of 15 feet. The floor of the Cathedral Room is covered by a shallow pool of water, averaging three inches deep.

The Candle Room, separated from the Cathedral Room by narrow vertical slabs of rock at the base, merges with the Cathedral Room at a height of 10 feet. The room is 10 feet long and 8 feet wide at floor level. On the west side of the room is a narrow ledge on which a delicate and beautiful formation resembling a candle with a trail of wax drippings has developed.

The passage from the Candle Room to the third room is 8 feet long and large enough to walk erect in. It ends at a ledge 5 feet high at the entrance to the room.

The third room is oblate in shape with a length of 13 feet, a width of 7 feet, and a ceiling height of 8 feet. At the far end of the room are a number of stalactites and flowstone, forming one of the prettiest parts of the cave.

The passage from the third room to the end room is extremely difficult to negotiate, having a width of 1½ feet and a height of 2 feet, and ending in a ledge 5 feet high at the end room. The room is roughly triangular in plan with a length of 9 feet, a width of 6 feet, and a height of 6 feet. Along the east wall is a ledge of flowstone 3 feet above the floor, that is covered with stalactites at the far end. The floor is covered with rock debris with a shallow pool of water at the far end. A narrow, low, curving passage leads off at the end of the room, but it is too small to permit further exploration.

The temperature of the air in the cave varied from 51° to 53°F. The humidity is 100 percent. The temperature of the water in the shallow pools was 48°F, and the water was weakly acidic with a pH in the range of 6 to 7.

Bowman's Addition Cave

Allegheny County, Cumberland Quadrangle
Location: EC 9/5/3
Elevation: 720

This cave is located in a quarry on the east side of

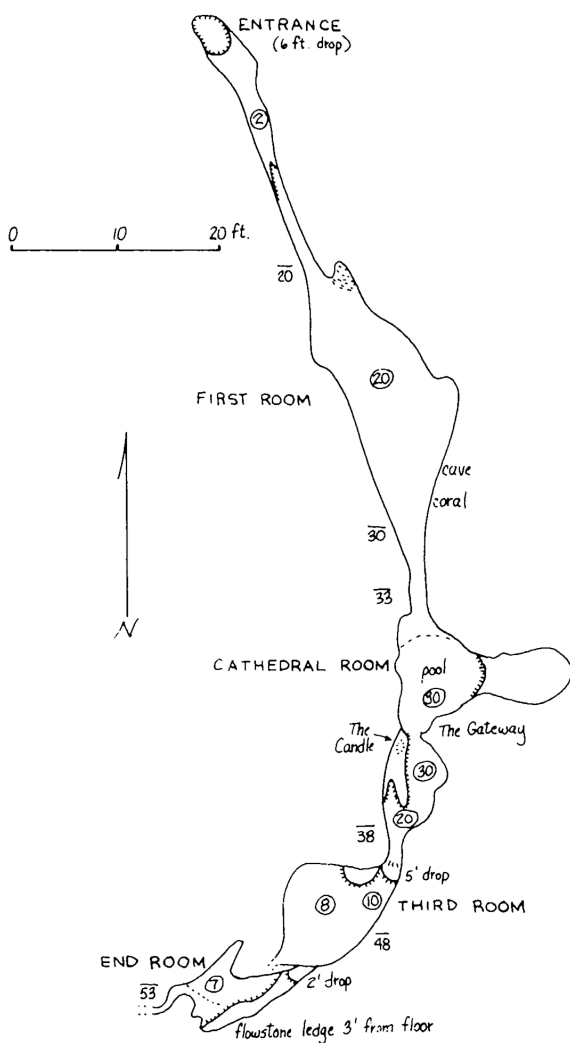


Figure 29. Atheys Cave, Allegany County. Surveyed by W. Davies and T. Richards, August, 1947.

Valley Road, south of Bowman's Addition. The entrance is a crawlway two feet in diameter and is filled with leaves. The passage slopes down for ten feet into a room 20 feet high, 40 feet long and 20 feet wide. The room trends S. 35°W. along the strike and is controlled in cross section by the bedding. Midway through the room is a high tube or chimney which is inclined along the beds at 60° on the right side of the room. It extends upward for at least 35 feet, but becomes too narrow to follow further. This cave is developed in the Tonoloway Limestone, dip 60° SE, strike S. 35° W.

Cumberland Bone Cave

Allegany County, Cumberland Quadrangle

Location: EC 4/1/8

Elevation: 840

In 1912, the Western Maryland Railway cut through Andy's Ridge near the town of Corriganville exposing a small cave. The clay and breccia in the cave were found to contain a "remarkable assemblage of Pleistocene vertebrate remains" (Davies, 1950). Between 1912 and 1915, J. W. Gidley of the U.S. National Museum recovered the remains of 46 species of animals including 28 thought to be extinct. In early 1950's Brother G. Nicholas discovered an additional passage on the north side of the cut which also contained bones. In 1952, with the cooperation of the Western Maryland Railroad, Nicholas excavated more fossil material. For a detailed account of Gidley's and Nicholas' discoveries and for a vivid discussion of the significance of their discoveries, the authors refer you to pages 172 to 180 in *Celebrated American Caves* edited by Charles E. Mohr and Howard N. Sloane.

Today very little of this cave still exists. Remnants may be seen on the south wall of the railway cut at the level of the roadbed, 100 feet below the original surface, and at the top of the north wall. According to Davies (1950), several small chambers were encountered at higher levels during the excavation of the cut including one which was reported to have connected with the surface at the top of the hill. The cave was developed in the Keyser Limestone which at this point is vertical (Davies, 1950).

Cumberland Quarry Cave

Allegany County, Cumberland Quadrangle

Location: SE 2/7/3

Elevation: 700

Cumberland Quarry is on the south side of Wills Creek, opposite Valley Street, in Cumberland. Two crawlways less than 20 feet long are developed in the east face of the quarry. The caves are in the Wills Creek Formation that is closely folded here into a series of anticlines and synclines.

Devils Den

Allegany County, Flintstone Quadrangle

Location: C 4/3/7

Elevation: 1030

The cave is located south of Flintstone on the farm of Harry Jackson. The entrance which is on a wooded hillside is easily reached by following the strike of the rocks northeast from the large spring near the house.

History: ²

Like many small caves the history of Devils Den is rather obscure. The cave has been well known to residents of Flintstone and, like Goat Cave, it has been the favorite play place for children for many years. No dates of any historical value occur in the cave.

Geology: ²

Devils Den is developed in the top part of the Tonoloway Limestone. The limestone is dense, fine-grained, platy, dark gray to black in color, and occurs in beds about one inch thick alternating with some massive beds. The dip is 70° E and the strike N 40° E. The cave is developed along the steeply-dipping bedding planes, and jointing is obscure and plays a minor part. The structure in which Devils Den occurs is on the west limb of a subordinate syncline on the eastern limb of a large anticline.

The cave is tied closely to the branch of tributary to Murley Branch at the Jackson residence. This stream flows underground for about one mile along a course that directly follows the strike of the rock with elevation difference of 20 feet from Flintstone to the spring. About one-half the drainage flows underground; the remainder follows the longer course of Flintstone Creek through Gilpin to a point where it joins Murley Branch, about 3 miles from Flintstone. Devils Den lies directly above the underground course and is probably a part of the network.

Description: ²

The entrance to Devils Den is through a rectangular sinkhole about 10 feet long by 5 feet wide with a drop of 10 feet. Entrance is best gained along the southeast edge where ledges and a pile of debris make a very easy drop. Beneath the sink is a rectangular

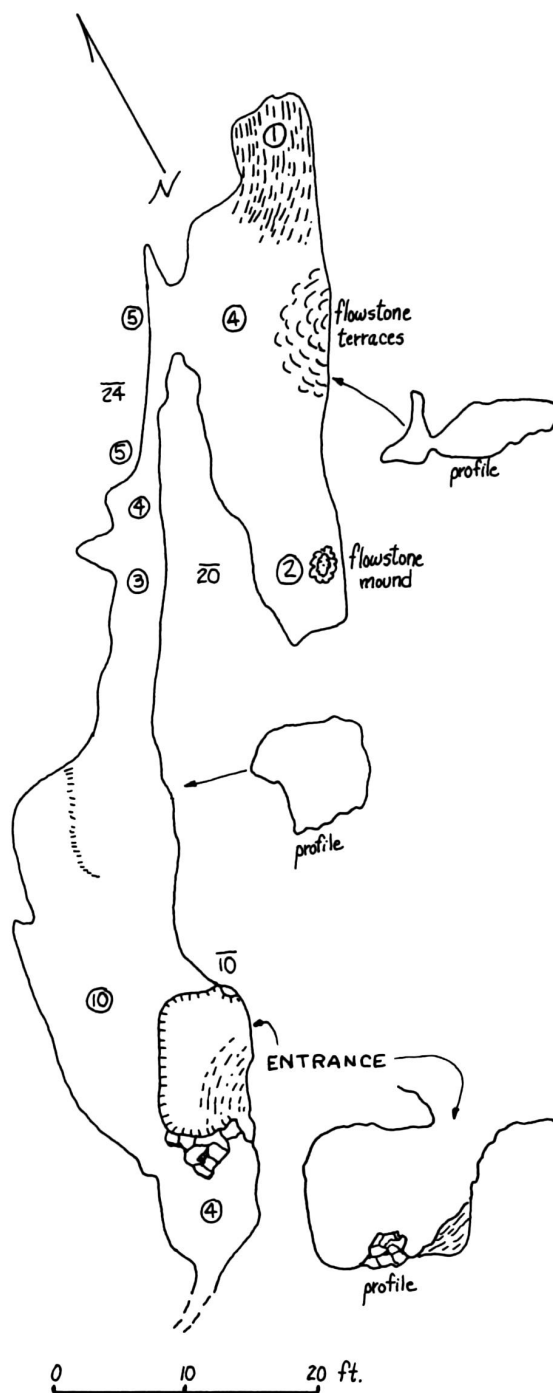


Figure 30. Devils Den, Allegany County.
Surveyed by T. Richards and W.
Davies, November 9, 1947.

room about 18 feet long and 15 feet wide with a ceiling height of 8 feet. Leading northeastward and gently sloping is a passage that grows progressively smaller until it pinches out 55 feet from the entrance. The passage follows the bedding planes of the limestone, and the floor is covered with rough slabs of limestone that have peeled from the walls. At the far end of this

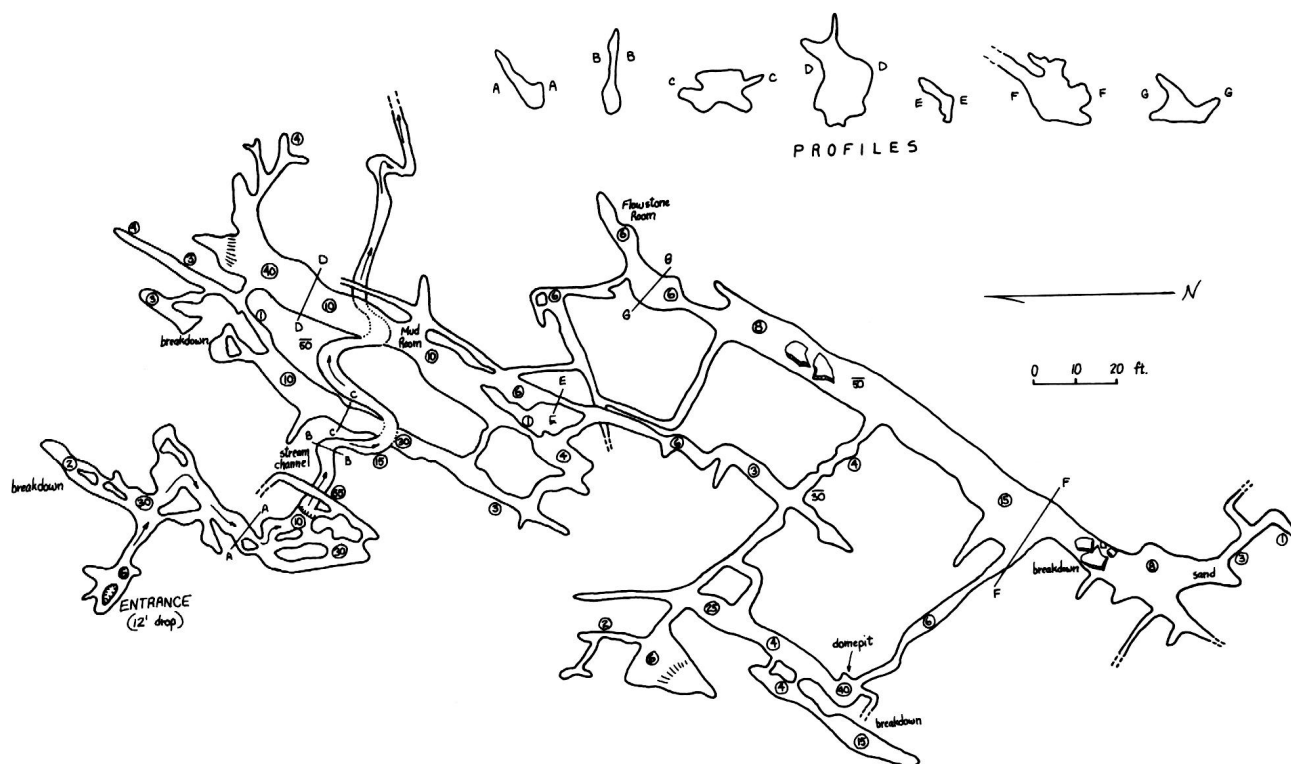


Figure 31. Devils Hole Cave, Allegany County. Surveyed by D. Slifer, R. Franz, R. Shockley, G. Leyman, and D. Rhodes, April, 1969.

passage is a low passage, 7 to 10 inches high and 6 feet wide, that opens eastward to a small room. The passage is close to the floor and is most difficult to negotiate. The room is about 45 feet long and is elliptical in shape with a maximum width of 12 feet directly opposite the connecting passage. The maximum height is 4 feet near the entrance, and the flat arched ceiling tapers gradually in all directions. The long axis of the room is parallel to the entrance passage. The north side of the room is filled with clay to within one foot of the ceiling. Flowstone in the form of small terraces is found along the east wall and is the only formation of any size in the cave.

Another passage extends southwest from the entrance. The opening into it is constricted by rock debris, and the entire passage is low. Beyond 10 feet it is a crevice too narrow to traverse.

Most of the cave is very dry and somewhat dusty. The floor at the far end of the entrance passage and in the side room is damp and has a thin film of wet brown clay. The ceiling throughout is of clean, unaltered limestone.

The cave is rather shallow. The main passage

drops only 27 feet which, combined with the entrance drop, gives a total drop of 37 feet. The surface rises only slightly along the axis of the cave.

Devils Hole Cave

Allegany County, Evitts Creek Quadrangle
Location: SE 5/2/2
Elevation: 1250

On the property of Marshall H. Tewell, on the west side of the Twiggstown-Flintstone road (Williams Road), northeast of Twiggstown, is one of the largest and most interesting Allegany County caves. The entrance is a narrow 12-foot shaft in the bottom of a large sinkhole which represents the head of a deep gully. During wet periods a small stream flows in this gully and seeps into the cave just before reaching the entrance. Although one can climb the shaft, a rope is extremely helpful.

Geology:

Devils Hole is developed in the Keyser Member of the Helderberg Limestone. The major passages follow strike joints along the same general strike of

the synclinal structure which extends to the southwest towards Twiggs and Horse Caves, with interconnecting passages being developed along the dip of the beds at the same inclination. Passage cross-sections are controlled by both bedding and joint plane intersection. The dip averages about 40° southeast, strike N. 35° east.

Description:

Devils Hole appears to be a combination of two different caves. The entrance shaft drops into an actively eroding stream passage which trends down dip for about 200 feet, while dropping 100 feet in a series of small waterfalls and cascades – to end in a siphon-crawl. The stream passage is typically a narrow fissure 10 feet to 30 feet high, but lowers gradually to a point which evidently floods to the ceiling occasionally. The stream generally ceases flowing in the summer.

Midway through its course this passage intersects at two points large passages constituting an upper level. These passages run roughly parallel and interconnect by narrow tubes or conduits which are inclined along the dip of the beds. They extend to the northeast for 60 to 100 feet but end in breakdown and clay fill. To the southwest (towards Twiggs and Horse Caves) and down gradient they encounter a series of four major tubes or conduits inclined at about 40° which slope down into a large trunk which is an abandoned stream channel. This old stream channel is typically 10 to 15 feet in diameter and is gravel floored. This passage is about 50 feet below the entrance (but still above the present stream, which may have served to pirate or behead this original watercourse). Large pieces of breakdown occur throughout this passage, as well as in the rest of the cave. The southwest end of the trunk terminates in a gravel and sand stream deposit which blocks the passage. Two of the "feeder tubes" encountered in the trunk passage may be followed updip through prodigious amounts of wet mud and small pools to an extension of the first upper level passage. Several vertical domepits ranging from 25 to 40 feet high are developed here. Fossil corals (*Favosites*) are exposed in the base of the largest one. Speleothems are rare in Devils Hole, but occur in scattered places as beautiful flowstone-covered walls and the usual stalactites and draperies. Slightly over one-fourth mile of passage was mapped in 1969.

Dressmans Cave

Allegany County, Cumberland Quadrangle

Location: C 9/8/4

Elevation: 760

Dressmans Cave is in the NW face of an abandoned quarry on the property of Mr. Orrie Sensabaugh of LaVale, Maryland. In 1969, the owner reported that he did not want people to visit the cave, especially children; consequently this cave should be considered as closed unless advance permission is obtained.

Geology:

The cave is developed in the Tonoloway Limestone which dips 23° S. and strikes S. 30° W. Fragments of speleothems on the quarry wall indicate that this cave was once more extensive prior to quarrying operations.

Description:

The cave is developed in the Tonoloway Limestone which dips 23° S. and strikes S. 30° W. floor. It opens to a short crawlway which drops into a 10 foot high fissure passage which continues for about 60 feet to the southwest and west. A small "skylight" entrance occurs in the ceiling of this first chamber. The terminal chamber is a high fissure which is almost divided into two different levels by breakdown and wall projections. It ends in a clay bank. Cave coral covers the walls and flowstone is developed in places, although blasting and vandalism has destroyed most of the few speleothems originally present. Although the blasting has fractured the walls in places, no hazardous breakdown seems to be present and the cave is relatively stable. The cave is rather dry except for the entrance during wet periods.

Fort Hill Fissure Caves

Allegany County, Lonaconing Quadrangle

Location: SE 5/1/9

Elevation: 1400

Three relatively deep fissure caves are located in wooded mountain land owned by the Potomac Edison Company, on the northern end of Fort Hill overlooking Rawlings.

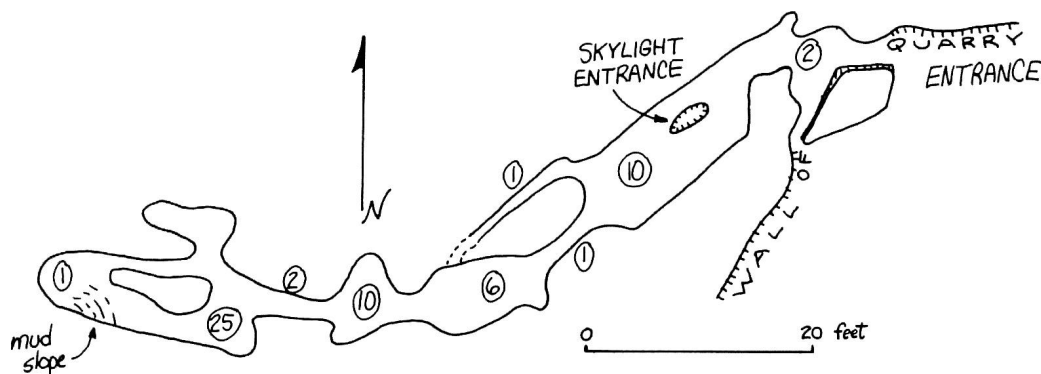


Figure 32. Dressmans Cave, Allegany County. Surveyed by D. Slifer, January 17, 1970.

The entrance to all three of these caves are within 450 feet of each other and align in a north easterly direction. The caves are relatively straight, narrow, featureless fissures with vertical entrances. They come fairly close to connecting with one another (see area map) and probably do, although the passages become impassable due to breakdown and narrowing.

All of the caves are joint controlled and are developed in horizontal beds of Helderberg Limestone (New Scotland Member). They apparently represent strike joints parallel to the axis of the anticline. The walls of these caves are incrustated with fossils (typical lower Silurian brachiopods, crinoids, and corals) and vast amounts of chert which forms projecting ledges and nodules. Speleothems, other than flowstone on the walls, are nonexistent. Although some solutional features are evident in places throughout these caves, their origin is probably tectonic, as witnessed by collapse features, relative paucity of clay or sediment, and unaltered joint planes in some places.

Description:

The caves are numbered in order from south to north. The No. 1 Cave entrance is at the base of a small sink 40 feet SE of the old logging road. It is one foot in diameter and opens to a typical high fissure, the floor of which slopes down very sharply for about 50 feet. At this point although the floor varies widely due to breakdown, the cave maintains a fairly constant level. The cave trends SW for approximately 350 feet. In places, the ceiling height reaches 50 feet or more, and the width averages about 10 feet. Isolated bats (*Pipistrellus*) were observed throughout the cave.

The No. 2 Cave has a double entrance, composed of two holes in the base of an elongate shallow sinkhole.

They drop 25 feet vertically into the center of a fissure passage. The major portion of the cave lies to the southwest at the base of a 16-foot drop.

The entrance to Cave No. 3 is also a small hole at the base of a shallow sinkhole. It drops 25 feet vertically to a 36° debris slope and trends to the NE for approximately 150 feet until it becomes too narrow to continue. Some rather large crinoid stem segments are weathered from the rock and are coated with a thin veneer of flowstone. Rope or cable ladder is necessary to negotiate the drops in these caves.

Goat Cave

Allegany County, Cumberland Quadrangle

Location: SE 4/5/9

Elevation: 720

At the end of Patterson Street in Cumberland is a small inconspicuous opening on the northwest side of the road. The opening is the entrance to Goat Cave.

History: ²

The cave has been known as far back as local residents can recall, and the entrance passage has long been a favorite play place for the children of the neighborhood. No dates or initials were seen within the cave which leaves no clues as to the times of former explorations.

Geology: ²

Goat Cave is developed in a steeply-dipping limestone bed in the Wills Creek Formation. The limestone is 10 feet thick and is sandwiched between beds of red shaly sandstone above and mottled, gray-green and red

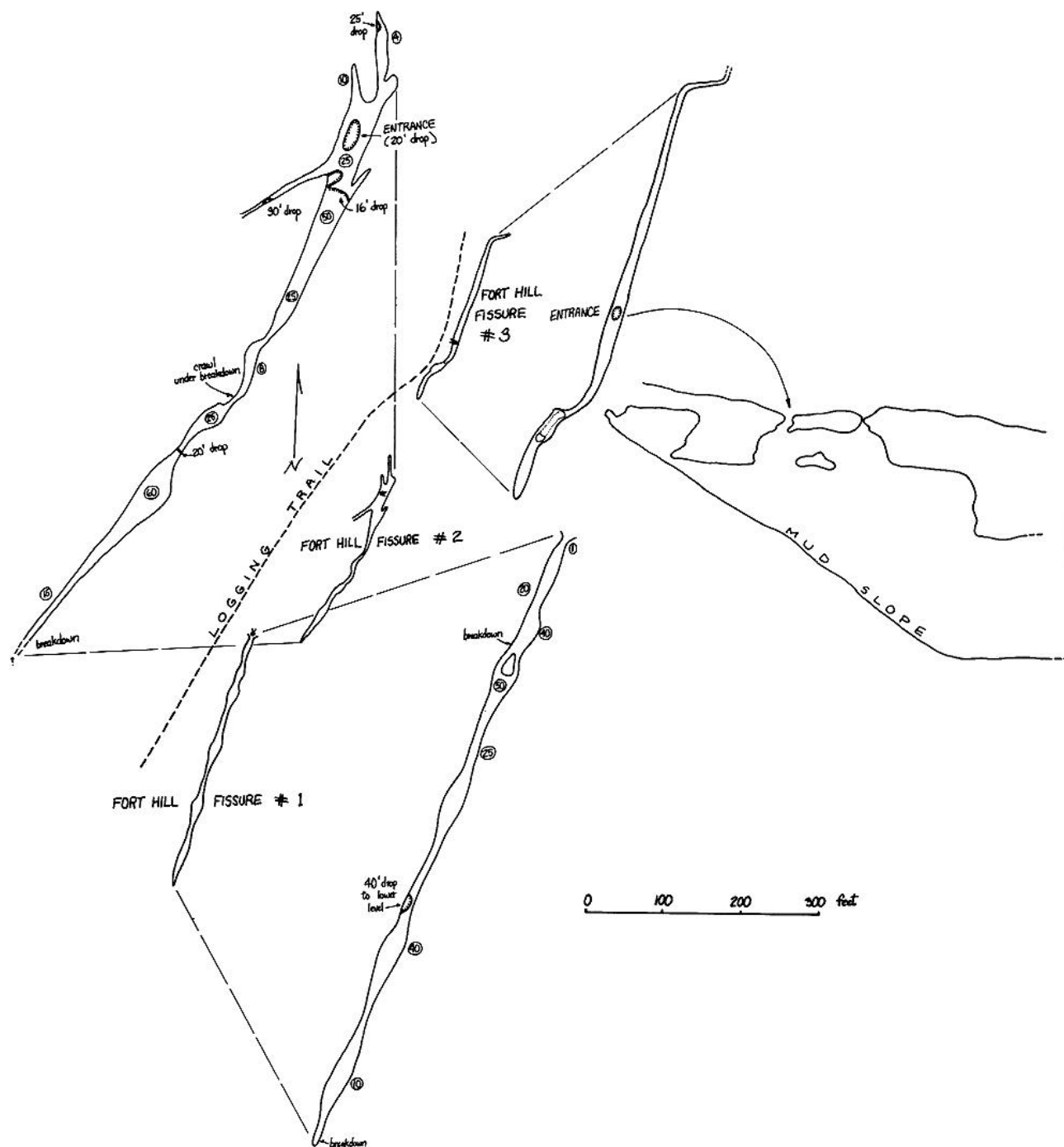


Figure 33. Fort Hill Fissures, Allegany County. Surveyed by D. Slifer, April, 1969.

sandy shales below. The limestone is thin-bedded and dark gray to black in color, striking N 20° E and dipping 54°E. The beds are strongly folded and contain many minor contortions and slickensides. Ripple marks are common in the beds adjacent to the limestone.

The cave is developed along the bedding planes and directly reflects the dip of the formation. Because of the narrow width of the limestone in which it is de-

veloped it follows closely the strike of the formation. Because of the non-calcareous nature of the adjacent rocks there are no side passages.

Description: ²

The entrance to the cave is a low narrow passage at the level of the road. It is 2 to 3 feet wide and 1 to 3 feet high. The cave continues as a narrow low tunnel

with about the same dimensions as the entrance for 25 feet. In the first 25 feet the cave is very dry, and the floor is covered with gray dust. Twenty-two feet from the entrance is a small pit that slopes down steeply to the east to connect with the lower level. The pit is too narrow to permit passage. Twenty-five feet from the entrance the cave is abruptly constricted, and the ceiling lowers to such an extent that the next 5 feet are barely passable. This constriction ends in a small alcove, 4 feet high, 5 feet wide, and 4 feet long, that is formed by a low chimney sloping upwards to the west. Between this alcove and the next alcove, four feet fur-

ther on, the passage is low and constricted with the added danger of loose rock on the west side. The second alcove is a low chimney similar to the first but slightly larger. Five feet beyond, the upper passage ends in a solid rock wall.

Connection to the lower level is through a narrow low slot, 3 feet wide, and 2 feet high, that drops 8 feet vertically to a small room approximately 6 feet square. A hole in the floor of this room, on the southwest side, opens into a vertical drop of 5 feet that in turn gives way to a wet mud-covered passage that slopes 60° for a drop of 15 feet to the lower level. Ropes are needed to accomplish these drops safely.

The lower level is 30 feet below, parallel to the upper level, and continues in two directions at the base of the slope. The north section is 1 to 2 feet wide and from 1 to 3 feet high. It continues for 50 feet beyond which it is too low for further progress. The south passage is slightly larger than the north passage but requires crawling for 75 feet to a point where the ceiling is too low to permit further exploration. Both passages are floored with damp gray clay.

No formations except small stalactites or films of flowstone are found in the cave.

Greises Cave

Allegany County, Evitts Creek Quadrangle

Location: WC 2/4/1

Elevation: 1020

Greises Cave is on the west side of Shriver Ridge approximately 200 yards east of Valley Road, north of Bowman's Addition. The cave is located on the property of Cumberland Bow Hunters. ²

Geology: ²

The cave is in the Tonoloway Limestone which dips steeply to the east. The passages are developed along a series of prominent joints. There is much fallen rock near the entrance chamber, and during the wet season water flows along some of the some of the upper passages.

History: ²

Apparently the cave was little known until 23 years ago though it is extensive and the opening is known to

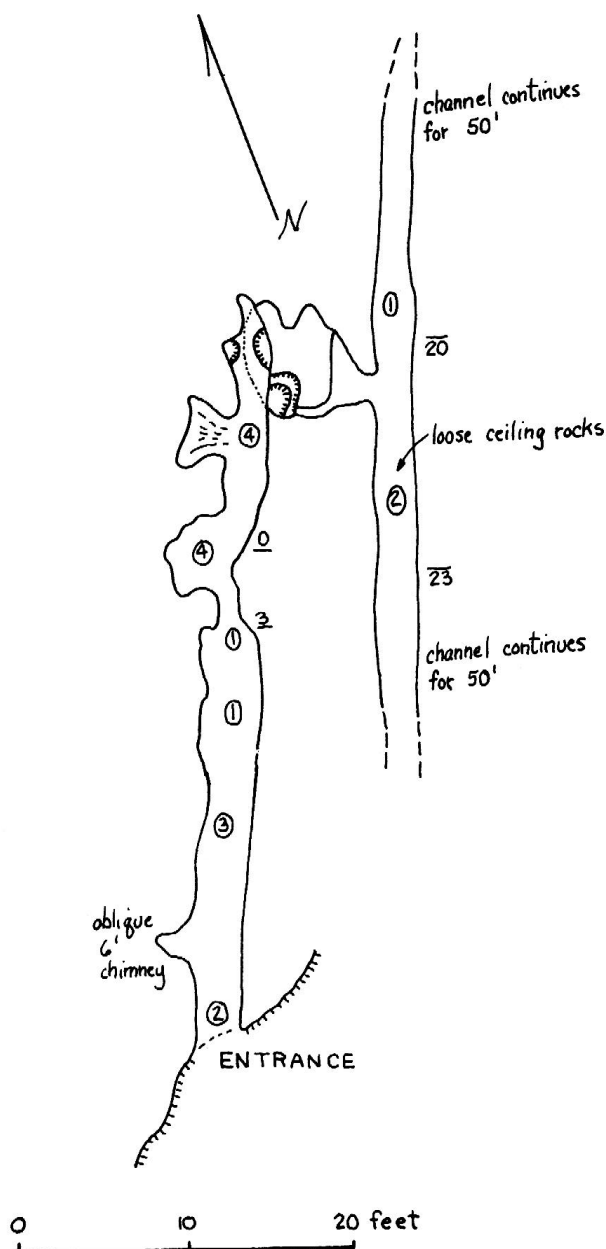


Figure 34. Goat Cave, Allegany County. Surveyed by W.Davies, November 8, 1947.

the local farmers. An old wire several hundred feet inside the cave was the only evidence that it had been previously explored.

Description: ²

The entrance is over a pile of rocks sloping 12 feet to a chamber about 20 feet square. From here a passage leads down at a steep angle for 200 feet and then curves to a crawlway 40 feet long. At the bottom is a "Z" shaped passage to the first large chamber. The passage is only 1 to 2 feet high and difficult to traverse because of its peculiar shape. It opens near the ceiling of the first large chamber. This chamber is 20 feet high, 10 feet wide and 15 feet long. A ledge leads along the wall near the entrance and foothold may be found at the end of it. At the bottom are two small chambers filled with mud.

A wide passage leads down from this chamber to a smaller room which narrows to a crawlway 15 feet long. The crawlway expands to standing height within 10 feet, but remains narrow throughout its length. At the end is a second chamber from which three passages continue, one to the left and two to the right. The left one is impassable beyond 10 feet. The right ones are actually a single passage divided by fallen rock. The chamber itself is 10 feet high and 15 feet long but only about 4 feet wide. A steeply sloping bank of mud climbs to an opening 3 feet in diameter which gives access to the Well Room, so named because of a shaft 25 feet deep in the middle of the room. The Well Room varies from 4 to 7 feet in height due to irregular formations. The shaft must be crossed to reach the other side of the room. Water, seeping along the sides of this room, forms a small waterfall over the edge of the shaft, making a descent of the shaft uncomfortable at best. At the base of the shaft is a second room, irregular in outline but about 6 feet square with the ceiling merging into the shaft itself. Three unexplored passages lead from this room. Further, 2 blind tunnels, each about 4 feet long, lead from the Well Room. The room is so wet and muddy that exploration from this point on is difficult. There are three small pools in ledges on the walls.

Haystack Mountain Cave

Allegheny County Cumberland Quadrangle
Location: SE 1/5/3
Elevation: 1000

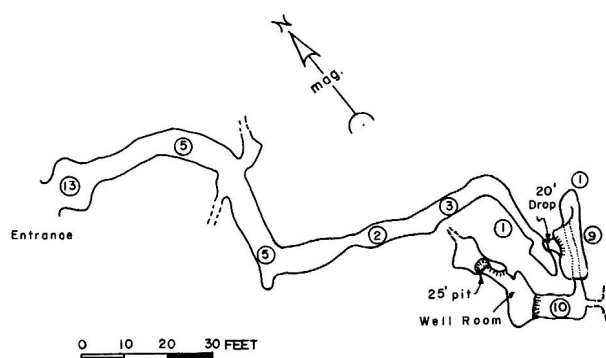


Figure 35. Greises Cave, Allegheny County. Surveyed by R. Schroeder, D. Anderson, and W. Dunlap, September, 1962.

On Haystack Mountain on the south side of Wills Creek in the Narrows is a shelter cave 100 feet below the edge of a prominent cliff directly above and overlooking a service station. ²

This is a shelter type cave in the Tuscarora Sandstone, resulting from the undermining and collapse of a number of sandstone beds.

Haystack Cave extends 50 feet along the strike of the beds. The sides slope upward to meet in a pointed ceiling varying in height from 2 to 10 feet. The cave is narrow and difficult as the passage is covered with rocks. No formations of any type are present, and portions of the roof are progressively slabbing.

Horse Cave

Allegheny County, Evitts Creek Quadrangle
Location: SE 7/8/8
Elevation: 1440

Horse Cave, also known as Dead Horse Cave, is located at Twiggstown, about 1000 yards south of Twiggs Cave. The cave entrance is in a wooded area near the Twiggstown-Spring Gap road on the property of Homer Twigg.

History: ²

The cave has been known for a considerable time, and there is no record of an actual "discoverer." No dates of any historical value were observed in the cave. The cave received its name from the misadventures of a horse which fell into the cave many years ago. Its remains are now scattered over the entrance room.

Geology: ²

Horse Cave is in a *Favosites* zone of the Keyser Limestone about 100 feet from the top of the Formation. This is 40 feet below the beds in which Twigg's Cave is developed but is on the same general strike. At Horse Cave the strata dip 40° W and strike N 30° E. The limestone is fine-grained, dark gray in color, and quite fossiliferous, the predominant fossil being *Favosites* corals. The cave is developed along a set of joints parallel to the strike and at right angles to the bedding. In combination with the bedding, the joints produce many passages with triangular cross sections.

Description: ²

The entrance sink has an axis N 80° E and slopes gently towards the entrance hole at the east end. This hole, 4 feet in diameter, is in two sections. The first drop is 6 feet vertically to a ledge that occupies practically the entire diameter of the pit. The second stage, that carries to the floor of the cave, is a vertical drop of 10 feet offset to the south. An old ladder made of tree limbs and slats covers this drop but is in such dangerous condition as to be useless. The entrance drop opens into the northeast side of the entrance room.

The entrance room is tent shaped, with one wall reflecting the bedding plane and the other a set of joints at right angles to the bedding. The room is 20 feet long, 15 feet wide, and 13 feet high at its apex. Large masses of fallen rock cover the north end of the floor, and from some of the rocks excellent specimens of *Favosites* can be obtained. The floor, except for the rock masses, is fairly level and covered by a layer of wet brown clay. Along the north wall a small narrow tunnel-like passage parallels the room and is gently inclined towards the north.

From the north end of the room a small passage connects with a room 12 feet wide and 6 feet high that pinches out beyond 15 feet. The floor of this room is covered with angular fragments of limestone and chert blocks.

Along the southeast side of the entrance room is a wide ledge, 4 feet high, that leads to a low triangular-shaped passage, 15 feet long, 5 feet wide, and 5 feet high at the apex, that opens into a high room at its south end. This room is also connected to the south end of the entrance room by a narrow slit and a 5-foot

drop. The room is 25 feet high, 20 feet long, and 15 feet wide. The south half is 10 feet below the remainder of the room, and a natural bridge crosses the depressed section and connects with a passage opening in the east wall. This passage is a crawlway that parallels the main part of the cave and extends to the north and south for 20 feet.

Beyond the bridge the cave consists of a series of irregular passages, sometimes wide and low, at other times narrow and high, that continue to a point 105 feet from the entrance where the main passage ends in a room 20 feet long, 15 feet wide, and 3 to 4 feet high. The east side of the room slopes upward at 30° to join another segment of the cave. This higher level is parallel to the lower level and extends 35 feet to the north and 20 feet to the south. It is low and with a height varying from 3 to 5 feet and a width of 7 to 10 feet. At numerous places it connects with the lower level by very small openings. A small crawlway at the south end of the upper level, now blocked by formations, may provide access to other parts of the cave if cleared.

