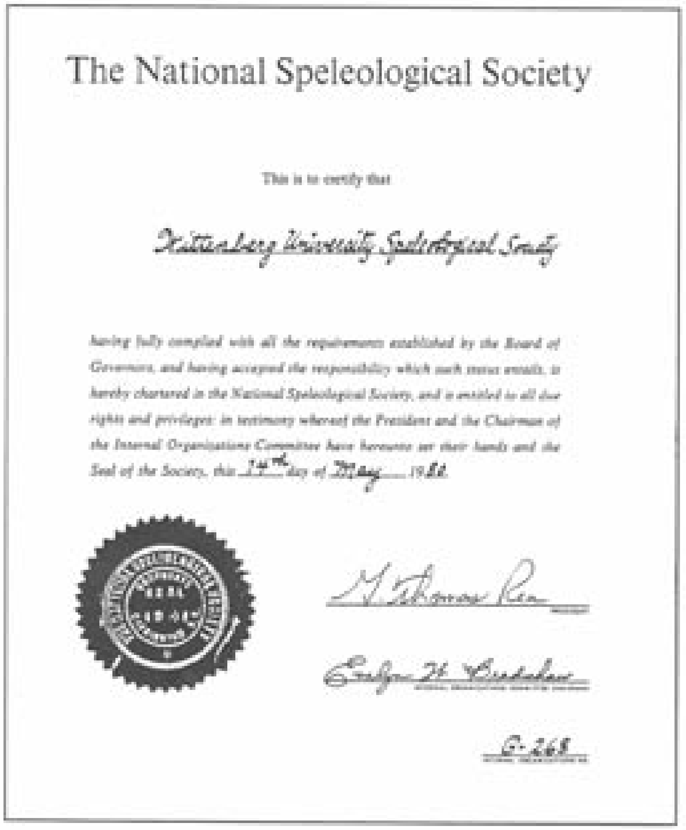
PHOLEOS

Journal Of The Wittenberg University Speleological Society

Volume 16 (I & II) July, 1997

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-268

Cover: Bill Stitzel and Horton Hobbs at Entrance #1 of Silvermine Cave, Carter Co., Kentucky
Photo by Megan Porter

ISSN: 0733-8864

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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
INTERNET: WUSS@WITTENBERG.EDU

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

MEETINGS: Wednesday evenings (when Wittenberg University classes are in session - call to confirm), 7:00 p.m., Room 206, Science Building (corner of Plum and Edwards - parking available in adjacent lot), Wittenberg University, Springfield, Ohio.

Editors' Note

It has been nearly two years since the last publication of *Pholeos*. In those years, WUSS has seen several changes. Younger officers have replaced seniors and accepted an unfamiliar responsibility. We are the leaders now and have a challenge to meet with a great tradition to maintain. The new officers have been enlightened to the world of caving and have learned the history of WUSS and the NSS. We have reorganized the grotto and its publication and the future looks promising for both.

This issue of *Pholeos* spans two years of WUSS history. Among several poems and book reviews, WUSS members have surveyed two caves, Omohundro and Silvermine caves. WUSS has seen the marriage of three of its members, Scott Engle (WUSS #0186) to Annette Summers (WUSS #0244) and Toby Dogwiler (WUSS #0255) to Katie Ramsey. We have also mourned the loss of a good friend and dedicated caver - Steve Kronk. Through all this WUSS has remained strong and we are proud of our work. We hope you enjoy the 1997 issue of *Pholeos* and look forward to several more issues in the coming years.

David Effron
NSS # 41545
WUSS President

The Year I Learned to Crawl

by
Rob Payn
A month from his first anniversary as a W.U.S.S.

I have been a member of the Wittenberg University Speleological Society and National Speleological Society for nearly a year. I instantly fell in love with caving after crawling through face deep cave water in my first wild cave. If I ever stopped to think about it, I am sure I would wonder why. But I have seen some many strange and beautiful places and met so many wonderful people, that there hasn't been a reason or time to care. It's just one of those unexplainable passions that appeared out of nowhere.

I have been on more caving trips than I can count, but they have all been in Ohio, Kentucky, Indiana, and West Virginia. I attended Speleofest, OTR, Crawl-a-thon, and the Cave Rescue Seminar at Carter Caves. Some of the WUSS trips I attended include (often more than once) Adams County, OH; Hoosier National Forest, IN; Rock Castle County, KY; Sloan's Valley, KY; and Carter Caves, KY.

One of the best things about WUSS is the academic atmosphere. There is no shortage of opportunity to learn more about all aspects of the cave. I have even had the opportunity to assist in several research projects being performed by various members. Though my current vocation is network engineering, ideas about classes in the sciences have recently been roaming around the back of my mind.

