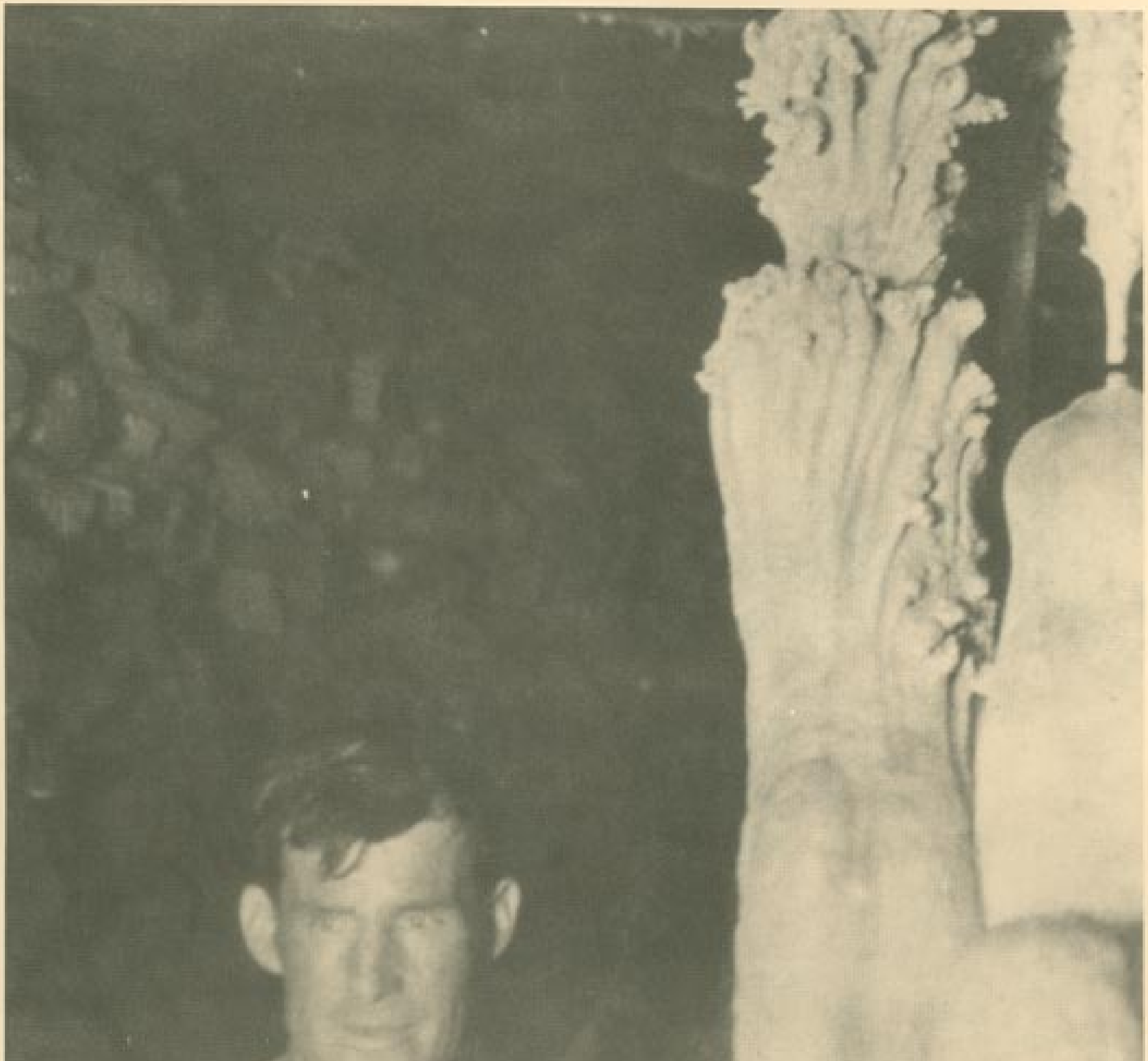
PHOLEOS

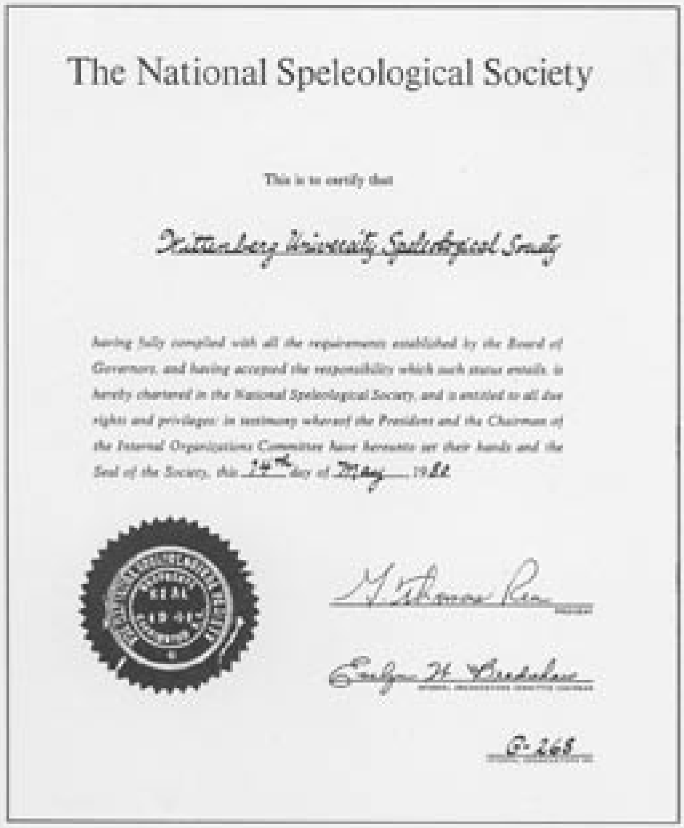
Journal Of The Wittenberg University Speleological Society

Volume 17 (I & II) October, 1998



The Wittenberg University Speleological Society

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



The National Speleological Society

This is to certify that

Wittenberg University Speleological Society

having fully complied with all the requirements established by the Board of Governors, and having accepted the responsibility which such status entails, is hereby chartered in the National Speleological Society, and is entitled to all due rights and privileges: in testimony whereof the President and the Chairman of the Internal Organizations Committee have hereunto set their hands and the Seal of the Society, this 14th day of May 1980

G. Thomas Rea

Evelyn H. Bradshaw

G-268

Cover: This photograph of Floyd Collins was taken August 8, 1923 in Crystal Cave, Kentucky, by John Bath of West Lafayette, Indiana. It was taken as part of a news story about the cave, but is not known to have been published with the article. This photograph, and another showing only cave formations, were given by Mr. Bath to his friend Grace McKee around the time of Floyd Collins death in 1925. Grace held onto the photographs until the fall of 1997 when she gave them as a gift to her nephew. The picture is provided by J. Andrew Roberts of the University of Cincinnati.

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JOURNAL OF THE WITTENBERG UNIVERSITY SPELEOLOGICAL SOCIETY

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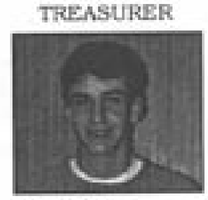

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GROTTO ADDRESS: c/o Horton H. Hobbs III, Department of Biology, P. O. Box 720, Wittenberg University, Springfield, Ohio, USA 45501-0720, Tel. (937) 327-6484, FAX: 937-327-6340
WEB: http://www.wittenberg.edu/witt/stud_orgs/wuss/ **E-mail:** WUSS@Wittenberg.EDU
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Editors' Note

This issue of *Pholeos* covers many different aspects of caving. We have included a research report on Movile Cave, Romania; the effects of histoplasmosis on cavers; and a first hand account of the fascinating sport of cave diving. Altogether, you are in store for a fairly diverse journal. We were also very fortunate to be able to include a rare photo of Floyd Collins; his unbelievable tale is one we all know. My special thanks to J. Andrew Roberts for putting this historic memory onto our pages.

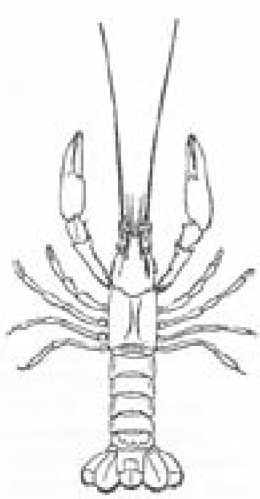
There are also reviews, caving photos, a humorous story of a misplaced caving feline, and poems to lighten the dark. Thank you for your continued interest and support. Cave Softly.

Dave Effron, Editor
NSS# 41545

Hi, I'm Jason and I am the *Pholeos* editor for the '98-'99 school year. Not to distract from this issue, but the '98-'99 year is going to be a special one for *Pholeos*. For the first time since 1995, two issues will be coming your way. We are also continuing to accept articles from outside the Wittenberg community for submission. Check out the last page for more information.

Now I would like to take a moment to thank a few people for their help with this issue. First I would like to thank Andy Roberts, who I got to know quite well at Crawl-a-thon doing the Tar Kiln plunge, and his unnamed aunt for granting us the right to publish the picture of Floyd Collins on our cover. I would also like to thank our past editor, Dave Effron, and his assistant, Marsha Butto, for all the work they put into getting this issue of *Pholeos* ready. Last but not least, I would like to thank Yuriy, Jess, Matt, Dr. Hobbs, and everyone who helped in proofing this issue – it was really a lot of help. Now that I've gotten that out of the way, the time has arrived for you to put on your cave helmet and begin to explore this issue of *Pholeos*. See you next issue!

Jason Moon, Editor
NSS # 45780



Untitled

by Matthew Beversdorf
NSS# 42333

Bats, flitting, screeching
flying in your face.
Watching, listening
guarding their sleeping place.

Resting during the day
feeding away at night.
Please be quiet in the cave
less you wake them into flight.