The cave is comparatively shallow, having from 8 to 10 feet of cover over the entrance room. The ground slopes upwards along the axis of the cave but is paralleled by the slope of the cave so that the cover remains relatively uniform.

Formations, other than flowstone, are scarce except in the rear part of the cave where stalactites abound, many of them of the "soda straw" type. Throughout much of the cave there are stumps of broken stalactites and stalagmites that have resulted from breakage due to settling or from vandalism.

Lover's Leap Cave

Allegany County, Cumberland Quadrangle

Location: SE 1/3/3

Elevation: 1200

On the north side of Wills Creek at The Narrows is Wills Mountain, the top of which is known as Lover's Leap. Three hundred feet west of the observation point is a fissure opening. The cave is opposite Haystack Cave and is apparently in the same fracture system. ²

The cave is developed as a fissure in the Tuscarora Sandstone that caps Wills Mountain. It shows

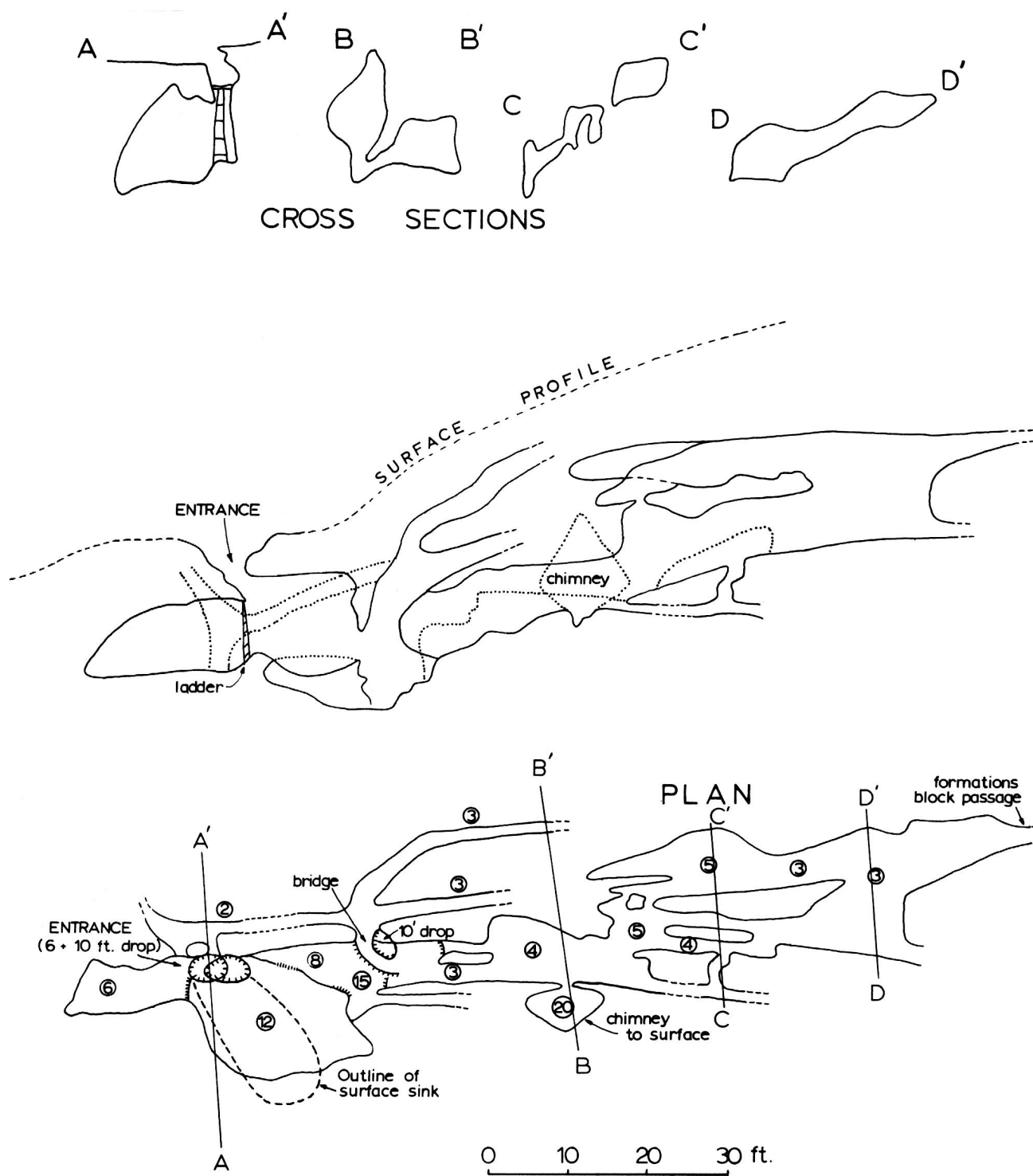


Figure 36. Horse Cave, Allegany County. Surveyed by W. Davies, July 21, 1946.

signs of being water worn, apparently having served as a drain to a lower chamber.

The hole at the top opens into a 6-foot drop which is 3 feet wide and 2 feet long. At the bottom is a narrow ledge which leads into a passageway that descends almost straight down for a distance of 40 feet. The

first 20 feet are easily traversed after which the passageway narrows and curves upwards sharply. It is blocked at this point by an old tree stump. There is much fallen stone on the floor and hanging pieces in the ceiling. A small passage, which eventually leads back to the surface a few feet from the entrance, leads off to the west from the narrow ledge at the base of the

entrance drop. Approach to the cave is extremely dangerous as it is close to the face of a cliff which has a sheer drop of over 600 feet.

Mt. Savage Road Quarry Caves

Allegany County, Cumberland Quadrangle

Location: C 1/9/6

Elevation: 900

Several small caves are found in quarries along Jennings Run on Little Allegheny Mountain, west of Corriganville. Two of these caves are located on the south side of the creek.

The largest of these has an impressive entrance located on the west wall of the quarry. The cave has approximately 100 feet of walking passage trending N 75° W and is developed in the Greenbrier Limestone (dip 14° W., strike N.-S.). In places the walls are covered with cave coral and there is an occasional display of speleothems. The passage ends in a clay plug. Numerous *Neotoma* inhabit the cave.

The second cave in this quarry is located high on the south wall. It is a low shelf-like opening which leads about 20 feet into a mass of breakdown. Many fissures and cracks lead through the breakdown, but none are large enough to follow. *Neotoma* signs and good drafts of air indicate passage beyond the breakdown.

Two very small solution tubes and shelters are developed in the little quarry north of Jennings Run, opposite the first quarry. Good solutional anastomoses are displayed in one of these caves.

Murley Branch Spring

Allegany County, Flinstone Quadrangle

Location: SW 1/5/1

Elevation: 1000

Two miles northeast of Twiggs Cave is a low, water-filled opening in a cliff facing north.

Geology: ²

Murley Branch Spring is developed in massive Tonoloway Limestone just above the base of the formation. The rocks are horizontal at the crest of a subordinate anticline.

Description: ²

A large stream of water, 10 to 15 feet wide and several inches deep, flows north from the opening. The cave is 6 feet wide and 4 feet high at the entrance and opens directly to a room 10 feet in diameter. A narrow crevice passage leads to the east and can be traversed with difficulty for 20 feet. The main passage continues to the south, but exploration is blocked by a siphon that extends 5 feet below the surface of the water. The water at the siphon is 10 feet deep. It is reported that a quarter of a century ago several young men penetrated the siphon during an exceptionally dry season. A passage is reported to extend straight to the south for 300 feet from the siphon with at least three deep pits in the floor.

A small cave is reported to lie 100 yards south of the spring. It was not found during the field work.

Pinto Limestone Mine

Allegany County, Cresaptown Quadrangle

Location: WC 6/2/6

Elevation: 700

Several large limestone mines occur in the Keyser Limestone in the cliffs along the Potomac River near Pinto. The largest of these was explored and mapped in 1966 by R.B. Schroeder and Joe De Giovanni of Cumberland, using scuba equipment to pass two water siphons. The last chamber entered was a natural one, but was not explored at that time. Numerous deep, active sinkholes are developed over this area (top of cliffs and beyond) and another cave is reported here but was not located.

Rhodes Cave

Allegany County, Lonaconing Quadrangle

Location: SE 2/9/3

Elevation: 800

Rhodes Cave is a fissure developed along a joint in the cliffs east of U.S. 220 south of Rawlings. It has an entrance at each end, and extends through the cliff for about 50 feet as a narrow walking passage. It is developed in the Tuscarora Sandstone.

Rocky Gap Cave

Allegany County, Evitts Creek Quadrangle

Location: C 3/8/2

Elevation: 1300

This cave is near the summit of the southern rim of Rocky Gap gorge, 350 feet above Rocky Gap Run. The entrance, which is four feet in diameter and seven feet deep, is hidden in a clump of *Rhododendron* very close to the cliff's edge. It is developed as a fissure cave along vertical joints in the Tuscarora Sandstone (dip 15° SE, strike S. 70° W.), with the bedding planes forming a perfectly flat ceiling throughout. The cave extends 120 feet to the southeast and is typically a fissure five feet wide and five feet to ten feet high. In some areas of the ceiling occur large numbers of filled burrows referable to *Arthropycus*.

The floor consists of breakdown and organic matter (leaf litter, etc.). Roots are numerous, growing from cracks and bedding planes. The cave is quite moist, with the walls actively dripping. When last visited it housed a large population of spiders (*Meta menardi*) as well as several *Pipistrelle* bats.

Stegmaier Orchard Caves

Allegany County, Evitts Creek Quadrangle

Location: SC 4/1/4

Elevation: 1000

Three caves are located in an open woodland on the west flank of Irons Mountain, east of Cumberland. They are owned by Mr. Herman Turner and derive their name from local usage due to their proximity to the orchards.

History:

The Stegmaier No. 1 Cave has been known by local residents for many years and has been used for a trash dump. No information on early exploration is known. The No. 2 Cave was discovered by members of the Survey in September, 1969, while investigating the other caves. The No. 3 Cave was discovered and opened up by Mr. John Stegmaier in 1951, and consequently explored by him and Brother G. Nicholas.

Geology:

These caves are developed on the west flank of an anticline in the Tonoloway Limestone. The strike of the strata here is due north-south and the dip is 43° W. All three caves have vertical or steeply sloping entrance passages which descend along the bedding planes in the direction of dip. They are controlled in part by a major joint set which trends approximately N 25° E, with less dominant joints affecting development of smaller connecting passages. The dip of the beds strongly controls the cross section of passages and rooms, which are inclined at an equivalent angle to the dip. Speleothem growth areas are controlled to a strong degree by bedding in the No. 2 and No. 3 Caves.

In Cave No. 3, which is the largest of the three, one of the nicest displays of helictites in the state is developed, along with the usual stalactites and a few small columns. The mineral aragonite grows in tiny clusters of white branching crystals on the ceiling and walls in some places. A "mud glacier" similar to that found in Twiggs Cave occupies the floor of the northern passage, making traverse of this area difficult but

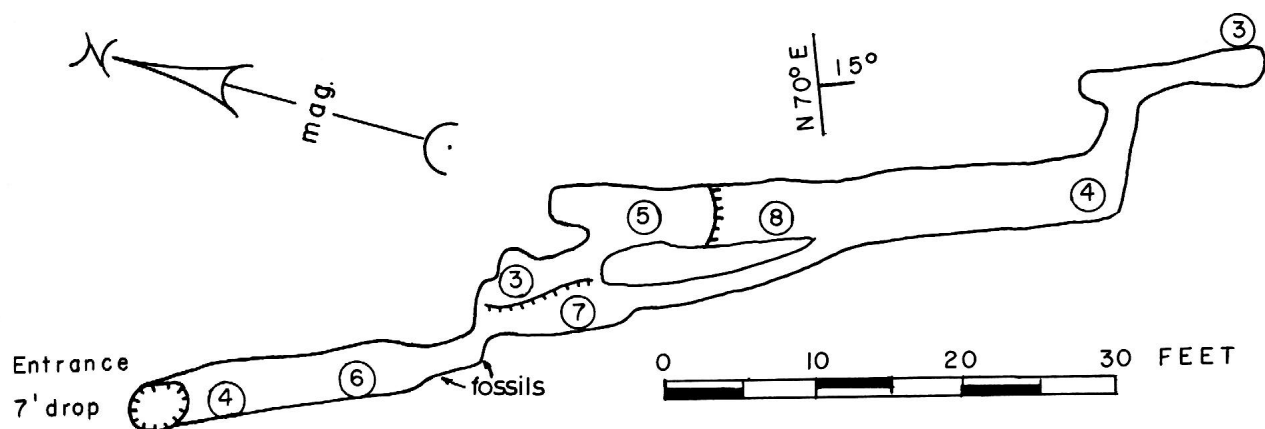


Figure 37. Rocky Gap Cave, Allegany County. Surveyed by R. Franz, 1965.

interesting. It appears to be extruding from the bedding planes near the floor, although no suitable source for such a quantity of sediment is obvious on the surface. At Twiggs Cave the mud is believed to originate from fine clay sediment in the bottom of a nearby sink-hole pond. The structure of the passages on the east side of the southern end of No. 3 Cave resembles that of the "mud chute" area in Devils Hole Cave. On the floor of the western edge of this room is a series of desiccation cracks in fine clay sediment 6 inches thick, which forms a number of even-sided "blocks" covering a layer of coarse sediment.

Description:

The entrances of these caves open within 550 feet of each other, at the same elevation, and are aligned along the strike of the bedrock. The entrance to Cave No. 1 is 5 feet square and drops 20 feet to join a crawlway to the east. A 6-foot drop is encountered after a series of turns in the crawlway. At the bottom of this 10-foot high dome pit is another tight crawlway, leading to two passages inclined along the dip of the beds, and which slope down into a long, narrow, dead-end fissure. There are no speleothems in this cave, and very little fill or sediment is present. The entrance sink contains much old trash and litter.

The entrance to Cave No. 2 is an obscure hole, 2 feet in diameter, beneath a fallen tree. It drops 15 feet into a low room. At a point 5 feet from the surface it constricts to a very tight squeeze. The room to the northeast of the bottom of the entrance drop is fairly well decorated with speleothems, including some soda straw stalactites up to 4 feet long. Several wood rats (*Neotoma*) and nests were observed here in 1969.

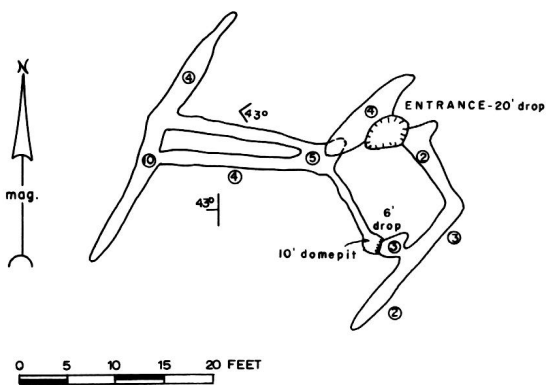


Figure 38. Stegmaier No.1 Cave, Allegheny County, Surveyed by D. Slifer and D. Weaver, September 20, 1969

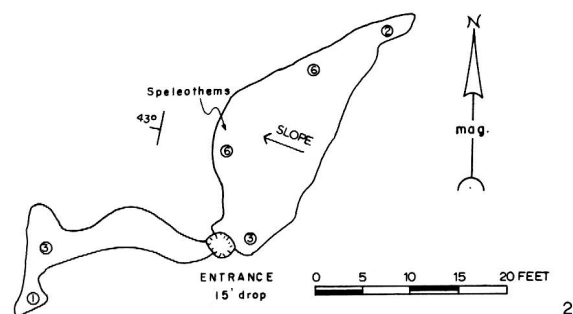


Figure 39. Stegmaier No. 2 Cave, Allegheny County, Surveyed by D. Slifer and D. Weaver, September 20, 1969.

The third cave is the most interesting of the three. The entrance is a narrow crack in an outcrop within a shallow sinkhole. It widens just inside and the passage slopes downward at 43° for 30 feet to a small column at the intersection of several passages. To the southwest is a tight, muddy crawlway to a low room and inclined side passage. The passage to the northeast slopes down into a series of two well decorated rooms. Helictites occur in relative abundance here, along with the usual speleothems. This passage is floored with about 2 feet of sticky, unctuous mud with the consistency of grease, making travel through the passage somewhat amusing.

Although the drops and slopes in all of these caves can be climbed by the agile explorer, a 50-foot hand-line would be helpful.

Tewell Caves

Allegheny County, Evitts Creek Quadrangle
Location: SE 2/8/6
Elevation: 1440

Three interesting leads open on the east side of a ravine on the property of M. H. Tewell, one half mile northeast of Devils Hole Cave. All three are developed in the Tonoloway Limestone and are within 200 feet of each other. Cave No. 1 is a vertical shaft 18 inches in diameter at the base of a shallow sink. It slopes sharply down for nine feet into a room four feet in diameter with a soft dirt floor. No passages lead off. Cave No. 2 is a small hole at the base of an outcrop 75 feet north of No. 1. It is too small to enter, but rocks thrown in can be heard to fall into a chamber. Cave No. 3 is 100 feet beyond No. 2, and is a solutionally enlarged strike joint to the east. It is two feet wide, eight feet deep and twenty feet long. It ends

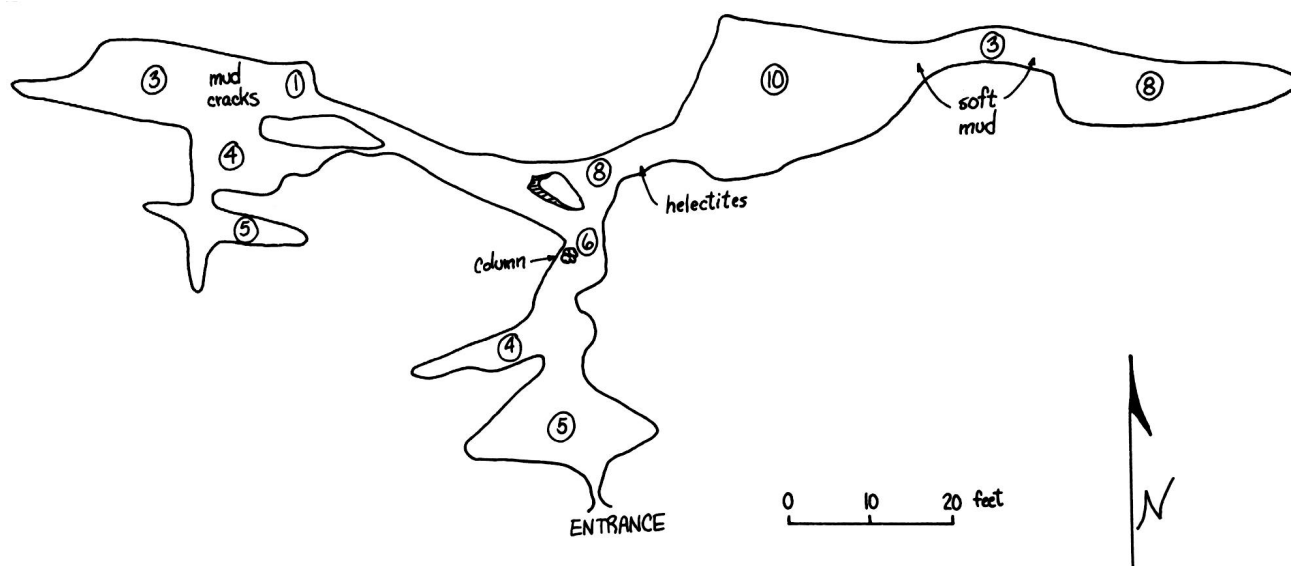


Figure 40. Stegmaier No. 3 Cave, Allegany County. Surveyed by D. Slifer and D. Weaver, September 20, 1969.

in an earth bank and breakdown. Numerous cave crickets were observed in the fissure.

Trash Pile Pit

Allegany County, Cresaptown Quadrangle

Location: NW 3/3/8

Elevation: 1080

Trash Pile Pit is located in a shallow trash-filled sink on the property of Richard Cover, LaVale, Maryland. Local residents report that the cave "has always been there" but it has been closed at least once and reopened. It has apparently been used for trash disposal for several generations. The only signature observed had the date 3-1-31.

The pit is developed along the bedding planes of the Tonoloway Limestone (dip 75° W, strike N 27° E) and drops 35 feet to a dome-pit-room 20 feet high and 10 feet in diameter. In the floor of this room are two small leads downward through several feet of accumulated trash. They both lead down to a small passage along the strike, but neither goes further than 15 feet. Some flowstone and cave coral decorate the walls of the pit.

According to local residents, there were once several other caves in the immediate vicinity which were filled by grading operations during construction of the

adjacent golf course. Drainage entered one of these caves in an old quarry (now filled) and flowed underground to resurge at the spring being used to supply water to Cresaptown (approx. NW 6/3/1, elevation-860 feet). According to a local person, this observation was established by placing chaff in the cave. It was reported to have been extensive.

Twiggs Cave

Allegany County, Flintstone Quadrangle

Location: SE 7/6/7

Elevation: 1360

This cave is located on the property of Homer Twigg at Twiggstown. The entrance to the cave is on the eastern slope of a limestone ridge 1500 feet south of the Twigg home.

History:

The history of the cave is rather short. The cave was opened and explored by the grandfather of the present owner in 1898. Subsequent extensive exploration was carried on by the present owner and his brother when they were boys. Further exploration was somewhat sporadic because of the difficulties presented by the entrance and muddy conditions. Dates and initials are rare as they are quickly obliterated in the clay that abounds in the cave. The oldest date seen was 1911.

Geology:

In the vicinity of Twiggstown the Helderberg Formation is comprised of three members totaling about 325 feet in thickness. Twiggs Cave is developed in a series of dark gray to black crystalline limestone beds that lie about 25 feet below the base of the Coeymans Member and 250 feet above the base of the Keyser Member. The limestone is somewhat knobby and is high in clay content.

The cave is developed on the western side of an anticline. The beds dip 60° W and strike N 40° E. A series of master joints trends N 40° E and dips 60° E. A series of subordinate vertical joints trends N 50° W. The cave is developed as two large parallel fissure openings along the master joints. Bedding planes are relatively unimportant except at the entrance where they form a small sloping passage. In cases where collapse has occurred the bedding planes are reflected in the walls of passages. The subordinate joints show up only in a few small side passages and in the low tunnel connecting the parallel fissures.

The large amount of clay in this cave is of considerable interest. In the first room at the base of the entrance slope a large amount of clay in the form of two "mud glaciers" is encountered. The clay is entering the cave through two chimney-like passages in the south end of the room and is a result of the accumulation of surface-derived material. These mud glaciers have characteristics similar to normal ice glaciers although their power to excavate material is practically nil.

The clay encountered throughout the rest of the cave cannot be so easily accounted for. The high clay content of the original limestone (12% by weight) contributes considerably. In the ceiling the process of leaching of the lime and development of residual clay is easily seen. The solid limestone forming the ceiling grades into a soft, light gray to white, somewhat coarse clay that has a thickness up to one inch. Outside of this is a zone of fine, wet, light brown clay about one quarter inch thick. The surface layer, less than an eighth of an inch in thickness, consists of somewhat coarse dark brown to dark gray clay. The surface of the clay has the shape of rough, blunt, clay stalactites, each stalactite being less than an inch long and about one quarter inch in diameter. The clay of the cave floor and lower walls is entirely different, and

its origin is open to various interpretations. It is generally dark brown to dark gray in color, 6 inches to 1 foot thick, and laminated. The individual laminae average 2 to 4 millimeters in thickness and are distinguished by minute changes in grain size. Two methods of origin appear possible. The clay may be a result of deposition from the underground stream which in wet weather may flood considerable portions of the cave. However, since the laminations are often found a considerable distance above the floor with the laminations following the contour of the walls, this hypothesis seems unlikely. The other hypothesis ascribes the source to the parent rock which is high in insolubles. These insolubles are deposited by thin films of water as the limestone is dissolved. The water transports the material from the upper part of the walls and deposits it in the lower sections. The laminations reflect varying conditions in the amount of water seeping into the passages.

Description:

The entrance to Twiggs Cave is through a vertical shaft, 25 feet deep, 4 to 8 feet long, and 1 foot wide. At the base of the shaft is a "Z" shaped passage about 40 feet long and sloping 45° which connects with the first room. This room has two "mud glaciers" at its south end that are slowly moving and covering the floor. The cave continues in a northerly direction from the first room as a passage, the Straightway, that is 10 to 15 feet wide and 10 feet high. Just north of the first room is a pile of broken rock leading down 25 feet to the level of the Straightway. The floor of the Straightway is made of fallen rocks to a considerable depth and many minor passages exist beneath the main level. The straightway, 85 feet long, ends in two chimneys at the base of which is a deep well. A narrow, crevice-like passage leads off the base of the first chimney and continues into a small room that ends in a mud wall. A small crawlway, 4 feet in diameter, leads off the west side and curves around to a narrow clay shelf at its junction with the second major fissure passage. Here is a row of six pits leading to a lower tunnel. The largest pit, the Kings Chair, affords access to the lower level that is a low tunnel 3 feet wide, 2 to 5 feet high, and 40 feet long. The passage continues along the base of a high sloping crevice. The passage is 15 feet wide and slopes steeply for 100 feet to a drop of 14 feet. This point, 192 feet below and 375 feet from the entrance, is at the stream level of the cave.

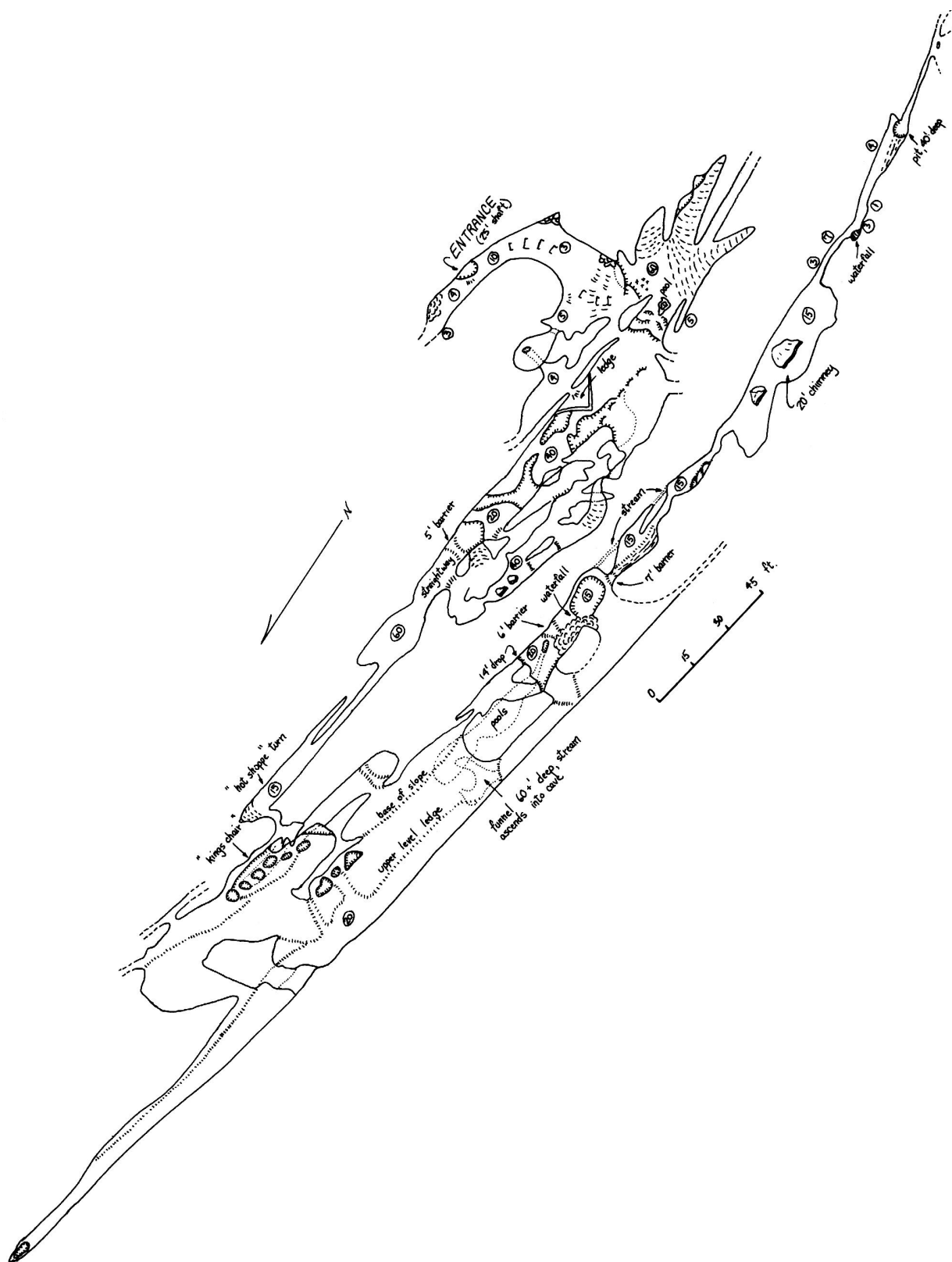


Figure 41. Twigg's Cave, Allegany County. Surveyed by W. Davies, 1946-1948.

The stream enters this section of the cave from below by a steeply sloping and curving shaft over 75 feet deep. The stream forms three shallow pools, each about 10 feet long, and then flows along the floor of

the cave. Twenty feet beyond the drop to the water level is a shallow pit into which the stream plunges with a loud roar. The cave continues as an ever narrowing passage, decreasing from 20 feet high and 10

feet wide to 3 feet high and 2 feet wide. In places the route of traverse is in the stream bed, in other places along a clay ledge above the stream. At 120 feet this passage ends in a small tunnel 2 feet high and 1½ feet wide, the floor of which is occupied by the stream. This passage, which necessitates a crawl, is 25 feet long and ends in a narrow crevice-like passage 10 feet high, 4 feet wide, and 10 feet long. At the southwest corner is a narrow slit in the floor down which the stream plunges to a lower level. This falls is over 50 feet deep. Bottom was not reached in soundings.

In 1946 a small tunnel was excavated through packed clay and gravel to a low passage that leads 30 feet to a pit which is 40 feet deep and 5 feet in diameter at the top. The base of the pit is a slit 1 foot wide which leads off into a crevice passage less than a foot wide. Traverse of this passage was not possible, but the cave appears to open up somewhat 30 feet beyond. The floor at the base of the pit is covered by a thin veneer of yellow clay of recent deposition indicating that the stream backs up to this level. The base of the pit is 290 feet below and 750 feet from the entrance.

Above the Straightway is another passage resulting from the fall of large blocks of limestone that form the ceiling of the Straightway and the floor of the upper level. The two levels are connected by a number of openings between the rocks, but access to the upper level is afforded at only one point. At the south end of the Straightway, near the 25 foot drop, is a flowstone ledge on the west wall that slopes steeply to the east. A traverse diagonally across the flowstone leads to a small hole that gives access to the upper level. The upper level passage is 10 feet wide and extends for 100 feet as a fissure similar to the lower levels. The fissure is 30 feet high and tapers out at both ends. Several massive stalactite formations are developed on the east side of the passage, and one of them gives beautiful musical tones when struck.

An upper level exists above the Kings Chair. It is a ledge 10 feet wide that lies 30 feet above the base of the fissure passage. At the north end this level develops as a separate passage extending over 100 feet.

Valley Road Quarry Caves

Allegany County, Cumberland Quadrangle

Location: EC 9/7/6

Elevation: 720

In a quarry in the Tonoloway Limestone on the west side of Shriver Ridge, opposite the dam on Dry Run, Valley Road, Cumberland, are two crawlways. The one near the road opens into a passageway 2 feet high, 3 feet wide and 7 feet long which separates into two impassable passages. The other, developed in a large fissure on the wide wall, is 10 feet high but so narrow that only a slim person can squeeze through. It extends into the side of the hill for 20 feet, finally narrowing until it is impassable. ²

BALTIMORE COUNTY

Beaver Run Shelter

Baltimore County, Lineboro Quadrangle

Location: EC 5/4/3

Elevation: 600

This small shelter cave consists of a low crawlway and stoopway about 20 feet long. The entrance is 3 feet high by 2 feet wide and has a talus slope leading to it. Muma (1945) reported finding some charred bones and a section of clay pipe in the talus near the entrance.

Meltons Cave

Baltimore County, Towson Quadrangle

Location: C 6/9/7

Elevation: 260

A small fissure cave is located above the quarried-out parking lot near the large dam at Loch Raven Reservoir. The cave apparently is an enlarged joint and is approximately 20 feet long.

CARROLL COUNTY

Argo Cave

Carroll County, New Windsor Quadrangle

Location: EC 8/6/1

Elevation: 620

The entrance to this cave is in the north wall of an

abandoned quarry in the Wakefield Marble. It is 4 feet in diameter and the cave is traversable for about 15 feet until it becomes too narrow. Local residents have reported the cave to be of considerable size at one time. It appears possible that material from the entrance could have slumped in to fill the now blocked passage. A strong draft was observed and it seems that only a moderate digging effort might yield more cave. The walls of the cave are solutionally pitted near the entrance.

Westminster Cave

Carroll County, Westminster Quadrangle
Location: WC 1/7/7
Elevation: 700

The entrance to this cave is in an old quarry facing east on the property of William T. Hastings, Hollow Rock Avenue, Westminster, Maryland. The cave now consists of one room 18 feet long, 15 feet wide, and 8 feet high. It is blocked at the rear by recent rockfall. Davies reported a small passage 4 feet in diameter extending for 8 feet through the wall but this has apparently been filled. The cave reportedly once continued for a considerable distance to the west. The cave is floored with concrete and was formerly used as a milk cooler. A small stream formerly flowed along the south wall into a narrow passage. The stream ceased flowing about 1940 when blasting was done nearby for the building of petroleum storage tanks.

Westminster Cave is in the Wakefield Marble which is white crystalline, and banded with gray-green zones high in mica. It is developed along a joint trending N 20° W with a dip of 60° W.

FREDERICK COUNTY

Buckeystown Cave

Frederick County, Buckeystown Quadrangle
Location: C 1/8/1
Elevation: 300

In the base of a small quarry along the eastern side of the woods midway between Buckeystown and Adamstown is a vertical opening which drops 25 feet into a small cave. At the base is a room 20 feet long by 18 feet wide. The rock along the walls of the room is shattered and broken due to collapse. One block over

20 feet long and 15 feet high has dropped "en masse". The broken slabs of rock average 4 inches thick and up to 4 feet long. The floor of the room is covered with logs, animal bones, and other debris.

On the north side of the first room is a passage 10 feet wide and 4 feet high that slopes steeply downwards for 15 feet over breakdown to a second room, 30 feet long and 20 feet wide. The ceiling of the room, which is 4 feet high, is made up of loose flat slabs of rock, which should be considered dangerous. The floor is covered with massive breakdown and is dry and dusty. No passages lead off from the room. A feature of particular interest is the occurrence of tiny but beautiful aragonite "flowers" on the wall of the southwest corner of this second room. The only other known occurrence of this mineral in the state's caves is from the Stegmaier No. 3 Cave in Allegany County.

Catoctin Creek Cave

Frederick County, Point of Rocks Quadrangle
Location: NC 4/8/6
Elevation: 360

This is a small rock shelter cave, 75 feet above the east bank of Catoctin Creek. The entrance is 10 feet in diameter and the cave trends southwest for 35 feet to end abruptly in a tight joint. The following two inscriptions were observed carved into the rock near the entrance: J. Albert, 1874, Gus Albert, 1881. The cave is developed along a vertical joint striking S 10° W, in a Precambrian mica schist. This shelter may have archeological significance.

Centerville Cave

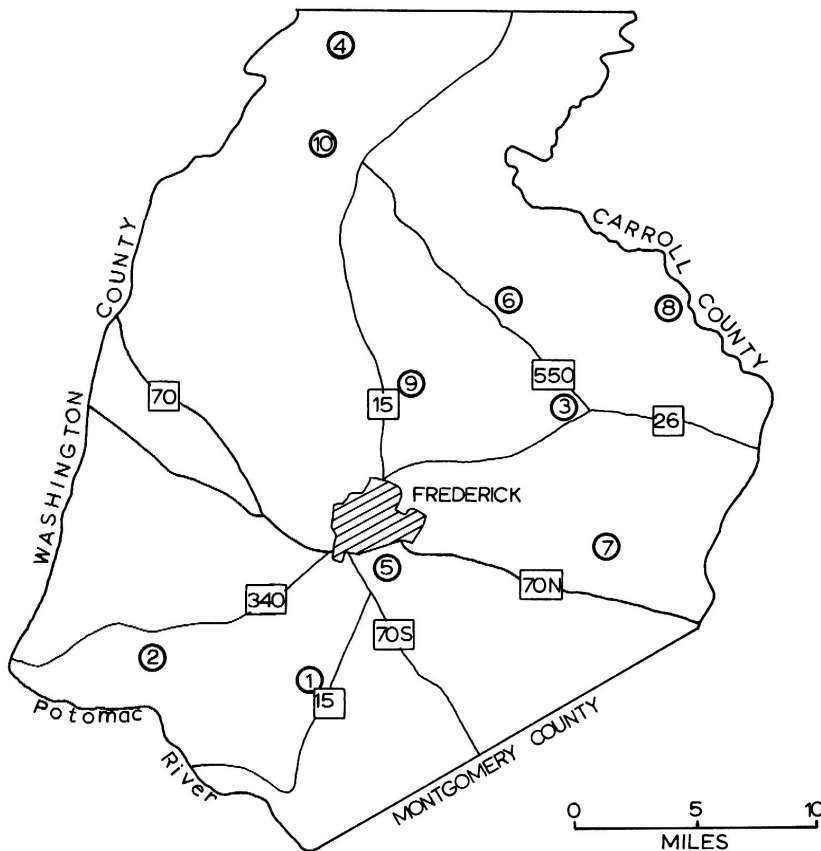
Frederick County, Woodsboro Quadrangle
Location:
Elevation:

A cave consisting of four small rooms is reported in an old quarry in the Wakefield Marble, one-half miles east of Centerville, along Coppermine Road. The cave was not located during field work.