And of course, it is impossible to love caving without loving cavers. I have never met a more accepting and enthusiastic group of people. I only hope that, someday, I can return to the caving community at least a fraction of what is has given to me.

I want to thank Megan Porter for introducing me to caving, Dr. Hobbs and the officers of WUSS for making sure I got underground frequently, safely, and softly, and all the members of WUSS for making it so much fun. This year has truly been a highlight in my life and I am looking forward to future years of caving getting even better.

Holy Chiroptera, Batman!

article by
Megan L. Porter

For those who have never encountered a friendly chiropteran, or perhaps would rather meet them for the first time on paper than in person, Elizabeth Royte presents some good general information about bats in her article "Holy Chiroptera, Batman!". In addition to the basic facts, Royte describes her first adventure with bats as Merlin Tuttle, executive director of Bat Conservation International (BCI), leads her into the Bracken Cave, Texas at dusk as the population of 40 million Mexican free-tailed bats is emerging. Both of these accounts are intertwined with the tale of how Tuttle became interested in science and caving, leading to the founding of BCI in Austin, Texas.

Royte's article is entertaining and adventurous and perhaps best suited for those interested in reading about an adventure in Bracken Cave or the basic facts about either chiroptera, BCI, or Merlin Tuttle. However, the main tone of the article is one of adventure, and none of the topics are covered in depth; most of the information about bats found in Royte's article can be found in BCI publications and videos.

The Truth About Bats and Trogs:

A Look at Merlin D. Tuttle's Saving the N.A. Beleaguered Bats

a review by
Jillian Benjamin

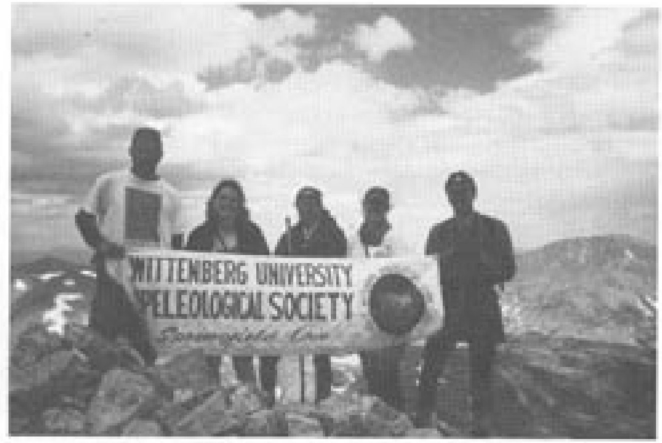
The plight of the bat has been a long struggle to overcome the misperceptions of society. The common belief is that bats are evil, the living incarnation of Dracula, literally creatures of the night. However, as so often is the case, our first conceptions are completely off base and that in judging the bat, sight unseen, we condemn a species to extinction.

In National Geographic's article *Saving North America's Beleaguered Bats* , Merlin D. Tuttle seeks to alert the general public as to the true nature of the bat. Tuttle, founder of Bat Conservation International, has discovered that the real danger to the existence of the gray (as well as other species) bat is lack of education. Thus the article focuses on alerting the public that bats are gentle creatures, beneficial to the survival of crops. Through photographic documentation and Tuttle's own research, this article takes the reader into a new understanding.

Frightful Sounds

by
Nikki Oskins

We see the struggle
within the storm,
of child and cat
searching for shelter
under the same rock



Atop a "14er".

Sarah Maurer squeezes through 6 1/4 inches at OTR.

David Effron tries to escape from the Finch box.

David Effron explores Lighthouse Cave, San Salvador, The Bahamas.

Untitled

by
Nikki Oskins

Prancing,
jaunting in my mind
over
gray and white,
Away from
the light in my eyes,
You are free to enjoy
what life you have left
no more
pain to endure. You will
learn to
survive...

The WUSS gang gathers around for one last picture at the NSS Convention '96.

Reminiscence

by
Tom Stitzel

Perched upon this rock,
looking past the nearness.

Beyond the momentary illusion
which is my weakness.

Listening the windy words
through ages blown meek.

Wrapped in whirling amazement.

Following floating thoughts
whatever lead which wills.

I think of you, my brother,
like summer storm its thunder.

Out of the blue,
no words, only wonder.

Realization

by
Tom Stitzel

How like chimera
is the aging heart which still rages against the troth
of a Father, a Mother, a God
who, like Media when betrayed,
tear apart the left from the right of the balancing act,
downward spilling its soured milk from breasts upon shoes
whose soles too thinly separate sustenance from the hot sands
of a scorched soul which searches nightly the netherland
for its family or friend,
and loses itself in embattlement in which there is no loss, no win,
only this living parable of fruitlessness.
Fervently it bellows,
Give me back the promise, my birthright,
someone, sometime, has stolen from me."
And rants for rescue from its desolation,
a barren landscape from which it cannot arise.