Especially later in the year
when many approach their long deep sleep.
When they rest with the bear
in their homes of deep.

Trash and Graffiti in Laurel Cave

by Jenny Hughes

Upon entering the upper level,
The phreatic part of Laurel Cave,
Our group saw things considered,
To be somewhat grave.

Wrappers, bottles, broken glass,
There was trash everywhere,
Cigarette butts, can's pull tabs,
Even people's clothes were there.

The writings on the walls,
Should never have appeared,
But they were there without question,
Though some were not too clear.

B, C, and D were "nightmares".
Or at least that's what they said,
While some names, dates, and carvings elsewhere,
Told stories of the dead.

These places were easily accessible,
Spacious, comfy, and dry,
Therefore, used for recreational purposes,
And as trash cans for some who went by.

We then traveled to the lower level,
Where different conditions were met,
It had formed under vadose conditions,
And the cave was moist and wet.

Here we found much smaller amounts,
Of the graffiti and trash,
Because the streams and narrow passages,
Had made it more difficult to pass.

As our hypotheses simply stated,
And our observations plainly show,
The greatest anthropogenic effects in caves,
Will be found where more people go.

Exploration of Underwater Cave Systems

by
Matthew G. Meister

A LOOK AT DIVING INTO THE DEEPEST, DARKEST WATERS IN THE WORLD.

"It's April 5th, 1988 in Tamaulipas, Mexico and even though it's a bright, hot, sunny day Sheck Exley is cold and alone in the dark. Oh yeah, he's also nearly 760 feet deep in Nacimiento del Rio Mante cave system in pursuit of the deepest dive ever accomplished by an independent, untethered, surface-to-surface diver" (Mount and Gilliam 15). "Only days before his 40th birthday and almost exactly a year later on March 28, 1989, Sheck Exley eclipses his own world record in the same cave reaching 881 feet" (17). In April 1994, Sheck Exley attempted a dive to 1000 feet in a cave system near Tampico, Mexico. It was on this dive that the cave diving community would lose one of its foremost explorers. For reasons unknown, Sheck Exley did not return from an attempt to reach the bottom of a cave system know as Zacaton.

What inspires people to push the edge of the envelope? Whether it is flight, space exploration, cave exploration, or underwater cave exploration, humanity has always pushed the limits in hopes of going further than those in previous generations. Without such persistence we may never have been able to fly and land have a man on the moon.

Exploring underwater caves is unique in that scuba technology has only been around for the last 60 years or so. Cave diving, and as a result, cave exploration is something that is still in its infancy. Every year new innovations are created in the world of diving, largely due to an active cave diving community. Let's take an in-depth look at those who venture into the darkness of the phreatic cave in terms of the people who have led and are leading the way in the exploration of new and deeper systems as well as their contributions to safety and conservation.

As early as 1953, scuba was used to explore underwater cave systems. Frank DenBlykker and Charles McNabb dove into Florida's Silver Springs and "on that first dive they stumbled onto the petrified remains of the elephant's ancient ancestor, the Mastodon" (Gilliam and Von Maier 47). Tom Mount began cave diving in 1962. "His introduction was with Zuber Sink (later renamed Forty Fathom Sink) where he would make numerous dives to 240 ft. to bottom out the cave with Frank Martz, another early cave enthusiast" (48).

North Central Florida serves as the cave diving capital of the world. Because of the many cave systems relatively close to each other, Florida still serves as the breeding ground for cave divers today. Early explorers plunged into the depths of systems which have come to be known as the Devil's Ear, Manatee Springs, Madison Blue Springs, Little River, Eagles' Nest, Morrison Spring, and DiePolder, just to name a few.

The Eagles Nest, formerly known as the Lost Sink, required new innovations in order to explore the system further. "The opening to the downstream cave was discovered by Mount and Martz in late 1968. This required the divers to negotiate a very tight restriction in the 280-290 ffw (feet fresh water) level before opening into a large and beautiful tunnel that is the major system of Eagle's Nest." Some of the new innovations that allowed explorers to go several hundred feet further than their predecessors included the use of DPV's (Diver Propulsion Vehicles) and the practice of multiple stage bottles (Gilliam and Von Maier 48).

Die Polder II, a sink hole near Weekie Wachee, Florida, also proved to be a cave heavily explored. "Will Waters, Jamie Stone, Jim Lockwood and Exley would be among the first to lead pushes into the infamous Die Polder II...with Dale Sweet reaching 360 ffw in 1980" (Gilliam and Von Maier 49). It would take 12 years for divers to survey new passage, laying down new line in this magnificent system. Dustin Clesi led Team DiePolder '91 to conduct these surveys.

Today, underwater cave exploration is still very active. William Rennaker and William Dooley have explored Convict Spring using alternative equipment configuration in the form of side mounted tanks. Also, the team continues exploration of cave systems in Brazil and Mexico.

Dr. Bill Stone led an extensive exploration of Wakulla Springs in Northern Florida. "During his milestone Wakulla Springs Project in 1987, Stone and his team explored over 2.3 miles of underwater passage, logging more than 450 dives at depths ranging from 260 to 320 feet (80-98 meters) and in the process helped pioneer the basic tools of modern technical diving" (AquaCorps N7 49). Stone also led an expedition to attempt to bottom "out the Huatla plateau system in Central Mexico - his consuming passion for more than 20 years" (AquaCorps N7 45).

One of the most noted groups of cave diving explorers today is the WKPP or the Woodville Karst Plain Project. Founded in 1987 by the late Parker Turner, WKPP has been conducting exploration dives in the karst region near Tallahassee, Florida. "The project is receiving assistance from the State of Florida as well as several federal organizations including the Department of the Interior, the Environmental Protection Agency (EPA) and the Department of Environmental Protection (DEP)" in order to provide important information on Florida's water supply and natural resources (AquaCorp N11 42).

Director George Irvine and cave explorer Jarrod Jablonski led the WKPP in world record dives. With the use of DPV's developed by engineer/explorer Bill Gavin, and new rebreathers, Irvine and Jablonski have completed unsurpassed penetrations in Wakulla and sister cave systems.

As you can see the founders of cave exploration are numerous and their work has paved the way for cave diving today. In the future, exploration will continue to yield deeper and longer dives, safer techniques, and further innovations in scuba diving. As a result, the sport will become safer and the conservation of these great systems will become more important.

Cave diving has not evolved without problems. Safety is of course first and foremost when mounting any expedition, but like space exploration or flight evolution the hobby has not come without a loss of human life. Just as efforts are being made to make automobiles safer and more environmentally friendly, safety and conservation in cave diving are synonymous.

As a direct result of the efforts of early cave explorers diving, techniques have evolved to become safer to the diver and the systems they explore. Tom Mount, one of the only living explorers of his generation who has outlived the likes of Sheck Exley, Frank Martz, Rob Palmer, Parker Turner and Rob Parker, has contributed significantly to safety and conservation through the development of training agencies.

Training is the key to safe cave diving and cave conservation. "Any one can die on any given cave dive for any given reason" is a statement that suggests just that. Tom Mount was a founding father of the National Association for Safe Cave Diving (NACD) and the founder of the International Association of Nitrox and Technical Diving (IANTD). These organizations are dedicated to safely training divers to enjoy cave systems around the world.

Sheck Exley has also contributed greatly to the safety and conservation issues in cave diving. One thing he did was help form the National Speleological Society - Cave Diving Section (NSS-CDS) as a sub section of the NSS specifically designed to deal with cave diving issues. He has also written many noted publications dealing with safety and conservation issues. *Basic Cave Diving - a blueprint for survival* is one such publication. In this guide, Exley outlines through accident analysis and an opening statement of the NSS's Cave Conservation Policy techniques essential to the success of any cave diver that are still in use today.

By training divers properly two issues are addressed: first is that of safety and second, conservation. Buoyancy control, streamlining equipment, and finning techniques are just a few practices cave divers must be proficient at in order to be successful. Hitting the ceiling or walls of passages with heavy cylinders, dangling equipment, or poorly placed kicks may destroy the natural beauty of a cave and cause diver stress.

Divers with poor buoyancy have left their mark in more than one cave. Hand prints, knee prints, and scrapes and scratches plague the walls of many of Florida's caves. Divers hitting the floor of caves may easily scar delicate clay floors in a low flow system. Fragile speleothems such as those in the Disney Land Room in a Cenote near Akumal, Mexico are easily damaged by poor skills. These marks will last forever. Poor buoyancy and dangling equipment can also add to the stress of the diver.

Poor finning techniques can damage a cave and cause a silt-out resulting in a complete loss of visibility. Underwater caves have different compositions. Mud, clay, sand, and other sediments can be easily disturbed by a divers kick or even exhaust bubbles. As a result, the water may go from crystal clear to completely cloudy, yielding no visibility in a matter of seconds. Also, a diver's fin kicking the walls or ceiling may cause damage to the system as well.

Training agencies have established three basic guidelines for all cave divers:

1) Have a minimum of three lights
2) Leave at least 2/3 air supply for exit
3) Establish a continuous guideline to the surface

Darin Cowhard, on a recent dive in DiePolder, stated "that it is the last place you want to have a primary light failure...it's like having a single 'Strike Anywhere' match in the middle of the Grand Canyon at night." Having a minimum of three lights minimizes the chances of having a complete blackout by having a backup for the backup. Redundancy, not over redundancy, is a key element to safe cave diving.

"Not allowing at least 2/3 of the starting air supply for coming out of the cave has been the second biggest single cause of cave diving fatalities" (Exley 12). By only using a third of the starting air pressure, a third is left for returning to the entrance and a third to contend with emergencies such as an out of air diver. Adequate air volume is the essential element in being able to survive underwater.