Friends Creek Cave

Frederick County, Blue Ridge Summit Quadrangle
Location: NE 8/3/5
Elevation: 560

Figure 42: Distribution of caves in Frederick County:



- 1) Buckeystown
- 2) Catoctin Creek
- 3) Centerville
- 4) Friends Creek
- 5) Grove Quarry
- 6) LeGore Quarry-Powells
- 7) Linganore Shelter
- 8) McKinstry's Mill
- 9) Monocacy River
- 10) Wolf Rock Fissure.

The entrance to this cave is 12 feet above the west bank of the dirt road leading to Friends Creek Anglers Association property, about one mile northeast of Friends of Creek Church. It is 1 foot high and 3 feet wide and enters a single small room which trends N. 60° W. for 20 feet and is 6 feet wide and 4 feet high. It is of little interest except for the fact that it occurs in the Catoctin Metabasalt and is, therefore, entirely non-solutional in origin.

Grove Quarry Cave

Frederick County, Frederick Quadrangle
Location: SE 5/5/1
Elevation: 300

Mr. Theodore Ruhoff, Arlington, Virginia, reports an opening on the east face of the M.J. Grove limestone Quarry, 1 mile southeast of Frederick. The opening is a large sand-filled room 50 feet long, 50 feet wide and 12 feet high. A chimney, 15 feet high, opens at the rear. The cave is in the Grove Limestone.²

LeGore Quarry-Powells Cave

Frederick County, Woodsboro Quadrangle
Location: C 7/2/6
Elevation: 380

Powells Cave is on the west side of Israel Creek, one mile north of Woodsboro, on the property of Luther Powell. It is a low passage requiring considerable crawling that extends over 100 feet to the north. The entrance is now blocked with stone dumped into it.²

In the LeGore quarry, 100 yards northwest of Powells Cave, is a series of cavernous openings in the north face. Quarrymen report that subterranean passages from these openings circle to the east and south apparently to join with Powells Cave. During quarry operations a large room was encountered at the northwest edge of the quarry which collapsed and carried a man into it.

Powells Cave and the openings in the LeGore quarry are in the Grove Limestone that strikes N 30° E and dips 60° E.

Linganore Shelter Caves

Frederick County, Libertytown Quadrangle

Location:

Elevation:

Several small shelter caves that contain Indian pictographs are reported to lie near the settlement of Linganore. These shelters could not be located during field work.²

McKinstry's Mill Cave

Frederick County, Union Bridge Quadrangle

Location: SC 3/6/4

Elevation: 440

This cave is on the west side of Sams Creek due west of McKinstry's Mill, on the property of Worthington Pearre. It is the largest Maryland cave known that is developed in the Wakefield Marble, having three entrances and about 200 feet of passage. The two main entrances face the creek and are about 4 feet square. Entrance no. 1 opens to a mud-floored room, 4 feet high and 15 feet in diameter, from which two passages lead off. One goes 30 feet to the southwest as a crawlway and becomes choked with mud and flood debris. Old relic flowstone and some small stalactites decorate the cave throughout. The other passage leads

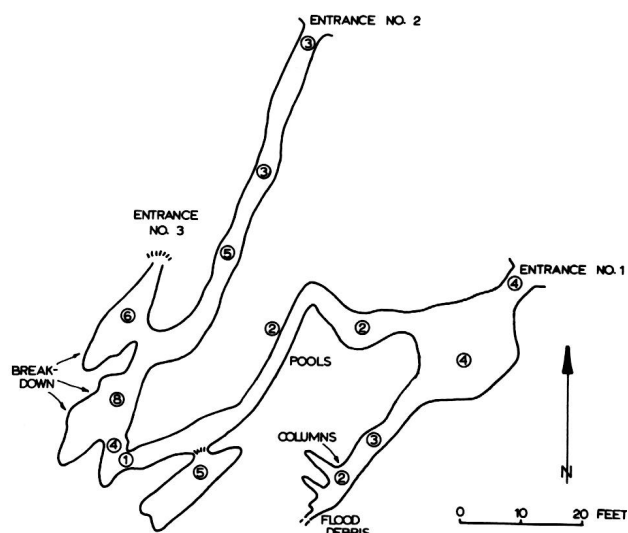


Figure 44. McKinstry's Mill Cave, Frederick County. Surveyed by D. Slifer and G. Lehman, May, 1969.

via some muddy crawlways to the other entrances. A quite vigorous draft of air was encountered in this passage. Southwest of entrance No. 3, the passage is larger but is blocked by breakdown. The No. 3 entrance, too small to traverse, is a small hole in a sink on the hillside above the No. 2 entrance. This cave is developed in the Wakefield Marble.

Monocacy River Cave

Frederick County, Frederick Quadrangle

Location: NE 2/3/7

Elevation: 260

This small cave is 20 feet above the east bank of the Monocacy River, east of Hansonville (just above the power line). The entrance is 4 feet wide and 2 feet high, at the base of a small cliff. The cave extends for 25 feet to the southeast as a crawlway and continues as a 10-inch tube. The floor is composed of river alluvium. It is developed in thinly-bedded Frederick Limestone.

Wolf Rock Fissure

Frederick County, Blue Ridge Summit Quadrangle

Location: SC 8/5/2

Elevation: 1400

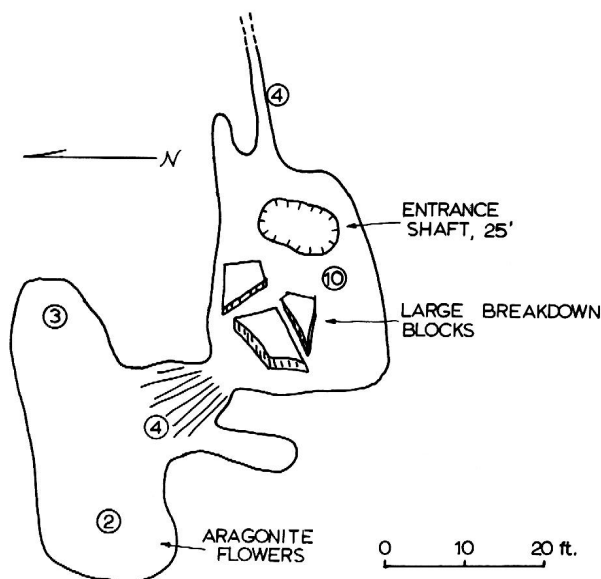


Figure 43. Buckeystown Cave, Frederick County. Surveyed by D. Slifer, 1969.



Figure 45. Entrance to Wolf Rock Fissure, Frederick County. Such caves are formed in non-carbonate rocks along joints or faults.

Wolf Rock, in the Catoctin National Park west of Thurmont, may be reached by hiking several foot-trails up the mountain. It is an isolated exposure of Weverton Quartzite, representing the approximate location of the axis of an overturned syncline. There are several fissure caves developed here. The deepest one is a vertical crevice 35 feet deep and up to 5 feet wide, trending N 20° W. for about 80 feet. It is located in the center of the rocks area. To the southeast it pinches down until it is too narrow to follow; to the northwest the last 30 feet has a false ceiling of breakdown blocks wedged between the walls. What appear to be slickensides and fault breccia occur on the walls, and suggest that these fissures are actually faults. Several other fissure caves occur to the north of the deep one. One has almost 50 feet of walking passage and intersecting joints cause a right angle turn in the passage.

GARRETT COUNTY

Crabtree Cave

Garrett County, Bittinger Quadrangle

Location: SE 9/4/4

Elevation: 1800

Crabtree Cave is on the north end of Backbone Mountain, west of Savage River Dam. It is not only the largest cave in Maryland, having 4200 feet of passage, but is also perhaps the most difficult to explore. The cave can be traversed as a circuit or loop, via the connection tube, by competent and thin explorers in an average time of 6 to 10 hours. It typically consists of high, irregular fissure passages which are constricted at varying levels, thereby necessitating much chimneying, crawling, and squeezing. A 50-foot length of rope is needed to negotiate a drop in the left passage when heading east.

History:

The cave was discovered in the workings of a small limestone quarry around 1860. The quarry was abandoned at the turn of the century due to a fatal accident in the operation, and since that time the cave has been continually visited. The oldest discernible date to be recorded is February 4, 1917. The cave is on the property of Mr. Newland of Luke, Maryland.

Geology:

Crabtree Cave is developed along vertical or steeply dipping joint planes in the Greenbrier Limestone, which is cross bedded and light gray to tan in color. Arenaceous limestone and red shale beds are mixed with the purer limestone. The beds strike N. 60° E. and dip 15° E. Joints striking N. 30° W. (dip 80° N.), N. 50° W. (dip vertical), and N. 50° E. (dip 80° N.) are developed in the limestone.

Description:

The entrance is a cleft 2 feet wide that drops 10 feet to the cave floor. A narrow, irregular fissure passage, 3 feet to 5 feet wide and up to 40 feet high, slopes gently to the southwest for 120 feet to a junction room, over 50 feet high. From here the two main passages of the cave diverge. One may enter either passage and follow a circuitous route through the cave and return

via the other passage. The passage leading west (right passage) is a high, coral-lined fissure. A stream flows from it across the junction room and descends into a sewer or stream channel at the base of the left passage. A ledge with a 15-foot overhang must be climbed in order to enter this section. A log ladder is usually present for this purpose.

The right passage terminates in a breakdown room which is apparently close to the surface as judged by

the presence of roots in some places. About 200 feet before the end of the right passage is a low 100 foot long crawlway, the connection tube, which leads to the left passage. Midway between this junction and the entrance is the Map Discovery Passage, which leads southwest for about 600 feet. About 350 feet further along the left passage (towards the entrance) is an inconspicuous hole leading into the Algonquin Passage which connects with the old mine near the entrance via the "Handshake Hole". The lowest point in the cave is

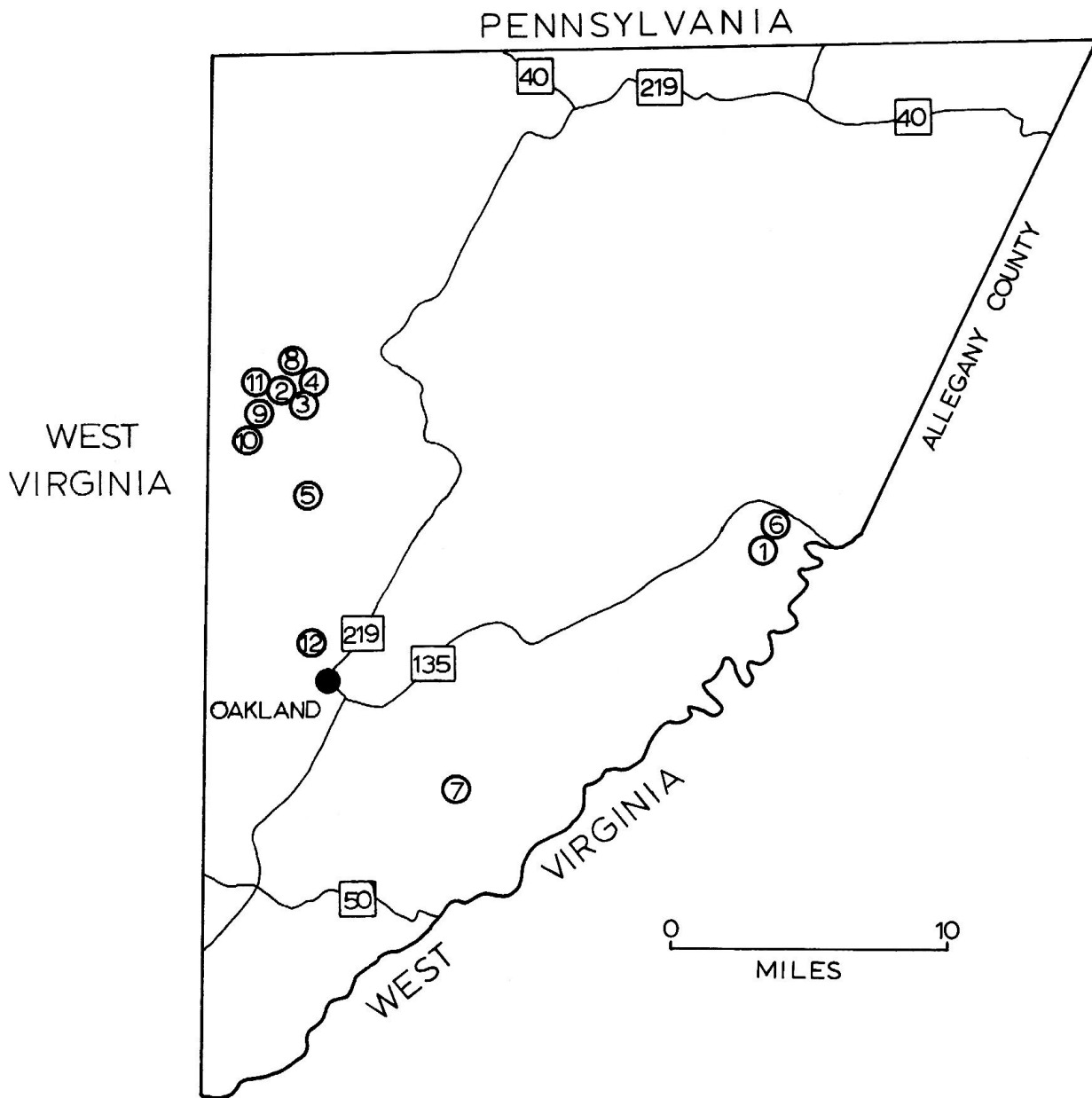
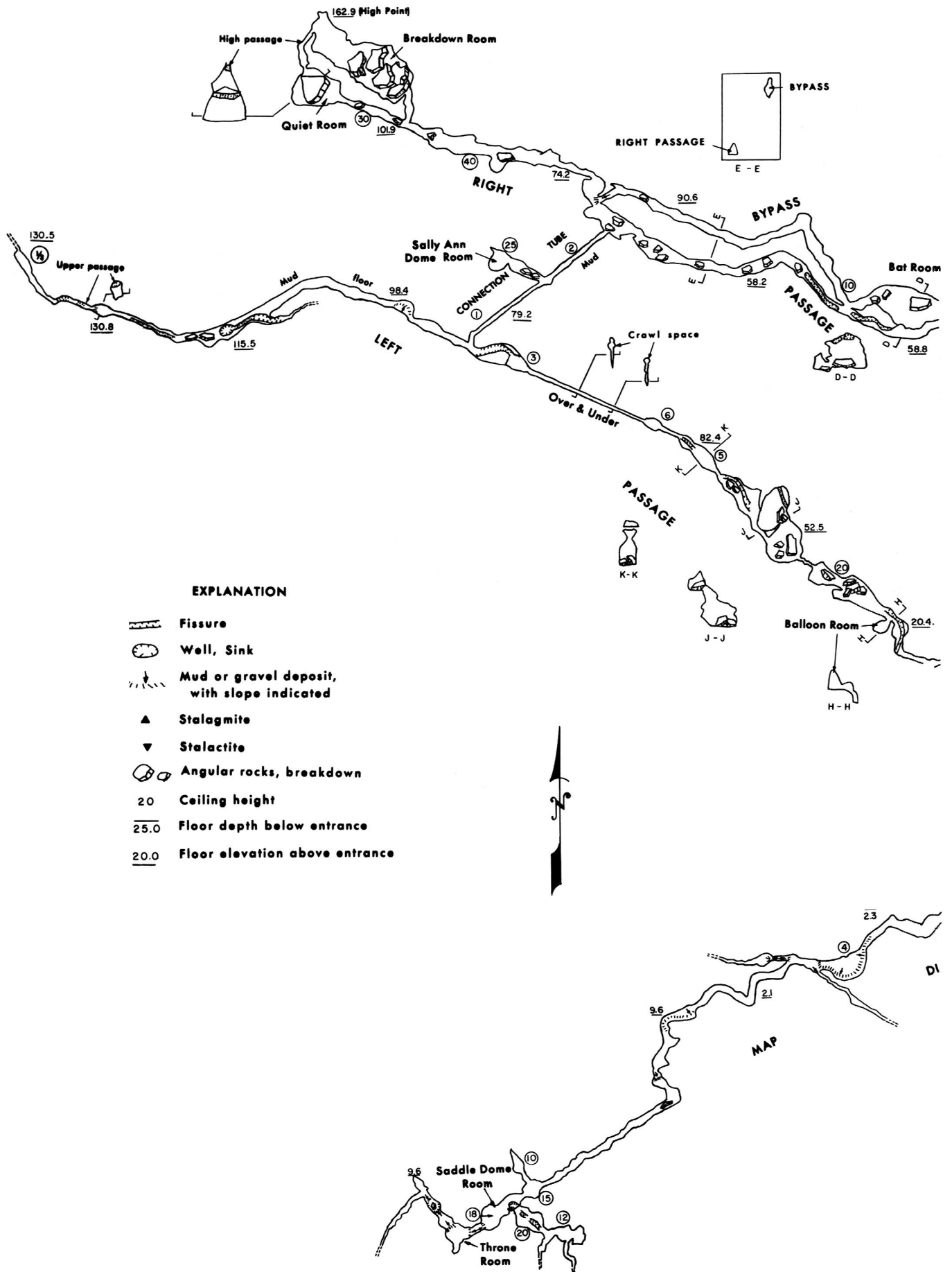


Figure 46. Distribution of caves in Garrett County: 1) Crabtree 2) Dead Man 3) John Friend 4) John Friend No. 2 5) Muddy Creek Falls Shelters 6) Old Salamander 7) Sand 8) Shelter 9) Steep Run 10) Surveyors 11) Weaver 12) Woods Place.



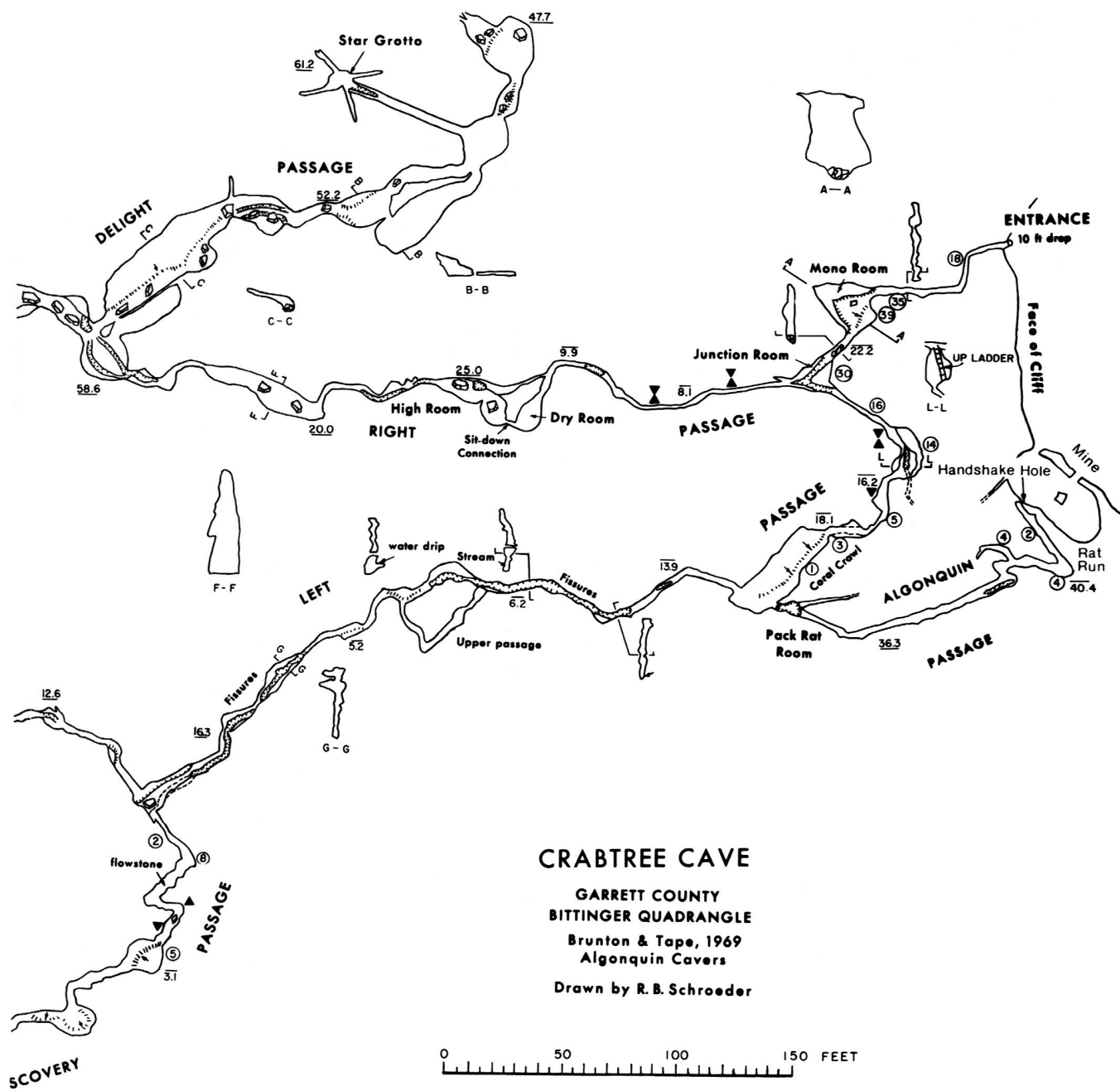


Figure 47. Crabtree Cave, Garrett County. Surveyed by Algonquin Cavers, 1969



Figure 48. A difficult traverse up a wall in Crabtree Cave, Garrett County. Note the cross-stratification in the Loyalhanna Limestone.

in this passage (40 feet below entrance), and the highest point is at the end of the right passage (163 feet above entrance). The cave therefore has a vertical relief difference of over 200 feet. Streams flow along the floor in both main passages, with a general circulation down dip to the east. (Map p.60-61)

Numerous pack rats (*Neotoma*) make camping and exploring in this cave quite interesting. In recent years, however, a marked decline in their population has been observed.

Dead Man Cave

Garrett County, Sang Run Quadrangle
Location: C 9/6/6
Elevation: 2100

According to local residents this used to be a rather

extensive and frequently visited cave in the 19th Century. The cave takes its name from a legend connected with its history. The legend has it that a family named Sines, in which there were two brothers, lived in the area in the 1860's. One of them was reportedly retarded and was murdered by the other, who buried his body in the cave which was subsequently filled up. In the 1960's Bob Corliss, of Swanton, Maryland, undertook to reopen the cave. A trash filled sink was entered and about 150 feet of passage explored to the site of an extensive blockage of fallen rock, which could not be bypassed. This particular sinkhole was revisited in 1970, and found to be closed at the bottom by an earth slump. The accompanying description and map applies to the accessible part of what is undoubtedly part of the same original cave and is entered through two entrances a few yards south of the sinkhole.

The main entrance is in the stream bed and con-

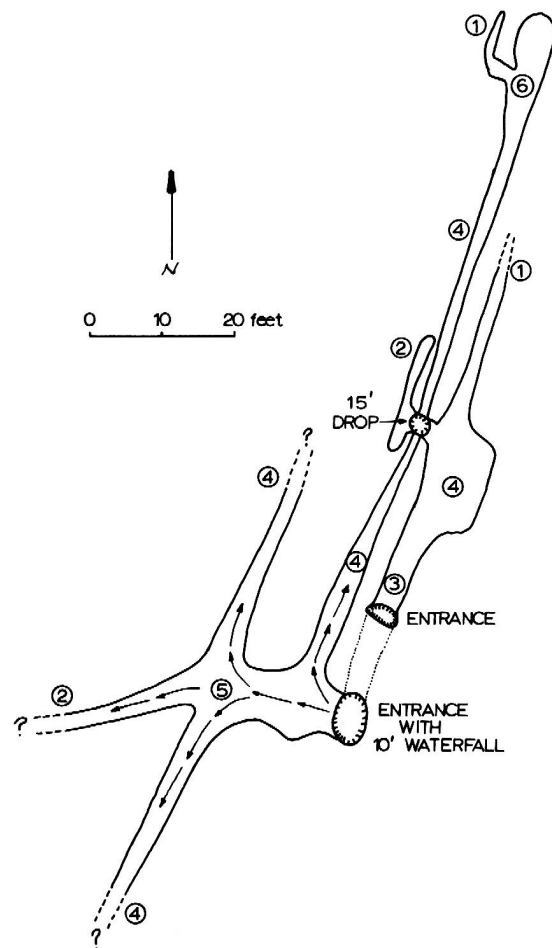


Figure 49. Dead Man Cave, Garrett County.
Surveyed by D. Slifer, April 11, 1970.

tains a ten-foot high waterfall where the stream enters the cave. A second entrance is higher up on the north bank of the valley about 20 feet away from the stream. Water from the stream flows into three passages below the waterfall, none of which have been adequately explored. The cave is developed in the Greenbrier Limestone.

John Friend Cave

Garrett County, Sang Run Quadrangle

Location: EC 1/8/3

Elevation: 2180

John Friend Cave, a well known cavern, is located near the town of Sang Run. The entrance, in a small clump of woods, is 800 feet north of the Ginseng Run road at an elevation of 2180 feet. The cave is on the property of Mrs. Stacia Purnell of Aberdeen, Maryland.

History: ²

John Friend Cave has been known since colonial days. Ample proof that the cave was explored at an early date is furnished by the names and dates on the walls. The oldest is that of W.J. Bowman, December 22, 1751. Another old one is that of Mary Hinebaugh, dated 1776. Other dates range from 1809 through 1948. Although the cave has the connotation "salt-peter" there is little evidence that it was used extensively for salt-peter earth. The only evidence of digging is in the rear portion where a large stalagmite has been all but obliterated by chipping. The stream, however, shows indications of having been trenched and may indicate some type of mining operation.

Geology: ²

The upper Greenbrier Limestone, in which the cave is excavated, is cross-bedded, buff in color, and about 65 feet thick. It is flat-lying and contains prominent vertical joints striking N 50° E. Subordinate joints trend N 60° W and N 80° E.

Description: ²

The entrance is in a shallow sink 10 to 20 feet in diameter. A vertical opening, 8 feet long, 5 feet wide, 15 feet deep, opens at the base of the sink and connects with the main passage. A small room, 15 feet wide and

high and 20 feet long, lies east of the entrance. Its sloping floor is covered with leaves, wood, and other debris that has fallen into the entrance.

The main passage extends west from the entrance for 25 feet as a small fissure 8 feet in height and width. At 25 feet, a drop of 12 feet to a lower level interrupts the passage. The upper level continues west for 100 feet and is connected by chimneys to the lower level. Traverse, however, is along the lower level in an irregular crevice 1 to 3 feet wide and 200 feet long. At two places near the end of the upper level, the passage enlarges to small alcoves 15 feet wide and 20 feet long. A small stream flows west along the lower level.

The passage is offset to the south 200 feet from the entrance and connects with a short passage leading from a dome pit. The dome pit, 10 feet in diameter and 30 feet high, has a cascade of water on its east side. For 100 feet west of this point the main passage averages 4 to 8 feet wide and 6 to 8 feet high and is easy to traverse. Some fallen rock covers the floor. The passage offsets 50 feet to the south at the junction. Here the main passage continues to the west and a low crawlway heads south. The crawlway opens after 20 feet into a series of three rooms, each 10 to 20 feet high, 10 to 12 feet wide, and up to 35 feet long. Beyond the third room the passage continues southwest but is too low for traverse. A stream flows into the main passage from the chimney in the second room.

West of the junction the cave averages 4 to 8 feet wide and high for 300 feet where it again is offset 50 feet to the south by a zig-zag known as the Bend. West of this point the passage enlarges to 6 to 10 feet wide with ceiling heights up to 30 feet. An upper level, connected to the lower level by a series of chimneys, is developed in this section. The main passage ends beyond 150 feet in a room 15 feet wide and 20 feet long that has clay banked to the ceiling. A small crawlway extends southwest at the east end of the room and receives the drainage of the cave. This passage extends for 248 feet but is low and narrow for most of its length. A small room, 58 feet from the entrance to the crawlway, 5 to 6 feet wide, 4 to 9 feet high, and 40 feet long, opens to the northwest. Two small streams enter this passage from the southeast.

The floor of the cave is compact brown clay and silt with occasional areas of fallen rock. Some stream gravel is mixed with the silt and clay. The floor slopes

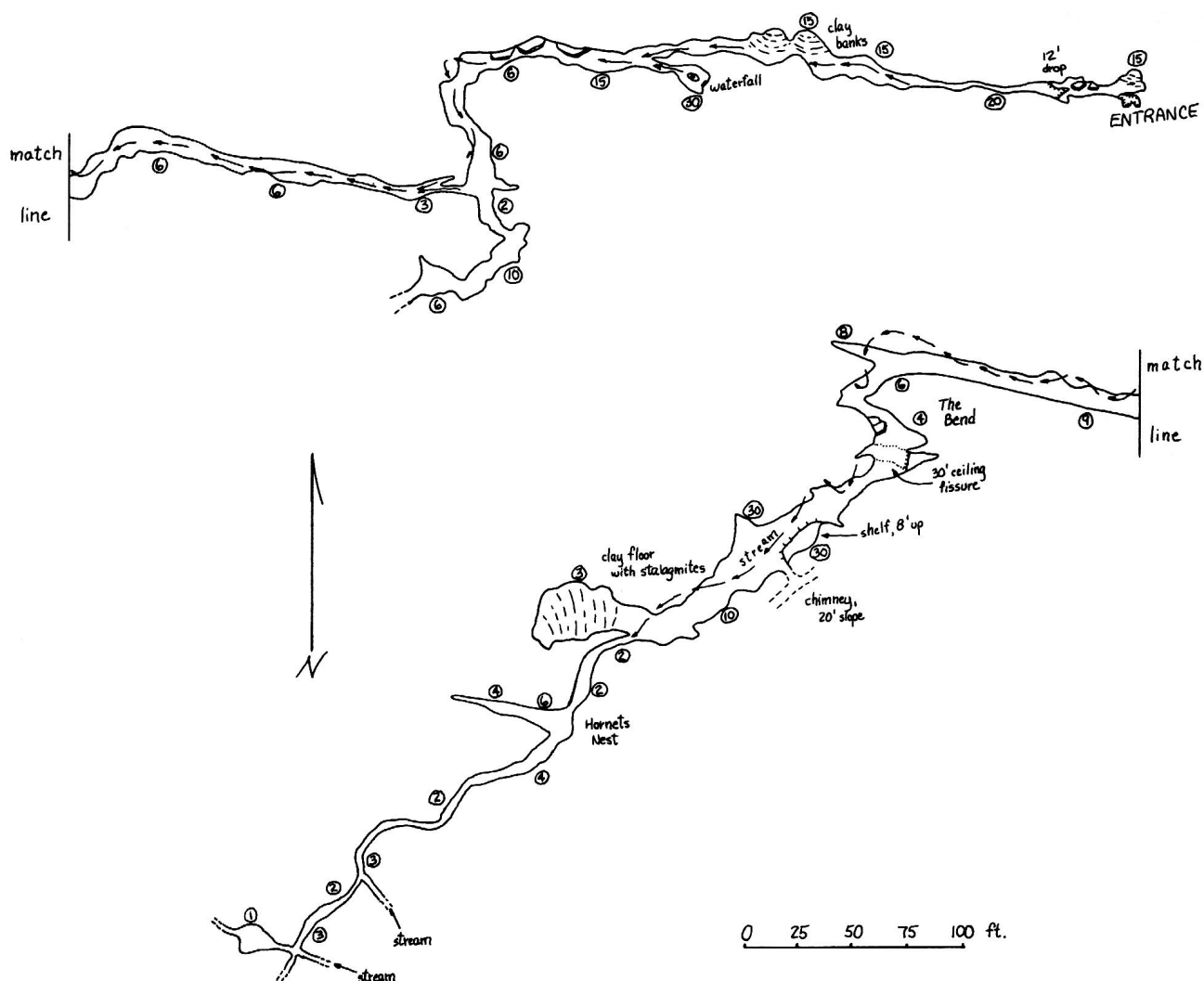


Figure 50. John Friend Cave, Garrett County. Surveyed by W. Davies and T. Richards, June 27, 1948.

gently to the west and, except for the connection between levels near the entrance, has no steep slopes or vertical drops. The stream is entrenched in the clay to a depth of one or two feet. It is reported to drain to the large spring at the Sang Run School.

Formations are rare in John Friend Cave and consist only of a few flowstone drapes and stalactites.

John Friend No. 2 Cave

Garrett County, Sang Run Quadrangle
Location: EC 1/8/8
Elevation: 2180

Davies reported this cave to be directly across the valley from John Friend Cave. It was closed with rock in the 1880's and according to many local residents was a rather large and well decorated cave. The land is

owned by Mrs. Stacia Purnell of Aberdeen, Maryland. A digging operation led by Doug Rhodes in April, 1970, opened up about 80 feet of walking passage which terminated abruptly.

Muddy Creek Falls Shelters

Garrett County, Sang Run Quadrangle
Location: SC 9/9/9
Elevation: 2260

Two small shelter caves lie at the base of Muddy Creek Falls, Swallow Falls State Forest, 8 miles northwest of Oakland. The largest shelter, on the north side of the creek at the falls, is 25 feet long, 15 feet wide, and 4 feet high. The second shelter, 20 feet to the south, is slightly smaller. The shelters are in soft limy sandstone in the upper part of the Pottsville Formation.

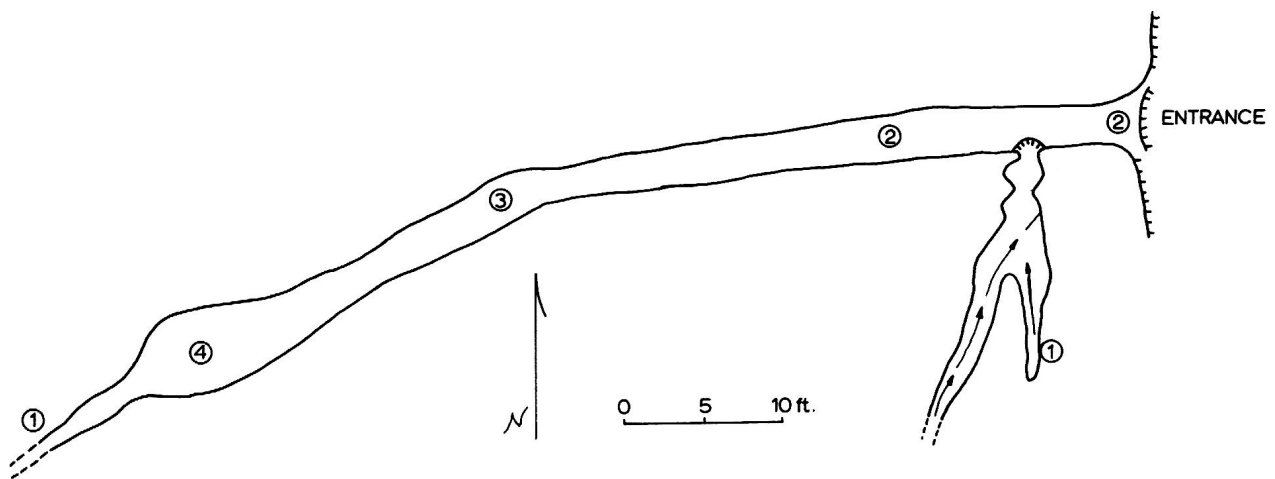


Figure 51. Old Salamander Cave, Garrett County. Surveyed by D. Slifer and D. Weaver, September 27, 1969.

Old Salamander Cave

Garrett County, Bittinger Quadrangle
Location: SE 9/5/7
Elevation: 1380

This small cave is developed in the Greenbrier Limestone, striking due W. and dipping 18°S., with the entrance occurring in the rocky outcrops below Savage River Dam, approximately 400 feet below and one-fourth mile east of the entrance to Crabtree Cave. It was discovered by R.B. Schroeder and E. Paxton in May, 1965.

The cave is a crawlway which trends west and southwest for 70 feet to a small chamber 4 feet high. A passage too small to traverse leads from the chamber and running water can be heard at the opening. The floor and walls of the cave are in places composed of rather coarse and unsorted stream gravel and sediments. Just inside the entrance is a 6 foot drop to the south, at the bottom of which are two low fissures containing water which varies in height with the river level (this represents the level of the river in the spillway below the entrance). The limestone in the walls of this lower level is cross-bedded.

The cave is named for its abundant population of long-tailed salamanders (*Eurycea longicauda*). Several cave rats were observed here and nests are built near the entrance.

Sand Cave

Garrett County, Gorman Quadrangle
Location: NW 5/6/9
Elevation: 2700

Sand Cave, the largest shelter type cave in Maryland, is on the east flank of Backbone Mountain, southwest of Kelso Gap.

History: ²

Sand Cave is ideally suited for human habitation and its history goes back to Indian times. Arrowheads, charcoal, flint chips, charred bones, and a bone instrument have been recovered from the soil near the entrance. Little of interest is connected with the cave since colonial times save that it has been frequently visited. Most initials and dates are obliterated, but a neat inscription – Elishas Cave – has been carved above the entrance.

Geology: ²

Sand Cave derives its name from the lithology of the rock in which it lies. It is developed in a white to gray, brown-stained, fine-grained massive sandstone of the Pottsville Formation. The strata strike N 40° E and dip 18° SE. Two prominent sets of joints cut the beds, one striking N 68° E and dipping 60° W and the other striking N 70° W with vertical dip.



Figure 52. Entrance to Sand Cave, a Garrett County shelter cave with a long history of human habitation

Description: ²

The entrance is a broad, low opening which is practically hidden by a luxurious growth of ferns, moss, and lichens. It is 100 feet wide and 2 to 6 feet high. The cave is of similar width but has heights up to 10 or 15 feet. The ceiling is an irregular surface which forms a broad, flat arch. The floor is covered by large angular blocks of sandstone that have fallen from the ceiling. Some of these are 6 to 8 feet long, but the average is about 4 feet in maximum dimension. At the front the floor is of coarse sand mixed with humus and charcoal, 2 to 4 inches deep, underlain by coarse brown sand. At the rear a stream falls over a large pile of rock, flows along the floor for a short distance, and disappears beneath the floor following a course along the east side of the cave.