Yet slumbering,
a seed awaits the aching heart to catch its breath.
It muses awhile on its own
with illumination slowly stinting like dawn upon the cliffs
at whose shadowed base still hibernates the truth which purifies.

Needing no one, no thing but patience, birth takes its time.

Vertical practice.

DESCRIPTION OF TWO SMALL CAVES FROM NORTHEASTERN KENTUCKY (BATH AND CARTER COUNTIES)

by

Horton H. Hobbs III (NSS 12386F) and Megan L. Porter (NSS 38171)

During February 1996 members of the Wittenberg University Speleological Society braved the winter weather and headed to Kentucky for survey work in two small caves. They were successful in completing the survey of each cave within a single trip, something very unusual for the group! ! The following descriptions and accompanying maps should provide the reader with information about these small but interesting karst features located in north central Kentucky.

OMOHUNDRO CAVE

At the invitation of Frank Bodkin and Tom Biebighauser of the Daniel Boone National Forest, 12 cavers convened on Bath County, Kentucky on the brisk morning of 10 February 1996 (Figure 1).

Figure 1. Survey crew for Omohundro Cave (photo by A. S. Engel).

A strenuous walk up a recently logged ravine (made difficult by having to go over, under, and through numerous downed trees) brought them to the head of the valley and to the entrance of Omohundro Cave (Figure 2). There they divided into three groups and began the survey of this small, joint controlled cave (total horizontal cave 376 m, 1234 feet; total vertical cave 9.3m, 30 feet) developed in the Newman Limestone Formation (Mississippian) and capped by the Corbin Sandstone (Lee Formation). Suunto compasses and clinometers and fiberglass metric tapes were employed for the survey (Figures 3 (map insert); 4 and 5). Strike and dip

Figure 2. Entrance to Omohundro Cave (photo by A. S. Engle).

Figure 4. Establishing "permanent" survey station in Omohundro Cave (photo by A. S. Engel).

Figure 5. Surveying in Omohundro Cave photo by A. S. Engel).

measurements were taken in various places within the cave; dip values were recorded consistently at 4° whereas strike readings were highly variable (0 to 130°). In addition, numerous ceiling joints were measured and, although variable, most trended in two distinct directions: 275° and 30°. Much of the cave is very dry and, aside from several moist areas beneath domes such as noted at "*Plecotus* Dome," flowing water was observed only in the far western branch of the cave and at the "Pool" (see map). There is very little speleothem development, yet some flowstone, gypsum blisters, and popcorn were noted throughout the passages.

The entrance is located in a prominent limestone outcrop at an elevation of approximately 335m (1100 feet) and the passage slopes downward gently in a northwesterly direction, the general trend of most of the cave. Within a short distance of entering the cave, signs of the presence of the Cave Rat (Eastern Woodrat), *Neotoma floridana*, were abundant and were represented by numerous nuts and fecal pellets in latrine areas; at least six nests were noted throughout the cave. One concentration of these nests was particularly noticeable about 34m from the entrance (see "*Neotoma* Nests" on map), however a nest with an active inhabitant was observed above the entry passage leading to "The Black Forest."

Immediately north of the concentration of nests a dense layer of travel fossil worm tubes was noted. The structure of the worm tubes had been replaced with chert and differential erosion resulted in the tubes standing out of the walls in relief (Figure 6). The west wall showed the best preserved and largest tubes although they were seen throughout much of the cave and varied in size (most were the diameter of a pencil).

Figure 6. Worm tubes (chert) on wall in Omohundro Cave (photo by H. Hobbs III).

The collapse of a large block of ceiling limestone ("Table Rock" - see map) produced a sizeable room. Beyond the room a small, tight crawlway on the east wall connects back to the worm tube section. Beyond "Table Rock," "*Plecotus* Dome" is a prominent feature and on the day of survey, a single individual of the endangered Eastern Big-eared Bat, *Plecotus r. rafinesquii* Lesson, hung along the wall of the dome. In addition to this bat species, 32 individuals of the Solitary Bat, *Pipistrellus subflavus* (Cuvier), were noted throughout the cave with greatest numbers occurring in "Signature Hall" (Figure 7). A single Big Brown Bat, *Eptesicus fuscus* (deBeauvois), was seen in a ceiling crack near the entrance area.

Figure 7. The Solitary Bat, Pipistrellus subflavus, *hanging from the ceiling in "Signature Hall," Omohundro Cave" (photo by H. Hobbs III).*

Figure 8. View from "The Overlook," Omohundro Cave (photo by H. Hobbs III).