"A guideline provides a certain, direct route to the surface. Becoming lost from the lack of a guideline has been a primary cause of a large number of cave diving accidents" is one reason why the training agencies have adopted the continuous guideline policy. In the event of a complete blackout by light failure or a silt out, a diver would still be able to make their way back to the entrance using the guideline.

Clearly, early cave explorers such as Tom Mount and Sheck Exley have contributed greatly to the safety of all cave divers as well as in the conservation of caves. As diving becomes safer, maybe a more educated public will be more willing to allow cave divers explore the unknown. As a result, hopefully no more cave systems, like Fanning Spring which was dynamited closed in the 1950's due to the deaths of two divers, will be blown up in order to close access to cave explorers.

Yet another example of this kind of treatment to caves in the early days was Morrison Spring. "Possibly one of the deepest cave is popular Morrison Spring in the Florida Panhandle....following the deaths of several divers, the local sheriff had enough and ordered the dynamiting of the passage leading to the third room thus sealing the passages forever" (Gilliam and Von Maier 49). With the onset of training and safety advances hopefully no more caves will close, and instead they will be explored and preserved.

In conclusion, underwater cave explorers have paved the way for safe diving and cave conservation. Training agencies developed by the early explorers clearly made diving safer by improving equipment, techniques, and establishing a set of guidelines. As diving becomes safer the general public will be less apprehensive toward cave divers, making access to private lands easier and the closing of caves less likely. Only the continued passion of people who are willing to give the ultimate sacrifice and have perseverance and ingenuity will keep cave diving on the forefront of innovation in the diving community.

In having the opportunity to cave dive myself, I have seen many systems that have been marred by those divers who went before me: rock formations tarnished by lack of proficiency in skills and a blatant disregard for training guidelines. These people undoubtedly give cave divers a bad reputation, but overall the community has progressed immensely in the last few years.

In October 1997, I had the opportunity to dive with one of the most renowned cave divers in the world, Bill "Bird" Oestrich, and receive instruction from another renowned explorer/instructor/videographer William Dooley in a course called Advanced Deep Air. Throughout the course, we made dives in the Little River Cave System, Madison Blue Springs, Fanning Springs, and Ward Sink.

On our first dive into Ward Sink I reached a maximum depth of 170 ffw. The sinkhole was not more than 75 feet in diameter but yielded a maximum depth of 190 ffw through a small overhang. There was an abundant amount of various fossils and barnacles as well as marine life in the shallower depths 20-30 ffw. The dive had a bottom time of 20 minutes with over 40 minutes of decompression.

Without the developments in equipment and diving technology by earlier cave explorers dives like this would not have been possible. Cave diving has given me an appreciation for the natural beauty of caves and the need to preserve these systems to the best of our ability.

Whereas I do not have the ambition to become an explorer of deep caves for a living, I plan on venturing to greater depths and furthering my abilities as not just a cave diver, but as a diving instructor as well.

Unfortunately great divers such as Sheck Exley, Rob Palmer, and Parker Turner perished in their explorations. One may wonder why a person would put so much at stake in order to go further and deeper. How deep is deep enough? Ned Deloach had this to say about Exley:

> I glanced over at Sheck. He was again lost in thought, staring blankly into the night. It had been fascinating listening to him discuss the facts and figures of the dive, but what I really wanted to hear about were the things that go on inside his head when he's buried under hundreds of feet of water, inside a rock crevice, on the very edge of life, and still going on. 'How are you going to decide when you have gone deep enough?' I asked. 'Fear.' Sheck answered immediately as if he had been patiently waiting for such a question. (AquaCorps N8 63)

Today the current depth record is 925 set by Jim Bowden. Bowden and Exley both made the 1000-foot attempt on the same day, on the same dive, in the same cave system. Only Bowden surfaced. When will the explorations of deeper depths and caves stop? Probably when the bottoms of all of the bodies of water and the ends of all of the cave systems have been reached.

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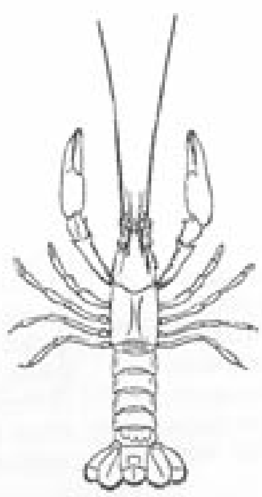
9. William Dooley cave diving instructor, videographer, High Springs, FL.

Preparing for a dive into Ward's Sink in Pasco Co., FL.

On the permanent line inside Madison Blue Springs, FL.

Underwater picture of Matt Meister fully equipped. Notice the redundancy?



Life of Movile Cave

by: Matthew Henry Decker

In 1986 while a scientist was excavating in a cornfield about ten miles from the Bulgarian border near Mangalia, Romania, in search for a site for a new power station, he came upon a peculiar sulfur smell. When he followed the smell it led him to the discovery of Movile Cave (Siggins 1997). He discovered an entombed cave that, for the first time in 5.5 million years, had been exposed to the surface. Inside the cave was a huge array of new species and abundant animal life that was adapted to life in the darkness and was able to provide food without the contribution from sunlight energy. Since the cave's inhabitants lived in the dark and closed environment for so long, they evolved to survive with what the cave provided. With the help of the ecosystem's warm temperature and hydrogen sulfide based atmosphere the cave has the diversity of interdependent species. The unsuspecting scientist had discovered the world's only encountered terrestrial environmental ecosystem, that is not dependant of photosynthetic energy from the sun, but rather from chemical synthesis (Dark cave life 1997, Anonymous 1997).

Hydrogen sulfide is what has allowed Movile to form and remain alive. The formation of the cave started millions of years ago when hydrogen sulfide, bubbling up from the earth, reacted with oxygen and formed sulfuric acid. The sulfuric acid then slowly dissolved the calcium carbonate of the bedrock, enlarging the cavern (Zimmerman 1994). Movile is one of many bottom-to-top formed caves in the world. Another cave that has been formed from this method of sulfuric acid corrosion is Carlsbad Caverns in New Mexico (Browne 1995).

Movile Cave's unique environment has made it possible to be teeming with the life that it has. The water in the cave is about 25,000 years old. This geological water is the key to the diversity of life in the cave. The contents that make this water different from more common spelean waters are hydrogen sulfide, methane, and ammonium ions (Anonymous 1997). The water is also much warmer than "normal" limestone caves with a temperature of about 20° C (Onac 1997). These factors help provide the support needed to sustain the life in the cave. The special water that makes up the vital components to Movile's life is preserved by the clay on the walls and ceiling which block outside water from entering.

Romanian cave divers were the first to explore Movile. Some things that they noticed in their exploration were that the cave's atmosphere is low in oxygen and is suffused with hydrogen sulfide and carbon dioxide. This mixture, similar to deep-sea communities near mineral-rich thermal vents, is usually poisonous and unsuitable for living things, but Movile is different because holds life. As the divers swam through the thermal water they would come up in "air-bells" or air pockets throughout the cave. All three air-bells in Movile are each uniquely different. Because the atmospheres are different, one creature may be abundant in one air pocket but not able to survive in the next (Anonymous 1997).

For most organisms in ecosystems, the sun is the primary source of energy that supports life. The process begins when plants capture the sun's energy and through photosynthesis change carbon dioxide and water into organic molecules. The course for food energy continues when animals and other organisms eat the photosynthetic plants. Even in caves, other than Movile, where light is absent, the troglobites of the deep cave are dependent on food energy washed in from the outside, which was developed from photosynthetic energy. This is why Movile is so significantly important: it supports life even though there is no dependence from outside light.

If food is not produced from the sun, then how do the animals obtain their energy?

The life in Movile cave is entirely supported by chemoautotrophic organisms, rather than being dependent on photoautotrophic organisms. Some of the chemoautotrophic organisms in Movile that provide the energy for all the other animals are strains of bacteria called *Thiobacillus*, *Thiothryx*, and *Beggiatoa* (Porter 1997, Vlasceanu 1997). These bacteria are on the bottom of the food pyramid and all the higher organisms diet on these bacteria or on each other. These chemoautotrophs synthesize organic molecules from carbon dioxide in the air and energy from the reaction from a chemical process with hydrogen sulfide (Cave dwellers' 1996, Browne 1995).

The process of food-energy formation begins when hydrogen sulfide (H_2S) oxidizes to form elemental sulfur (S). From this oxidation, 83 kcal of energy are released. This energy, using CO_2 as an inorganic carbon source, then produces the organic molecules, which are vital for life. The process of oxidization continues through several reactions to form sulfate (SO_4^{2-}), each time producing more energy which is used to produce more organic compounds (see equation 1) (Chapelle 1993).

hydrogen sulfide (H_2S) — (oxidation) → energy + sulfur (S) — (oxidation) → energy + sulfite (SO_3-) — (oxidation) → energy + sulfate (SO_4^{2-})

Equation 1: Oxidation of hydrogen sulfide to sulfate

Besides producing organic molecules, the bacteria are also responsible for producing sulfuric acid. This acid helps breakdown the calcium carbonate of the cave, increasing its size. Equation 2 represents the reactants and the products of the chemical processes in Movile Cave. Again the special water mixture is substantially important because its pH value allows for the chemical reactions to occur (Summers 1995).

$$H_2S + O_2 + CO_2 + H_2O \rightarrow \underline{\text{aerobic bacteria}} \rightarrow 2[CH_2O] + 2H^+ + SO_4^{2-}$$