The cave apparently extended further to the south at one time. A low ledge on the northeast, and large

blocks of sandstone in a small depression, similar in form to those in the cave, are indicative of this.

A second cave lies in this area, but it could not be located. It is reported to open in the face of a large cliff as a crawlway 8 feet long beyond which it enlarges enough to permit walking for 1000 feet.

Shelter Cave

Garrett County, Sang Run Quadrangle

Location: C 6/6/1

Elevation: 2000

This small rock shelter is developed in the Greenbrier Limestone and overlooks the Youghiogheny River. It is about 20 feet deep and 5 feet high. It would seem to have been an excellent shelter for aborigines, although it is not known if artifacts have ever been found here to indicate such habitation.

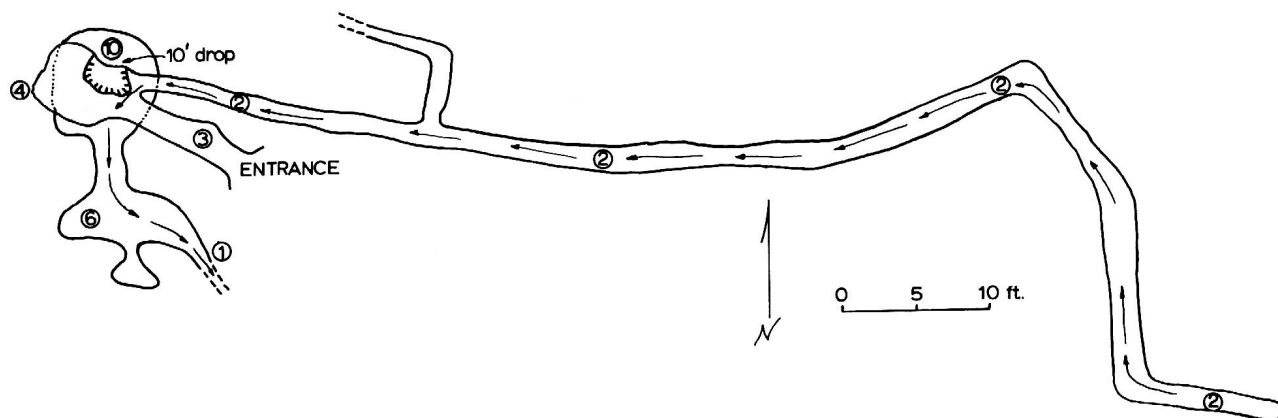


Figure 53. Steep Run Cave, Garrett County. Surveyed by Md. Cave Survey, 1970.

Steep Run Cave

Garrett County, Sang Run Quadrangle
Location: EC 4/9/7
Elevation: 2200

Steep Run Cave was discovered in 1955 by Bob Corliss and Bob Glaze. The entrance is a 3 foot diameter hole in a rocky stream bed, about 25 feet below the point where the stream sinks through cracks and gravel entering the cave below. Fifteen feet inside the entrance one encounters another small stream issuing from the long crawlway passage to the east. This stream flows over a 10 foot drop into a lower room and disappears into an impassable siphon at the bottom. Steep Run Cave is developed in the Greenbrier Limestone.

Surveyors Cave

Garrett County, Sang Run Quadrangle
Location: EC 7/4/8
Elevation: 2100

Surveyors Cave was discovered by Bob Corliss, of Swanton, Maryland, who provided the following description to the authors. The entrance receives a small stream of water, which flows through a portion of the cave, at one point forming a small waterfall under which the explorer must pass to continue. Several hundred feet of traversable passage was explored to a point where the cave terminates by pinching down. Surveyors Cave is developed in the Greenbrier Limestone.

Weaver Cave

Garrett County, Sang Run Quadrangle
Location: C 9/6/4
Elevation: 2300

This cave was discovered by Dave Weaver in April, 1970. It is located about 250 feet above Dead Man Cave in the same stream valley. A small spring emerges from an outcrop and flows downhill for 50 feet and enters the cave. The entrance is a fissure 4 feet high and 2 feet wide which slopes down to a passage trending NE for about 70 feet to a point where it is too constricted to follow. The passage can be seen to open up beyond, however. The stream enters a left passage 20 feet inside the entrance and flows down to a series of two pools and a dead end passage. Weaver Cave is developed in the Greenbrier Limestone.

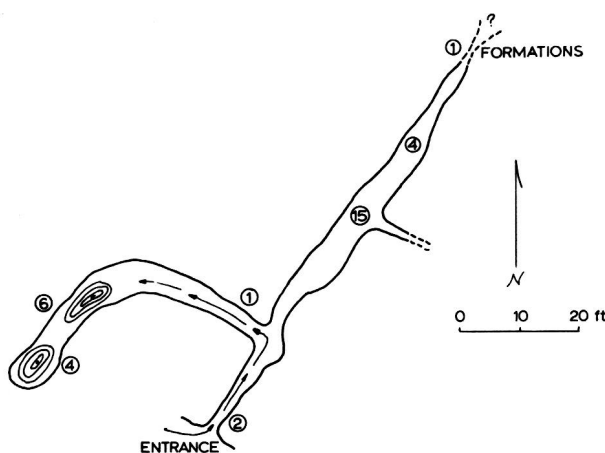


Figure 54. Weaver Cave, Garrett County. Surveyed by D. Slifer and D. Weaver, April 11, 1970.

Woods Place Cave

Garrett County, Oakland Quadrangle

Location:

Elevation:

This cave is reported to lie four miles north of Oakland, east of the road to Swallow Falls. The entrance leads down in step-like terraces for 50 feet to a passage of unknown length. The cave was not located.²

HOWARD COUNTY

Camels Den

Howard County, Ellicott City Quadrangle

Location: WC 5/3/7

Elevation: 240

Camels Den is a shallow rock shelter, 15 feet long, 6 feet wide and 8 feet high, in the Cockeysville Marble. It is 20 feet above the Patapsco River, with a talus slope below the entrance.

WASHINGTON COUNTY

Ankeney Cave

Washington County, Hedgesville Quadrangle

Location: NC 4/6/4

Elevation: 400

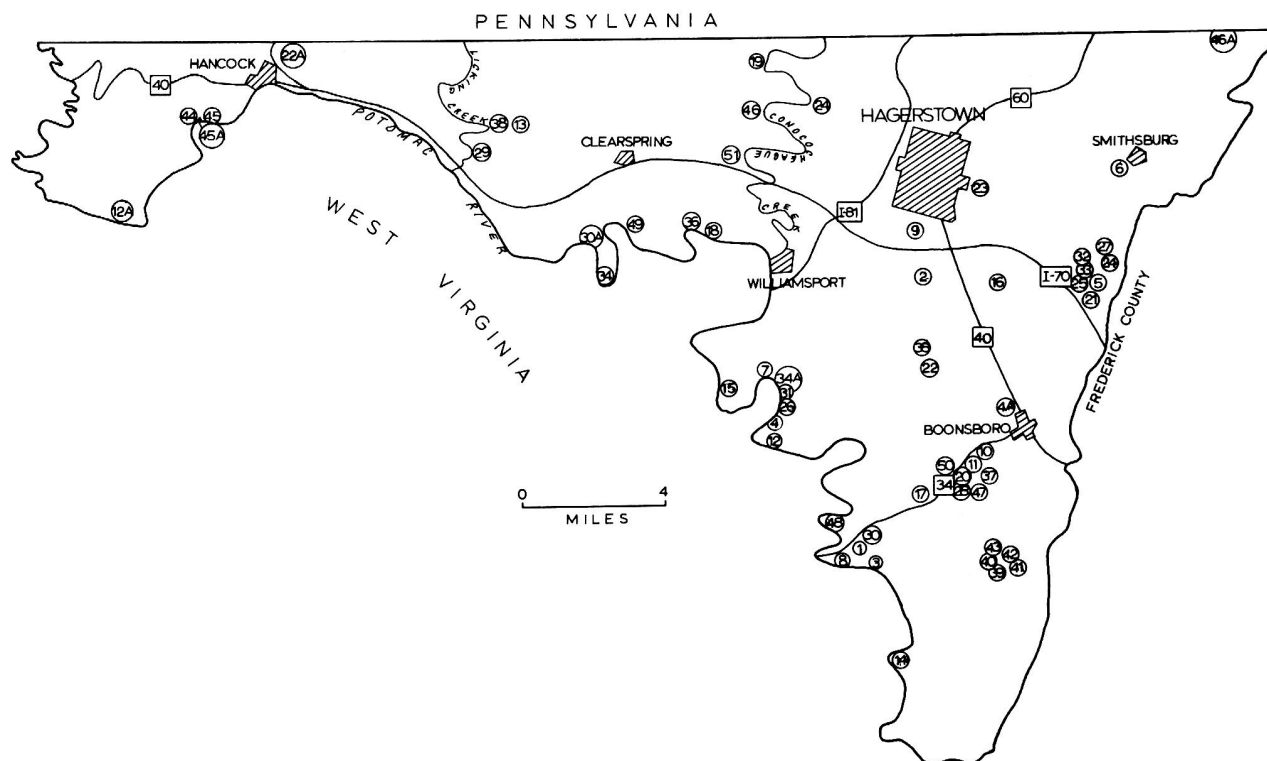


Figure 55. Distribution of caves in Washington County: 1) Antietam 2) Antietam Creek 3) Antietam Quarry 4) Artz 5) Bowman 6) Busheys 7) Cave-in-the-Field 8) C. & O. Canal 9) Cool Hollow Well 10) Crystal Grottoes 11) Crystal Grotto Quarry 12) Dam No. 4 13) Darby 14) Dargan Quarry 15) Dellingers 16) Dog House 17) Drain Ditch 18) Eby 19) Fairview 20) Flooks Fissure 21) Ground Hog 22) Grove 22A) Hepburn 23) Holmes 24) Winders 25) Houpt 26) Howell 27) Jugtown 28) Keedysville 29) Licking Creek 30) Marker 31) McMahons Mill 32) Mt. Aetna 33) Mt. Aetna Quarry 34) Natural Well 35) Neck 36) Pinesburg 37) Red Hill 38) Revells 39) Rohrsersville Column 40) Rohrsersville-Hogmaw 41) Rohrsersville Keedy 42) Rohrsersville King Quarry 43) Rohrsersville No. 5 44) Round Top Summit 45) Round Top No. 2 45A) Round Top Mines 46) Schetrompf 47) Snively 48) Snyders Landing 49) Two Locks 50) Wheeler Rd. Crevice 51) Wilson.

This cave is reported by several sources to be in the rocky escarpment on the west side of "The Neck" south of Clearspring, on the property of I. Donald Ankeney.

It could not be located during fieldwork in 1969. The entrance is supposedly small and obscure, and slopes down to a passage containing at least two rooms and some speleothems. According to the owner, no one has ever completely explored it. This cave is in the Conococheague Limestone.

Antietam Cave

Washington County, Keedysville Quadrangle
Location: WC 7/9/9
Elevation: 380 feet

A crawlway over 100 feet long is located on the east side of a ravine east of the village of Antietam. The cave is of little interest except for local reports that insist it connects with an opening in a quarry at Burnside Bridge, 2 miles to the north. The cave could not be located during fieldwork in 1969; the authors believe the entrance has been filled or covered. The cave is developed in the Tomstown Dolomite.

Antietam Creek Caves

Washington County, Funkstown Quadrangle
Location: NW 9/2/5
Elevation: 440

Three small caves in the Beekmantown Limestone occur in the west bank of Antietam Creek between Funkstown and Roxbury. The entrance to Cave no. 1 (dip 33° SE, strike S 45° W.) is in an outcrop fifteen feet above the creek, and the cave is formed by the intersection of two joints at right angles. The entrance drops eight feet into a narrow trash-filled room. From this room, a tight passage follows a strike joint ten feet to the southwest.

Cave No. 2 (NW 9/6/2) is twenty feet above the west bank of Antietam Creek. The entrance is three feet by two feet, and the cave extends for fifteen feet as a low crawlway.

The third cave (C 4/7/9), which is at the tip of the meander at Roxbury, is 2½ miles south of Cave no. 2. There are two entrances to this cave in an outcrop twenty feet above the creek. The entrances join just

inside the cave and continue as a low crawlway twenty feet to the southwest. The ceiling of the cave is developed in a reddish siltstone while the floor is Beekmantown Limestone.

Antietam Quarry Cave

Washington County, Keedysville Quadrangle
Location: SW 1/6/7
Elevation: 400 feet

A small cave is located in the north wall of a quarry south of Antietam overlooking the Potomac River. It is an opening which is two feet in diameter and thirty feet above the quarry floor. It consists of a six foot crawlway which intersects a perpendicular passage, 15 feet long and three feet high. The cave is located in the Tomstown Dolomite.

Artz Cave

Washington County, Williamsport Quadrangle
Location: ?
Elevation: ?

Southwest of Downsville, Artz Cave is reported to be near the top of a 40 foot cliff overlooking the Potomac River. The cave entrance, a crawlway 18 inches in diameter, extends 15 feet to a small room. The floor of the room slopes 30° to a small dome pit ten feet deep. Two small passages are at the base of the pit: one passage leads upwards into surface breakdown and the other slopes down to a pool. Flowstone and other speleothems occur in a small passage to the right of the entrance passage. The cave is developed in the Beekmantown Limestone and has a total of 150 feet of passage.

The cave could not be located during fieldwork in 1968. What appeared to be a collapsed or filled entrance was found in the proper area and the authors believe this may be Artz Cave.

Boonsboro Sinks

Washington County, Funkstown Quadrangle
Location: SE 4/1/1
Elevation: 500

The Boonsboro Farmers Livestock Exchange excavated a pond in the field north of their buildings in

the mid 1950's. It held water for several weeks and suddenly drained. There were no less than seven sink-holes observed in this pond bed in 1968. The largest ones are twenty feet deep and four to six feet in diameter. All of them are filled with clay at the bottom, thereby making the cave(s) below inaccessible. Digging yielded no results. The pond bed area still receives considerable run off from the watershed to the east. This evidence, plus the fact that a well drilling rig lost its bit in a 15 foot space while drilling for a restaurant located 0.3 mile south of the pond bed, makes the prospect of finding caves here very good. The pond bed sink holes are located in the Tomstown Dolomite.

Bowman Cave

Washington County, Funkstown Quadrangle

Location: NE 9/8/9

Elevation: 640

The entrance to Bowman Cave is a tight slit under a low ledge in a forested meadow, east of Beaver Creek. The first 15 feet is crawlway. The passage then divides into a 20 foot crawlway to the west and a larger, clay-floored passage trending northeast for 50 feet. This passage which is five feet in diameter ends abruptly at a clay bank. A low crawlway atop the clay fill was enlarged by digging and can be followed for another 20 feet. More digging in a small crawlway at the floor level on the north side of the larger passage made it possible to squeeze through a keyhole and drop ten

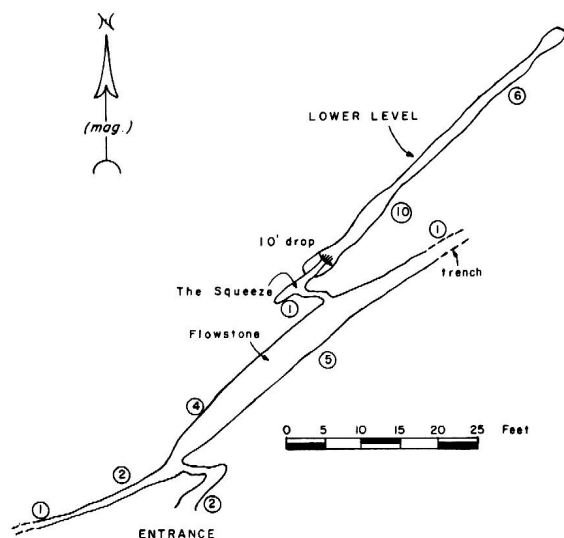


Figure 56. Bowman Cave, Washington County.
Surveyed by M. Haymond and D.
Slifer, October 8, 1967.

feet into a parallel fissure passage. This trends northeast for 50 feet and constitutes a lower level. The lower level passage is blocked by very sticky clay. The upper passage contains some small flowstone decorations which are stained bright red and orange, probably by iron minerals in the rock. Bowman Cave, which is named after its discoverer, Terry Bowman of Hagerstown, is developed in the Tomstown Dolomite.

Busheys Cavern-Cavetown Quarry Caves

Washington County, Smithsburg Quadrangle

Location: SW 6/6/1

Elevation: 760

Three caves are located in a quarry near Cavetown. All have been greatly altered by quarrying activities and appear to be in danger of collapse.

History: ²

Busheys Cavern is the oldest known cave in Maryland. Mention of the cavern is contained in early Moravian Journals dated 1748 where Joseph Spangenberg wrote... "On July 12th. they passed over South Mountain and came on the same day to the 'Canigotschik' (Conococheague), where they inspected a remarkable cave, which passes through the earth for 300 yards. In its opening 1000 people can stand, then it separates into two branches". Though the Journal places the cave on Conococheague Creek other notes in the journal and field searches indicate that Busheys Cavern is the cave in question.

For many years the cave was owned by Robert Hughes and later by Dr. Elisha Bishop. Dr. Bishop began quarry operations in 1883 that were continued until 1944. At the end of the 19th century, F. M. Bushey took over the quarry operations. The cave was used as a source of saltpeter early in the 19th century, and vats and troughs were installed. According to Peter M. Haver the vats and troughs, which no longer exist but are on record, are the northernmost record for saltpeter leaching activities within the confines of a cave. A few insignificant saltpeter caves exist at a latitude farther north than Busheys in this country, but none seem to have been of the former size and significance of Busheys.

The cave was open to the public in 1823 as evidenced by the following newspaper advertisement in a Washington County paper:

"James Camper, having been at considerable expense in fitting up the cave for the accommodation of the public, most respectfully informs them and his friends that he will, in commemoration of the glorious independence of the United States of America, brilliantly illuminate it on the 4th, 5th, and 6th days of July next. That no one be disappointed, he begs leave to state that he cannot admit any person into the cave on those days for less than 12 ½ cents. Any person throwing stone or anything else in any part of the cave, particularly the water at the extreme end of the subterranean passage, will be fined one dollar. The cave will be kept in good order during the summer. Families or parties wishing to visit this wonderful work of nature can have it illuminated at any time by sending a letter (postpaid) to James Camper, Cavetown, or they will be admitted and provided with light for 6 ½ cents each. For the accommodation of visitors and others he will have a supply of good porter, beer and ale."

Quarrying operations ate into the cave in 1925. The entrance collapsed first, followed by the inner portions, due to blasting.

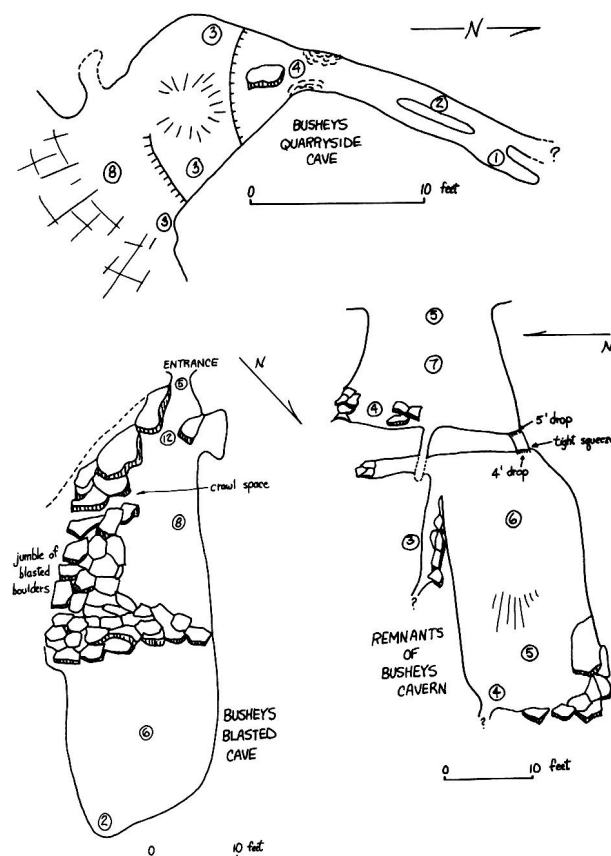


Figure 57. Busheys Cavern-Cavetown Quarry Caves. Surveyed by P. Haure and M. Houpt, October 19, 1969.

Geology: ²

Busheys Cavern was in black dolomite at the top of the Tomstown Formation. The strike is N 60° E and the dip 45° W. The cave was developed along a series of joints that trend N 60° W. Overlying the Tomstown Formation in the upper part of the quarry are 30 feet of massive, black, phyllitic, calcareous shale of the Waynesboro Formation.

Excavation in the cave and adjacent quarry area yielded a number of fossil bones. Twenty-five species, twelve of which are extinct, were obtained by Dr. Charles Peabody in 1905 and were described by Oliver P. Hay.

Description: ²

Little is left of the cavern today except a small part of the large entrance hall. The entrance is a moss-covered shelter 11 feet wide and 6 feet high that ends in a small crevice passage leading to a room 23 feet long, 20 feet wide, and 5 feet high. This room is floored with large boulders that have dropped from the roof. In the roof and walls are large broken blocks that are precariously balanced and in danger of collapse. On the north side of the room a part of the original cave is seen at the base of a pile of rock 15 feet below the present floor. Old initials are discernible on the walls in this part. The treacherous condition of the rocks makes it dangerous to enter this cave and visitors should keep out.

The cave was reported to be 500 feet long and to consist of an entrance, 58 feet wide and 8 feet high, leading to a room about 140 feet in diameter. A series of passages varying from 4 to 40 feet in width led to a lake 100 feet long, 20 feet wide and 7 feet deep that occupied the end of the cavern. The rooms were beautifully decorated with delicate stalactites and massive columns. In the southwest corner of the first room was a series of terraces (Venus Baths) made of oval rosette basins rising 25 feet above the floor. Complete description of the cave is in Scharf's History of Western Maryland and in the Peabody's archeological study.

Busheys Quarryside Cave was discovered in the quarry during operations in May, 1881. It was a fissure 15 feet high, extending into a well decorated chamber 90 feet long, with a gallery 90 feet long at right angles to the fissure. The far end of this fissure exists

as a shallow gallery 60 feet above the floor in the center part of the quarry. This small chamber is full of small stalactites and columns which have suffered little from the quarry operations.

Busheys Blasted Cave which was surveyed by Peter M. Hauer is located at the northern edge of the quarry, at about the same level as the second cave. The main entrance is a five foot drop to a large chamber extending 50 feet to the northeast. Average ceiling height is 8 to 10 feet and width is 20 feet. The last 10 feet is the extent of the original floor, bearing one stalagmite. The rest of the floor is a downslope of shattered breakdown. The southeastern wall is a badly shattered jumble of breakdown with a crawl in it leading to a maze of passages in the breakdown which have at least two other entrances. The cave is exceedingly dangerous.

Cave-in-the-Field

Washington County, Williamsport Quadrangle
Location: SC 1/2/8
Elevation: 380

The entrance to Cave-in-the-Field is in a prominent sinkhole in a meadow southwest of Downsville.

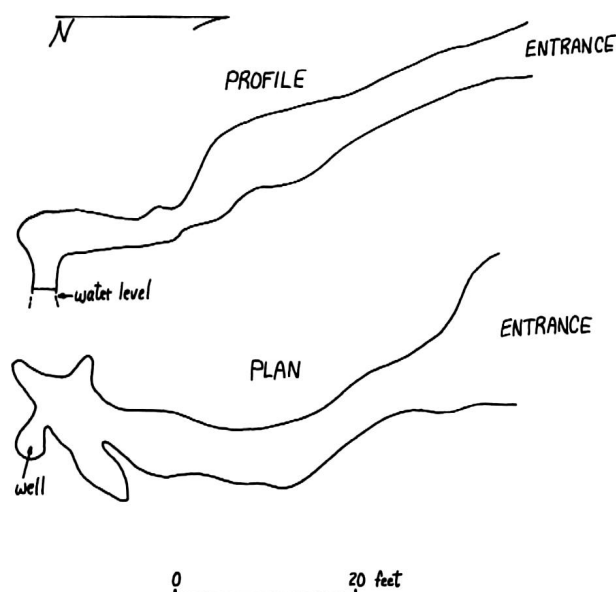


Figure 58. Cave-in-the-Field, Washington County, Surveyed by D. Slifer and D. Fanning, September 7, 1968.

The entrance is four feet high and fifteen feet wide. The passage slopes down at a 30° angle for sixty feet to a small low room containing a cylindrical well eight feet high. This well usually contains several feet of water, although in very dry seasons it recedes enough to allow one to look into a low water-filled passage which becomes a siphon. This cave is hydrologically related to McMahons Mill Caves and Howells Cave, 750 yards to the south. Organic debris on the ceiling indicates that the cave floods occasionally, due to surface runoff from the watershed to the north of the area. This cave is in the Stones River Limestone.

C. and O. Canal Cave

Washington County, Shepherdstown Quadrangle
Location: EC 4/9/1
Elevation: 370

On a farm southeast of Shepherdstown there are several old lime kilns near the Chesapeake and Ohio Canal. In the hillside behind the barn there are two deep quarries, one filled with water. The water-filled quarry contains a large cave entrance on its south face.

According to local reports the cave was opened by quarrying operations in the early 19th century. The limestone was burned in the nearby kilns and the product was reportedly shipped to Washington, D. C. via the canal and used in early construction of the Washington Monument. The cave is used today by local students for a clandestine party site.

Geology:

This cave is developed on the southeast flank of a minor anticlinal fold in the Elbrook Limestone close to its contact with the Conococheague Limestone.

Description:

The entrance is 35 feet wide and six feet high. The cave is a single room extending east for 70 feet to a clay bank. It is eight to ten feet high and 30 feet wide. Several small holes continue beyond the clay bank.

Cool Hollow Well

Washington County, Funkstown Quadrangle
Location: C 5/1/3
Elevation: 440

At the base of a 35 foot man made well, in the front yard of Mr. Long's "Cool Hollow House", near Funkstown, there is a low passage which trends south-west for at least 20 feet. The passage was exposed by a partial collapse of the rock lining the well. It would require digging in order to enter but a mass of loose rock directly overhead makes this unwise. Definite solutional pockets were observed on the ceiling. The cave is in the Elbrook Limestone.

Crystal Grottoes

Washington County, Keedysville Quadrangle

Location: NC 3/1/5

Elevation: 420

Crystal Grottoes, the only commercial cave now open in Maryland, is also one of the largest in the state. Nearly one half mile of passage was mapped in 1968. It is owned by Joseph Downs, Boonsboro, Maryland.

History: ²

The cave was discovered in 1920 as a result of quarry operations for road material. Drills penetrated the passages near the present entrance, and an opening was effected by blasting. Because of their beauty and commercial possibilities the caverns were spared in the quarrying: and, in 1922, after clearing and installation of electrical equipment, the caverns were opened to the public. The entrance house was originally a wooden structure. It was replaced in 1942 by the modern stone structure.

Geology: ²

Crystal Grottoes is developed on the east side of a broad subordinate anticline in the Tomstown Dolomite with a dip of 20° E and a strike of N 30° E. The pattern of the cave is strongly controlled by three sets of master joints. The major influence is from those striking N-S, with subordinate passages reflecting joints trending N 30° E and N 30° W. The cave is essentially horizontal throughout its extent and the passages are typically high and narrow. A great deal of brown and red clay fills most of the cave to a considerable extent; the commercial tour routes involved the removal of up to 6 feet of this clay in places. Sediment fills many of the undeveloped passages to within a foot or two of the ceiling, thereby making many crawlways. No streams exist in the cave, although a small "lake" or pool is maintained by drip water.

Description: ²

Entrance to the grottoes is by a stairway in the entrance house. The first room is 8 feet below the entrance house and is oblate in shape, being 30 feet long, 10 feet wide, and 15 feet high. At each end it is pinched out by mud flows and narrowing of the passage. This room originally contained a considerable number of formations, but quarrying operations and clearing of passages have removed them except along the west wall where flowstone and stalactites are abundant. Connecting the entrance room with the rest of the cave is a small tunnel 6 feet high that is reached by stairs going down 6 feet. From this point on the cave is a series of fissure-like passages of unsurpassed beauty. The fissures are uniformly 4 to 6 feet wide with ceiling heights varying from 60 to 40 feet. The floor shows little change in elevation throughout the cave. With the exception of the passage from the Blanket Room to the exit, the passages are continuously lined or covered by formations. Delicate drape-like stalactites, bacon rinds, and stout columns predominate. The colors are generally pure white or buff with occasional deeper tints. The passages forming Fairyland are studded with stalactites and stalagmites of a delicate light blue hue.

The passages between Fairyland and the Blanket Room are dense with beautiful formations which are striking because of their clean white surfaces. In this area, where formations are occasionally absent, the ceiling and walls are covered by a green-gray residual clay, which combined with the graceful contours of the ceiling rivals the formations in beauty. This clay is an integral part of the dolomite and remains a residual product upon the dissolving of the carbonates. It is porous and retains the structure of the original beds. When dry it is quite strong although the surface is powdery, but when wet it is soft and weak.

The Blanket Room is the largest room in the caverns, being 30 feet and 20 feet wide. Large sheets of stalactites and bacon rind hang in clusters from the ceiling, which is here 20 feet high.

The passage leading to the Golden Lake is profuse with formations and in part is bridged by flat-lying travertine, a condition that is found in many of the passages not open to the public. The Golden Lake is a small pool fed by water dripping from the ceiling. In wet seasons the water accumulates at a rate necessitating periodic bailing.

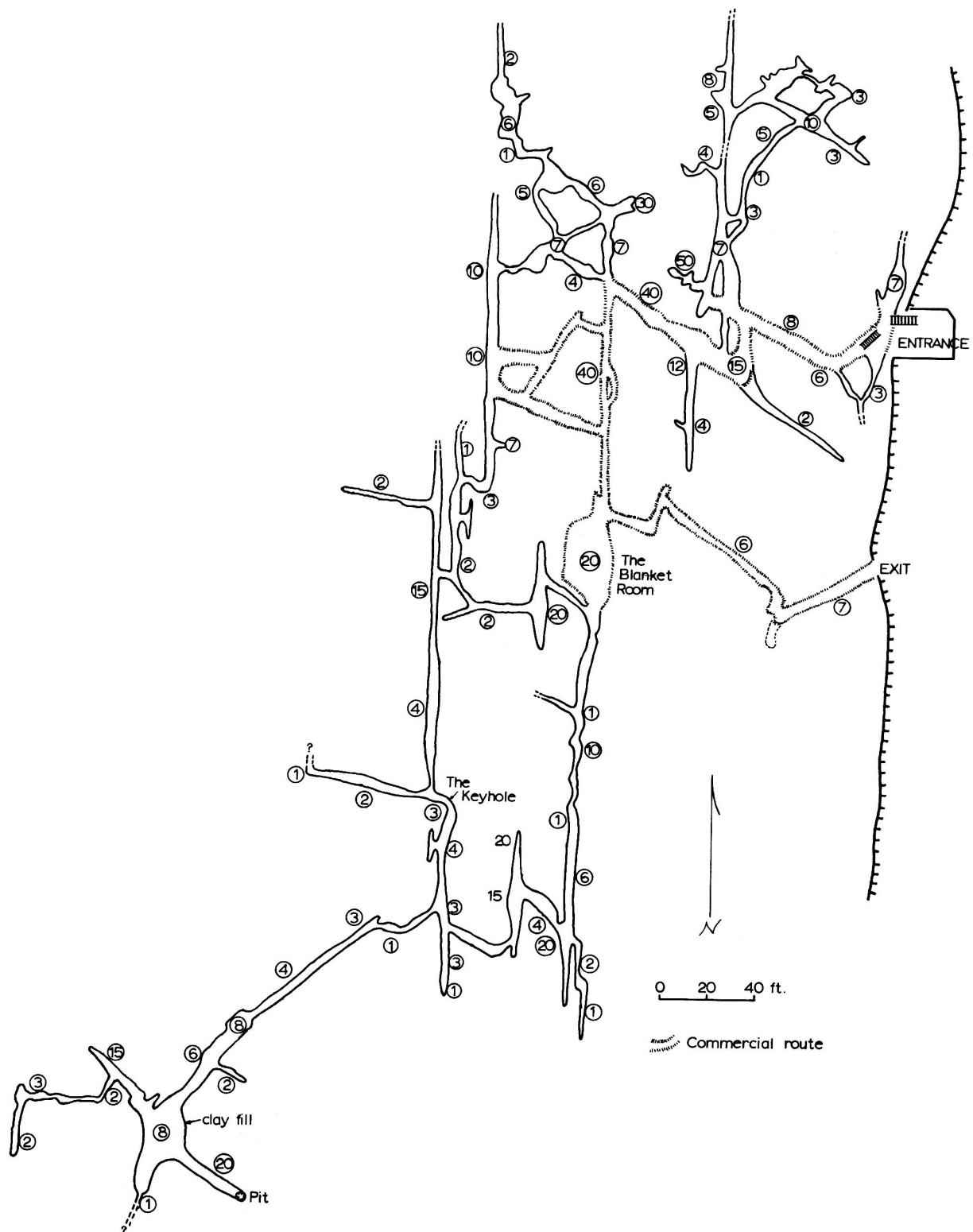


Figure 59. Crystal Grottoes, Washington County. Surveyed by Maryland Cave Survey, August-September, 1968

The remainder of the cave is along a passageway similar in size to those already described except that formations are sparse. The walls are sooty brown in color and of a nodular texture. The last 40 feet of the cave is through a stone-walled passage leading up a gentle grade to the exit.

The passages not open to the public are similar to those already described except they are constricted at many points. Orange-brown clay that covers the floor and lower walls of these passages is often overlain by calcareous formations. With one exception these passages are developed at the same level as the main cave. The exception is the passage at the extreme end of the Flowstone Way that descends about 15 feet below the general level. The commercial tour route covers approximately one third of the known cave.

Crystal Grottoes Quarry Caves

Washington County, Keedysville Quadrangle
Location: NC 3/4/1
Elevation: 420

Two small caves are located on the south bank of a tributary of Antietam Creek, adjacent to the limestone quarry 300 yards southwest of Crystal Grottoes. Both caves are in the same formation, Tomstown Dolomite, as the commercial cave and are no doubt geologically related to it. They exhibit an identical passage orientation, with major joints striking north-south. They consist of narrow fissures with a mud floor. A few dead speleothems may be seen in the larger one. All leads pinch out or end in clay fills.

Dam No. 4 Cave

Washington County, Shepherdstown Quadrangle
Location: NC 3/4/7
Elevation: 320

The impressive entrance of Dam No. 4 Cave is located at the base of a cliff 100 feet high along the Chesapeake and Ohio Canal.

Geology: ²

Dam No. 4 Cave is in the Conococheague Limestone which strikes N 15° W and dips 55° E. The limestone is massive, fine-grained, and black in color. A prominent joint striking N 85° W in combination with

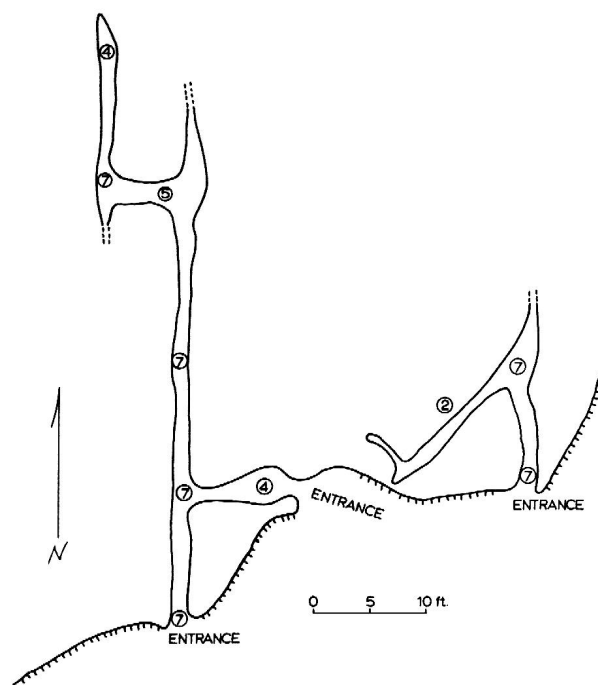


Figure 60. Crystal Grottoes Quarry Caves, Washington County. Surveyed by Maryland Cave Survey, 1968.

the bedding planes controls the pattern of the cave.

Description: ²

The entrance, 15 feet wide and 20 feet high, connects with a passage of similar dimensions that extends north for 100 feet where it is offset 20 feet to the east. The floor rises gradually from the entrance and is covered by a shallow slow-flowing stream. At the east end of the offset the cave continues north for 40 feet as a small passage 4 feet wide and 4 to 6 feet high. Beyond this it is triangular in cross section with a height and width of 3 feet. It reduces gradually in height until beyond 25 feet it is less than a foot above the stream that forms a deep pool at this point. A side passage leading from the east end of the offset slopes steeply upwards for 30 feet to a small room at the base of a chimney. The chimney, 30 feet high and 10 feet in diameter, with flowstone and stalactites along the wall, has a floor of wet clay. A small fissure passage on the west side of the chimney leads north 40 feet to a similar chimney. The latter chimney is connected to the main stream passage at a point 40 feet from the offset by a narrow fissure.