Several large pieces of breakdown provide for a relatively large room (Figure 8) that can be observed easily from one of the blocks dubbed "The Overlook." Leading out of this room is a crawlway trending north (Figure 9). This section of cave terminates in "The Black

Figure 9. Crawlway leading to "The Black Forest," Omohundro Cave (photo by A. S. Engel).

Forest" where a layer of shale approximately 50cm (20 inches) thick is a prominent feature on the east side of the passage. The left wall is strewn with breakdown and a floor crevice runs the length of this subterranean corridor, terminating in a shallow pit. This very tight passage can be negotiated only by very small individuals, particularly when visiting the region beyond the "Squeeze."

The room at "The Overlook" continues as a breakdown-floored tunnel (Figures 8 & 10) to the "Junction Room" where a passage turns south and extends to the west for approximately 65m. Several pits are encountered in the floor of this section, one leading to the lowest point in the cave, 4.9m below the entrance elevation. This passage floored with sand ends in breakdown with a small trickle of water flowing to the east that disappears in a low, gravel-floored tube.

Figure 10. Breakdown-floored passage in Omohundro Cave (photo by H. Hobbs III).

From the "Junction Room," the main passage continues to the northwest through the "Signature Hall" where many signatures (graffiti?), some dating back to 1843, were observed (Figure 11). Many large pieces of breakdown make up the floor of this area (Figure 12) and these blocks must be negotiated in order to reach the terminus of the passage at the "Penthouse," the highest point in the cave at 4.4m above the entrance. A small stream enters and forms a tiny pool (see "Pool" - map) at the base of several of these limestone blocks.

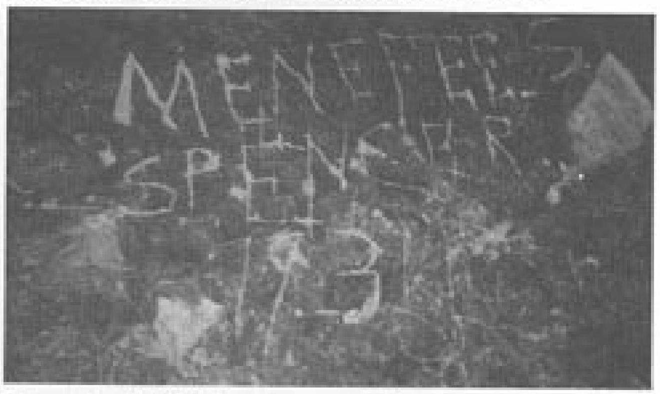


Figure 11. A 1931 signature, one of many in "Signature Hall," Omohundro Cave (photo by H. Hobbs III).

Figure 12. Large breakdown slab in "Signature Hall," Omohundro Cave (photo by H. Hobbs III).

In addition to the organisms referred to above, fauna observed on the survey trip were: heleomyzid and mycetophilid dipterans (flies), cave crickets (both *Hadenoecus sp.* and *Ceuthophilus sp.*), the spider *Meta americana*, pigmented millipede, and collembola (springtails). Prior to the WUSS survey, on 30 January 1992 Tom Biebighauser, Evelyn Morgan, Terry Omohundro (all U. S. Forest Service), and Wesley Omohundro visited the cave. They noted 14 Solitary Bats, 3 Little Brown Bats [*Myotis lucifugus* (LeConte)], 2 Big Brown Bats, 2 Wood Rats (5 nests - Figure 13), cave crickets, and orb weaver spiders.

Figure 13. Cave Rat nest in Omohundro Cave (photo by A. S. Engel).

Onset Computer Corporation data loggers were placed in several locations to record continuously air temperature and relative humidity values. They were placed 1) approximately 3m inside the entrance, 2) on a block of breakdown about 25m within the cave (on rock to left of ceiling height 2.1 - see map), 3) on "Table Rock" (Figure 14), 4) at the "Junction Room," and 5) at the "Pool." These loggers were launched at the various sites and removed upon completion of the survey approximately seven hours later. Representative data are shown in Figure 15 and certainly support the

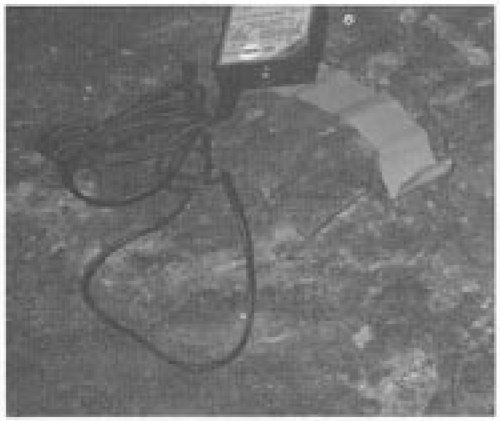


Figure 14. Data logger used to gather continuous temperature data in Omohundro Cave (photo by H. Hobbs III).

premise that inner cave environments are far less variable and more predictable than those on the surface.