Equation 2: Chemical process that occurs in Movile Cave

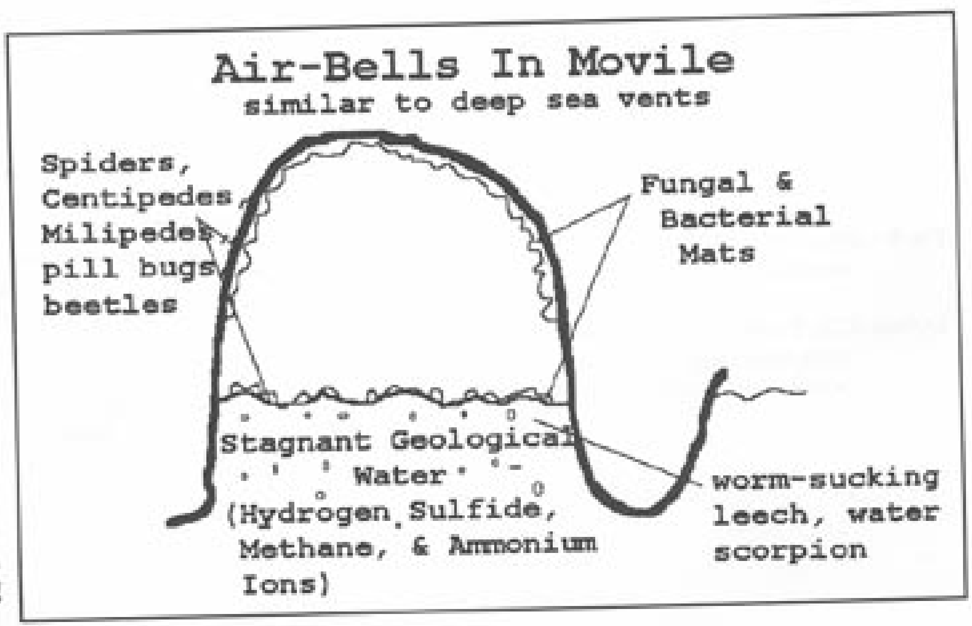
These autotrophic bacterial species, along with an unidentified fungus, grow in large "mats" floating in pools of water or on the cavern walls in the cave (Dark cave life 1997). It is described that the mats of bacteria and fungus "gently ride the surface of the lake, kept afloat by methane-gas bubbles, or clinging to the rock walls in the air-bells" (Zimmerman 1994).

The species of Movile Cave are divided into two different groups: those that live above the water on the walls and floors and those that are aquatic and live in the water. The animals that are in the aquatic community live about two inches from the surface. The terrestrial land animals not only live on the walls, but they also graze on the floating mats of bacteria and fungi. In both groups, terrestrial and aquatic, there are bacterial-feeding creatures and also carnivorous organisms that prey on each other or on other bacteria-eating organisms (Zimmerman 1994).

So far, there has been 48 species discovered that live in Movile Cave, and 33 of them were unknown prior to the accidental finding of the cave. All the species in the cave are invertebrates (Browne 1995). Among the new creatures that were discovered are three species of spiders, a two-inch centipede, four species of terrestrial isopods or pill bugs, *Haemophis caeca* - a worm-sucking leech, and an insect called a water scorpion. Some of the other previously known species that are found in the cave include six types of springtails, a millipede, a bristletale, two pseudoscorpions, several spiders, four beetles, four species of woodlice, and an acarine (Browne 1995, Skindrud 1996, Cryptozoology zone). All of the needs that these animals require for life are provided in the cave except oxygen, which seeps in through the cracks in cave walls.

It was the discovery of one species of spider that helped postulate the theory of how the creatures became entombed in the cave and when it happened. This particular spider that was found in Movile's passages is thought to be a relative to a spider who inhabits the Canary Islands, located in a tropical climatic zone, off the coast of northwest Africa. From this information, the following belief was created:

> According to scientists, about 5.5 million years ago there was a significant climate change in the world. This time period was at the end of the Miocene Epoch. The climate altered from tropical to temperate and the atmosphere became cold and dry. Thermophile and thiophiles were forced to crawl into warm underground caves similar to Movile in order to survive the climatic change of the time (Browne 1995). The creatures that inhabited Movile probably entered the cave from the bottom through the Sarmtian Sea that, along with the Mediterranean Sea, was dried up during



this time (Onac 1997). When the animals became trapped in the cave, they were forced to evolve in order to survive.

Troglomorphy is the unique structure exhibited by organisms as they become better adapted to the dark cave environments. It is believed that the evolutionary change that occurred in Movile happened rather rapidly compared to most evolutionary patterns, and changed within a few ten or hundreds of thousands of years (Browne 1995). All of the creatures of Movile have adapted by losing their pigmentation and their sight. Some have also morphed by enlarging their appendages and antennae with chemical and electrical sensors, which help them feel their way in the dark. These and other adaptations, with the support from the sulfurous bacteria, have allowed the creatures to survive for the time they have been encased in the underground dwelling.

Even though the cave was discovered in 1986, it could not be investigated and researched until 1989 because the Romanian dictator Nicolae Ceausescu kept tight control on all scientific investigations. When Ceausesu was overthrown in 1989 research rapidly began (Dybas). The National Science Foundation and the National Geographic Foundation provided funds to research the cave. Teams of biologist from the University of Cincinnati and from the Institute of Speleology in Bucharest researched the cave and found the many discoveries (Dark cave life 1997).

Movile Cave was a very important find for the scientific world. The accessibility for research, compared to similar deep-sea vent communities, allows us to understand more about how environments can survive without sunlight. Evidence from Movile might even provide us with the answer to whether there is life on Mars. Because the cave is so unique and fragile, scientist are trying to preserve the cave from any human-caused damage. They have kept their research on a low impact level in several different ways. Airlocks were put on the entrances to keep temperature constant. Clean coveralls are required to be worn in the cave, and the number of visitors and the time they are allowed in the cave are also kept to a minimum. One idea has even been suggested to preserve the ecosystem from further damage by pumping the unique water from the cave and create a similar cave situation in a laboratory for observation. Whatever is done, it is important that Movile remains the living cave it is.

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The Yucatan's Flooded Basement

Author: Michael Agar

Photography: C. C. Lockwood

Smithsonian, April 1998 Vol. 29(1) pp. 94-106

Review by
Sarah Maurer

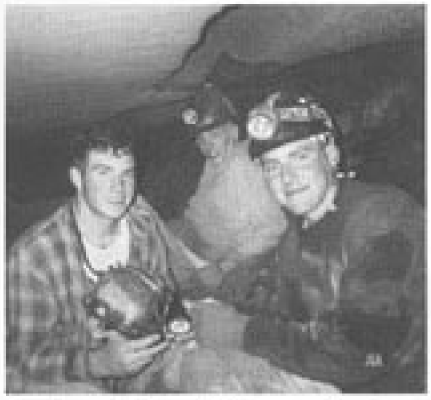
Anyone who marvels at the persistent and growing popularity of cave diving, an ultra hazardous sport that routinely claims the lives of its pioneers as well as its novices, will be somewhat satisfied by Michael Agar's story. An experienced ocean diver, Agar arrived on Mexico's Yucatan peninsula, a current cave dive hot spot, to undertake his first dives under the direction of accomplished explorers Gary and Kay Walten.

His dedication to providing a "big picture" portrayal of this fascinating region makes his expansive piece for Smithsonian much more than a personal account. Agar briefly discusses the various cave systems, personalities, and politics of the region. He gives deserved attention to the local Maya, who have a strong spiritual connection with the caves that has been largely ignored by gringo tourists and professionals.

Most significantly, Agar and Lockwood succeed brilliantly in offering us some justification for partaking in an activity with such a sobering mortality rate. Lockwood's photography captures not only the elegant subterranean beauty of the Yucatan, but also the enviable mobility of the cave diver free to explore these landscapes unhindered by gravity. Agar's narrative manages to be both gritty and lyrical; he draws in the skeptical reader by imparting early the dangers of the dive, then delights him with vivid descriptions of "roller coaster passage" and "weeping pillars." The power of these descriptions alone makes this an excellent read; few authors have so skillfully captured the sport's experience of motion as Agar has here.

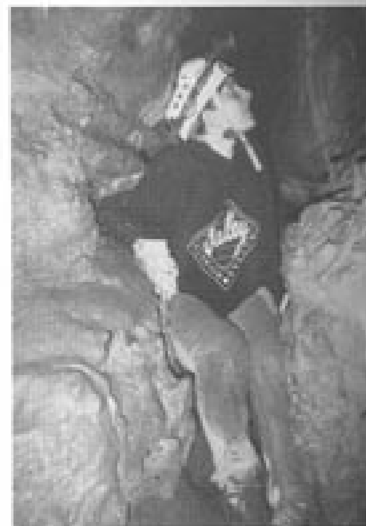
Cave diving enthusiasts and those seeking technical information may be disappointed, since the article avoids delving into great detail in any single area. In the tradition of the Smithsonian, this is an expansive piece written for an audience that might otherwise never have known a sport such as cave diving existed. Unburdened by jargon, however, Agar's work maintains a light and readable presentation of an experience well worth reliving.

WUSS Photo Gallery



Damion explains a lighting problem to Dave. Photo by Michael Ann Doran.

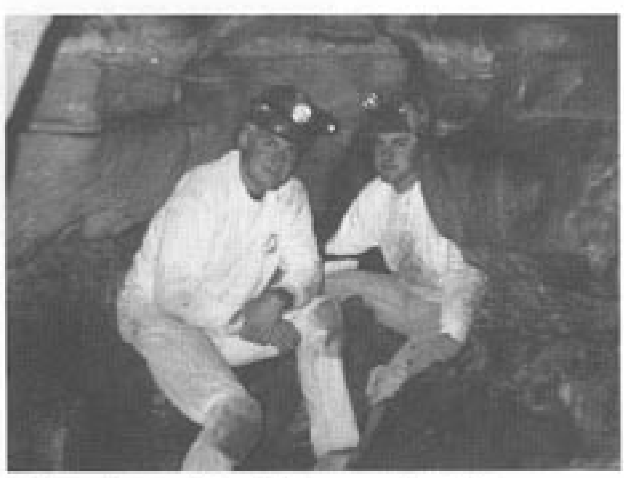
The cave at Greer Spring. Photo by Rob Payn.