In addition to the formations found in the chimneys, there are a number of small helictites growing on

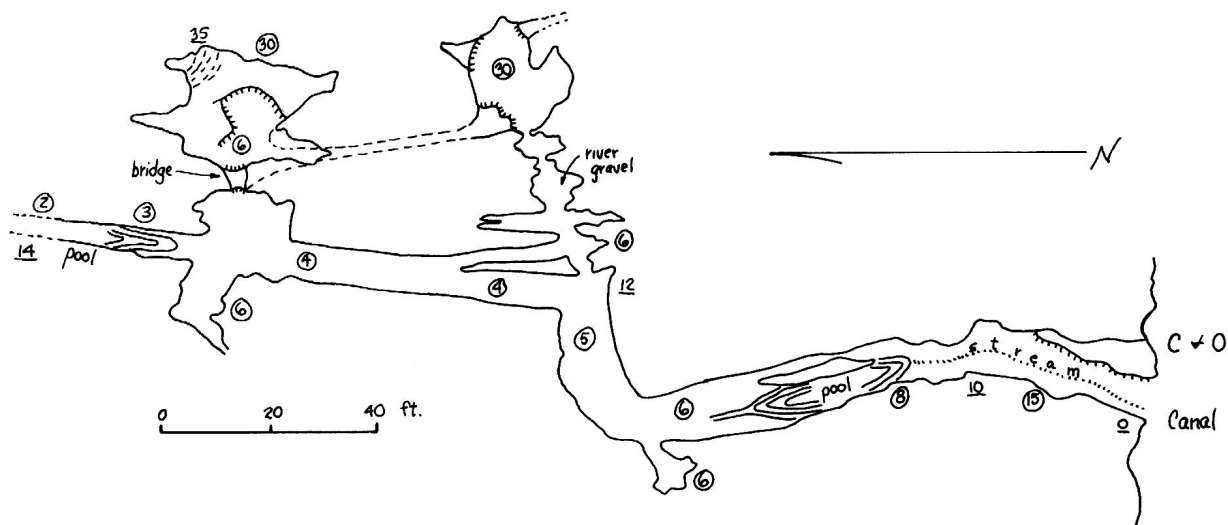


Figure 61. Dam No. 4 Cave, Washington County. Surveyed by W. Davies, November 6, 1949.

knobs of broken stalactites scattered along the ceiling of the stream passage beyond the offset. Rounded pebbles and boulders of river gravel lie at the base of the first chimney and have come into the cave from the gravel terrace that caps the hill above the cave.

Dam No. 6 Mine

Washington County, Great Cacapon Quadrangle

Location: NE 1/1/2

Elevation: 540

This mine has its entrance in the crest of Tonolo-

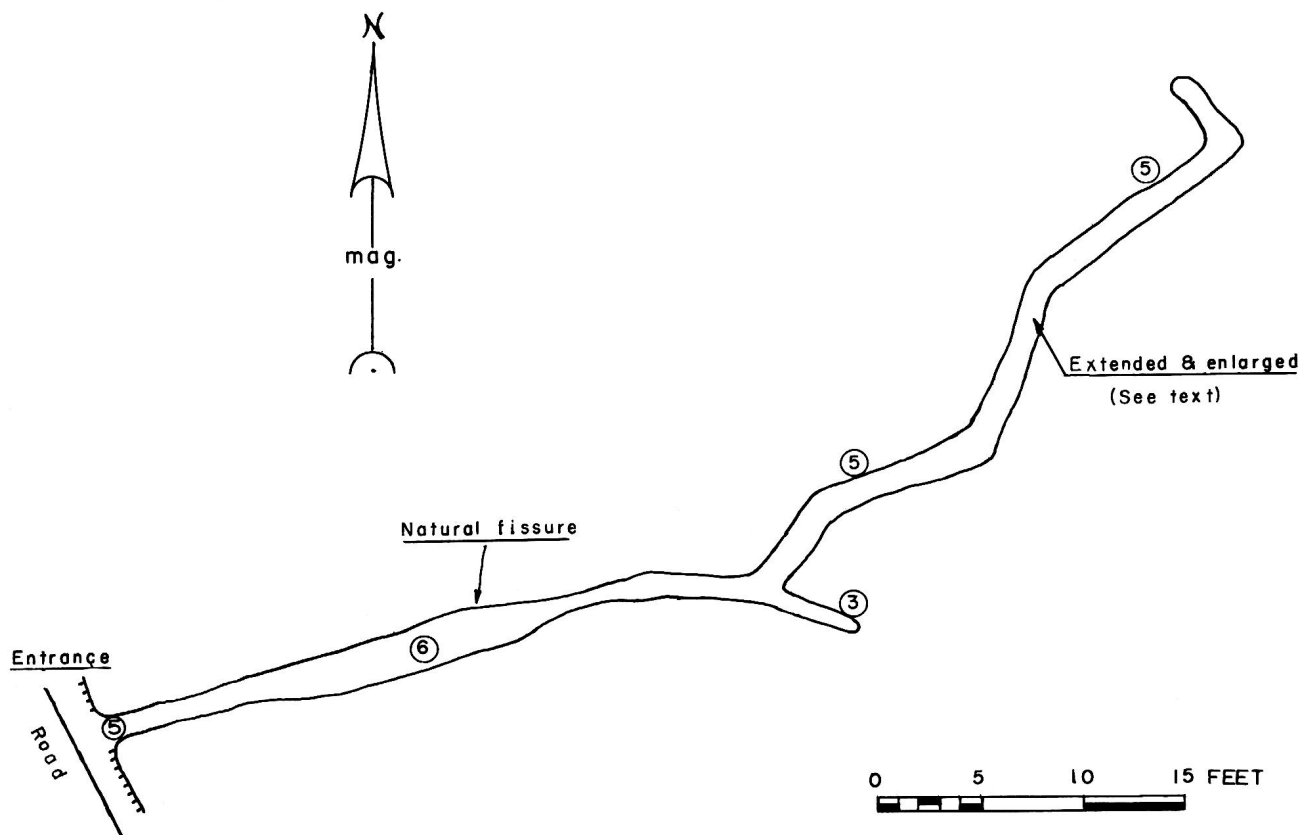


Figure 62. Dam No. 6 Mine, Washington County. Surveyed by O. Slifer and R. Franz, October 13, 1968.

way Ridge, overlooking Great Cacapon across the Potomac River. It is in the Oriskany Sandstone, which contains the large glass sand quarries at nearby Berkeley Springs, West Virginia. The first 50 feet of passage appears to be natural; that is, it was probably a fissure type cave which has been expanded and continued by early mining. Casts of fossil brachiopods can be seen on the walls in the natural section.

Darby Cave

Washington County, Cherry Run Quadrangle

Location: EC 5/5/2

Elevation: 560

Darby Cave consists of a single passage, ten to fifteen feet in width and height and ninety feet long. Rattle Run Creek enters the entrance and flows through the cave to form a deep pool at the end, where a siphon prevents further exploration. Prolonged dry weather may permit access to further passage. Several crawlways lead from the existing passage but all are blocked by debris from flood water. A resurgence of the stream has not yet been found. Darby Cave is in the Tonoloway Limestone (dip 45° W.; strike N. 30° E.). It is on property owned by the Western Maryland Sportsmen's Club.

Dargan Quarry Caves

Washington County, Harpers Ferry Quadrangle

Location: NW 1/5/6

Elevation: 300

Dargan Quarry is located southwest of Dargan along the Chesapeake and Ohio Canal. An opening at the northeast corner, 20 feet above the quarry floor, is a remnant of a former cave. The cave now extends for 20 feet into the quarry wall and is blocked by breakdown. The passage is six feet high and three feet wide.

One hundred feet south of the first cave, there is another small opening in the quarry wall. This cave consists of a fissure passage, six feet high and one foot wide that trends east for 25 feet where it becomes too small to traverse.

There is an impressive opening two hundred feet south of the quarry. This large entrance which is eight feet high and ten feet wide is, according to local reports, an old manganese mine. The mine trends south-

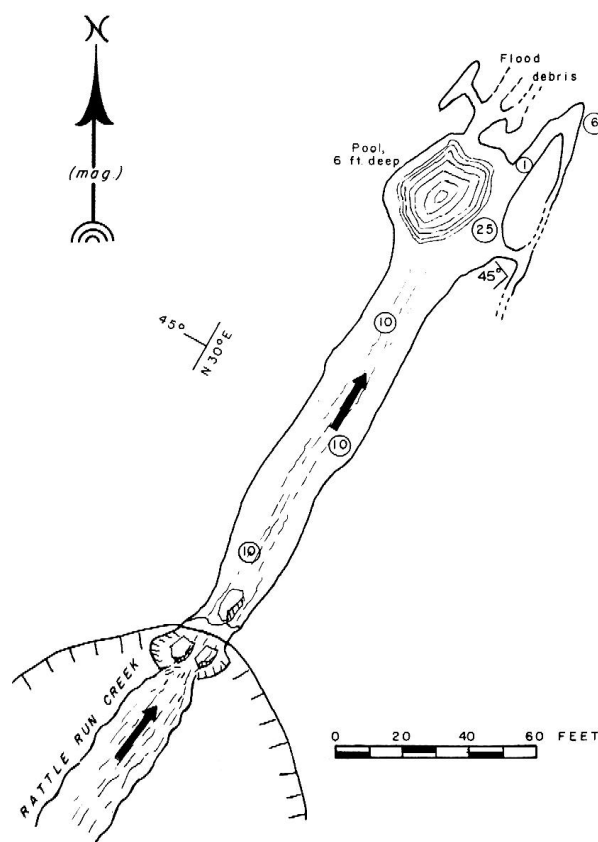


Figure 63. Darby Cave, Washington County.
Surveyed by D. Slifer, D. Fanning, and
R. Benner, March 1968.

east for 65 feet to a smaller rear entrance, four by five feet, which opens into a second quarry. Midway through the mine there are two natural cave passages leading off both sides. One is a crawlway, one to two feet in diameter, which trends north for at least 25 feet. Opposite this crawlway there is a larger passage, approximately five feet in diameter, which trends south for 25 feet to breakdown.

Dellingers Cave

Washington County, Williamsport Quadrangle

Location: NW 1/5/6

Elevation: 300

The entrance of Dellingers Cave is near the top of an escarpment about 100 feet above the Potomac River. Geology: ²

Dellingers Cave is in the base of the Stones River Limestone which strikes N 30° E with a vertical dip. It is developed along joints striking N 50° W, N 10° W, and E-W, and along the bedding planes.

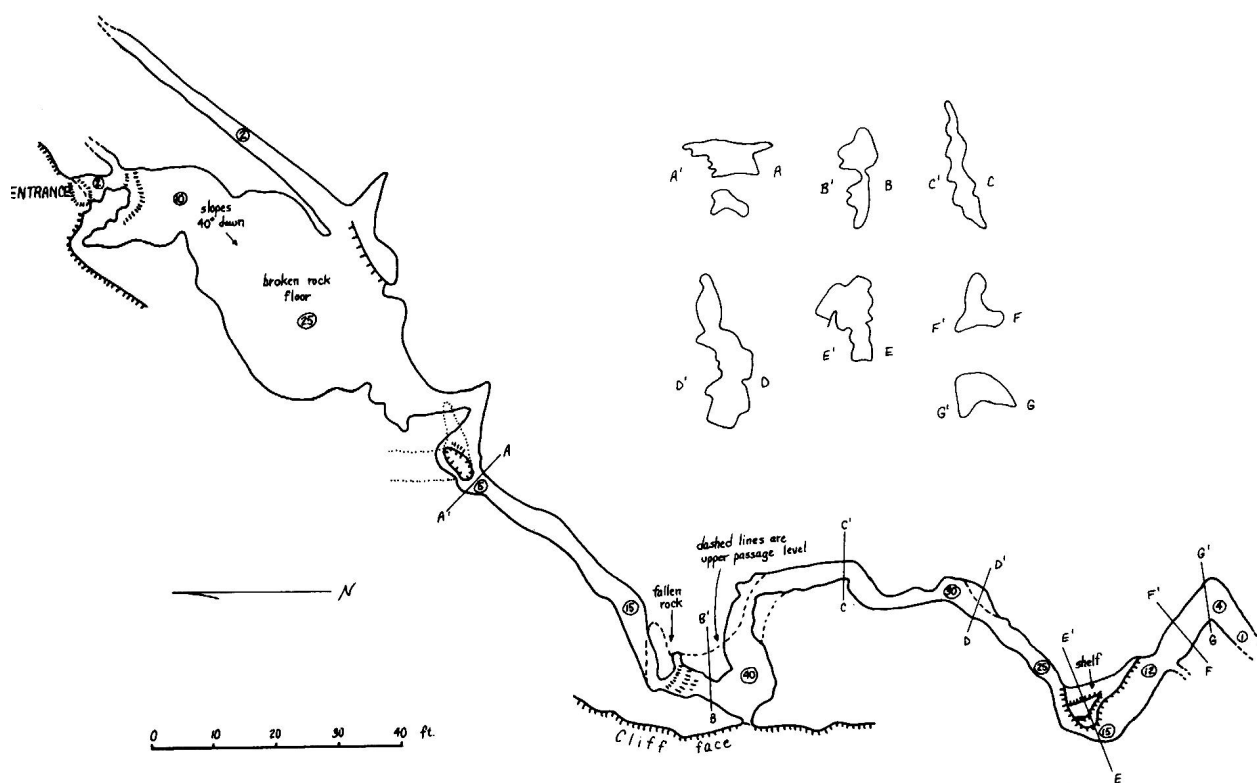


Figure 64. Dellingers Cave, Washington County. Surveyed by J.P. St. Clair, 1946.

Description: ²

The entrance is a small hole that opens into a corridor with a floor sloping steeply to the south. The corridor, 10 feet long and 10 feet wide, connects with a large room to the south. The second room is 19 feet wide and 35 feet long and slopes to the southeast. On the east side is a low scarp leading up to a small alcove. A low passage leads N 40° E for 50 feet from the alcove. From the room the main passage continues southwest, paralleling the face of the cliff. For 70 feet it is rectangular in cross section, 4 to 8 feet high and 6 to 15 feet wide. Subordinate lower passages underlie and connect with the main passage in this section. Seventy feet from the large room the passage is a fissure, 4 to 8 feet wide and up to 30 feet high, that alternates in direction from S 10° E to S 40° W. Beyond 160 feet, the fissure reduces in height to a crawlway less than a foot high.

The floor of the cave is covered with plates of broken limestone that are covered by thin flowstone near the rear of the cave. The cave is dry and few formations

remain intact. The ceiling of the cave remains at a uniform level with the floor sloping down from the front and rear towards the center of the main passage.

Dog House Cave

Washington County, Funkstown Quadrangle

Location: EC 2/7/1

Elevation: 500

A small cave near Beaver Creek is developed in the hillside behind an old chicken farm which is now owned by Cushwa Brick Company of Hagerstown. The cave takes its name by virtue of the former canine occupancy. The entrance which is one foot high is located under a low ledge of rock. The cave is a single low crawlway which trends southwest for 20 feet. Scattered white soda straw stalactites occur on the flat ceiling. The cave is developed along horizontal bedding in calcareous shale near the contact of the Elbrook Limestone and the Waynesboro Formation.



**Figure 65. Dellingers Cave, Washington County.
Surveyed by J.P. St. Clair, 1946.**

Drain Ditch Cave

Washington County, Keedysville Quadrangle
Location: NC 1/5/8
Elevation: 390

The entrance to this small cave is in a roadside drainage ditch along Maryland Highway 34, north of Keedysville. The entrance which is a one foot slit through fractured rock opens into a sloping crawlway that trends northwest and enlarges to a low room ten feet in diameter. The cave is located in the Tomstown Dolomite.

Eby Cave

Washington County, Mason-Dixon Quadrangle
Location: SW 7/6/4
Elevation: 470

In the corner of an open meadow near Pinesburg

there is a square hole which is three feet wide. It consists of a narrow pit, twenty feet deep, which ends in a crevice passage six feet high and ten feet long. Both ends of the crevice, which trends northwest, are blocked by clay fill. Eby Cave is owned by Mr. Eby who resides in the adjacent house west of the cave. It is in the Chambersburg Limestone.

Fairview Caves

Washington County, Mason-Dixon Quadrangle
Location: C 1/4/1
Elevation: 400

A number of openings are developed near Fairview in a low cliff forty feet above the west bank of Conococheague Creek. One is a large shelter-like entrance ten feet high and five feet wide, from which flows a spring. This cave extends along a joint trending south for almost forty feet, where it becomes too small to traverse. Several vertical chimneys and higher passage indicate a possible upper level to the cave.

Two hundred feet southwest of this cave is an entrance which leads to a cave resembling Davies' description of Fairview Cave for the first thirty feet. Some question, however, exists as to whether this is the one he describes. Almost 400 feet of passage have been mapped in this very tight and muddy cave.

Geology:

The cave is developed in a thrust sheet of the Chambersburg Limestone, very close to a contact with the Martinsburg Shale. The passages are found along a series of major north-south oriented joints in beds which dip 10° east and strike due north.

Description:

The entrance passage is four feet square and leads to a small, low room out of which leads a low crawlway. The crawlway is actually the top of a vertical fissure or channel which is nearly filled by stream alluvium. This passage trends south for 100 feet and then swings to the west where it opens up into a walking passage. This passage parallels the first and leads out of the central room as a narrow fissure for forty feet to the north. At the southern end of the room there is a nearly vertical mudslide which joins a more southerly trending

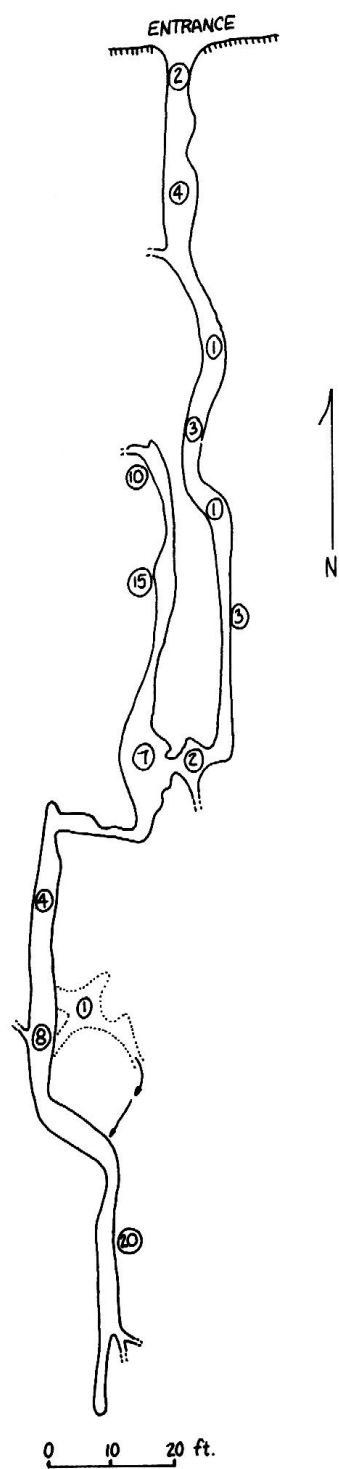


Figure 66. Fairview Cave, Washington County.
Surveyed by D. Slifer and D. Franz,
April 20, 1968.

passage for 160 feet. Intermittent sections of a slightly lower level with a stream bed opens up into walk can be observed along the eastern flank of the passage, which is narrow and high and inclined at right angles

to the dip of the beds. A few flowstone and drapery formations exist here; however, most of the cave is devoid of speleothems and is exceedingly muddy and wet.

Flooks Fissure

Washington County, Keedysville Quadrangle

Location: NC 5/5/5

Elevation: 440

A fissure was opened by Hurricane Hazel (1955) on the property of Austin Flook. In 1965, the cave was 35 feet deep but now has been filled with trash. The entrance is 2 feet wide and 15 feet long. The fissure which is 0.5 miles north of the Snively Caves is in the Tomstown Dolomite.

Groundhog Cave

Washington County, Funkstown Quadrangle

Location: EC 3/3/3

Elevation: 580

In the ridge east of Bowman Cave there is a small cave, the entrance of which was formerly a groundhog hole. Steam issuing from the opening on a cold winter morning disclosed the presence of the cave. The entrance was enlarged exposing a steeply sloping shaft which drops four feet into a triangular shaped room, ten feet long and four feet high. The passage trends southwest. The cave is in the Tomstown Dolomite.

Grove Cave

Washington County, Funkstown Quadrangle

Location: SC 4/1/9

Elevation: 380

The entrance of Grove Cave is four feet in diameter and is located at the mouth of a wooded ravine in an outcrop 25 feet above Antietam Creek. The cave trends northeast for 15 feet, gradually becoming too small to permit passage. Four springs were observed emerging from the same hillside, north of the cave. Falling or rushing water is heard inside one of the springs. Grove Cave is found in vertically dipping beds of the Elbrook Limestone.

Hepburn Cave

Washington County, Hancock Quadrangle

Location: NC 8/3/7

Elevation: 510

A mile north of Hancock, on the property of Mr. Ned Hepburn, is a small hole which receives drainage water from a watershed of several square miles. Although suffering badly from organic pollution, the cave was entered and explored by the survey in 1969. The entrance is a hole 2 feet in diameter which drops 7 feet into a low room trending east and curving to the SE for 20 feet. Here it drops 3 feet into a second room 6 feet wide and 12 feet long with a pool of polluted water covering the floor. No leads go out of this room and the water obviously escapes downward through the floor.

The cave is developed in vertically dipping strata of the Tonoloway Limestone, very close to a contact with the Wills Creek Shale. Local residents say that "the hole" drains most of their valley (area to the west flank of Cove Ridge). A possible resurgence is suspected in the very large spring, which supplies water to the community of Hancock, and is located three-fifths of a mile southwest of the cave. This projected path seems rather likely since the line between the cave and spring exactly follows the strike of the relatively isolated body of limestone in a southwesterly direction. It is of interest to note that a pond situated on this line is reported to have difficulty holding water.

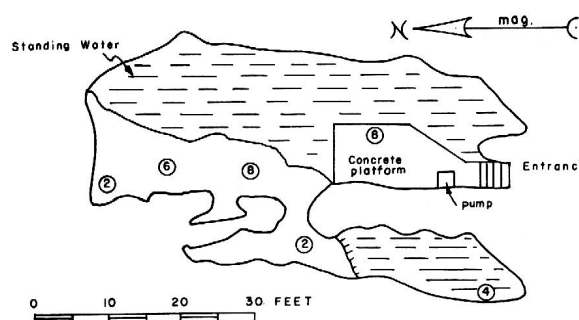
Holmes Cave

Washington County, Hagerstown Quadrangle

Location: SC 9/7/7

Elevation: 600

The entrance of Holmes Cave is a two foot square hole on the west side of the low ridge, 0.3 mile north of Hagerstown Junior College. The cave extends northeast along a joint for 20 feet as a crawlway. The passage then drops four feet as a crawlway. The passage then drops four feet into a small room which doubles back under the entrance. The cave is dusty and contains no speleothems. Thirty feet south of the cave there is a small opening in the base of a six foot sinkhole, but it is too small to negotiate. Holmes Cave is in the Beekmantown Limestone.



**Figure 67. Hought Cave, Washington County.
Surveyed by R. Franz and D. Kramer,
August 30, 1966.**

Hought Cave

Washington County, Funkstown Quadrangle

Location: NE 9/4/4

Elevation: 520

The entrance, in a low ledge in front of the house of Clifford Hought, gives access to a single passage 6 to 8 feet in diameter and 60 feet long. A stream once flowed from the cave, but the water is now dammed and piped to the trout hatchery nearby. A large concrete platform inside the entrance supports pumping equipment. The floor of the cave is covered with water varying in depth from a few inches to 4 feet. The west side of the passage contains some breakdown. A few speleothems, notably soda straw stalactites, occur in the cave, which is developed in the base of the Elbrook Limestone.

Howell Caves

Washington County, Williamsport Quadrangle

Location: SC 1/4/9

Elevation: 340

Several openings and solutional pockets are developed in the limestone cliffs near McMahon's Mill (formerly Charles Mill or Cedar Grove Mill) along the Chesapeake and Ohio Canal. The entrance to Howell Cave, at the base of a cliff, is a low, gravel-floored crawlway which extends for twelve feet to connect with a room approximately 18 feet in diameter and ten feet high. A muddy crawlway leads to a second room which is ten to 20 feet wide and 100 feet long. Several gravel-bottomed, clay pits approximately six feet deep are developed in the floor of this room but their relationship to the drainage of the cave

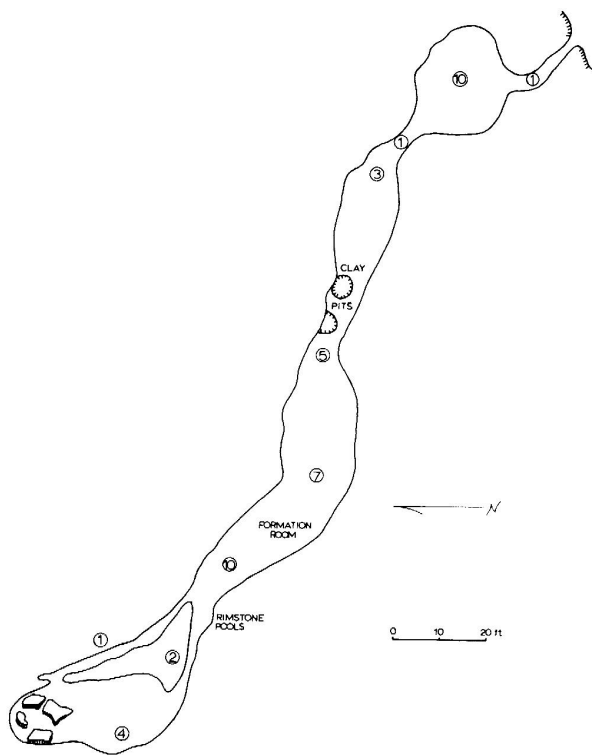


Figure 68. Howell Cave, Washington County.
Surveyed by D. Slifer and D. Fanning,
September 7, 1968.

is not clear. Speleothems are common in the rear of this room. A third crawlway which is floored with massive flowstone and a few shallow rimstone pools leads into the last room which is 30 feet long and terminates in very treacherous breakdown. During the spring and early summer, it is impossible to enter the cave due to a stream flowing from the cave entrance.

Local residents insist that this cave formerly connected with a sinkhole, 700 yards north of Howell. This may well be "Cave-in-the-Field" which fits this description. Howell Cave is developed in flat lying beds of the Stones River Limestone.

Two hundred yards up-river from Howell Cave is an impressive 5ft.x3ft. entrance in the cliff face, 20 feet above the canal. This has been dubbed Little Howell Cave (SC 1/4/4). From the entrance, a gravel-floored crawlway trends NE for 30 feet. It intersects an eight foot high perpendicular passage which is 20 feet long. A narrow crevice is offset from this passage to the NE for 15 feet and pinches down. Little Howell is in the Stones River Limestone striking N 5° E and dipping 20° E.

A small shelter (SW 3/6/6) opens in the cliff face 200 feet up-river from Little Howell. The opening is 6 foot square at the entrance and tapers down to a narrow fissure fifteen feet inside. It is in the Stones River Limestone.

Jugtown Cave

Washington County, Myersville Quadrangle
 Location: NW 3/7/4
 Elevation: 740

This cave is one of the larger in Washington County with over 600 feet of low stream passage. The entrance is in a sink on a wooded hillside on the property of Mr. Walter Bromley of Smithsburg, Maryland. It is 6 feet wide and three to five feet high and opens into forty feet of low breakdown passage terminating in a room ten to twelve feet high. This entrance passage slopes steeply before entering the room.



Figure 69. Small domepit in the ceiling of Howell Cave, Washington County. Note the growth of speleothems around the rim due to descending water.

Geology:

Jugtown Cave is developed at the base of South Mountain in the Tomstown Dolomite (dip 55° W., strike $N.20^{\circ}$ E.) adjacent to the Antietam Quartzite to the east. The cave trends to the southeast towards the mountain, with the stream flowing northeast from the direction of the impervious quartzite and phyllites toward the carbonates in the Hagerstown Valley. This indicates that the cave should end about where it does on the southeast end, but much more passage should exist to the northeast. All leads in this area, however, are blocked by alluvium and/or water.

The existence of a surface stream over the cave (which contains a subterranean stream) and near the entrance poses another puzzling question concerning the speleogenesis here. The sub-surface stream has a good gradient at the head (end of stream passage), as reflected by the solutional-erosional features here. About 150 feet from the end of this section the stream passage becomes aggradational and several inches of course alluvium cover the floor. This gravel is quite similar to the ceiling conglomerate deposits of Winders No. 1 Cave, indicating perhaps that the two caves are genetically related, but of different relative ages. The fill sequence in Winders would seem to indicate that it is older than Jugtown (Winders Cave is one-fourth mile southeast of Jugtown). Both caves contain occasional solution pendants and anastomes – evidence of phreatic development.

Description:

A high passage from the north end of the entrance room continues for 100 feet before pinching out. Just beyond the room this high passage intersects a low stream passage and then a high dome. In the ceiling of the dome, which can be reached by scaling a steep clay slope, names and dates have been carved into the soft limestone. The most interesting of these inscriptions is "Landers and McGinley, 599th, 1867". There are no formations in the high passage.

The stream passage which intersects the old section is the longest channel in the cave and extends southeast for approximately 500 feet. Along this channel there are several rooms, the largest having a ceiling height of twenty feet. Most of this passage, however, is either a low crawlway or a high narrow fissure. Stalactites and small draperies occur intermit-

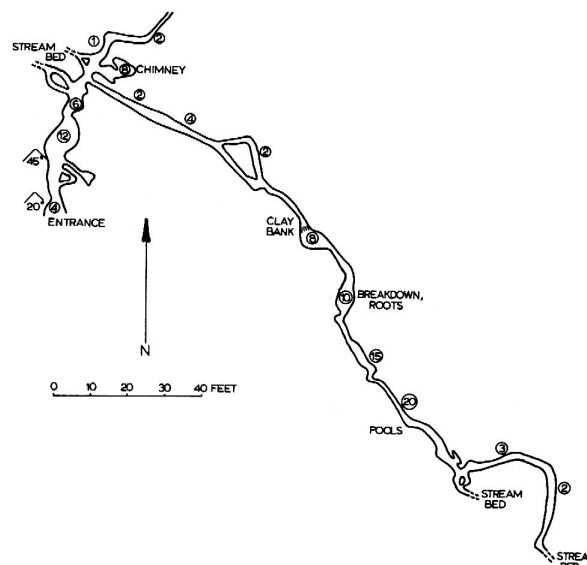


Figure 70. Jugtown Cave, Washington County.
Surveyed by D. Slifer and R. Franz,
December 2, 1967.

tently along this passage. The character of the stream channel changes in the last 200 feet from a gravel-floored crawlway to high fissure passage in which the stream flows over bare limestone with little or no alluvium present. Pools varying from a few inches to two feet in depth occur commonly in this section. Several large roots protruded into the cave in this area and in some cases the root hairs form large mats in the pools of water. Eventually the passage becomes too low to traverse.

Keedysville Caves

Washington County, Keedysville Quadrangle
Location: NC 5/1/4
Elevation: 400

Six small caves occur in limestone outcrops along the east bank of Little Antietam Creek south of Keedysville. The topography in this area is a continuation of the broken limestone plateau to the south which contains the Snively Caves. The plateau is dissected by deep crevice sinks and solutionally modified vertical joints and has been quarried to a minor extent along the western flank. None of these caves exceeds 50 feet in length and all are controlled by the major joint system striking north. They are typically narrow fissures and crevices and in some instances small rooms. These caves are dead and usually dry with some scant flowstone decoration and much break-

down. The caves are developed in the Tomstown Dolomite.

Licking Creek Caves

Washington County, Cherry Run Quadrangle
Location: SC 6/3/1
Elevation: 480

A half dozen openings occur in the cliff face along Licking Creek directly under the I-70 bridge. They are either narrow fissure or low crawlways which are developed along joints trending to the southwest. None can be followed by further than 20 feet, due to the narrowing of the passage. These caves are in horizontally-bedded Helderberg Limestone.

Marker Caves

Washington County, Keedysville Quadrangle
Location: WC 8/4/9
Elevation: 320

History:

The following quote from Scharf's *A History of Western Maryland* (Vol. II, p. 986) has led to the investigation of Marker Cave:

"On the land of James Marker, three miles southeast of Sharpsburg, is a cave, which tradition says was used both as a dwelling and a burial place. This cave is about twenty feet in diameter, and about six feet in height, and contains two rooms. The opening to the inner room is so small that it would be difficult of access. In digging in this cave a year or two ago, a quantity of ashes and burnt bones was found, buried underneath large flat stones. There were also bead ornaments, arrow-heads, and flints, and a pipe of exquisite workmanship."

Description:

The entrance is 4 feet square and faces the Antietam Creek, at the bottom of a 40-foot cliff. The cave is small and Scharf's description is accurate except for his reference to an inner room. The only lead out of the entrance room is a tight six-foot crawlway which leads to a vertical chimney too narrow to climb. The

cave is on the land of Mr. Austin Stottlemeyer.

An archeological investigation in 1964 yielded evidence of Indian habitation. A child's jawbone and several adult metacarpals and a vertebra were recovered from the bottom and from ledges along the chimney in the back, along with various animal bones and teeth. Charcoal, pottery shards and bones were found in parts of the entrance room floor, although this area has been disturbed by the previous digging efforts of others. The finds from the chimney were most promising, as their state of disarray and orientation seemed to indicate that they had been washed down from above. This evidence is cited for the probable existence of an upper-level burial chamber, which the Indians had to have gained access to by another entrance. Investigation of the meadow directly over the cave and above the cliff yielded the discovery of several sinkholes in a small area, which align in a southwesterly direction. The most promising one was 200 feet from Marker Cave and was filled with field stone. This was excavated to a depth of twenty feet and abandoned, although small stones occasionally could be heard falling farther below into an open space. A crawlway three feet in diameter was also discovered on the cliff face thirty feet above Marker Cave. The crawlway trends southwest for twenty-five feet and pinches down. These caves are in the Tomstown Dolomite – dip 25° E., strike S. 20° W.

McMahons Mill Caves

Washington County, Williamsport Quadrangle
Location: SC 1/4/9
Elevation: 380

Two caves and many deep sinkholes are located in the woods above the cliffs overlooking the Potomac River near McMahons Mill (formerly Charles' Mill).

Cave No. 1 is at the bottom of a sinkhole almost directly above Howell Cave, on the property of Joe Hartle, of Hagerstown. The entrance is 2 feet by 2 feet and opens to a room 25 feet in diameter and 15 feet high. Some flowstone occurs on the north wall of this room. Under this wall a low, broad crawlway slopes down over a clay floor to the north for 20 feet. Here it splits into a tight 8-foot crawl to the northeast and a low, wet crawl to the north for at least 20 feet. This cave is in horizontally-bedded Stones River lime-

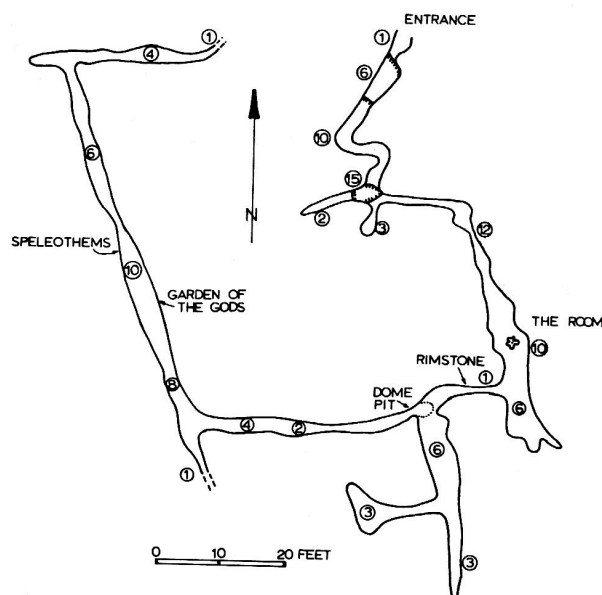


Figure 71. McMahon's Mill Cave, Washington County. Surveyed by D. Slifer and D. Fanning, January 11, 1969.

stone and is largely joint controlled.

Cave No. 2 (SC 1/4/8) is on the rim of a large sink, in the woods, 500 feet northwest of Cave No. 1. The entrance is 1 foot high and 3 feet wide and slopes down to a 4-foot drop where the passage becomes a narrow meandering fissure 6 to 8 feet high. This trends southwest for 20 feet and drops 15 feet to a lower level. A series of tight crawlways slopes down to the west for 15 feet into a rather well decorated room. Coral formations, rimstone pools, columns, and draperies decorate parts of the room, which is 6 to 10 feet high. By cutting through some flowstone blocking a low crawl to the west out of the room, it was possible to extend the cave to a parallel joint-controlled passage via a 10-foot dome pit. This cave is an upper level to an intermediate drainage link between Natural Well, Cave-in-the-Field, and Howells Cave. Inaccessible sections of this lower level can be seen below the crawlway which enters the first room from the north. Cave No. 2 is developed along joints in flat-lying beds of Stones River Limestone.

Mt. Aetna Cave

Washington County, Funkstown Quadrangle
Location: NE 6/9/3
Elevation: 540

History:

The cave was discovered in August, 1931, when vapor was observed issuing from small crevices in some rocks. In the spring of 1932 it was opened commercially. After six months the commercial venture was abandoned as revenues did not justify operation. The electrical equipment was in good condition when the cave was visited in 1947. The property was bought in the early 1960's by J. Bernard Wilt, Rockville, Maryland. Due to increasing vandalism of the cave, Mr. Wilt sealed the entrance soon after acquiring it; and the cave remains closed today (1970).

Geology:

Mt. Aetna Cave is developed in dense, sub-crystalline, gray dolomite assigned to the Tomstown Formation. The strike is N. 52° E. and the dip 28° E. A prominent set of joints trends N. 38° W. The cave is developed along the strike of the beds.

Description:

The entrance to the cave is in a small wooden building 30 feet above and 50 feet east of the road. A flight of concrete stairs descends 15 feet to the floor of the cave. The main passage of the cave is a straight level tunnel varying from 10 to 15 feet wide and 8 feet high. At places formations are so dense that the passage is restricted to 2 or 3 feet in width. A short flight of steps 37 feet from the entrance leads to a roomy passage on the east. A large column necessitates a detour in the main passage just south of these steps. For the remaining 354 feet of the main passage the cave is beautifully decorated by myriads of stalactites and columns. Delicate "soda straw" stalactites abound mixed with an abundance of "carrot" types. Bacon rind with unique fluted edges as well as some flowstone add to the decorations. These formations were so dense at the time of discovery that a passageway had to be cut through them. The passage terminates in a low tunnel 4 feet wide and 3 feet high that pinches out 30 feet beyond the end of the large passage.