Omohundro Cave is on U. S. Forest Service land and is considered closed.

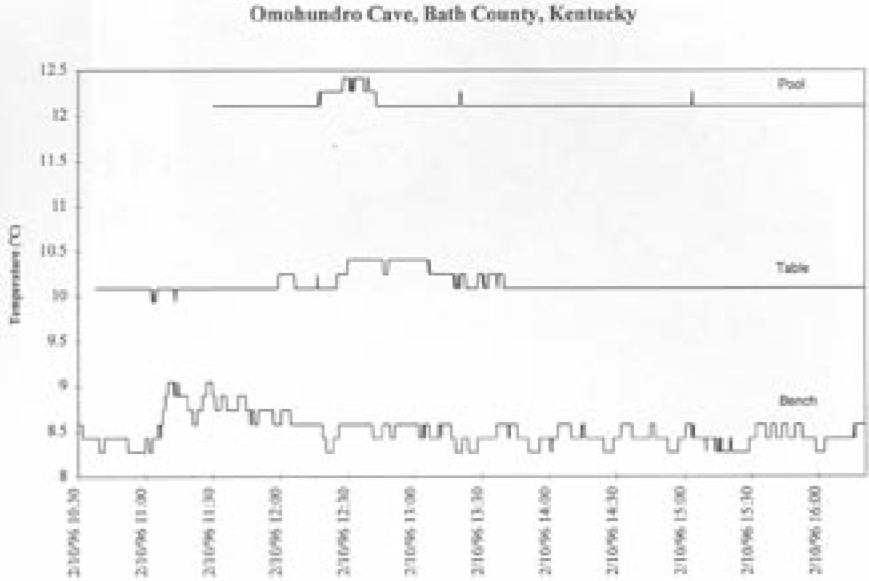


Figure 15. Air temperature data from three sites within Omohundro Cave.

SILVERMINE CAVE

As part of the continuing survey of Canyon Cave in Carter County, Kentucky (map and description to be published in Pholeos, Volume 17), Silvermine Cave was surveyed on 24 February 1996 by five members of WUSS (Figure 16).

Figure 16. Survey crew for Silvermine Cave (photo by A.S. Engel).

This small cave (total horizontal cave 253 m, 830 feet; total vertical cave 8.9 m, 29 feet) is an inaccessible part of Canyon Cave located on the northwest extremity of the ridge in which Canyon Cave is developed. It displays four entrances: Entrances #2 - #4 (Figure 17 - map insert) are found at the base of a limestone cliff and Entrance #1 is situated at the top of the outcrop (see map). South of these entrances are two, small caves (Crevice Cave and Spider Hole) and to the north are Harassment Cave and Scott Hollow Cave (Summers 1995). These caves, including Silvermine Cave, are developed in the Ste. Genevieve Limestone Member of the Mississippian Newman Limestone Formation.

Entrance #1 (see cover) is located in a small sinkhole and a stoop passage slopes downward leading to a downclimb that intersects the main cave. To the left (northwest) the walking passage leads by an apparently blasted/dug pit 3.9 m (12.8 feet) deep (="Miner's Pit"). Beyond this the sinuous tunnel passes by Entrance #2 (Figure 18) and continues to the north (Figure 19), terminating at the cliff Entrance #3. Several steps north and Entrance #4 is entered. This small crawlway trends east for 17 m (56 feet) and intersects the main cave. To the left (north) the passage terminates in the Pirate's Cove, so named because of the numerous rats and rat nests and a particularly pesky rodent with one eye! To the right of the T-Junction, the passage trends to the south in a very dusty, dry stoop and crawlway (Figure 20). A low, steeply downsloping crawlway leads to the

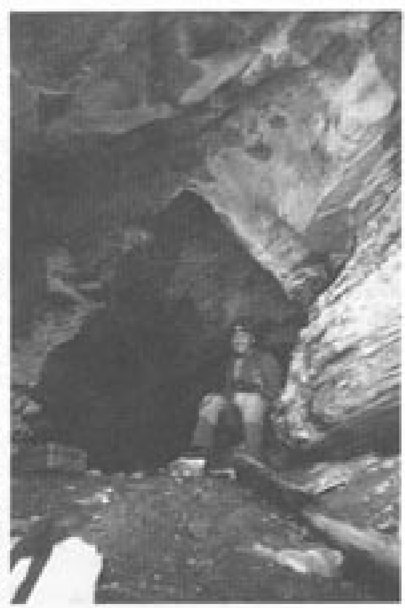


Figure 18. Entrance #2 to Silvermine Cave (photo by A. S. Engel).