Senior Mikie Doran stops to see cave life in Freeland's Cave, Adams Co., Ohio. Photo by Dave Effron.

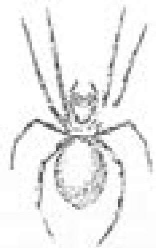
Big Spring: 1998 Missouri Convention. Photo by Rob Payn.

Rob Payn studies the resurgence at Greer Spring during the 1997 NSS Missouri Convention. Photo by Horton Hobbs III.



Brothers Matt and Dave Effron pause for a GQ pose while caving.

What a bunch of WUSSes. Photo by Dave Effron.



Is this really necessary! Mikie Doran and Dave Effron get ready to go caving.

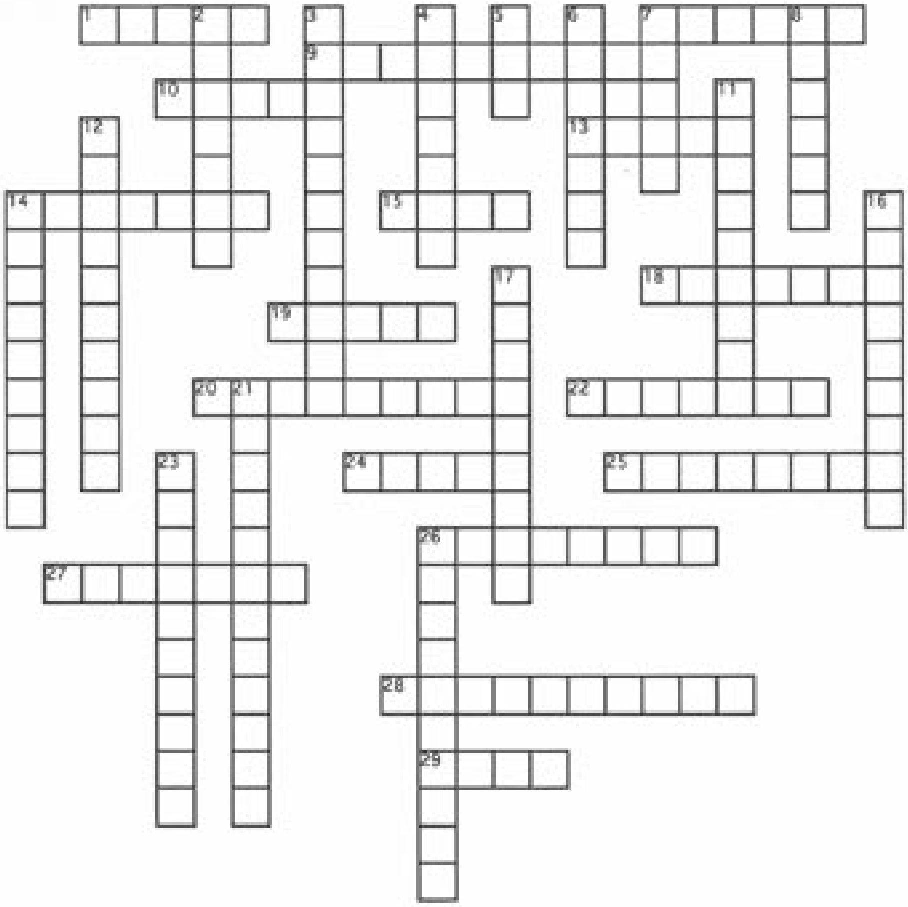
Toby Dogwiler admires the fantastic speleothems. Photo by Rob Payn.

No turning back now. Except for one last smile.

Toby Dogwiler at Elkhorn Mountain Cave. Photo by Rob Payn.

What bravery. WUSS cavers await the chance to see the upper level of Laurel Cave, Carter Co., KY. Photo by David Effron.

CROSSWORD PUZZLE



ACROSS

1. A vertical section of cave, usually requiring the use of a rope.
7. A rock wedge or arch spanning a passage.
9. Water entering and depositing speleothems.
10. A person who visits and explores caves for sport or scientific research, a speleologist.
13. A low passage through which progress can only be made on hands and knees, or on belly.
14. A narrow, vertical or steeply inclined fissure.
15. A natural underground cavity, formed by the action of water, lava, wind, waves, ice, etc...
18. A vertical shaft, either open to the sky or inside a cave.
19. A line of fracture in a rock, caused by movement of the earth's crust.
20. Rock formations built up by continuously dripping or seeping groundwater.
22. A narrow cave opening.
24. A limestone region where the rapid drainage of rainwater underground creates many caves.
25. A horizontal climb along a ledge or between the walls above the floor of a passage.
26. A place where water sinks or has once sunk underground.
27. A hollow mark on a rock wall or floor caused by the force of water.
28. The upper surface of the waterlogged or phreatic zone of the earth's crust.
29. An almost circular cave passage.

DOWN

2. A large hall-like cavern, opening out from a passage or shaft.
3. A lamp sometimes used by cavers, with a flame produced by burning acetylene gas.
4. A temporary camp in a long- distance cave exploration.
5. A layer or stratum in a belt of sedimentary rock.
6. A calcite formation resembling a frozen waterfall.
7. A point at which a rope, ladder, or climber can be anchored to a rock.
8. A small chamber or cave, often illuminated in a show cave.
11. A continuous sheet of calcite covering a cave wall or floor.
12. A surveying instrument for measuring angles of dip or slope.
14. The wearing away of rock by the abrasive action of particles in fast-flowing water.
16. American term for caver.
17. Sedimentary rock containing calcium carbonate, ideal for the formation of caves.
21. A small basin with a calcareous edge formed by thin films of flowing water.
23. A formation, usually of calcite, growing from a cave floor.
26. A formation, usually of calcite, hanging from a cave roof.

Histoplasmosis: A caver's disease

by David Effron
NSS# 41545

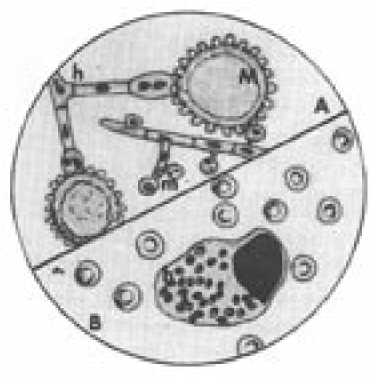
ABSTRACT

Histoplasmosis is a fungal disease caused by the organism *Histoplasma capsulatum* which resides in bat guano and bird droppings. *H. capsulatum* grows in flat sheets in warm humid environments such as those found in temperate and tropical caves. It affects approximately 40 million Americans and is on the rise since immunocompetant patients can no longer fight off this disease. Anyone can be exposed to histoplasmosis and there is no known immunity to the disease. Severe complications can arise from a single exposure of spores if the bodies defenses fail and allow the disease to disseminate, spreading throughout the body. Young and old, male and female, healthy and sick are affected each year. Prolonged inhalation and the concentration of spores in the air can determine the severity of exposure. *H. capsulatum* is a devistating disease that can grow in nutriet poor environments such as caves, attics, and storm cellars.

INTRODUCTION

In 1906, histoplasmosis was recognized by scientists, but was not known as a potential threat to the caving community. By 1947, the myth of a "caver's disease" hit American cavers with considerable alarm and fear. Most believed caves were healthy places free of pollutants and allergens. Dust pneumonia bothered some cavers for a few days, but it had rarely lasted more than a week and had never killed anyone. In 1952, five cave-related deaths were reported among guano miners in Mexico (Halliday 1966). This was certainly cause for alarm.

The first scientist to piece together the clues was not a caver. Dr. Michael Furcolow worked for the United States Public Health Service as a epidemiologist and had seen 13 outbreaks with similar conditions not related to caves (Halliday 1966). He began looking for a correlation between these conditions and those identified with cave sickness. Dr. Furcolow gathered reports from the 13 outbreaks and oddly enough all the cases were small groups exposed to dusts containing bat, bird, or other animal droppings (Halliday 1966). He also found that all the cases were in the Midwest. Eventually, the link was made between these cases and a small fungal spore named *Histoplasma capsulatum*. The first diagnosed case in the U.S. was reported in 1932 in Tennessee, according to The Centers for Disease Control (CDC 1996).



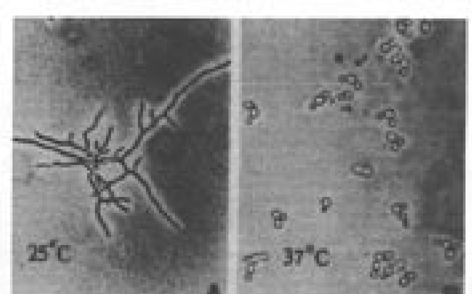
NSS Bulletin, December 1994

Figure 1.
A. Sketch of the mycelial form of *Histoplasma capsulatum* showing hypha (h), macroconidia spores (M), and microconidia spores (m). Magnified 1575X.