The upper passage leaves the main passage at a point 37 feet from the entrance where narrow stairs on the east lead upwards for 10 feet. The upper level consists of three rooms connected by low narrow passages. The northern room, measuring 40 feet long by

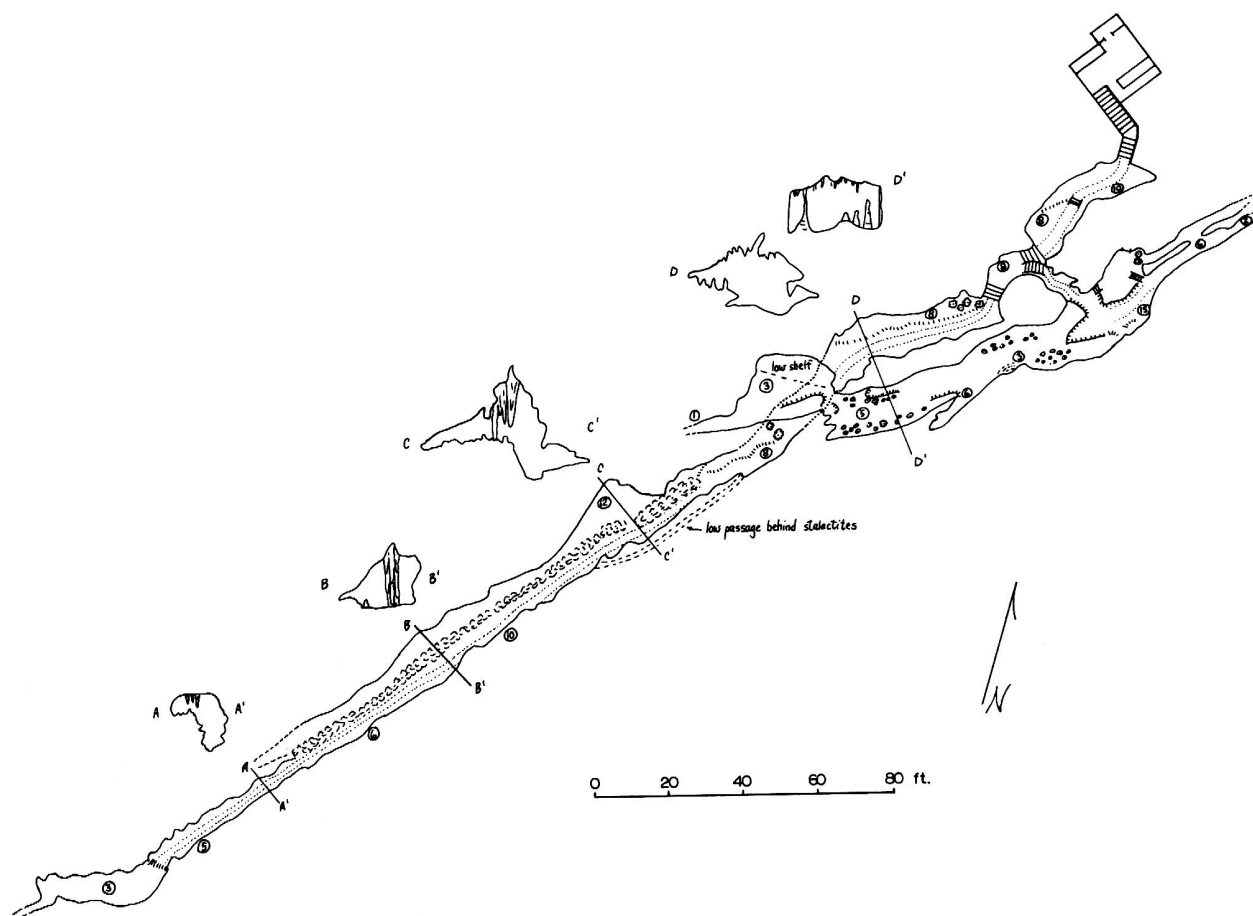


Figure 72. Mt. Aetna Cave, Washington County. Surveyed by J.P. St. Clair and D. Mears, 1946.

18 feet wide, with a ceiling 15 feet high, is the only one developed for public inspection. It is filled with numerous formations similar to the main passage. On the north side is an opening through which the original entrance to the cave was made. A set of clay-covered parallel passages, each 2 feet in diameter, lead off the northeast end of the room and can be traversed for 30 feet.

At the southwest end of the room a formation-choked passage, 4 feet in diameter, leads 25 feet to an undeveloped room 40 feet long by 12 feet wide. The slope of the floor is irregular due to fallen rock. The ceiling is made of thousands of delicate "soda straw" and "carrot" stalactites that show two distinct stages of interrupted growth. Columns and large stalagmites clutter the floor and in places are so dense as to block passage.

The third room is offset and connected to the southwest end of the middle room. This room has a

ceiling height of 4 feet and is 20 feet long by 15 feet wide. Formations are less plentiful and are found along the west wall where a series of short columns line a low shelf. A passage 15 feet long and 2 feet in diameter leading off the southwest end of the room is choked with formations.

Mt. Aetna Quarry Cave

Washington County, Funkstown Quadrangle

Location: NE 9/2/8

Elevation: 540

A small cave passage occurs in the west wall of the limestone quarry south of Mt. Aetna Cave on Maryland Highway 66. An opening which is 4 feet high and 2 feet wide opens into a narrow, dusty passage which is 4 to 6 feet high. The cave, which trends west for 25 feet, is developed in a white, marble-like member of the Tomstown Dolomite.

Natural Well

Washington County, Williamsport Quadrangle
Location: NE 9/2/8
Elevation: 540

One and one-fourth miles west of Downsville, on the farm of J.K. Scott, is a small wooden structure enclosing a sinkhole. A stream flows out of a deep pool, across the sinkhole, and into a siphon-crawl at the other side. An electric pump is installed over the pool and the stream serves as a well for the adjacent farmhouse. This stream is thought to be an integral part of the drainage system which involves Cave-in-the-Field, McMahons No. 1 and No. 2, and Howells Caves to the southwest. Natural Well is located in the Stones River Limestone.

Neck Cave

Washington County, Hedgesville Quadrangle
Location: NC 7/6/7
Elevation: 400

The entrance to Neck Cave, in an outcrop by the Potomac River, is about 400 yards northwest of the farm at the tip of the neck. It is developed along the bedding planes of the nearly vertical Conococheague Limestone (strike N-S). The entrance, facing the river, is 5 feet high and 3 feet wide; the passage extends to the north for 40 feet where a back entrance (3 feet by 3 feet) opens to the west, perpendicular to the bedding. The cave is likely of tectonic origin, representing a parting between beds; no solutional features were observed. Numerous sinkholes exist in the fields behind the bluffs to the north of this point (western edge of neck). No other caves have been found in the area, although the owner of "the Neck," Mr. I. Donald Ankeney reports a cave along the northwest margin which could not be located. (See Ankeney Cave)

Pine Hill Caves

Washington County, Funkstown Quadrangle
Location: C 7/7/3
Elevation: 500

Several caves are known to exist in a sloping meadow 300 yards east of Antietam Creek, due east of Breatheds Station on the property of Mr. Shifler. During fieldwork, a local resident who had been into

the caves was interviewed. He stated that two vertical shafts opened in this area around 1920. The deepest was 70 feet deep and opened into a large room about 25 feet high with a body of water in it. No further exploration was attempted beyond this room by the original parties. The other shaft was about 15 feet deep and led to a well decorated chamber – dimensions or extent unknown. Both caves were closed by the owner in the 1930's with logs and stone, and remain so today. They are developed in the Elbrook Limestone.

Pinesburg Cave

Washington County, Hedgesville Quadrangle
Location: NE 3/6/7
Elevation: 380

Pinesburg Cave is located near the top of a cliff along the C & O Canal. A passage, 3 feet wide and 6 feet high, extends N. 30° E. for 30 feet beyond which it is reduced to a crawlway 45 feet long. The cave is blocked at the rear by breakdown and formations. The floor of the passage is dry clay. Powdery stalactites and flowstone decorate the walls of the passage. Pinesburg Cave is developed along bedding planes in the base of the Stones River Limestone which strikes N. 30° E. and dip 80° E.

In Pinesburg Quarry, 200 yards west of Pinesburg Station, is a small crawlway in the north face of the lower level. It is 25 feet long and curves to emerge in a small hole in the quarry face west of the entrance.

Red Hill Cave

Washington County, Keedysville Quadrangle
Location: NC 4/5/7
Elevation: 420

Red Hill Cave is located in a small quarry south of Keedysville, on the property of Mrs. Remona Athey. The entrance is 4 feet by 4 feet and has remnants of a stone wall on the left side – purpose and origin unknown.

The cave consists of a single passage which slopes downward at 13° and trends north for 110 feet. Midway the channel enlarges to permit walking. It is a relatively shallow cave; root tips are abundant in the ceiling and walls for the first 50 feet. Several large

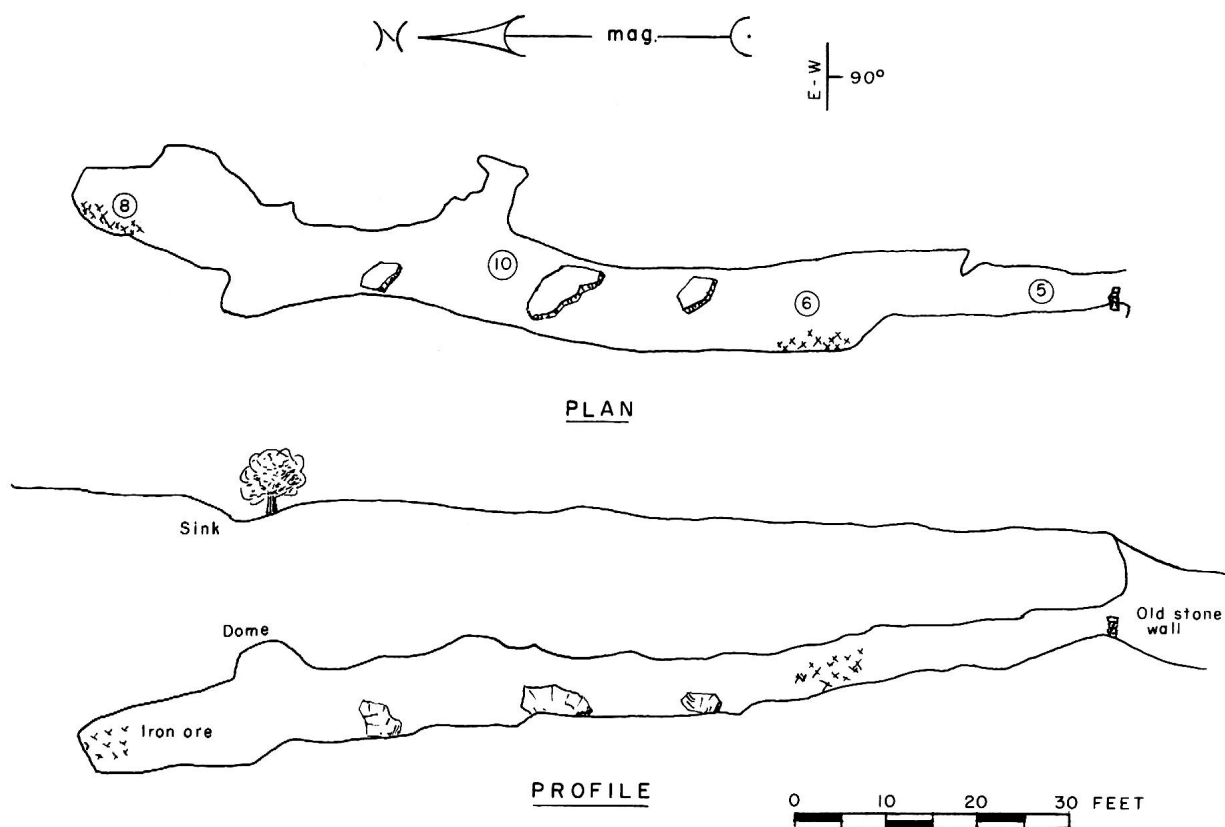


Figure 73. Red Hill Cave, Washington County. Surveyed by M.T. Haymond and D. Slifer, October 28, 1968.

blocks of breakdown cover the floor in places, which is composed of red clay throughout.

Although this is a solution cave in carbonate rock (Tomstown Dolomite), local persons refer to it as an iron mine. This is because the cave was once filled with a sequence of iron-rich sediments and minerals. The cave has been mined to its current dimensions. No historical records of the mining are known and it is assumed to have been a pre-Civil War prospect operation by local iron furnaces. The cave shows evidence of digging in several places, the most obvious being the "ore pit" at the end of the passage, where strikingly colorful veins and pockets of yellow-orange ore can be observed. It is typically a yellowish clay-like mass – not metallic – consisting of irregular wavy layers or strata of clay and rock matrix interbedded with darker black or brown clay and exposed bedrock. A series of mineralogical analyses was performed on the cave sediments and ore at the University of Maryland, Soil Mineralogy Lab (Franz and Slifer, 1969), which determined the ore to be 30%

to 50% goethite ($\text{FeO}(\text{OH})$) at its purest. Very slight traces of manganese, copper and zinc were noted, but the sediment bulk is goethite in a siliceous clay matrix. The bedrock is a very pure dolomite, which appears to be devoid of calcite in this area – explaining the complete lack of speleothems or flowstone in the cave.

Revells Cave

Washington County, Cherry Run Quadrangle
Location: EC 7/5/3
Elevation: 450

The entrance to Revells Cave, on the property of Frank Revell of Big Pool, is in an outcrop on the south side of Licking Creek near Pecktonville.

Geology:

Revells Cave is in thin-bedded black limestone of the Tonoloway Formation at the crest of an anticline.

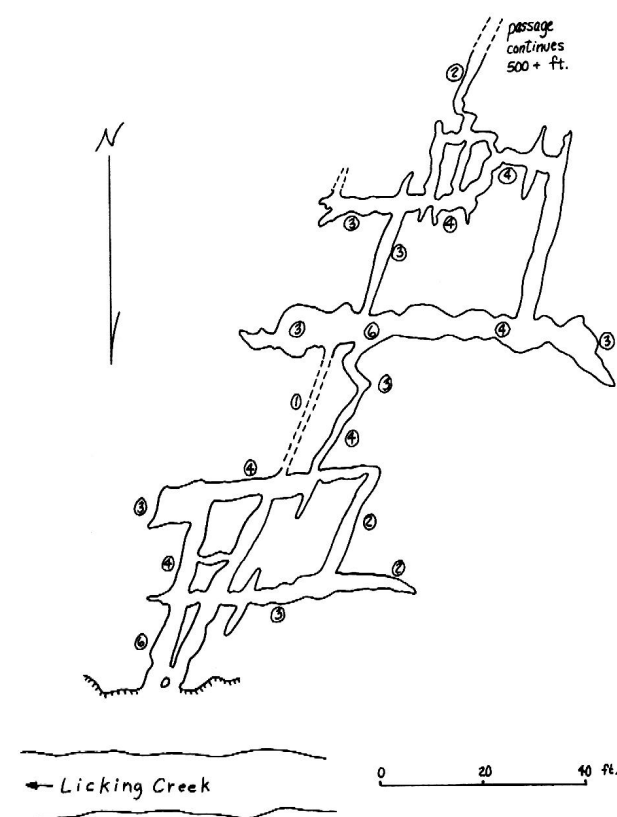


Figure 74. Revells Cave, Washington County.
Surveyed by W. Davies and W.
Brierly, September 25, 1949.

On the east flank the dip is 15° , on the west it is 10° .
 The strike is N. 5° E.

Description:

The entrance passage, 8 feet wide and 6 feet high, connects with a maze of small interlacing passages averaging 2 feet wide and 4 feet high. The main passage is along the crest of an anticline with the subordinate passages lying slightly lower on the flanks. The cave is reported to continue through the hill 1000 feet to the south and to connect with an opening in a small quarry. The passage requires crawling and squeezing most of the way, but in one place it opens into a small room with a deep pit flanked by a narrow ledge. Formations consists of a few columns and stalactites scattered throughout the passages. The main passage has a floor of rock, and the subordinate ones of clay.

Rohrersville Caves

Washington County, Keedysville Quadrangle
 Elevation: 520

Five caves are known from the area north of Rohrersville and west of Locust Grove. Two of these – Hogmaw Cave and King Quarry Cave – have several hundred feet of passage and are rather interesting. The remaining three – Column Cave, Keedy Cave, and Rohrersville No. 5 Cave – are small and of little interest. All but the latter occur within 1000 feet of each other and are no doubt genetically related and represent the same original system. Evidence for this is obtained from drainage observations and a surface correlation of the maps.

History:

Nothing is known of the history of these caves. King Quarry and Column Cave are fairly recent since their entrances are in modern quarries. Hogmaw Cave has been known by residents for years, but was never fully explored.

Geology:

All five caves occur in the Tomstown Dolomite. The area itself is almost entirely surrounded by meta-

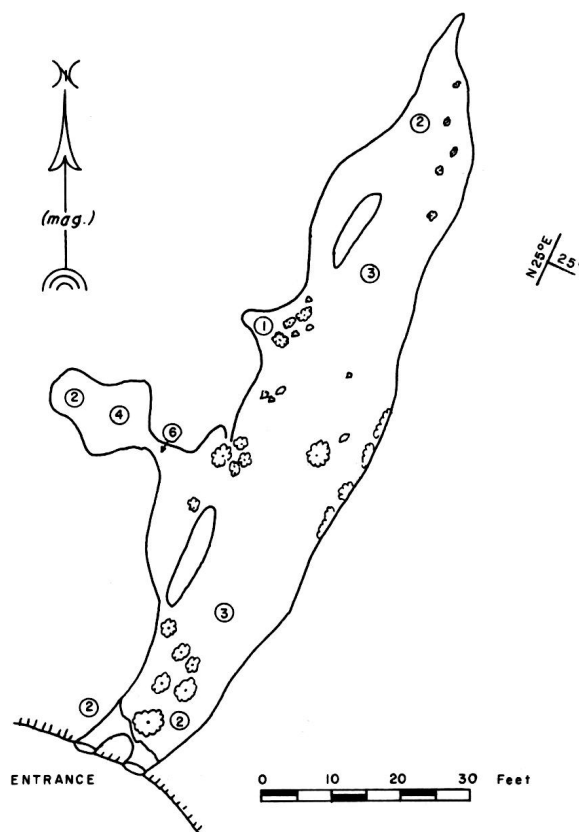


Figure 75. Rohrersville Column Cave, Washington County.
Surveyed by D. Slifer and
M.T. Haymond, November 12, 1967.

morphic or igneous rock bodies – Catocin Metabasalt to the south and west, Antietam Quartzite to the east, and a localized marble to the north, with faulting along the metabasalt contact. The caves are drained by Little Antietam Creek. The major portions of the caves are developed along strike joints, with bedding exerting an influence on passage shape and speleothem occurrence. The general dip is 25° to the east – away from the upthrown fault block of the metabasalt to the west.

Column Cave (C 6/2/3): Column Cave, which is very dry, may once have been an upper level of Hogmaw Cave, which follows the water level and extends below a part of the dry cave. Column Cave is 250 feet south of Hogmaw's entrance, at the base of a small quarry (120 feet east of Little Antietam Creek). Mr. Archie Hood also owns this cave. It takes its name from the abundance of columns throughout its length. This low cave, which has only one area in which a man may stand, trends northeast for 120 feet. It is typically 20 feet wide and 3 to 4 feet high. A short side passage is encountered on the west side of the main channel. This cave, like the others, has suffered heavy vandalism, a deplorable fate in light of the beauty once displayed here. It is in the Tomstown Dolomite, dip 30° SE., strike N. 25° E.

Hogmaw Cave (C 6/2/3): The entrance to Hogmaw Cave, which is owned by Mr. Archie Hood of Clarksville, Maryland, is 550 feet south of the King Quarry Cave entrance. Water is encountered in the cave throughout the year, fluctuating as much as three feet, depending on the season. Consequently, it has yielded much of the biological material reported from the system. The cave entrance, which is on the south-eastern face of the sink, opens into a short crawlway leading to a small room containing a shallow pool of water. Beyond the pool the cave divides into two passages. The short, right passage ends in a small water-filled dip with a siphon.

The second or main passage is a very muddy, Z-shaped crawlway extending for 70 feet. Beyond the narrow crawl, the crawlway becomes a wide channel with ceiling heights from 5 to 8 feet. This passage narrows to the east and leads via a tight squeeze through columns and a near-siphon to a low, broad breakdown room. A tunnel to the north drops 8 feet into a trench containing from 3 to 5 feet of water. Several side passages branch off from this section but become too tight to follow.

Returning to the main passage, we find a route which turns south, by-passing a large, nicely decorated room. The east end of this room is profusely ornamented with columns, white soda straws, small stalactites, and draperies. On the dry, clay floor of this room many interesting invertebrates were collected among decaying nuts and piles of wood which were probably brought into the cave by small mammals. Beyond this room, the muddy passage again opens up into a wide channel. A water-filled crevice, 4 feet wide and 10 feet deep, is encountered approximately 50 feet from the formation room. Persons unknown to the authors have placed a large wood plank across this "well," giving easy access to the rest of the cave.

An attempt to explore the shelf near the bottom of the pool was made in 1964. With aid of an aqualung, a water-filled passage, 4 feet in diameter, was followed for 30 feet until clouding of the water forced a retreat. No subsequent efforts have been made.

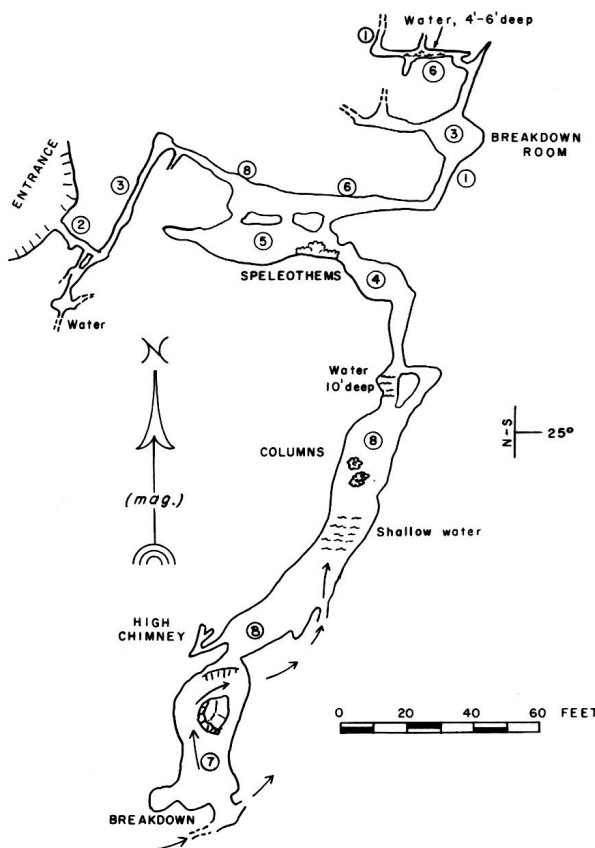


Figure 76. Hogmaw Cave, Washington County. Surveyed by D. Slifer and A. Kramer, December 15, 1967.



Figure 77. Main passage in Hogmaw Cave, Washington County. Note the structural control of speleothem growth.

Beyond the crevice and a clay bank, the passage opens into a large, beautifully decorated tunnel, 20 feet wide and 8 feet high. Water one or two feet deep covers the floor of the channel for almost 100 feet. The floor of this passage is solid, presenting no danger to the caver. Beyond this long chamber lies another large room, also with a submerged floor. Many large stalagmites, stalactites, and columns are found in this section. This passage is developed along a major joint with the same orientation as King Quarry Cave. The bedding here, however, is dipping 25° E., and serves to modify passage dimensions and decorations. A long "row" of stalactites and columns occur along a bedding plane intersection and stretches the length of the room. Drapery is developed on the dipping walls and breakdown faces. A stream flows into the rear of this room but the stream channel is too low to negotiate. This last room ends in breakdown, possibly due to blasting in the small quarry nearby which contains the entrance to Rohrsersville Column Cave.

For all practical purposes the cave terminates at this point. However, the survey maps show a coinci-

dence of Hogmaw Cave's southern end (breakdown room) with the small quarry's northeast face, as well as the overlapping of Column Cave. Hogmaw Cave is in the Tomstown Dolomite (dip 25° E., strike N.-S.).

Keedy Cave (C 6/3/1): A cave 330 feet east of Hogmaw, near a fence line on the property of John Keedy, has been named Keedy Cave. The entrance is partially covered by two large tree stumps and slopes down at 45° for 25 feet to a small, low room. Two low, dusty crawlways lead off from the room, each about 20 feet in length before pinching down.

King Quarry Cave (C 3/8/6): King Quarry Cave is in the large quarry on the property of Mr. P.V. Orcino of Washington, D.C. The cave was exposed by quarrying operations during construction of Maryland Route 67 in 1960, but was not entered by the workmen. The entrance is a two by four-foot slit, 20 feet above the quarry floor at the head of a talus slope. It extends through badly fractured rock for 6 feet as a crawlway and opens into a room. Extreme caution should be taken in entering and exploring this cave,

as the blast damage is severe and has resulted in the product of loose breakdown and fractured walls. After the first 60 feet the blast damage becomes less apparent but evidence of blasting can be seen throughout the entire cave.

From the entrance, a large room averaging 15 feet high and 20 feet wide can be followed to the south for 160 feet to a clay bank. Seventy feet from the end of this room there is a connection to a lower room on the east. This lower room is roughly 80 feet long and 30 feet wide. Six leads off the room branch out into crawlways and side passages in which areas of beautiful speleothems occur, including helictites, small rimstone pools, draperies, and columns. Many of the formations are covered with small crystals of calcite causing them to sparkle in the light of the caver's head lamp. The floor of this room is sticky clay with several pits up to 5 feet deep carved into it. Evidence points to the existence of a still lower level. A small stream is encountered in a fissure leading out of the northern end of this room, possibly entering the cave from the shallow pond on the adjacent quarry floor.

The cave seems to continue to the south, but is blocked by clay-fill or pinching out. Discovery of a lower level would probably give access to a cave of similar dimensions lying between King Quarry and the large compound sinkholes to the south. The longest of the Rohrersville Caves is Hogmaw (the local name for this area) at the far end of this sinkhole. Water drains out of Hogmaw Cave, flows across the sink (forming a pond) and disappears between large blocks of limestone on the north face of the sink towards King Quarry Cave. A fluorescein dye test may give clues to its resurgence. King Quarry Cave is developed in flat lying, massive beds of Tomstown Dolomite.

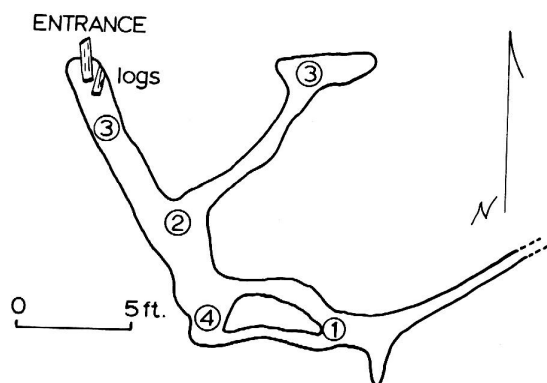


Figure 78. Keedy Cave, Washington County.

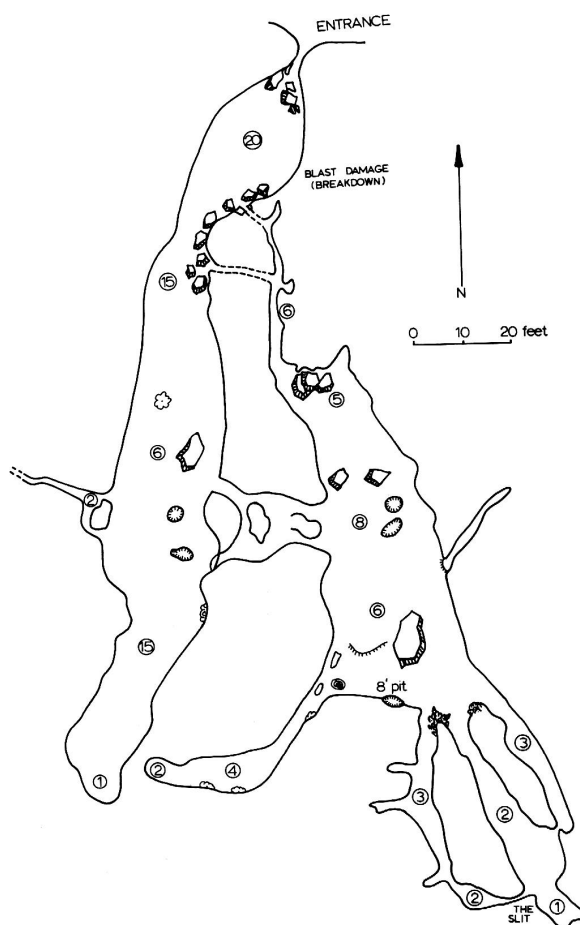


Figure 79. King Quarry Cave, Washington County. Surveyed by M. Haymond and D. Slifer, November 11, 1967.

Rohrersville No. 5 (C 3/5/8): A small hole on the west side of an outcrop drops 5 feet into a narrow fissure. The fissure flattens to a crawlway which trends east for 20 feet. Midway through this crawl there is a side passage, also extending 20 feet. Keedy Cave and No. 5 Cave are in the Tomstown Dolomite.

Round Top Mines

Washington County, Hancock Quadrangle
Location: WC 8/1/9
Elevation: 500

There are numerous abandoned limestone mines and several small caves along the railroad cuts and the C & O Canal near Round Top, the most obvious of which are frequently visited by explorers and hikers. It is likely that most of these mines were originally caves which have been enlarged by operations for obtaining cement rock that was burned in the kilns



Figure 80. Blast damage resulting from quarry operations in King Quarry Cave, Washington County.

nearby and shipped on the canal. The majority of these mines are straight passages which follow the strike of anticlinal fold axes. The rock was apparently easily mined by “peeling” the bedding planes off of the walls as slabs, and the constant passage configuration and wall slope facilitated placement of timbers for shoring. Consequently, most of these mines have triangular cross-sections with a ridge of breakdown and debris on the floor and heavy timbers supporting the walls in places. Standing water, of varying depth is found in some of the mines, along with old metal pipe which was apparently used for pumping purposes. No speleothems have been observed in these mines. The footing is precarious in most cases and should be considered dangerous, but the walls and ceiling appear to be relatively stable and free from danger of collapse.

Due to the nature of these mines and their lack of anything to vandalize, along with their obvious entrances and frequent visitations by persons of all sorts, the authors have decided to depart from the location coding system used throughout the book for caves and use instead a more easily followed graphic description of locations. Directions are referenced to the old, ce-

ment mill (five ovens and a brick chimney) below Round Top Hill, west of Loner Siding.

Mine No. 1: The entrance is 130 feet east of the cement mill and 40 feet above the tracks of the Western Maryland Railroad. It is 10 feet wide and 3 feet high and trends northeast for about 30 feet. This is either a natural cavity caused by shale slumping between limestone beds or a small test site for a mine. It is developed on the east limb of a syncline at the contact between shale and limestone beds of the Wills Creek Formation (dip 25° W., strike N.-S.). Fossil ostracoda (*Leperditia*) are found on bedding planes near the entrance to this mine.

Mine No. 2: The entrance is 6 feet high and 15 feet wide and is directly north of the old cement mill, 35 feet above the railroad. The passage heads northeast for about 150 feet, varying in height from 7 to 20 feet. Drill marks are common in the walls, and heavy timber shoring is still present along the walls.

Mine No. 3: The triangular entrance, 6 feet wide and 4 feet high, is 200 feet west of the mill, on the level

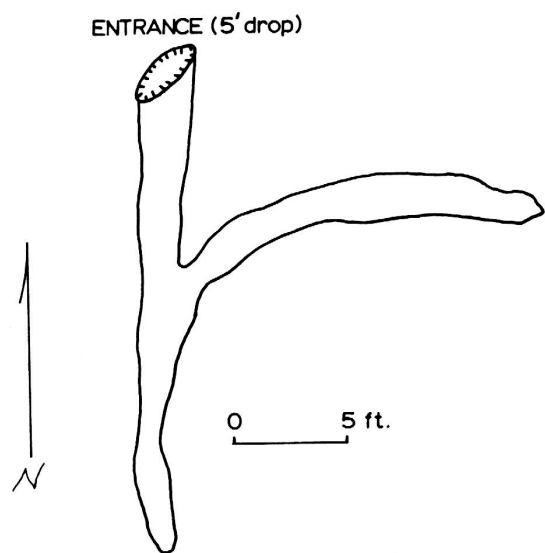


Figure 81. Rohrersville No. 5 Cave, Washington County.

of the railroad tracks. The mine trends northeast for 75 feet and is 6 to 10 feet high and 15 feet wide. Some loose breakdown is present, necessitating caution in visiting this mine.

Mine No. 4: This is the largest of the mines at Round Top. The entrance is 450 feet west of the mill and 15 feet above the railroad. The walk-in entrance is partly obscured by a pile of talus and cliff debris.

The mine follows the axis of an anticline (see Fig. 83) at N.40° E. for over 500 feet. The passage is from 26 to 50 feet high and wide, and the floor is covered with much loose breakdown. Water is pooled along the northwest side and at the end of the passage, where a small shallow lake is formed.

Mine No. 5: This mine is 1100 feet west of the cement mill, in the bank at a point 20 feet above the C & O Canal towpath. The entrance was originally 20 feet square but is now partly filled by slumping and collapse of debris from the railroad construction above. This one also follows the strike of an anticline, trending N. 30° E. for over 400 feet. Just inside the entrance are ruins of old brick and stone structures, which were probably bases for mechanical hoists or equipment. Towards the back there is much timber shoring against the walls, and water on both sides of the passage.

Cave No. 6: This cave is 800 feet west of the mill and 20 feet above the towpath. It is probably a good example of what the mines originally looked like (as natural cavities) prior to being enlarged. The entrance is 3 feet by 3 feet and opens to a passage 6 feet high and 10 feet wide at the base, with a triangular cross

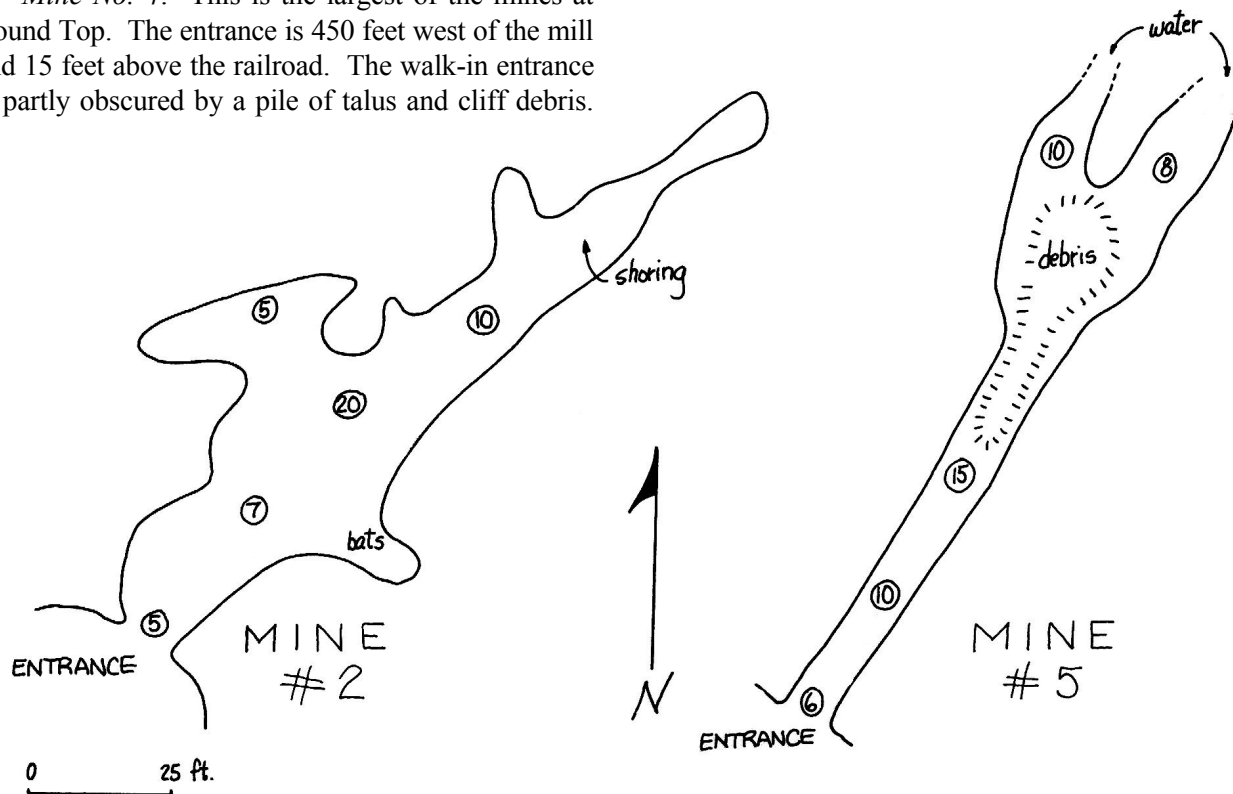


Figure 82. Round Top Mines, Washington County. Surveyed by D. Slifer, March, 1969.

section. It follows the strike of a minor anticline for 30 feet at N. 40° E. The passage becomes a narrow slit (separation between beds) too tight to follow, but a vigorous draft of air indicates that it may be more extensive.

Mine No. 7: The entrance is 400 feet west of the mill and 35 feet above the towpath. It is a hole 4 feet in diameter, sometimes partially covered by vines, which slopes down sharply into a passage which follows the strike of the beds for 160 feet to the northeast and 40 feet to the southwest. It is in the Tonoloway Limestone which dips 30° N. and strikes S. 35° W. The passage is very uniform with perfectly flat walls which represent a 10-foot separation between bedding planes. Remnants of old wooden tracks for mining carts still lie on the floor.