Figure 19. Surveying in cave passages between entrances #2 and #3, Silvermine Cave (photo by A. S. Engel).

Figure 20. One of several low, dry crawlways in Silvermine Cave (photo by A. S. Engel).

southeast and is too low for continued progress although voice connection to Canyon Cave has been made.

From this connection tube, the passage trends to the east and then makes a hairpin turn, remaining low, sinuous, and very dry. Some small breakdown has been placed on the south wall and within a few meters another junction area is encountered. A small, low crawlway extends for several body lengths to the west and terminates. A very tight passage extends to the southwest where it intersects "Miner's Pit," observed first when approached from Entrance #1. The main cave continues from this intersection, trending generally to the south as a rock-floored, dry stoopway. At a T-junction several rat nests were observed and the passage to the left (southeast) terminates in a small dome; to the right the walking passage brings one to the climbdown encountered when entering from Entrance #1.

This small cave has very limited speleothem development and has been modified due to the activity of miners. A "Mr. Fultz" started searching for gold and silver in the area around Oakland during the 1930's. He was a persistent prospector and he even hired several men to dig in Silvermine Cave. One of those hired was "Lonnie Burton, Sr." who was paid $0.75 a day, which was a significant sum during that period of time (Sam Plummer, Carter Caves State Resort Park, pers. comm.). Tally marks are still visible in parts of the cave.

When the cave was surveyed by WUSS on 24 February 1996, the following organisms were observed: Thysanura (bristletails), *Meta americana* (spider), *Ceuthophilus sp.* (cricket), either *Euhadenoecus puteanus* (Scudder)? or *Hadenoecus cumberlandicus* Hubbell and Norton ? (cricket), staphylinid beetle, *Scoliopteryx libatrix* (Linnaeus) (moth), Siphonaptera (flea), heleomyzid flies, *Sayornis phoebe* (Latham) phoebe nest, *Eptesicus fuscus*, and many *Neotoma floridana* (rats - latrines, nests). As a special note, the rats played an important role in verifying not only that Canyon Cave and Silvermine Cave are connected but also that Crevice Cave is a part of the system as well. In the "Pirate's Cove" much pink flagging tape was encountered during the cave survey. These tapes are used to aid in marking stations when surveying passages. Using a permanent marker, the tape strands are always labeled with the station number and were used during the surveys of Canyon and Crevice caves. Flagging tapes were observed in the "Pirate's Cove" area of Silvermine Cave and the numbers displayed confirmed that the rats are moving through small passages that cavers cannot negotiate that connect these three caves. Some distances traveled by the rats were in excess of 100 m, a feature noted by Clark and Clark (1994) of rats in caves in northeastern Oklahoma. More discussion of this will appear in the description of Canyon Cave to appear in a future issue of *Pholeos*.

Silvermine Cave as well as Canyon, Crevice, Harassment, Scott Hollow, and Spider caves are located on private lands and should not be entered without permission from the land owner.

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Geological, Ecological, and Environmental Challenges to the Construction of Reservoirs In Karst Terrains

by
Toby Dogwiler

"Flow gently, sweet Afton, among thy green brass,
We'll be damming thee up in a couple o' days
-adapted from Robert Burns

Abstract

In the past century societies have undertaken the widescale construction of dams to satisfy their recreational, navigational, energy, water supply, and flood control needs. Although engineers have learned to deal with many challenges in building and maintaining successful dams, karst terrains still afford formidable obstacles to the erection of watertight, structurally sound impoundments. Additionally, as understanding of a reservoirs impact on the local environment and ecology has increased, engineers and planners have had to deal with complex conservational issues in karst areas.

Introduction

Man has attempted to build dams to enable the efficient impoundment of water since the third century B.C. (Smith and Tobin, 1979) Today reservoirs dot our landscapes, serving many functions including flood control, navigation, hydroelectric power generation, recreation, and wild life conservation. However, prior to 1927 the Army Corp of Engineers, along with most civil engineers, failed to recognize the feasibility of these structures to serve the above purposes (Morgan, 1971). As a result, only a few large scale reservoirs were built prior to 1927, the first being constructed by the Miami Conservancy District following a disastrous 1913 flood (Smith and Tobin, 1979).