B. Sketch of the yeast form of *capsulatum* (h) inside a phagocytic white blood cell in a blood smear. Magnified 1000X.

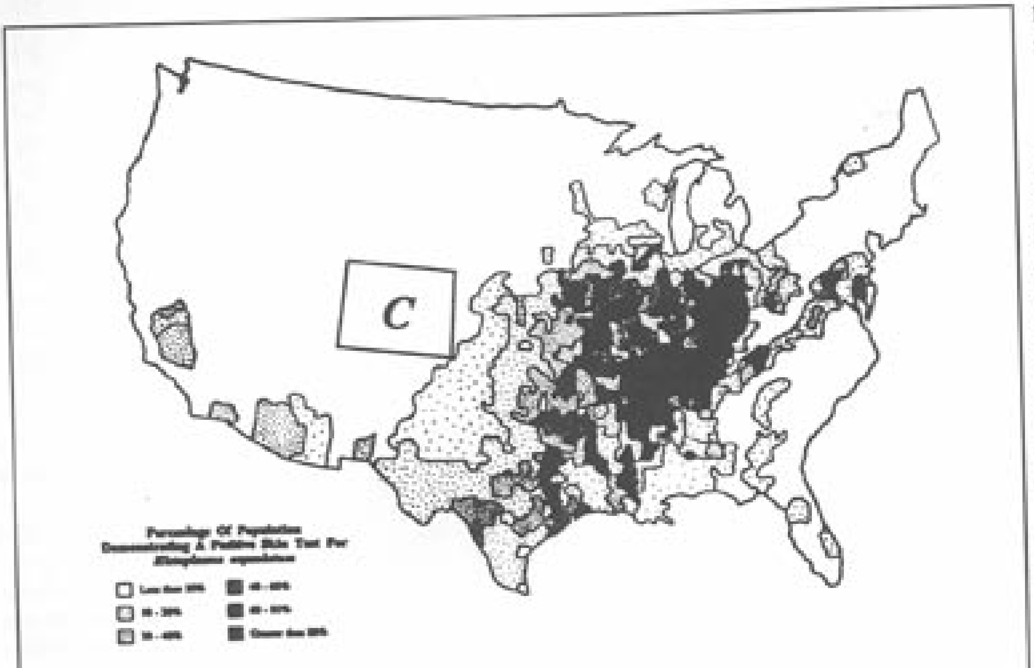
What is *Histoplasma capsulatum*?

H. capsulatum is a dimorphic fungus that grows as a mold and as a yeast (Fig. 1 and 2). When the ground is disturbed *H. capsulatum* spores are released from their nutrient rich substrate with fingerlike projections, called tuberculated chlamidospores, surrounding the organism (Wisener 1976). These spores are very light and even the slightest disturbance can release them into the air. The chlamidospores also are very small, 1-5 thousandths of a millimeter in diameter, and are easily inhaled unnoticed by the host and may lead to histoplasmosis. *H. capsulatum* can be found in all subtropical and tropical regions and to a lesser degree in temperate zones in the U.S. (Lewis 1989). The distribution of *H. capsulatum* in the U.S. is shown in Figure 3.



Rocky Mountain Caving, Autumn 1995

Figure 2.
The dimorphic forms of *Histoplasma capsuatum*.; a) as a mycelium at around 76 degrees F, b) as a yeast at around 98 degrees. F.



Rocky Mountain Caving, Autumn 1995

Figure 3. The distribution of *Histoplasma capsulatum* throughout the US as determined by serological testing of Army recruits.

What is Histoplasmosis?

H. capsulatum is the etiologic agent of histoplasmosis and is spread by inhalation of the spores. Histoplasmosis has been identified in 25 species of bats, mice, dogs, cats, skunks, and foxes as well as humans (CDC 1996). However, the disease is only spread as a mycelial form where soil enriched with guano or other animal fecal matter is present. It requires relatively warm humid environments in which to thrive. The infectious disease cannot spread though direct contact and therefore cannot be labeled as an epidemic.

However, histoplasmosis is a highly infectious pulmonary and disseminating disease. Most cases of humans contracting histo have been due to exposure to the fungus from a cave, chicken house, or a storm cellar (Wisener 1976). Histo is endemic in Europe, Africa, Asia, and in the United States, the Mississippi- Ohio Valley region reported that 60- 90 percent of adults had been infected with *H. capsulatum* (Lavoie 1984).

CONCLUSIONS

Anyone can get histo, but only about one tenth of one percent of all the individuals will develop any symptoms (Lavoie 1984). Approximately 1 in 5000 will develop serious conditions and of those most are immunosuppressed patients (Barton 1995). A half a million new cases have been estimated to occur in the U.S. annually, however 90 to 95 percent are asymptomatic (Infectious Diseases 1996). In the United States alone approximately 40 million people have at one time in their lives been infected with *H. capsulatum.* Most cavers would probably test positive to a histoplasmin test, meaning they have fought the disease and now their body carries the antibodies to fight further contractions.

Severe conditions

There is no vaccine against histoplasmosis, although the body does a good job fighting off the disease and keeping the spread of developing yeast cells under control. There are a few rare occasions where the body cannot fight the disease and serious complications arise. Some of the more affected population include immunosuppressed patients (eg. AIDS), oncology patients, dialysis patients, and small infants. Infants are especially at risk because primary histoplasmosis can lead to disseminating histoplasmosis which affects the child's entire body greatly (Disseminating Histoplasmosis 1996). Infants' immune systems are not capable of handling large doses of the infection and complications are often fatal if left untreated. Some symptoms of histo are described as mild cases of the flu: fever, chills, headache, loss of appetite, unproductive cough, and chest pain (Barton 1995). Symptoms usually occur within 5 to 18 days after exposure (usually around 10) and the severity depends on the concentration of spores and the length of exposure (New York Dept. of Health 1996, Lewis 1989).

There are four clinical forms of histoplasmosis classified according to the spread of the disease: acute pulmonary, chronic pulmonary, acute disseminated, and chronic disseminated. The best way to prevent a histo reaction is simply sero-converted, meaning your immune system recognizes the disease from a previous exposure and has already made the antibodies to fight the next encounter. If you are new to caving and do not live in endemic areas watch where you cave! Some caves have unusually high concentrations of this bug typically in more tropical caves. Even after contracting histo, your body is not immune to infection. Your body will probably resist larger and larger doses and eventually build a tolerance to a histo infection in the future. The reason cavers are prone to histo infections is due to a prolonged exposure to the fungal spores. Caves are ideal media for the fungus to grow. Caves are constantly warm environments, usually around 100 percent humidity, and for the most part undisturbed grounds for the molds to grow. There are also plenty of guano rich caves in the world.

Facts about histoplasmosis:

- 80 percent of the population with histo, even in endemic regions, are asymptomatic.
- 90 percent of all cases originate from avian feces not bat.
- Indianapolis, Indiana had the largest outbreak of over 120,000 cases.
- There are a half million new cases occuring each year and 90- 95 percent are asymptomatic.

DISCUSSION

Diagnosis of histoplasmosis is extremely rare. The symptoms are similar to the flu and cases are extremely rare. For proper diagnosis a CT and Chest X-rays (CXR) are necessary. A CXR alone can be misleading and even the trained eye of a medical doctor can mistake trademark signs of histoplasmosis. There is some hope for early detection. With new technology and better equipment histoplasmosis is no longer an unidentifable disease.

A skin test for histoplasmin antigens in the body is not effective since 40 million Americans would test positive and show no clinical symptoms. Also the histoplasmin test takes several days to culture and determine histo from other fungus diseases, such as *Blastomycosis, Aspergillosis, Mucormycosis, and Coccidioidomycosis*.

Wheat (1986) reports a new technique in the diagnosis of *Histoplasma capsulatum* infections by serological testing for the antibodies using a radioimmunoassay. The radioimmunoassay tests the urine and serum for *H. capsulatum* antigens. He notes that 38 of 41 patients (93 percent) were accurately detected for disseminating histoplasmosis. Zero false positive tests were obtained. Wheat concluded that the radioimmunoassay represents a useful new method for the rapid diagnosis of disseminating histoplasmosis, the most lethal condition of this disease.

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The Evolution of Troglobitic Cave Salamanders

by: Jason Moon
NSS# 45780

Salamanders are well known to many people. That is not really surprising, considering that there are over 300 species of salamanders in the world (Brandon 1971). One place that many people do not think of them as being is in caves. After bats, salamanders are the most abundant species of vertebrates in caves. Unlike bats, however, some species of salamanders have evolved so that they spend their whole lives in caves and are referred to as troglobites (Moore 1997). This paper focuses on these troglobitic salamanders and how they evolved .

There are nine species of troglobitic salamanders in the world (Moore 1997), eight of which are found in the United States (Brandon 1971). Most of these troglobitic salamanders are neotenic, never morphologically progressing beyond the larval stage. Characterized by reduced pigment and eyes, these troglobitic salamanders eat flatworms, small crustaceans, and insects, that they find in the aquatic environment in which they live (Moore 1997).

Troglobites are cave organisms that are highly adapted to cave life and cannot live outside the cave. All troglobites share some common features with each other and those that are discussed in this paper are listed below:

- Loss of pigmentation
- Reduction of eyes
- Increase in function of other senses
- Change in feeding structures
- Elongation of limbs
- Reduced size
- Changes in reproductive biology and life cycle (Kane 1985, Gillieson 1996)

One adaptation of troglobites is a loss of pigmentation. While salamanders are no exception to that, some troglobitic salamanders have more pigmentation than others. This seems to be dependent on how adapted the salamander is to cave life. The loss of pigmentation in troglobites is most likely due to natural selection, since salamanders with lower energy requirements are going to be the most likely to survive in caves (Brandon 1971).

Another characteristic of troglobitic salamanders is their diminished eyesight. This is usually due to both a decrease in the size of an eye and its histological simplification. The eye structure in troglobitic salamanders seems to be largely the effect of neotenic trends, in which the adult salamanders retains characteristics of the larval stage. The most likely explanation for this is so that it has lower energy requirements. Eyes take up a surprisingly large amount of energy and by not expending the energy to both make them correctly and maintain them (for eyesight), troglobitic salamanders save a lot of energy. Natural selection plays a role in this, allowing the salamanders with less energy requirements (due to the loss of eyesight) to have a better chance of both living in and reproducing in the deep cave environment (Brandon 1971).

In order to make up for the loss of sight, the other senses of troglobites usually become more pronounced. Troglobitic salamanders are no exception. It retains neuromasts from their larval stage, which are sense organs that are sensitive to water movement. These help the salamanders to find food in the total darkness of a cave (Brandon 1971).