Cave No. 8: This is a shelter cave which is developed in the apex of a closely folded anticline in the Bloomsburg Formation, 900 feet east of the mill and 25 feet above the canal. It is 50 feet wide, 20 feet high, and 40 feet long.

Round Top Summit Cave

Washington County, Hancock Quadrangle

Location: WC 8/1/4

Elevation: 1340

Round Top Summit Cave is one of the larger and more interesting Washington County caves. Approximately 600 feet of passage is known to exist; most of it is high, narrow fissure-type passage, lined with vast amounts of well developed cave coral. This cave is not recommended for novices or heavy persons, due to the many narrow and jagged squeezes, vertical drops, and tricky climbs.

History:

Nothing is known about discovery or early exploration of this cave. However, the following quote from Scharf's "*A History of Western Maryland*" (1882, p. 38-39) may be in reference to this very cave. He discusses the abundance and quality of limestone near



Figure 83. Lake in rear of Round Top Mine No.4. The shape of the lake room conforms to the limbs of an anticline in the Tonoloway Limestone.

Round Top and proceeds to relate that, "Above this stratum of spar, a nearly square hole leads into a cavern hollowed out of the upfolded limestone by the tremendous forces which have crushed the mountain and split open the beds of stone. This cave has never been adequately explored. It is reported to have been the abode of a family of black bears, which were traced into it and finally destroyed. It is supposed to be of enormous length, and to be formed in part of vast fissures extending to fearful depths."

Geology:

The cave is developed along joints in the thick-bedded, knobby black limestone of the Keyser Formation.

Description:

The entrance is 5 feet wide and 3 feet high. It opens to a slightly larger passage which slopes steeply south for 20 feet, where a vertical drop of 40 feet brings one into a high fissure about 10 feet wide. At the southwest end of this fissure is a steep slope leading

down to a crawlway. The cave continues for about 500 feet to the southwest as a series of high narrow passages trending S. 10° W. and S. 60° W. They are lined throughout with dense cave coral and occasionally some flowstone. Several drops are encountered, which lead down to lower levels of the same passage, the deepest being 30 feet. The cave ends in breakdown, an estimated 100 feet below the entrance.

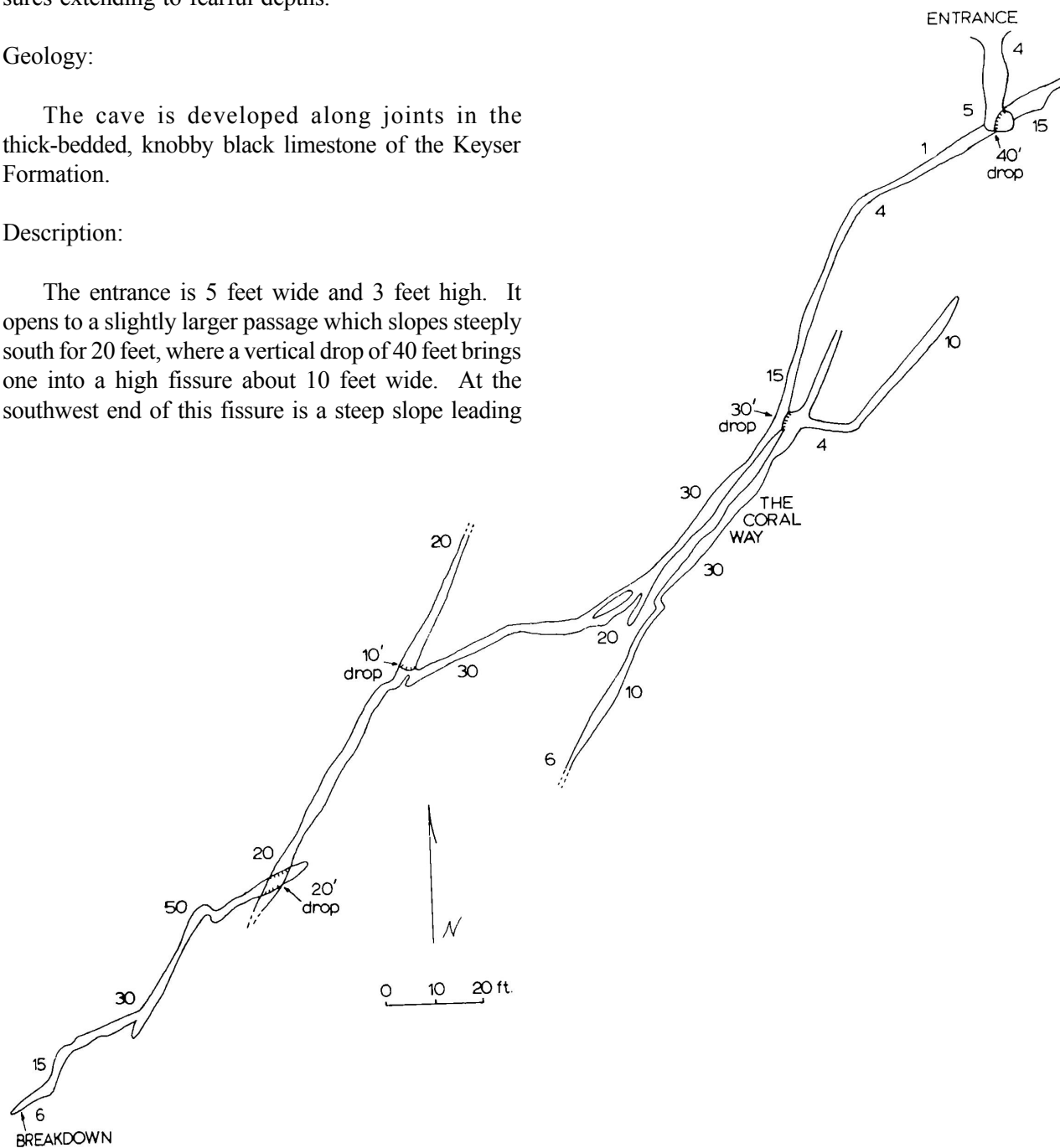


Figure 84. Round Top Summit Cave, Washington County. Surveyed by D. Slifer and R. Franz, November 24, 1968.

Round Top No. 2 Cave

Washington County, Hancock Quadrangle

Location: WC 8/1/5

Elevation: 1100

Davies reported a Round Top No. 2 Cave in 1950 which supposedly was a straight passage approximately 400 feet in length. Repeated efforts were taken to locate it but to no avail. The only cave found in the vicinity consists of a straight passage trending north-east for about 60 feet. It varies from one to five feet in

height and width, is triangular in cross section and has a floor of loose rock. No speleothems are developed. A 20 foot crawlway is developed at the base of the same escarpment, approximately 300 feet west of the No. 2 Cave. Both of these caves occur in the Tonoloway Limestone.

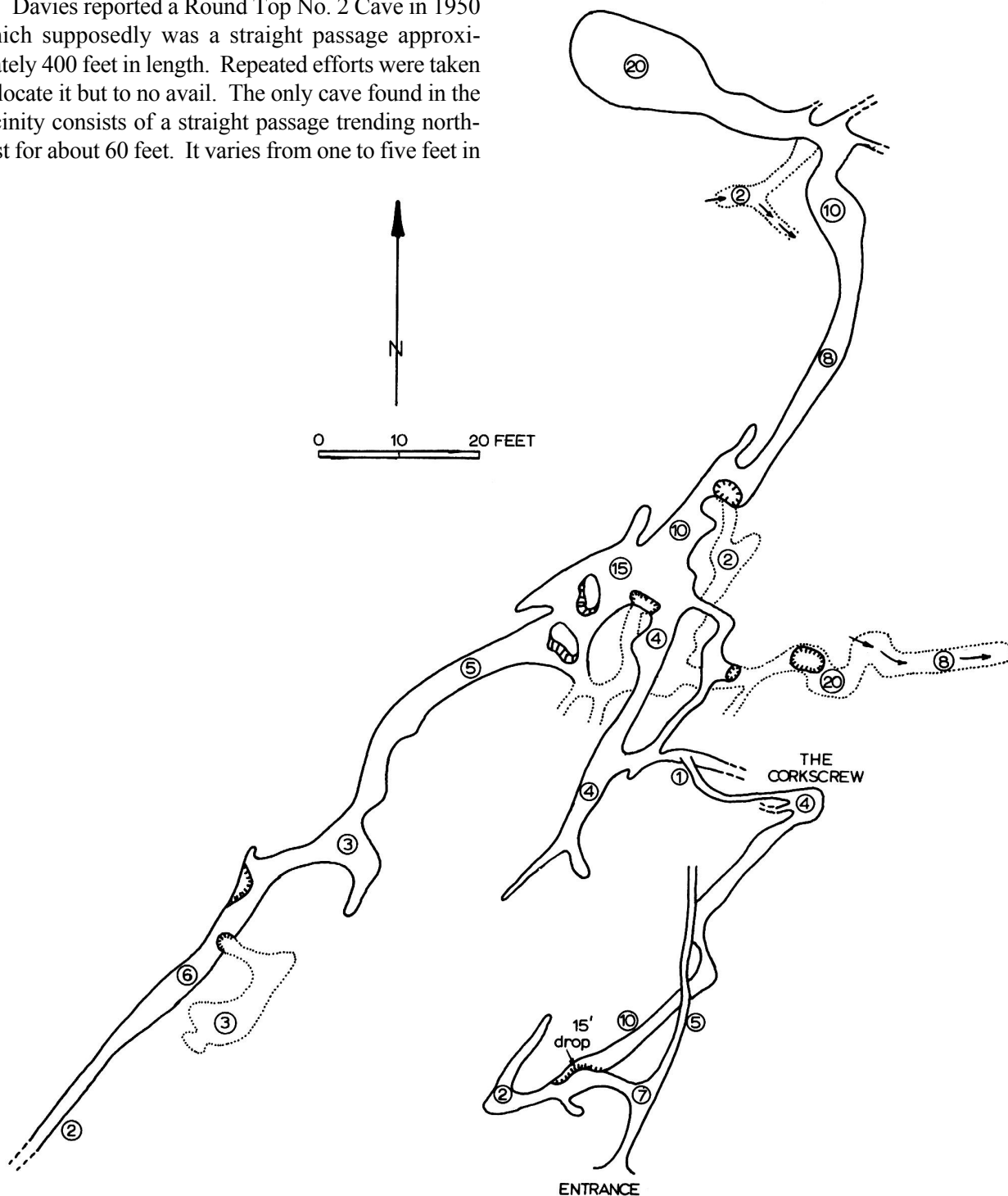


Figure 85. Schetromph Cave, Washington County. Surveyed by D. Slifer and R. Franz.

Schetromph Cave

Washington County, Mason-Dixon Quadrangle

Location: WC 6/9/4

Elevation: 420

Schetromph Cave is east of Conococheague Creek and two miles north of Wilson. The entrance is 40 feet above a large spring that feeds several watercress ponds. Approximately 500 feet of passage has been mapped in this rather sinuous cave. Much of the passage is very narrow and several places require quite a physical effort to traverse.

Geology:

The cave is developed along bedding planes and is in the Chambersburg Limestone (strike N. 30° E., dip 65° W.) near the contact with the Martinsburg Shale. A similar situation exists for the Fairview Caves, one and one-half miles to the north.

Description:

The cave consists of three levels. The constricted entrance slopes into the uppermost one which trends north for 25 feet as a narrow fissure. To the west there is another passage which crosses a 2 ft. wide, 15 ft. deep pit and pinches down after swinging sharply to the north. This pit drops into the second level. Rope is not essential but may be of value in ascending. The second level winds about 40 feet to the northeast. Here one encounters the “corkscrew,” aptly named to describe a very narrow crevice, lined with coral and projections, which twists upwards into a larger northeast oriented passage. The main room lies 25 feet to the northeast of this point. The room is 15 feet high, 20 feet long, and 10 feet wide. Some very attractive, relatively intact travertine curtains can be found here. Several large pieces of breakdown cover the floor, which contains three different leads downward into the third or lower level. This level is discontinuous and occurs in three different areas of the cave, although a water connection is evident from the flow patterns. The central portion of the lower level contains a rapidly flowing stream which is probably the spring below the entrance. Two more passages can be followed out of the main room at opposite ends for a distance of about 150 feet each. The passage to the southwest ends in a tight crawlway, too small to follow. A strong draft of air was observed here, indicating more passage beyond.

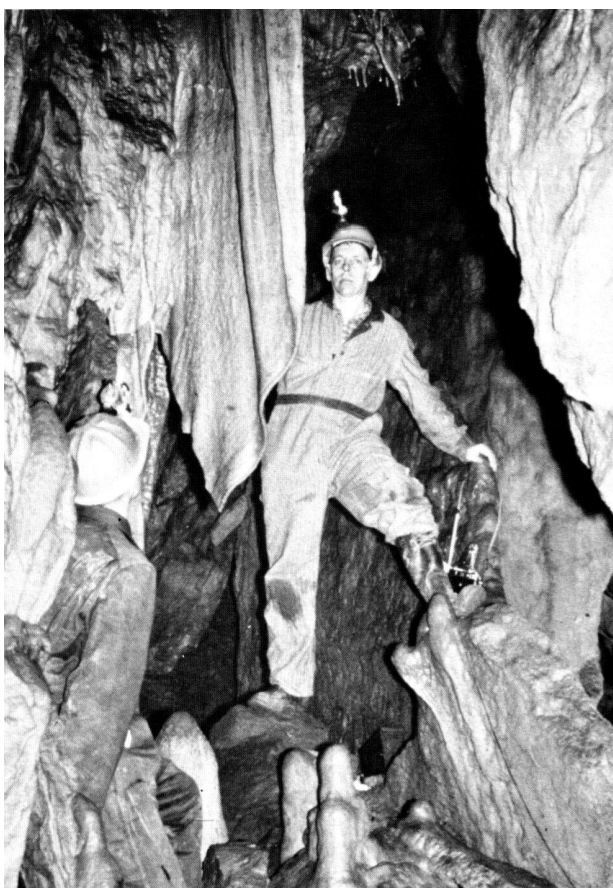


Figure 86. Main room in Schetromph Cave, Washington County showing travertine drapery and stalagmites

Shockeys Cave

Washington County, Blue Ridge Summit
Quadrangle

Location: NW 7/5/1

Elevation: 1400-1500

This cave is reported to be in the base of the 40-foot cliffs northeast of Falls Creek near Fort Ritchie. Several sources say that a bootlegger named Shockey used this cave for moonshine activities during prohibition, and the story goes that a gun battle ensued when police assaulted his hideaway.

The cave is supposedly a single room of little extent – to be expected since the area exposes Weverton Quartzite. The cave could not be located during fieldwork for this report. One local report has it that the entrance was sealed with rocks years ago.

Several small fissure-type passages and talus caves

were found in the rocky ridge 3/8 mile north of Lake Royer; however, none exceeded 15 feet in extent. They are also in the Weverton Quartzite.

Snivelys Caves

Washington County, Keedysville Quadrangle

Location: NC 5/8/5

Elevation: 400

The Snivelys Caves are situated in the dissected rocky plateau area east of the Little Antietam Creek near Eakles Mill, one mile southeast of Keedysville. The property is owned by Roy G. Reeder of Keedysville, and the caves are named for George Snively, a former owner.

History:

Snivelys No. 1 Cave was more extensive at one time but a great part has been removed in quarry op-

erations carried on over a generation ago. The back room of the cave is a veritable guest register with its walls and ceiling covered by names and initials. The oldest is dated 1908 but most are 1921 and 1925.

Geology:

The Tomstown Dolomite, in which the cave is developed, is a massive blue-black dolomite about 1000 feet thick that becomes light grey on weathering. The cave lies in beds 100 feet above the base of the formation. It is located on the east limb of a minor anticline dipping 20° E. The strike is due north. A major joint system trends N. 60° E., and subordinate systems strike N. 20° E. and N. 55° W. All joint planes are vertical.

Description:

The entrance to Snivelys No. 1 Cave is a horizontal hole 1 to 2 feet in diameter. Projecting spines from

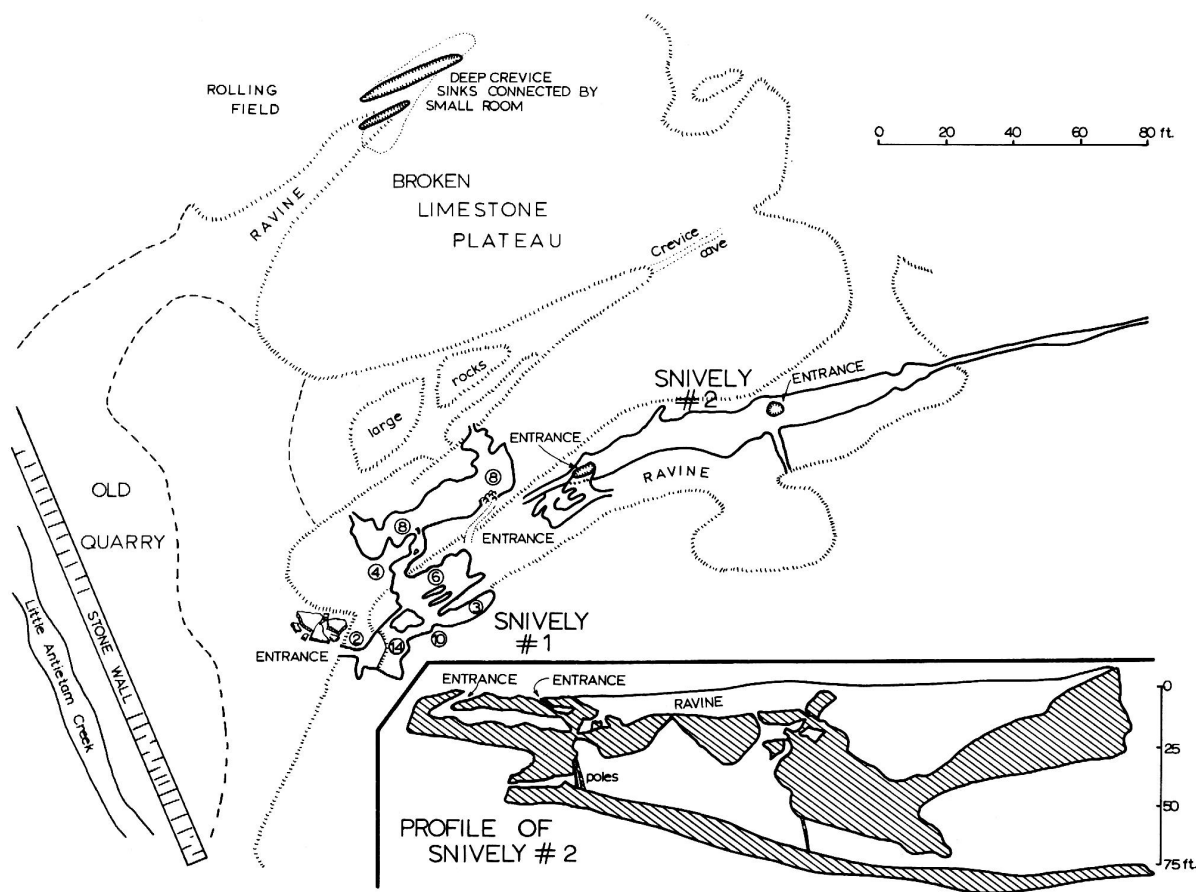


Figure 87. Snivelys Caves, Washington County. Surveyed by W. Davies, D. Mears, M. Mears, and J.P. St. Clair, May 5, 1946.

the ceiling make it difficult to crawl through it. At 10 feet the crawlway ends in an overhanging ledge with a drop of 8 feet to a room. The room is 15 feet in diameter and 20 feet high with a conical cross section. A passage, 8 feet high, leading from the room pinches down beyond 50 feet to a small crawlway 10 feet long. Midway along the passage a short side passage connects with a room on the east. From this room a narrow passage leads to the third and largest room in the cave. Midway along this passage a formation blocks the way, making it necessary to crawl a short distance. The large room is 40 feet long, 10 to 15 feet wide, and 8 feet high. At the end of the room a beautiful, pure white flowstone, resembling a frozen waterfall, is developed. This formation is among the largest and prettiest in any of the caves of Maryland but, unfortunately, has not escaped defacing. A narrow low crawlway leads behind the formation and trends towards the second room of the cave. It is 20 feet long and ends in a pool.

The cave is relatively dry except for a small pool at the north end of the second room. Except for this



Figure 88. Flowstone-draped wall in Snively Cave No. 1, Washington County.

room that is floored with wet clay, the floor of the cave is soft dry earth or broken stone. Air circulation in the cave is poor, and large parties (8 people) have raised the temperature from 57 to 70°F. in a short time.

The second cave, Snivelys No. 2 Cave, is located on top of the bluff a short distance to the east and north of Snivelys No. 1 Cave. It is in a steep-sided shallow ravine, 10 to 20 feet below the surface of the hill, that has formed by the settling of rock into large solution channels. The surface of the ravine is covered by large broken rocks, and entrance to the cave is gained through passages in the debris. The drop at the entrance is about 15 feet vertical. The cave is a fissure, 5 to 10 feet wide at the entrance, becoming progressively narrower until beyond 100 feet it is too narrow to traverse. The fissure is vertical and continues to the surface. The roof of the cave is broken limestone blocks that are wedged in the fissure. The floor is covered by a 6 inch layer of black dirt and leaves under which is yellow clay mixed with small chips of decayed limestone. Bones of small animals, nut shells, and twigs lie on the floor. The cave is dangerous and should be traversed with caution because of loose rocks.

In the rocky upland adjacent to the caves are several smaller passageways. Fifty-five feet to the east of Snivelys No. 2 Cave is a narrow ravine at the head of which is a fissure-like passage, but it is too narrow to traverse. At the north end of the upland is an elliptical pit 35 feet deep, 50 feet long, and 20 feet wide that probably leads to passages but is now filled with debris at the base.

Snivelys No. 3 Cave is approximately 100 feet north of Snivelys No. 1 Cave and is located near the mouth of a ravine under a mass of breakdown. The entrance is now a crawlway but prior to quarrying the cave was undoubtedly much larger and easier to enter. The entrance crawlway which is 2 to 4 feet in diameter trends northwest for 10 feet and intersects a larger passage which is 6 to 10 feet high and 4 feet wide. This passage trends northeast for 20 feet to breakdown. Minor archaeological digging in 1964 and 1968 uncovered many animal bones, small stone chips, and a number of long, hollow shell beads, probably from a necklace or breast plate. Two rock shelters in the top of the rocky area were excavated in 1969 by the University of Maryland Anthropology Department. Evidence of Indian habitation was af-

forded by the uncovering of many artifacts, bones, and fire pits.

Snyders Landing Caves

Washington County, Shepherdstown Quadrangle
Location: NE 7/9/7
Elevation: 315

Two caves and some rock shelters occur in the cliffs along the Potomac River west of Sharpsburg. The entrance to Cave No. 1 is 4 feet high and opens into a straight tunnel extending southwest for 125 feet. The cave varies from 1 to 20 feet high. The floor consists of clay and river gravel.

Two rock shelters (NE 7/7/5) are found 0.5 mile southeast of Cave No. 1. The larger, upper one, which

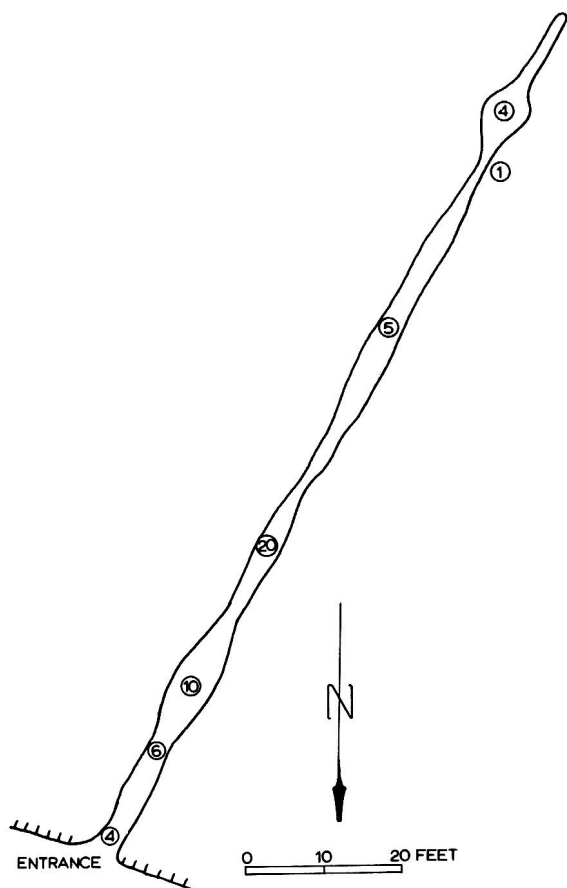


Figure 89. Snyder's Landing Cave No.1, Washington County Surveyed by D. Slifer and L. Franz, September 14, 1968.

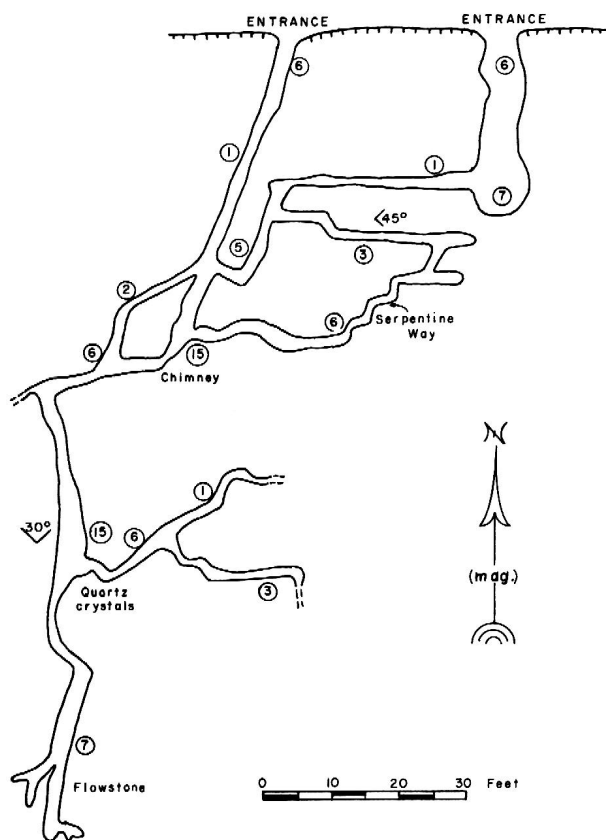


Figure 90. Snyder's Landing Cave No.2, Washington County. Surveyed by D. Slifer and L. Franz, September 14, 1968.

is approximately 75 feet above the canal, is 20 feet high and 25 feet wide. It is developed along a north-south joint. The lower shelter, which is at the level of the Chesapeake and Ohio Canal, contains some relic speleothems. A small spring flows from this rock shelter.

Five hundred feet farther downstream from the shelter, there is a second cave (NC 7/9/6). The three entrances of Cave No. 2 are spaced like points of a triangle on the cliff face. Passages originating from the two lower entrances connect but only with the greatest difficulty. The cave consists of tight crawlways and narrow fissures. The passages contain very few speleothems but in one section there are tiny quartz crystals covering bedding planes on the walls. Fine alluvial sediments cover the floor. The third and upper entrance was not investigated. These caves and rock shelters are in the Conococheague Limestone.

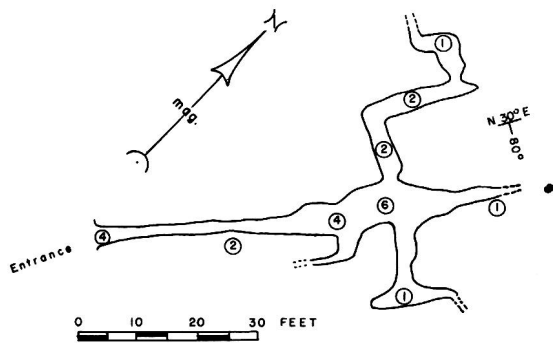


Figure 91. Two Locks Cave, Washington County.
Surveyed by D. Slifer and R. Franz,
November 23, 1968.

Two Locks Caves

Washington County Hedgesville Quadrangle
 Location: NC 3/7/9
 Elevation: 400

Several small caves and solution holes are developed in the bluffs along the C & O Canal, south of Two Locks. The northernmost cave is a 4-foot square opening in the cliff face, 20 feet above the river. It consists of a single room 10 feet in diameter and 5 feet high and is used as a roost by numerous pigeons. One hundred feet south of here is a fissure which extends south for 30 feet. The entrance to the largest cave is 150 feet to the south, in a small hollow 30 feet above the river. It trends northeast as a crawlway for 40 feet before opening into a somewhat higher passage with two side passages. These extend for short distances on both sides of the entrance passage as low crawlways. The caves are in the Beekmantown Limestone that strikes N. 30° E. and dips 80° E. and are developed along the bedding planes.

Wheeler Road Crevice

Washington County, Keedysville Quadrangle
 Location: NC 2/1/2
 Elevation: 430

This impressive crevice entrance is located on the eastern flank of a ridge northeast of Keedysville. A vertical fissure, which is 15 to 20 feet deep and 4 feet wide, trends northeast for 25 feet. The passage slopes

down to a crawlway which continues in the same direction for another 20 feet. Several passages branch off for short distances on both sides. Portions of the walls and ceiling are composed of unconsolidated fill and are subject to collapse. On several occasions local farmers have thrown dead livestock into the cave. Wheeler Road Crevice is in the Tomstown Dolomite.

Wilson Cave

Washington County, Mason-Dixon Quadrangle
 Location: SW 2/6/7
 Elevation: 420

Wilson Cave was discovered and opened by Maryland Cave Survey members in March, 1968. The entrance is in a shallow sinkhole in a wooded area near Wilson.

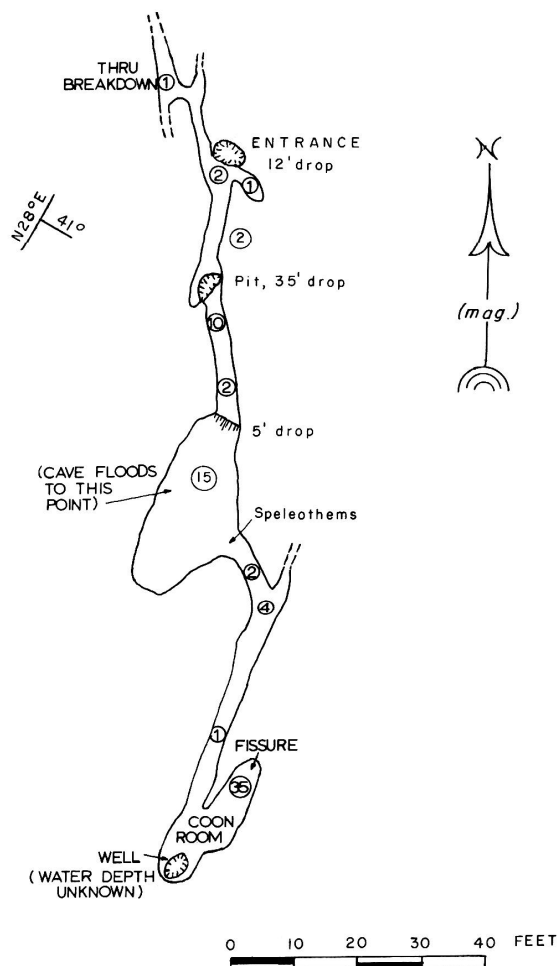


Figure 92. Wilson Cave, Washington County.
Surveyed by D. Slifer and D. Weaver,
September 21, 1969.

Geology:

Wilson Cave is developed in a thin band of Chambersburg Limestone (strike S. 28° W., dip 41° SE), which outcrops as karst between the Stones River Limestone to the west and the Martinsburg Shale (and Conococheague Creek) to the east.

Description:

The entrance is 3 feet by 2 feet and drops 12 feet through breakdown and trash to a low crawlway leading south for 10 feet, where it intersects a narrow pit 35 feet deep. At the base of the pit is another crawl to the largest room in the cave. A crawl to a second, smaller room leads on. The north end of this terminal room (named the Coon Room for its inhabitant) is a narrow, vertical fissure at least 35 feet high which resembles the pit near the entrance. The south end of the Coon Room ends over a vertical well 2 feet in diameter, containing water of unknown depth which fluctuates as much as 6 feet in level. No leads were found from this well during low water period. Due to the nature of the shape of the well, absence of footing, and deep water, this hole is very dangerous to enter, as the explorer cannot climb back out but must be lifted out. A member of the Survey was nearly lost in 1969 when checking this well because his sole companion was not prepared to pull him out.

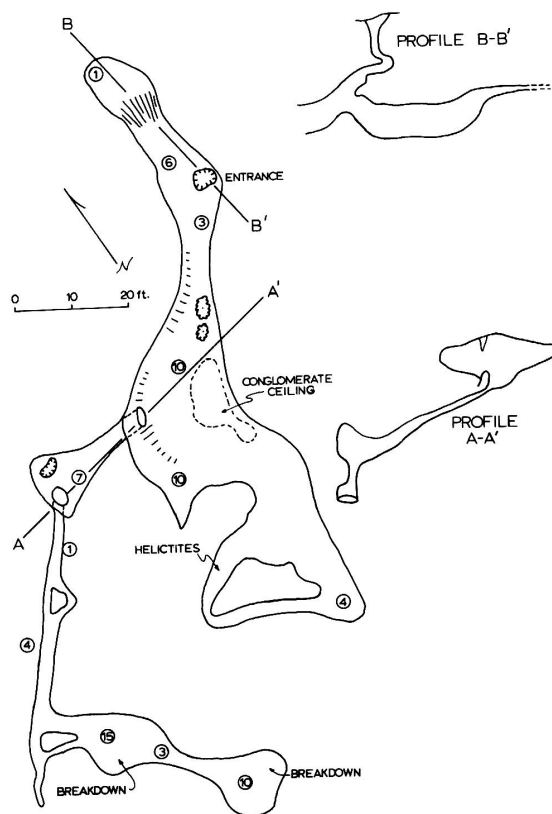
Winders Caves

Washington County, Myersville Quadrangle
Location: NW 5/2/3
Elevation: 700

On the east flank of a wooded ridge southwest of Jugtown are two small caves on the property of Mr. Winders (Route 66, one mile north of Mt. Aetna).

Geology:

Winders No. 1 is developed in the Tomstown Dolomite dipping 18° W. and striking N. 10° E. A feature of interest is the portions of "conglomerate ceiling" in the main room. Large and small rounded rocks cemented by a brown matrix cover the ceiling in places, with delicate white soda straw stalactites growing from the material. This conglomerate is a remnant stream deposit which at one time completely filled the chamber. Subsequent partial removal of this



**Figure 93. Winders Cave, Washington County.
Surveyed by D. Slifer and M.
Raymond, October 28, 1967**

fill somehow left parts of it on the ceiling. It is quite stable and poses no danger of collapse. It is interesting to note that Jugtown Cave (1/2 mile northwest of Winders Cave) may be related through the occurrence of identical stream gravel in its low gradient water channel at the present time.

Description:

The entrance to Cave No. 1 is an 8-foot vertical shaft followed by a tight corkscrew passage which drops in several steps to a point 25 feet below the surface. A passage 6 feet high and wide is entered here. Thirty feet to the north, the channel terminates in a clay bank. The ceiling at this point displays well developed solutional grooves (anastomes) indicative of phreatic development. South of the entrance shaft the passage enters the main room – 100 feet long and approximately 20 feet wide. It is well decorated with a variety of speleothems in places. The room ends in

breakdown. In the middle of the room a small crawlway beneath a rock shelf on the west side slopes sharply downward to a small room with two clay pits, both 6 feet deep. At the bottom of one is an opening to 60 feet of muddy crawlway leading to two connected breakdown rooms about 20 feet in diameter.

The entrance to Winders No. 2 Cave is in a small tree-filled sink approximately 450 yards south of

Winders No. 1, on the same ridge. Beyond the opening, which is 3 feet high and 5 feet wide, the passage slopes downward about 20 feet and widens to 6 feet in diameter. It trends northwest and pinches out after 60 feet. Fifty yards to the north is another, larger sink filled with trash. Local reports indicate the existence of another cave here, but much digging would be required to uncover it. Winders No. 2 is in the Tomstown Dolomite.

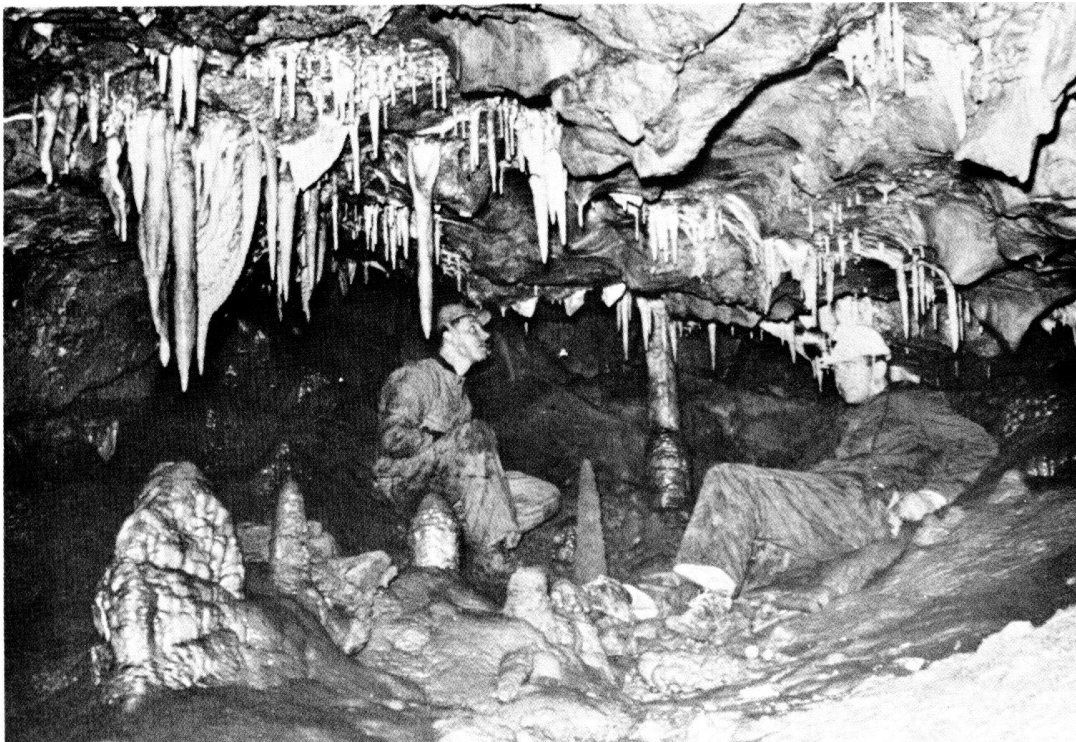


Figure 94. Main room in Winders Cave, Washington County.