Karst areas demonstrate unique geological and biological challenges to reservoir engineers. Reservoirs in such terrains have demonstrated an alarming lack of water tightness due to seepage through cavernous zones underneath and around dams (White, 1988) These problems have proven difficult, if not impossible, to overcome, mainly because the extent of the subterranean cavities is often hard to delineate. Often, elaborate techniques have had to be employed to mitigate leakage through subreservoir conduits. Naturally, construction times and project costs are sharply increased and the economic practicality, if not the mechanical integrity, of the structure is jeopardized. When ecological and environmental issues and impacts are considered concerns, also become ideological. Thus, when constructing dams in karst terrains geological, ecological, and environmental issues must be examined to determine the mechanical and economic feasibility of the project.

METHODS

When considering potential sites for dam construction engineers evaluate it against several criteria (adapted form Creager, et al., 1945):

(1) The character of the foundation
(2) The Topography of the area and its effect on the dimensions of the dam and quantity of material that will require excavation
(3) Availability and character of materials for construction
(4) The value of the necessary lands and water rights
(5) Requirements for unwatering (i.e. coffers, pumping , etc.)
(6) Transportation facilities and accessibility
(7) Availability of sites for construction equipment and camps
(8) The safety of the structure

Beyond these requirements the site must ultimately provide a location that, at a reasonable cost, will be properly suited to the purpose for which the dam is intended. Criteria (1) and (2) encompass what Burwell and Moneymaker (1950) suggest is the most critical constraint on locating a dam" Geology. The importance of geology was first realized after the St. Francis Dam, California failure in 1928 and the leakage (because of subterranean piracy) of several Tennessee Valley Authority (TVA) dams in the 1930's. Proper geologic investigation is the simplest, and most economical, way to single out sites that may be unsuitable for a dam due to karst features. Additionally, as researchers have begun to understand and document the ecological repercussions of reservoir construction, preservation of local biological communities has become a valid consideration (see Hobbs, 1992; Hobbs and Wells, 1972).

Methods of site investigation

Naturally, any area underlain by soluble bedrock may present difficulties in dam construction and subsequent maintenance. However, limestones and dolomites present the most common problems to dam engineers, and only they will be dealt with in this report. Simple field studies will suggest a site is unsuitable if caves, springs, and/or sinkholes are found. Faults and extensive joints and fractures in the limestone also greatly increase the potential for dissolution to have occurred (Burwell and Moneymaker, 1950); furthermore, limestones interbedded with shales and/or that are more chemically impure are less likely to contain solution channels (Creager, et al., 1945).

If a site is suspected of having a cavernous limestone it is necessary to determine the extent of any solutional features. This may be achieved through physical exploration of caves, aerial photograph interpretation, geophysical techniques, core drilling, and fluorescent dye tracing (Burwell and Moneymaker, 1950; White, et al. 1995; White, 1988; Creager, et al., 1945).

Ecological Assessment

In karst areas where reservoir construction has been proposed, an ecological assessment must be conducted. Included in this assessment should be inventories of species abundance, and population and community dynamics. The impact of inundation, fluctuating water levels, and siltation of aquatic and terrestrial organisms inhabiting these areas should be ascertained.

Constructing Reservoirs in Karst Terrains

When construction of a reservoir in a karst area is deemed practical several low cost techniques can be utilized to remediate minor points of leakage in an otherwise sound, watertight dam. Shallow, small conduits below the dam and the river bed can be eliminated by excavation (Burwell and Moneymaker, 1950). Deeper and/or larger conduits may be blocked off with concrete, construction of a grout curtain (Figure 1), or filled with asphalt (White, 1988). However, no definitive engineering methods have been developed to block open lateral conduits located in the valley walls (White, 1988).

Repairing Leaky Reservoirs in Karst Terrains

When a reservoir in a karst region fails to acceptably hold water, high remediation costs are normally required to reestablish the integrity of the dam. In cases where leakage is relatively low, and confined to a small area, grout, asphalt, or concrete injected through a large diameter borehole(s) may plug the seep. However, if the subterranean conduits are large, and leakage high, the only alternative is to construct a grout curtain (Figure 1). Often solution in carbonate bedrock beneath river channels extends to 100m (Burwell and Moneymaker, 1950). The grout curtain consists of two offset and interconnected rows of 18 inch diameter boreholes lined with asbestos cement pipe and filled with grout (White, 1988). In essence, this forms a second dam (the first being the original surface impoundment) in the subsurface.

RESULTS

In the past century many dams were plagued by karst related difficulties during and after construction. Problematic reservoirs in the former Yugoslavia and Spain have been well investigated by LeGrand (1973) and Eraso (1981), respectively. For our purposes, however, several TVA projects can demonstrate successful following case histories are loosely paraphrased from Burwell and Moneymaker (1950).