Troglobites also usually have adaptations to help them feed more effectively. Along with the neuromasts, troglobitic salamanders also have an increased number of teeth and a broader, flattened head with an elongated snout. The increase in the number of teeth seems to come as a result of greater adaptation to cave life. This is an important adaptation to troglobitic salamanders, which must deal with a lack of food on a continuous basis. By having more teeth, they are more efficient in catching and holding prey. This adaptation seems to have been due to natural selection, since the salamanders that can catch and keep their prey are the most likely to survive. The other way salamanders are more efficient feeders is through the structure of the head. Their head structure resembles that of mud puppies, which live on the bottom of still or slowly moving water. For this reason, it is thought to be a common adaptation among salamanders in that type of living conditions. The head structure in troglobitic salamanders results in more efficient feeding movement and more efficient functioning of the neuromasts in feeding. The snout, which is typically elongated and flattened, is also an adaptation to help in navigating without eyes (Brandon 1971).

Another adaptation of troglobites is longer limbs. The most likely reason for salamanders having them is so they might raise their heads above the substrate to locate food more efficiently. This, along with the slower movement that longer limbs provide, helps the salamander to locate food through the use of their neuromasts (Brandon 1971).

Troglobites are usually smaller than other members of their genus. Salamanders are no exception. Their smaller size can be best seen in the number of trunk vertebrae that they have. There is some disagreement about whether or not this is an adaptation. Nowadays it is generally thought to be more the result of primitive stock of salamanders than an adaptation. Regardless of the reasons for the reduction in the number of trunk vertebrae, it seems likely that natural selection played a role in troglobitic salamanders never having evolved past their primitive traits (Brandon 1971).

Troglobites also adapt by changing in their reproductive biology and life cycle. In salamanders, this is usually due to neoteny. Neoteny is a common evolutionary strategy among salamanders in harsh environments, when salamanders retain larval characteristics in their adult form. This results in a number of neotenic traits in troglobitic salamanders, some of which have been mentioned before in this paper. One that has not been though is the retention of gills in salamanders (Sweet 1976). Neoteny results from a lack of food, especially during the early growth of the salamander (Brandon 1971).

Now that we know what kind of adaptations salamanders have, it makes sense to talk about how they might have evolved. Most the literature describes troglobitic salamanders as having pre-adapted to cave life before they enter the cave. Usually then after entering the cave, it goes through more adaptations. Samuel Sweet described something along those lines in his theory on how troglobitic salamanders developed in the Edward's Plateau in Texas. Sweet believes that salamanders evolved into troglobites for two reasons, the restriction of ancestral populations to springs and the erosion of the upper part of the plateau region (1976).

Salamanders are found in springs in Texas. There the populations usually adapt to spring life by taking on neotenic traits. Later when the springs begin to fail due to the erosion of the upper plateau area, the salamanders are left in a difficult position: they can either look for a new source of water or follow the spring down into a cave. Some salamanders are able to make it into the springs but many more perish trying. Due to the gradual nature of spring failure, salamander populations have the critical evolutionary time necessary to adapt to the changing conditions and eventually to the cave itself. After they make it into a cave, they usually become troglobites (Sweet 253).

Salamanders are very much a part of cave life. One way in which they become permanent residents of the cave is by taking on troglobitic traits that help them to survive in the food-poor environment of a cave. The ones discussed in this paper are a loss of pigmentation, a reduction in the eyes, an increase in the function of the other senses, changes in the feeding structures, elongation of the limbs, reduced size, and some changes in the reproductive biology and life cycle. How these traits come about are due to a number of reasons, of which neoteny is the most frequent. Troglobitic salamanders also seem to have been adapted somewhat for cave life before they even enter it. An example is the neotenic spring salamanders of Edward's Plateau. Troglobitic salamanders are one of the most interesting species found in caves. Maybe you will see one the next time you are in a cave.

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A Collection of Web Sites for Cavers

by Jason Moon
NSS# 45780

A Karst Primer
http://www.umsl.edu/~joellaws/ozark_caving/springs/sprkarst.htm
Learn more about the region where caves are found.

The Formation of Caves
http://www.kdu.com/caveform.html

Biospeleology
http://www.utexas.edu/depts/tnhc/.www/biospeleology
The guide to cave organisms – complete with pictures and descriptions.

Bat Conservation International
http://www.batcon.org

The Virtual Cave
http://www.goodearth.com/virtcave.html
Explore a virtual cave!

Lechuguilla Photo Map
http://www.europa.com/~gp/lech.html
More neat pictures of caves.

Caves and Caving in the UK
http://www.sat.dundee.ac.uk/~arb/speleo.html
The perfect example of what a grottoes page should look like. Information for beginning and advanced cavers alike. For example, you can find a description of what to bring on your first trip or information on vertical. A definite must see.

Cave Survey Program Archive
http://www2.wku.edu/www/geoweb/karst/survey_programs/#win

Speleo Scribbles
http://150.203.35.27:8080/cave/cavenews.html
Message board for cavers.

National Speleological Society
http://www.caves.org
Come here to find out more about the NSS or any of its' grottoes.

Caving WWW Sites
http://rschp2.anu.edu.au:8080/cave/cavelink.html
A good starting point for finding other caving sites.

GORP's Caving Resources
http://www.gorp.com/gorp/activity/caving.htm
Yet another good starting point.

For an updated list of caving web sites, check out the Pholeos website (*http://www.wittenberg.edu/witt/stud_orgs/wuss/pholeos/*). From there you can connect to any of the sites on this page.

Hail to Sullivan Cave!!!

Members decided to purchase Sullivan Cave, Indiana's third longest cave, during the December Indiana Karst Conservancy Board of Directors meeting. The property includes a 27-acre wooded tract with the Sullivan Cave entrance and will require 70,000 dollars (this sum includes funding for cave improvement payments). If anyone would like to make a tax-deductible donation, please send it to:

Indiana Karst Conservancy
PO Box 2401
Indianapolis, IN 46206-2401.

If you have internet access, visit the IKC's website at http://www.caves.org/~joshua/ikc/ to view additional information, the full management policy, and the IKC's fundraising activities. Or contact Bill Tozer, Chairman of the Sullivan Cave Committee at 9698 S. 150 W., Pendleton, IN 46064; e-mail: wtozer@aol.com; who can be reached with questions or suggestions.

Less Than a Roar

by David Effron
NSS# 41545

It is said that curiosity killed the cat. This is a story of a brave caver who's curiosity led to shear terror:

The hills of Rockcastle County, Kentucky have some of the most beautiful landscapes in this part of the world. Large cliff faces, vast uninhabited forests, and caves of multiple levels and difficulties. Last fall, I set out with three other explorers to examine this terrific area. Of course, we had no directions, no agenda, and no time limit. The perfect way to cave, right? We started ridge walking around a small creek bed that had a large limestone face with many little cracks. The adventure was in finding something that few other cavers had seen before. No matter how big or small, every crack at every level was checked. We tried pushing each one with no luck... except for one. It was at the top of the cliff with an opening the size of an elongated shoebox. Matt, my brother, and Kyle (a friend) were the first two in. I was amazed to see them squeeze through the small hole but they did, and it opened up inside. One right after the other, we all fit in. So, Melanie (another friend) and I decided to retrieve our gear from the car and go exploring. Our car was at the bottom of the ridge, just off a small dirt road. When we got there a small orange cat greeted us. He was looking at my car and seemed interested in where we had come from; just as we wondered the same. But hey, we did not have time for a kitten so Melanie and I petted him a couple of times and grabbed the gear out of the car. We headed up the hill with everyone's equipment and the cat, right behind us. We joked about finding a helmet that would fit our curious friend and decided the cat would turn back when it saw where we were going.

MUD members Melanie Hoppe, Matt Effron, and Kyle McCrea play with Zeus.

We found Matt and Kyle just inside the entrance eagerly waiting. With our packs secured and extra lights ready, we entered the cave. Right away we were startled by a strange noise. We listened again, and there he was at the entrance; the silhouette of a most unusual cave inhabitant, with a purr! The cat's meow echoed through the cave like a lion's roar and we began to laugh as the little lion followed us into the darkness with no sign of apprehension.

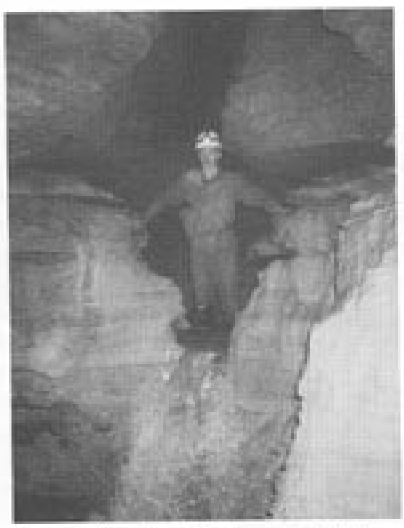
Well, now our team consisted of five members. We made good time and progress even with the addition of our new friend. We gave him the name "Zeus" for his boldness and bright color. The cave, "Zeus's Cave," was much larger than we thought and it had passages leading off in many directions. This was fascinating. There were no survey points, no signs of graffiti, no obvious trails, nothing telling me that this was a trafficked cave. We pushed most of the leads and eventually stopped for a break after a few hours of crawling. A passage had opened up into a semi-large room in which we could stand up and stretch. The only one unaffected was Zeus, who couldn't wait for us to put down the Chex-Mix and water and continue caving.