ARCHEOLOGY OF MARYLAND CAVES AND ROCK SHELTERS

by Tyler Bastian ³

Rock shelters, rock overhangs, and cave entrances were commonly used as convenient but temporary shelters by the prehistoric Indians just as they are used today by outdoorsmen waiting out a storm or enjoying a rest. Archeological remains found in some Maryland caves and shelters may be as much as 8,000 years old. Unfortunately, many of these irreplaceable records of the past were excavated before the advent of modern scientific archeology or have been thoughtlessly destroyed by relic hunters and others who have neither the knowledge or resources for properly recording and preserving their findings. The fascination that leads to the frequent exploration of rock shelters and caves, and the general knowledge that archeological remains may occur in such places makes their archeological record exceptionally vulnerable to destruction by casual digging.

The purposes of this discussion are to summarize what is known about the archeology of caves and rock shelters in Maryland, and to emphasize the urgency for preserving the archeological features and deposits for future investigation by experienced archeologists or persons working under the direct supervision of a professional archeologist.

The present summary is based on the few available published sources, and on a brief inspection of field notes and collections from several unpublished sites. Considerations of available time have prevented detailed analysis of any site or examination of all known collections. Nevertheless, an inventory or summary will be useful even if it accomplishes little more than pointing out how much remains to be done. It should also stimulate others to report additional sites and collections unknown at this time. For economy of words, I use the word "shelter" when speaking in general about caves, overhangs, and rock shelters.

The time dimension of cultural remains in Maryland rock shelters and caves is partly known from archeological stratigraphy at a few sites (i.e. BA 24 and CE 6), but most of our information about the chronology is inferred from comparisons with stratified and dated sites in other nearby states. There are no radiocarbon dates from Maryland shelters

The earliest, adequately documented cultural remains in eastern North America are those termed Paleo-Indian and dated between 8,000 and 11,000 B.C. The Paleo-Indians hunted large, now extinct mammals, notably the mammoth. The climate of Maryland was cooler and moister in those times than it is now. The most distinctive artifacts of the Paleo-Indian cultures, fluted projectile points, occur in Maryland as widely scattered, isolated finds, but none are known to have been recovered from shelters in the state.

The succeeding Archaic cultures were present in Maryland between 8,000 and 1,500 B.C. and subsisted by hunting small game, gathering seeds and roots, and fishing. The climate was somewhat like that of today. Artifacts attributable to these cultures are fairly abundant in most parts of Maryland and are perhaps the most common kind found in rock shelters. One of the earliest Archaic projectile points is characterized by a triangular outline, usually serrated edges, and notches at both basal corners as well as in the middle of the base (often referred to as bifurcate-base points). Points of this type, dating from around 7,000 B.C., are known from shelters in western Maryland (WA 13). Many of the stemmed and notched points reported from Maryland shelters can be attributed to Archaic cultures. Bannerstones and grooved axes, also characteristic of Archaic cultures, are sometimes found in Maryland shelters.

For a relatively short time between the Archaic and later Woodland cultures, a culture known as Transitional was present in Maryland. It is characterized by bowls made of soapstone or steatite, and by broad spear points. Remains of the Transitional culture are especially abundant in Frederick County shelters. The Transitional cultures are dated between 1,500 and 1,000 B.C. or somewhat earlier and later.

The succeeding Woodland cultures are characterized by ceramic pottery and the use of domesticated plants. They span the time between 1,000 B.C. and early historic times. Woodland artifacts are included in most of the archeological shelter deposits in Maryland. The earliest pottery is tempered with inclusions

³ Maryland State Archaeologist

of soapstone fragments, types of intermediate age are usually tempered with sand or crushed rock other than soapstone, and the latest types usually have crushed shell temper. Early Woodland pottery has been found in several shelters Frederick County, and later pottery types have been found in most shelters containing archeological deposits. Direct evidence for domesticated plants has been reported only from Bushey Cavern (WA 18) where charred corn cobs were recovered. Woodland artifacts are more varied than early types, and they include pipes, ungrooved axes (celts), bone awls and fishhooks, pendants, and shell beads. Late Woodland cultures are characterized by large villages on major rivers, so it is likely that the shelters served as temporary camps for hunters and travelers.

The history of archeological investigations in Maryland caves and shelters can be divided into two parts. The earlier period includes the latter part of the nineteenth century and the first years of the present century when a few sites were explored and reported. The entire period is spanned by a series of investigations by the Smithsonian Institution and Phillips Academy from 1877 through 1905 at Bushey Cavern east of Hagerstown; they are summarized below. Some brief notices were published concerning the discov-

ery of a few artifacts in rock shelters near Baltimore (Harlan, 1883; McGuire, 1880). Several writers report arrow points, beads, a pipe, burned bone, and ashes from a cave on Antietam Creek below Sharpsburg (Fowke, 1894, p. 63; Scharf, 1882, p. 986; Smith, 1884, p. 798), and a skeleton is reported to have been found under a nearby ledge (Smith, 1884, p. 798). The cave on Antietam Creek is apparently Marker Cave, where recent investigations have revealed additional materials (described elsewhere by Franz and Slifer).

The later period of archeological exploration in Maryland caves and shelters began in the early 1940's and extends to the present time. No investigations seem to have been reported between 1905 and 1943 when Martin Muma began to explore Maryland caves. Muma carried out some test excavations and noted archeological remains in three caves in widely separated areas of the state. In the early 1950's, Frank Corliss, a local amateur archeologist, and the Upper Ohio Valley Archeological Survey of the Carnegie Museum in Pittsburgh tested a few caves and rock shelters in Garrett County. In Frederick County a number of rock shelters and small caves have been excavated within the past two decades by several per-

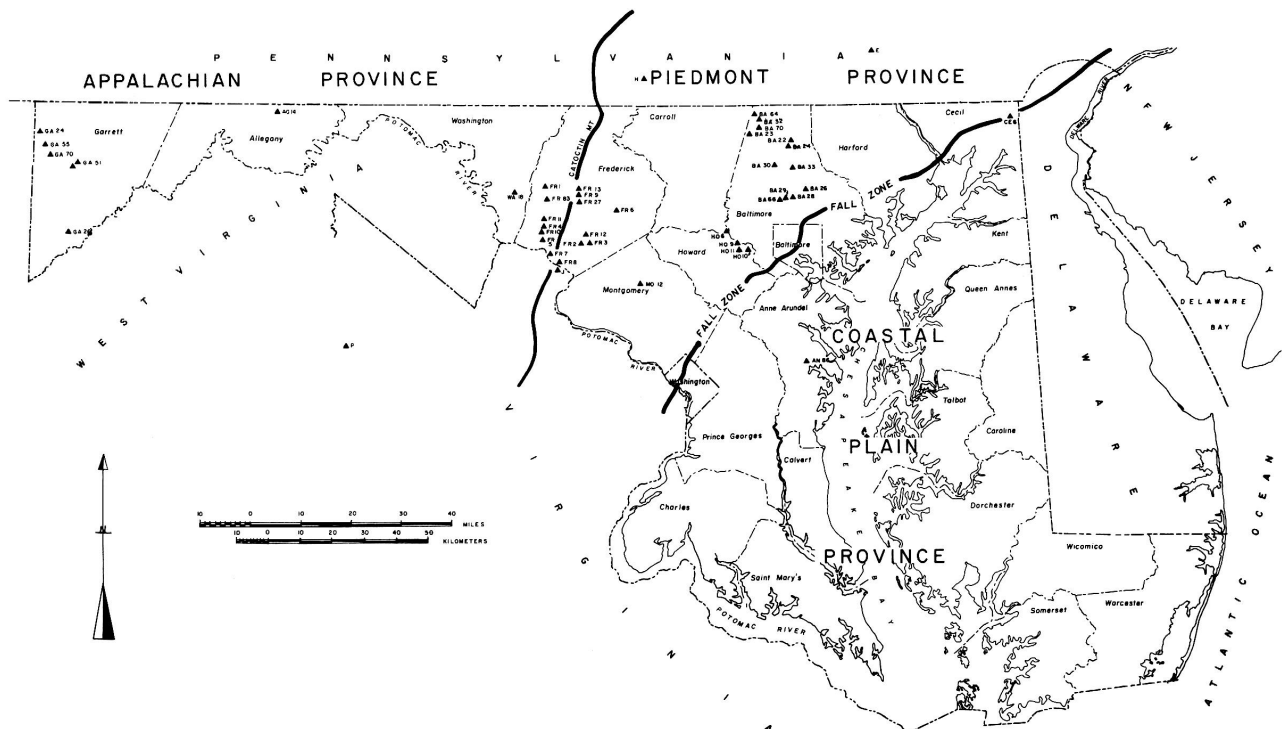


Figure 95. Caves and rock shelters containing archeological deposits in Maryland. Selected sites also shown in areas adjacent to Maryland: E = Erb (Kent and Packard, 1969), J = Jeffery-Harris (Johnson, 1968), P = Panther (Scheulen, 1967), H. Heck (Kinsey, 1958).

sons, but principally by Spencer O. Geasey during the 1950's. From 1956 through 1968 the Archeological Society of Maryland carried out a series of rock shelter excavations, mainly in Baltimore County but also one each in Montgomery and Cecil counties (see Archeological Society of Maryland News Letters).

One of the most remarkable sites in Maryland, Bushey Cavern was extensively investigated nearly 100 years ago, but the results were largely unreported so the site has remained archeologically little known. Bushey Cavern, now destroyed by a quarry, was situated in a limestone ridge near the east side of the Hagerstown Valley, facing east toward the Blue Ridge, and overlooking a tributary of Antietam Creek. The cave has a long history (Davies, 1951, p. 36) so it is likely that its deposits were casually investigated long before the site became known to science. The excavations made at Bushey Cavern in 1877 by Frank H. Cushing of the Smithsonian Institution (Baird, 1878, p. 38) represent the earliest archeological excavation of a shelter recorded for Maryland. No report seems to have been prepared, but the specimens collected by Cushing are preserved at the Smithsonian (Cat. Nos. 31871-96 and 403145-250A). Additional excavations were conducted by J. D. McGuire in 1903 (Peabody, 1908, p. 8) and again there is no report but the specimens are preserved in the Smithsonian (Cat. Nos. 273210-51). In 1905, Warren K. Moorehead and Charles Peabody, under the auspices of the Phillips Academy of Andover, Massachusetts, conducted systematic excavations in Bushey Cavern, and the meager results of their effort were published in detail and the specimens placed in the Division of Archaeology at Phillips Academy (Peabody, 1908, p. 8). The cave is described as having a large entrance 60 feet wide and 8 feet high leading to a room 140 feet in diameter. Several passages lead from the room, but archeological remains seem to have been largely or entirely confined to the main outer room. Labels on soil samples collected by Cushing indicate that "recent ash" extended to 11 or 12 inches, "ancient ash" was found between 15 and 27 inches, and "red argillaceous earth" extended below the ash for a considerable depth. Peabody (1908, p. 8-12) reports that the deposits toward the front of the cave consisted of ashes, vegetable mold, and decomposed limestone mixed with pebbles and blocks of limestone; artifacts occurred up to 70 inches deep. Toward the back there was a hard stalagmitic floor containing some cultural debris and overlain with a thin layer of "vegetable mould." Al-

though not mentioned in Peabody's report, it seems possible that most of the deposits encountered by Moorehead and Peabody had been previously dug over. This assumption might be reinforced to some extent if, as it appears, very few artifacts were recovered, because Cushing found large numbers of artifacts during his explorations. Unfortunately, Peabody's report is not clear about the number of specimens recovered.

Only a brief summary of the Bushey Cavern artifacts is possible here, although the site fully warrants detailed analysis for publication as a separate report. The specimens considered are those collected by Cushing in 1877 and by McGuire in 1903, and those few reported by Peabody (1908) from his 1905 excavations. The collection of approximately 60 points is mainly comprised of medium- to large-size, straight-stemmed and broadly side-notched forms, but there are a number of unnotched triangular specimens. Most are made of rhyolite, but quartz, black chert, and Pennsylvania jasper are represented. Archaic and Late Woodland types predominate; Middle Woodland corner-notched types are absent. There are few other objects of chipped stone. The ground stone artifacts include 12 polished celts, a grooved ax, and a two-hole gorget with an elongated shallow depression extending between the holes and a series of grooves on each end of both lateral edges. Other ground and/or pecked objects include two double-faced grinding stones or mullers (one with a shallow pit on either face), a large single-faced grinding basin with a circular basin, and several pitted cobbles.

Pottery from Bushey Cavern includes 2 sherds of the Early Woodland, smooth-surfaced, steatite-tempered Marcey Creek Plain type, sherds of the Middle Woodland Popes Creek Cord Marked type, and 9 Late Woodland sherds including Keyser Cord Marked, New River Cord Marked, and Potomac Creek Cord Impressed. There are a number of sherds, including a huge rim section, of the protohistoric Susquehannock pottery type, Munsee Incised. A large group of sherds of an unidentified type are coarsely grit-tempered, cord-roughened, and include flat bottoms. Finally, there are sherds of miniature vessels, 2 ceramic disks, and a number of fired-clay globs.

The collections includes a notable series of about 30 pipe bowls and pipe stem fragments, mostly of Susquehannock types. They include trumpet-shaped

bowls, square bowls with thick, incised collars, bowls with high castellations, and human and animal effigies. Also remarkable is the large number of bone artifacts including mammal and bird splinter awls, ulna and cannon awls, large mat needles made from split ribs, turtle shell cups, tubular beads of bird bone, antler tine projectile points, and antler tine cylinders or flakers. Particularly distinctive are two bear molar pendants which have one root ground away so that they resemble a foot. They are known from an early 17th century Susquehannock site in the lower Susquehanna Valley, from several late prehistoric and early contact sites in western New York, from early contact sites in southwestern Pennsylvania, and from an early 17th century contact site in eastern West Virginia (Mayer-Oakes, 1955, p. 123; Witthoft, 1952, p. 249). The only shell artifacts in the Bushey Cavern collection are a disk bead and a few mussels with moderately ground edges. Also found was a piece of charred bark with marginal perforations, and several charred corn cobs. Bone refuse is abundant and varied, and it is fortunate that the early investigators saved so much of it. A list, probably incomplete, of the species represented is included in Table 2.

The diversity of materials recovered from Bushey Cavern can not be duplicated from any other archeological site now known in Maryland, although a greater quantity of material has been preserved from several shelters, including Alberts and Tuscarora in Frederick County. Cultural stratigraphy are reported from a few shelters, including Hargett-King in Montgomery County, Ballard in Baltimore County, and Frantsi in Cecil County, but in all cases there seems to be some mixing of the relatively shallow deposits. There is a tendency for shelters with a generally southern exposure to have been occupied most intensively, although no data are available on the number, size, and orientations of shelters in which archeological deposits are absent (Table 3). In most shelters the Late Woodland remains are much more abundant than earlier materials, particularly when the relatively short time span of Late Woodland (less than 1000 years) is considered in relation to the several thousand years of the preceding Woodland and Archaic cultures. The increased use of rock shelters by the Late Woodland cultures may be partly a reflection of the growing population as deduced from the size and number of open Late Woodland sites along the major rivers.

In reviewing the available data for Maryland, and considering it in the light of cave and rock shelter archeology in adjacent regions, it is painfully evident that our present techniques are not revealing nearly as much information as might be obtained by more sophisticated approaches. Even where the excavations were carried on under reasonably well-controlled conditions, none of the available reports provide full descriptive and provenience data which would allow us to evaluate the interpretations presented, or to revise the interpretations in the light of new data. A great deal of work remains to be done with the archeological data already available from Maryland shelters. In the meantime, there is an urgent need to conserve those archeological deposits which still remain in caves and rock shelters. Archeological excavations should be undertaken only by trained and experienced persons. The greatest contribution that speleologists, amateur archeologists, and other interested persons can make to assure that we will eventually learn more about the archeology of caves is to inform others of the significance and importance of proper investigation. Should the qualifications of any investigator be in doubt, he should be discouraged from doing any digging until the State Archeologist or a university professor in an anthropology department specializing in North American archeology has been consulted. In the long view, it will be far better to preserve now and dig later when our recovery and observation techniques are more refined, than to dig now and have nothing but a few boxes of Indian relics to show for our efforts.

Most of the information about Maryland shelters has been obtained from amateur investigators who have generously shared their knowledge with me. Individual acknowledgments are listed in Table 1. My own investigations of Maryland shelters have been limited to visiting a few sites to check their locations, measure their sizes and orientations, and to examine a few collections. My dependence on the hard labor of others is considerable. In addition to those persons listed in Table 1, I am indebted to Dr. Clifford Evans, Chairman of the Department of Anthropology, Smithsonian Institution, for allowing me to examine the collections from Bushey Cavern, and to Frederica Paine, aid in the Division of Archeology, Maryland Geological Survey, for drafting the accompanying map and for typing several drafts of this report. I should also like to acknowledge the assistance of Mr. William B. Marye in establishing the location of "Ellora."

As mentioned at the end of the Baltimore County section of Table 1, a site known as "Old Indian Cave" was reported to be located near Ellora in Baltimore County (Harlan, 1883). As I was unable to locate Ellora in either modern or historical sources, I called on Mr. Marye, a student par excellence of local history, whose sleuthing not only located Ellora, but also two rock shelters in the vicinity. The site is not definitely identified, but two shelters are known in eastern Baltimore County within 4 miles of Ellora (now known as Lynch's Desire). One shelter fits closely Harlan's brief description; it is 8 ft. high, 25 ft. long, over 33 ft. deep, faces WSW, and is about 130 ft. above a stream. Shallow soil deposits on the floor have been recently disturbed

and there are older spoil piles in front of the shelter. No aboriginal artifacts were seen. A well-worn path, abundant modern trash, and remains of recent fires indicate that the shelter is popular. Perhaps the same was true a century ago and would explain the presence of oyster shells mentioned by Harlan; the site seems too far inland to expect oyster shells in an aboriginal context. There are some current rumors about a few Indian artifacts being found in the shelter. The second shelter known in the vicinity is much closer to Ellora, is smaller than the one described by Harlan, does not appear to have been disturbed, and yielded no evidence of occupation in a brief test conducted by the Maryland Geological Survey in February, 1971.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter; O = overhang, C = cave,</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
ALLEGANY COUNTY (AG)									
14	Flintstone	S	-	21	-	6	W	Points, flakes, pottery, a pipe stem, and bone refuse suggestive of Archaic through Woodland components. Observations by G.R. Minnick and R.A. Thomas in 1966 indicate extensive disturbance by unknown persons. Investigations, including two 2 x 3 - foot test pits, by R.C. Gibbs and others in 1970 confirmed previous observations.	G.R. Minnick, correspondence, 1966 and 1969; R.A. Thomas, correspondence, 1971; R.C. Gibbs, notes on file with MGS.
ANNE ARUNDEL COUNTY (AN)									
86	Briar	S	-	-	-	-	-	One point and two sherds found by H.T. Wright.	T. Mayr, conversation, 1970.
BALTIMORE COUNTY (BA)									
22	Panther	S	-	-	-	-	-	One sherd.	ASM site file; B. Fisher, conversation, 1970.
23	Graves Run	S	-	-	-	-	SE	Archeological deposits destroyed by unknown persons prior to 1960.	ASM site file; B. Fisher, conversation, 1971.
24	Ballard	S	-	-	-	1	SE	Points, pottery and other artifacts in partly stratified deposits ranging from Late Archaic through Late Woodland. Excavated 1960-62 by ASM under direction of T.L. Ford who is preparing the report.	ASM News Letter, Vols. 6, 7 and 8; T.L. Ford, conversation, 1970.
26	Martin	O	2.5	5	2	5	ESE	Points, scraper, and pottery. Excavated by H. Stinefelt and Reed Martin ca. 1962.	ASM site files.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.) (Continued)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter, O = overhang, C = cave,</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
28	Iglehart I	S	2	6	3	3	ESE	Points, knives, pottery, and other artifacts ranging from Early Archaic through Woodland in deposits up to one meter deep. Excavated 1964-66 by ASM under direction of K.B. Didier who is preparing the report.	Didier 1966; ASM News Letter Vols. 10 and 11; ASM site file.
29	Iglehart II	S	2	14	2	2	NE	Points and pottery. Excavated 1964-66 by ASM.	ASM News Letter, Vol. 10 and 11; ASM site file.
30	Crimmins	S	-	-	-	-	-	Points and pottery ranging from Archaic to Woodland. Excavated by ASM 1967-68 under direction of R.S. Cox.	ASM News Letter, Vols. 13 and 14; Gibbs 1968; ASM site file.
32	Pretty Boy	S	-	-	-	-	-	Points and pottery. Partly disturbed by random digging. Test excavations in 1969 and 1971 by B. Fisher.	MGS site file; B. Fisher, conversation, 1971.
33	Glencoe	S	3	8	8	5	SE	Points and a scraper. Three of the four points appear to be Late Woodland. Test excavation in 1970 by C.R. Hazard.	MGS site file; C.R. Hazard, conversation, 1970.
FREDERICK COUNTY (FR)									
1	Myersville	O	3	4.5	2.5	2	W	Points, pottery, and refuse bones indicative of intermittent occupation from Archaic through Late Woodland. Excavated in 1951 by S.O. Geasey and A.E. Selckmann.	S.O. Geasey, conversation, 1971.
2	Buckeystown	S	1	2.5	3.5	18	NE	Points, a knife, hammerstone, pottery, and bone refuse. Early through Late Woodland occupation. About 3 m. in front of shelter a cache of 17 large rhyolite bifaces were found under 2 large rocks: these may be Archaic. Excavated in 1951 by S.O. Geasey.	Geasey 1965: 30-35.
3	Buckeystown II	S	2.5	2.5	2.5	9	NE	Points and pottery indicative of Late Woodland occupation. Excavated in 1951 by S.O. Geasey.	Geasey 1965: 36-37.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.) (Continued)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter, O = overhang, C = cave,</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
4	Everhart	S	3	4.5	3	3	S	Points, strike-a-light, bannerstone fragments, faceted hammerstones, soapstone vessel fragments, pottery, ceramic pipe fragments, bone awls and fishhook, and abundant bone refuse. Early Archaic through Late Woodland cultures represented. Excavated by S.O. Geasey and A.E. Selckmann ca. 1952-54. Manuscript report prepared by Geasey.	Geasey, conversation, 1971; ASM Newsletter, Vol. 5, No. 6, p. 3; Woodward 1966: 4.
5	Alberts	C	3	3.5	9	15	NW	Points, hammerstone, pottery. Archaic and Late Woodland cultures represented. Excavated ca 1954 by S.O. Geasey.	S.O. Geasey, conversation, 1971; Franz and Slifer, this report (referred to as Catoctin Creek Cave).
6	Boyers Mill	S	11	5	17	1	W	Points, drills, knives, eke-a-light, gorget fragment, slate pendant, hammerstones, ceramic pipe fragments, and refuse bone, pottery, and stone-lined fire pit (Late Woodland). Archaic through Late Woodland cultures present. Excavated 1954-56 by S.O. Geasey.	Geasey, 1968
7	Catoctin-Lander	S	-	6	2	18	NW	One point, flakes, mussel shells, bone refuse. Excavated by S.O. Geasey ca. 1955.	S.O. Geasey, conversation, 1971.
8	Kanawha	C	-	-	6.5	15	up	Points, celts, discoidal, serpentine pipe fragment, pottery, turtle shell bowl, and bone refuse. Early Archaic, Transitional and Early Woodland cultures present, but mostly Late Woodland. Excavated ca. 1956 by S.O. Geasey and W. Kline.	S.O. Geasey, conversation, 1971. Not listed by Franz and Slifer.
9	Tuscarora I	S	2	10	3	4.5	ESE	Points, knives, blanks, bannerstone, pestle, hammerstone, pottery, and bone refuse. Early Archaic through Late Woodland cultures represented. Excavated ca. 1960 by S.O. Geasey.	S.O. Geasey, conversation, 1971; Woodward 1966: 4.
10	Ax	S	-	3.5	2	8	NW	S.O. Geasey, conversation, 1971. Points, grooved ax, pottery, and bone refuse. Archaic, Early Woodland, and Late Woodland cultures present. Excavated ca. 1952 by A.E. Selckmann and S.O. Geasey.	S.O. Geasey, conversation, 1971.
11	Chalcedony	O	3	6	2	3.5	W	Points and pottery. Archaic and Late Woodland. Excavated by A.E. Selckmann and S.O. Geasey ca. 1952.	S.O. Geasey, conversation, 1971.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.) (Continued)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter, O = overhang, C = cave.</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
12	Frinyfrock	S	-	-	-	2	SW	Points, pottery, and ceramic pipe fragments. Components include Late Woodland. Excavated ca. 1965 by A.E. Selckmann.	Geasey 1965: 37; S.O. Geasey, conversation, 1971.
13	Tuscarora II	S	1.5	3	2.5	2.5	-	Points and pottery Late Archaic through Late Woodland cultures represented, but mainly the latter. Excavated 1962 by Western Chapter, ASM, under direction of S.O. Geasey	S.O. Geasey, conversation, 1971.
27	Log Cabin	S	9	6	2	1	-	Points and chips of probable Archaic cultures. Excavated by S.O. Geasey.	S.O. Geasey, conversation, 1971.
83	Gladhill	S	-	-	-	-	-	Points, pottery and other artifacts. Archaic through Late Woodland cultures represented. Excavated by J. Hastings.	J. Hastings, conversation, 1970.
GARRETT COUNTY (GA)									
24	Savage	S	3	26	6	-	SE	Points, knives, drills, pottery, bone refuse. Archaic through Late Woodland. Some digging by unknown persons prior to excavation by F.R. Corliss and F. Augustine in 1949, by W.J. Mayer-Oakes and E.R. Corliss in 1951, and by D.W. Dragoo and F.R. Corliss in 1952.	Corliss 1954: 8; I.R. Corliss, field notes, 1951; Carnegie Museum's field records by Mayer-Oakes and Dragoo kindly made available to me by Dragoo.
26	Sand	C	1.5	30	30	-	SE?	Points, flake scrapers, pottery, shell bead, bone awl, bone refuse, charcoal, and refuse pits, one of which had been partly lined with stones and used as a fire-pit. Almost exclusively Late Woodland culture represented. Excavated by R.G. Slattery and others ca. 1942, by M.H. Muma in 1943, by F.R. Corliss and C.E. Home in 1950, by F. R. Corliss in 1957, and by H.T. Wright ca. 1960.	Barloga 1944; Muma 1944a; 1945: 17; Corliss, field notes; H.T. Wright, field notes; R.G. Slattery, correspondence, 1971; also see Franz and Slifer, this report.
34	Lynx	O	-	-	-	-	-	One corner-notched point and chips.	F.R. Corliss, conversation, 1970.
51	Rock Camp	S	-	-	-	-	-	Points, scraper, knife, sherds, bone refuse, and fire-pits. Excavated by H.T. Wright and F.R. Corliss ca. 1955.	H.T. Wright field notes; FR. Corliss notes.
55	White Rock	S	-	15	5	17	SE	Points suggest Late Woodland occupation, although no pottery has been reported. Disturbed by unknown persons prior to tests by F.R. Corliss in 1964 and by Guy Hinebaugh in 1966.	F.R. Corliss, notes; W. Va. Geological Survey, archeological site record by G. Hinebaugh, 1966.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.) (Continued)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter, O = overhang, C = cave,</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
75	Sang Run	S	-	-	-	15	-	Small triangular unnotched points, pottery, and bone refuse. Only Late Woodland culture represented. Small test excavated by P. Cresthull ca. 1965.	P. Cresthull, conversation, 1971.
HOWARD COUNTY (HO)									
6	Woodstock	S	2.5	3.5	6.5	-	NE	Points, chips, and historic artifacts. Tests by G.C. & E.R. Wilcox in 1966 and by R.J. Horpel & D. Petchie.	Wilcox 1969; R.J. Horpel, conversation, 1971.
9	Camels Den	S	2.5	2	4.5	6	-	Artifacts reported to have been found, but test by M.H. Muma in 1943 revealed no cultural material	Davies 1950: 36, 72; Muma 1945: 16; 1946: 31; W.U. Morgan, conversation, 1971.
10	Eleysville I	S	-	3	6	1.5	W?	Chipped stone artifacts, pottery, and bone refuse reported by J.D. McGuire; historic artifacts recovered in a test by W.U. Morgan and W. Clark.	McGuire 1880; W.U. Morgan, conversation, 1971.
11	Eleysville II	S	-	-	-	15	E?	Point, scraper and bone refuse reported by J.D. McGuire.	McGuire 1880; D. Muirhead, conversation, 1971.
MONTGOMERY COUNT (MO)									
12	Hargett-King	S	-	12	7.5	0.5	SW	Points, sherds, post molds, bone refuse, charcoal, early type of glass beads. Archaic through Late Woodland cultures present. Excavated 1961-62 by Southwestern Chapter of ASM.	Tidwell 1964; Tidwell and Woodward 1965.
WASHINGTON COUNTY (WA)									
13	Chickadee	S	-	12	-	4.5	NW	Points, sherds, bannerstone. Archaic through Late Woodland cultures present. Excavated 1969-70 by University of Maryland anthropology students under the direction of J.I. Gross	Wells 1969; J.I. Gross, conversation, 1971.
18	Busheys Cavern	C	3	21	29	-	E	Points, knives, drills, celts, gorget, grooved ax, grinding stones and basins, hammerstones, pottery, ceramic pipes, bone awls, needles and beads, turtle shell bowl, shell beads, charred corn cobs and bone refuse. Excavations by F.H. Cushing and H.J. Biddle in 1877, by J.D. McGuire in 1903, by W.K. Moorehead and C. Peabody in 1905, by the owner and other unknown persons.	Baird 1878: 38; Peabody 1905; 1908; Smithsonian Institution, Museum of Natural History, Department of Anthropology collections.

**Table 1. Rock shelters in Maryland containing archeological deposits.
(Dimensions in meters.) (Continued)**

<i>No.</i>	<i>Name</i>	<i>Type: S = shelter, O = overhang, C = cave,</i>	<i>Height at entrance</i>	<i>Width at entrance</i>	<i>Depth (length) of main opening</i>	<i>Elevation above nearest stream</i>	<i>Direction entrance faces</i>	<i>Summary of archeological data</i>	<i>Sources of information</i>
19	Marker	C	3	3	-	12	-	Points, beads, pipe, sherds, bone refuse, charcoal, and human bones are reported, but none are described in any detail. Investigations in 1881 by J.P. Smith and in 1964 by unknown persons.	Fowke 1894: 63; Scharf 1882: 986; Smith 1884: 798; Franz and Slifer, this report.

- Notes:
1. The numbers of the rock shelters are from the archeological site file maintained by the Maryland Geological Survey; sites in each County are designated by a separate series of numbers preceded by a two-letter abbreviation for the county.
 2. ASM refers to the Archeological Society of Maryland (a section of the Maryland Academy of Sciences).
 3. MGS refers to the Maryland Geological Survey's Division of Archeology.

Table 2. Faunal remains from archeological deposits in Maryland rock shelters.

	<i>AG 14</i>	<i>FR 2</i>	<i>FR 3</i>	<i>FR 6</i>	<i>FR 83</i>	<i>GA 51</i>	<i>WA 18</i>
Squirrel					X		X
Beaver						X	X
Wood Rat							X
Porcupine							X
Fox							X
Bear							X
Raccoon				X			X
Skunk							X
Lynx							X
Deer	X	X	X	X	X		X
Elk							X
Turtle		X	X	X	X		X
Turkey				?			X

Table 3. Orientation of shelter opening and quantity of cultural debris.
(Includes only those sites for which reasonably complete quantitative data are available.)

<i>Site</i>	<i>Direction entrance faces</i>	<i>Depth of midden (cm.)</i>	<i>Approximate quantities of artifacts</i>		
			<i>points</i>	<i>sherds</i>	<i>other</i>
BA 26 Martin	ESE	51	6	50	1
BA 28 Iglehart I	S	107	18	502	-
CE 6 Frantsi	NW	66	52	845	16
FR 1 Myersville	W	30	-	-	-
FR 2 Buckeystown I	NE	30	4	149	6
FR 3 Buckeystown II	NE	10	2	14	0
FR 4 Everhart	S	61	(231 chipped stone artifacts)		
FR 5 Alberts	NW	38	16	-	1
FR 6 Boyers Mill	W	38	143	365	65
FR 9 Tuscarora I	ESE	-	(240 chipped stone artifacts)		
FR 10 Ax	NW	-	12	35	-
GA 24 Savage	SE	46	65	-	6
GA 26 Sand	SE?	30	27	-	6
GA 55 White Rock	SE	15	6	0	1
HO 6 Woodstock	NE	46	4	0	-
HO 10 Eleysville I	W?	46	0	6	3
HO 11 Eleysville II	E?	13	1	0	-
MO 12 Hargett-King	SW	30	118	167	21
WA 18 Busheys Cavern	E	69+	60+	100+	145+

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FIGURE CREDITS

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Figures 12-13, D. Slifer

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Figures 15-18, J. E. Cooper (courtesy of National Speleological Society)

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Figure 45, D. Slifer

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Caving Organizations in the Maryland area:

Baltimore Grotto, Baltimore, Md.

D. C. Grotto, District of Columbia

Nittany Grotto, State College, Pa.

Philadelphia Grotto, Philadelphia, Pa.

Pittsburgh Grotto, Pittsburgh, Pa.

Reading Grotto, Reading, Pa.

Shenandoah Valley Grotto, Staunton, Va.

York Grotto, York, Pa.

Current addresses and phone numbers are available from the National Speleological Society, 2813 Cave Avenue, Huntsville, Alabama 35810, (<http://www.caves.org>) or from Maryland Geological Survey's web site (<http://www.mgs.md.gov/esic/caves.html>)

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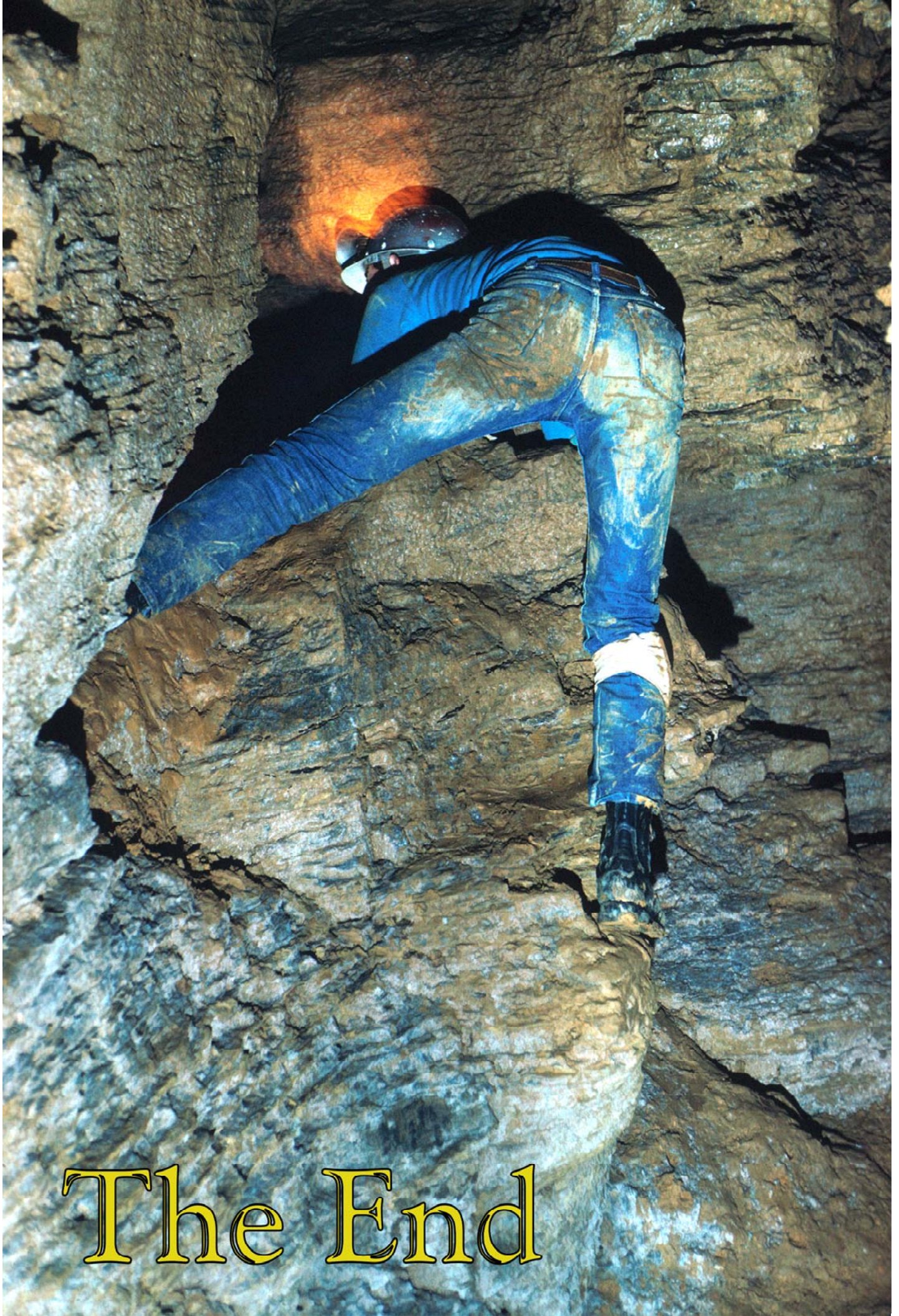
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