After our short break, we followed a passage to what appeared to be the end of the cave. At this point the cave bottomed out and led straight down to a deep underground river. I figured this water must connect to the surface creek that was nearby and probably had something to do with the cave's formation. We descended down the canyon until we reached the water; hoping to find another level in which to explore. This part of the cave was exhausting. We had to shimmy across the underground stream in order to stay dry which was hard on our joints and muscles. But, it was extremely hard on Zeus, who soon found he was not made

Kyle McCrea explains the finer points of caving.

to be a caver. The four of us pushed to the bottom and found nothing but water. Tired and disappointed we ascended the canyon. On the way up we heard Zeus's cries for help. We didn't think the cat would follow us down the canyon but he had made it part of the way. When I found Zeus, he was curled up on a ledge with no where to go. However, when my light hit his eyes, his groans turned to purrs and the fear of being left in the darkness was lifted. Conveniently enough, the cat helped us find the way out. Zeus was in a terrific hurry to exit this nightmare and we appreciated the leadership. However, some of Zeus' passages were only large enough for a cat. We did manage to return to the entrance with much rejoice by Zeus, the cat with a big curiosity and a meow that was barely less than a roar.

Stop, that tickles!



Are you finished taking my picture yet? Jason Moon standing above one of the waterfalls in Pine Hill, KY. Photo by Rob Payn.

Jason Moon posing for an entrance shot of Pine Hill. Photo by Rob Payn.

The Zen of Vertical. Matt Beversdorf practicing the art of yoga. Photo by Jason Moon.

And Then There Was Mars

by Marsha Butto

Lechuguilla Cave in New Mexico, the deepest cave in America, probably does not provoke the curiosity of the average caver. However, Larry Mallory, an entrepreneurial ecologist, and other researchers think that this cave may hold interesting clues to life on Mars. Mallory, with the aid of the National Aeronautics and Space Administration (NASA) is attempting to discover Martian life and find a practical use for the tiny life forms that inhabit Lechuguilla.

For many years, scientists considered the surface of Mars and Lechuguilla Cave sterile. Three and a half billion years ago, the Martian atmosphere thinned and allowed the entrance of ultraviolet light that probably killed life on the Martian surface. Scientists attributed Lechuguilla's sterility to the fact that the cave lacked water flow and bats or insects to bring organic matter into the cave.

At present, Mallory and his fellow researchers are contradicting the "sterility theory" of Lechuguilla and Mars. They have discovered extremely hungry cave bacteria in pools in Lechuguilla that derive energy from three minerals prominent in Mars; manganese, iron, and sulfur. The process of oxidization of minerals is called chemolithotrophy. The bacteria in Lechuguilla possess unique characteristics. They can be freeze-dried, and if the internal conditions remain unchanged, one can rehydrate them. Channels, sedimentary rock, and meteorites, suggest an existence of a large amount of water on the Martian surface as recently as 100 million years ago. Fortunately, much of the bacteria on Mars has little chance of being exposed to solar radiation and probably has little chance of being damaged. If scientists can revive dormant bacteria, we will have a better understanding of Martian life.

Mallory is also hoping to incorporate medicine into his study of cave bacteria. He intends to culture and isolate thousands of new strains of bacteria and tests their medicinal properties. Mallory is eager to begin his medical research; he has formed a private company, Biomes Inc., with pharmacology researcher, Jim Bigelow. The company's goal is to create drugs and potential treatments for cancer and other diseases. A long-term goal of Biomes Inc. includes exploring Martian microbes and studying their medicinal properties.

Larry Mallory and his fellow researchers are attempting to clear our ambiguous notions about Martian life through the study of Lechuguilla's pools of bacteria. With continued study of Lechuguilla's cave bacteria, we may all come to believe that Mars possesses more than just "little green men." Extensive studies of microbes inhabiting Lechuguilla and the Martian surface will hopefully create a happier, healthier society.

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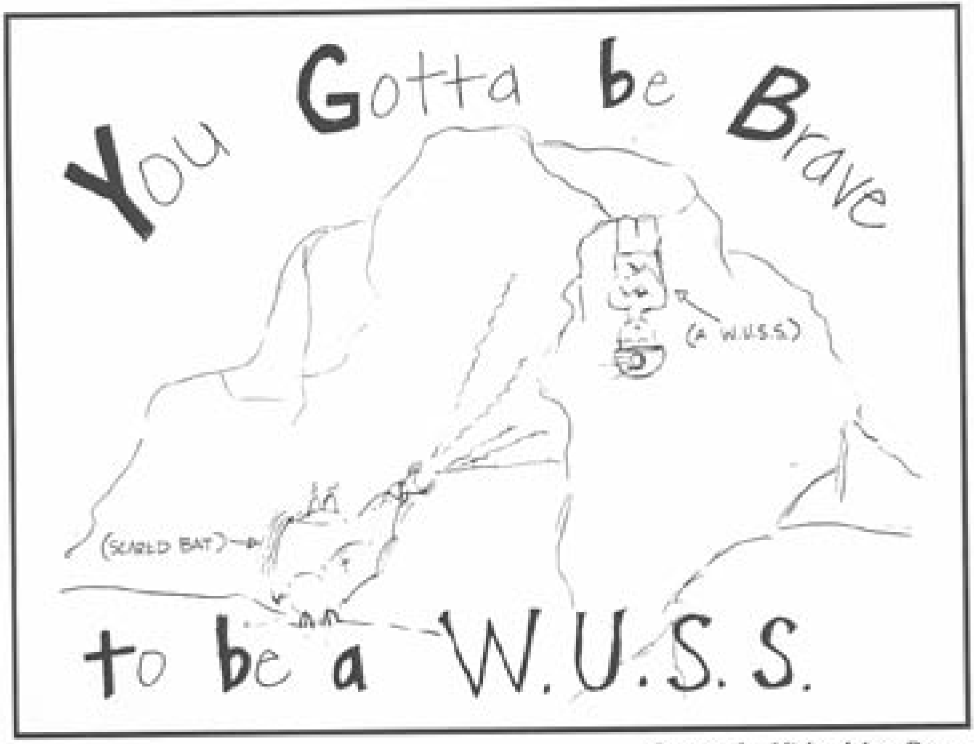
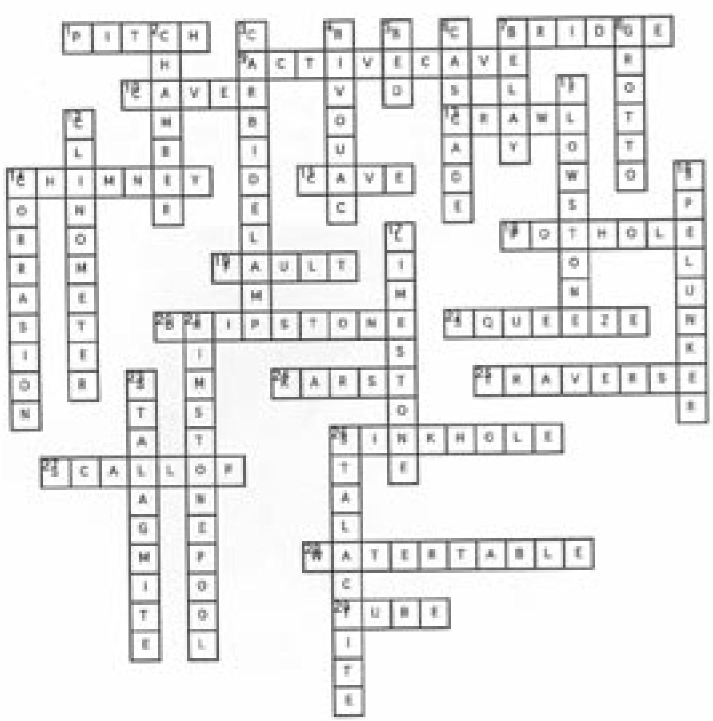
Nelson, P. 1996. The cave that holds clues to life on mars. National Wildlife, 36: 38-42.



Cartoon by Michael Ann Doran

Crossword Solution



Interested in Submitting to Pholeos?

INFORMATION FOR CONTRIBUTORS

EDITORIAL POLICY: Manuscripts treating basic research in any aspect of speleology will be considered for publication. They must not have been previously published, accepted for publication, or be under consideration elsewhere.

All manuscripts are to be in English. Metric and Celsius units must be used, and SI units are preferred. The CBE Style Manual, the Handbook for Authors of Papers of the American Chemical Society, and Webster's Ninth Collegiate Dictionary are useful guides for matters of form and spelling.

The original of the manuscript must be typed doubled-spaced on one side of white bond paper approximately 8.5 X 11 inches, leaving margins of one inch. Use triple space above headings. Submit four copies for prompt review. Number pages consecutively at the top right-hand corner. Underline scientific names of genera and lower categories. Acknowledgments should be on a separate, double-spaced page. Each figure and table must be referred to in the text. Text references are by author, followed by year of publication. The sequence of material in the manuscript should be as follows.

1. The *title* page should include the title, author's name, affiliation, and mailing address.
2. The *abstract* should not exceed one double-spaced page. It should contain a summary of significant findings and note the implications of these findings.
3. The *introduction*.
4. *Methods and materials*.
5. *Results*.
6. *Discussion*.
7. *Literature Cited*. List all publications referred to in the manuscript alphabetically by first author on a separate sheet of paper (double-spaced). Each citation must be complete, according to the following examples:

Article: Peck, S.B. 1974. The food of the salamanders *Eurycea lucifuga* and *Plethodon glutinosus* in caves. NSS Bulletin, 36(4): 7-10.

Book: Moore, G. W., and N. Sullivan. 1997. Speleology: Caves and the cave environment. St. Louis, Missouri: Cave Books.

Chapter: Hobbs, H.H. 1992. Caves and springs. In C.T Hackney, S.M. Adams, and W.A. Martin (eds.), Biodiversity of Southeastern United States/Aquatic Communities. John Wiley & Sons, pp. 59-131.

8. *Figures and Tables*. Should be self-explanatory, not requiring reference to the text. Each table should start on a separate sheet. Headings and format should be consistent.

Address all manuscripts and correspondence concerning editorial matters to Editor, Pholeos, c/o Horton H. Hobbs III, Dept. of Biology, Wittenberg University, P.O. Box 720, Springfield, Ohio 45501-720.