Hales Bar Dam, Marion County, Tennessee

The Hales Bar Dam, located on the Tennessee River, has become the classic example of insufficient site investigation. Before construction the reservoir site was chosen solely based on its narrow gorge. The dam was constructed from 1905 to 1913; originally the project

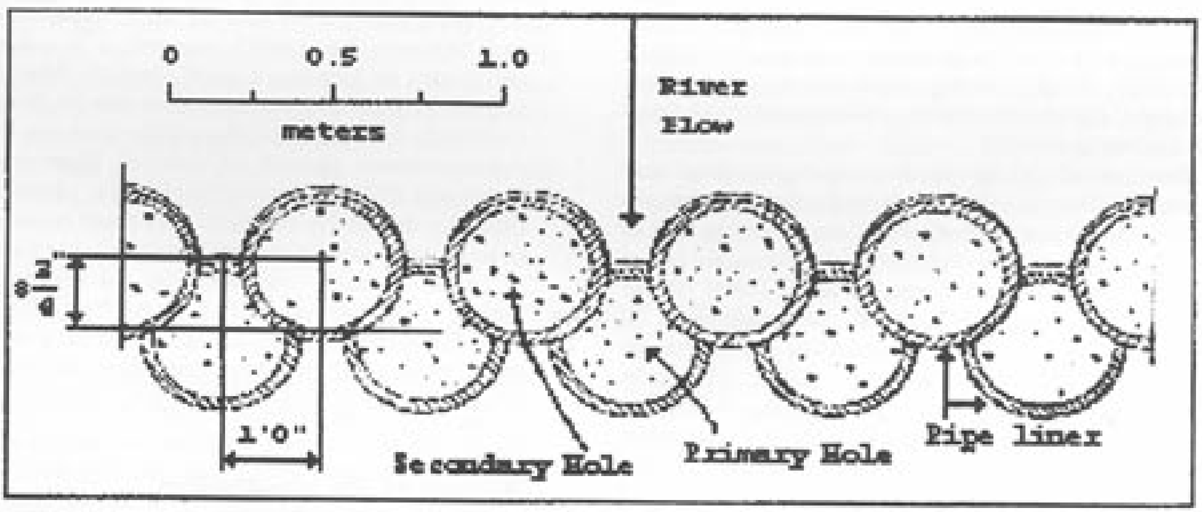

Figure 1. Schematic diagram of a subterranean grout curtain (plan view) used by the TVA to seal leaky karst dams (After White1988).

was to have lasted two years and cost $3,000,000 but due to leakage through the foundation costs skyrocketed to $11,536,889. Fourteen days after completion of the dam the first leak was discovered. Several other leaks rapidly developed, and by 1919 had become sufficient to require drastic remediation. Between 1919 and 1921 78,324 cubic feet of molten asphalt was pumped into the cavities serving as conduits. The leakage was only reduced, and by 1930 was greater than in 1919, amounting to 1200 cubic ft/sec. When the TVA acquired the reservoir in 1939 the leakage was determined to be 1700 cubic ft/sec. A grout curtain was installed to a depth of more than 100 feet below the original river channel, and the leakage was eliminated except at one point.

Kentucky Dam, Southwestern Kentucky

Although the site for Kentucky Dam, on the Tennessee River, was underlain by extensively dissolved vertical cavities filled with residual clay and chert, construction was approved. To deal with potential leakage, two methods were implemented. To ensure the bearing strength of the foundation, the filled vertical cavities beneath the river bed were flushed out and backfilled with concrete and then a thick reinforced concrete slab was placed over the channel. To further ensure watertightness a grout curtain was constructed beneath the dam. These measures resulted in essentially a 195 feet high, subterranean arch dam built from the top downward.

Douglas Dam, east of Knoxville, Tennessee

At the Douglas Dam Site the cavernous limestone was contained within the upper 70 feet of bedrock. The primary remediation technique administered was to simply excavated the upper 30 to 60 feet of bedrock. This technique was subsequently augmented with grouting of some minor conduits.

DISCUSSION

The TVA case histories presented above emphasize the extreme methods that are required to erect watertight impoundments successfully in regions underlain by cavernous bedrock. Ingenuity and perseverance were able to overcome natural obstacles in these examples. However, they clearly indicate that in the future extensive lateral cavernous zones and/or numerous subchannel solution cavities should signify that a site is not suitable for dam construction (Burwell and Moneymaker, 1950; White, 1988). When building dams in karst areas every effort should be made to estimate accurately the financial implications of the additional construction techniques required to avert potential leakage problems.

The cave environment is capable of supporting many types of organisms, however, the distribution and ecology of many cavernicoles is poorly known (Hobbs, 1992). Culver (1982) discusses the adaptations made by many of these subterranean organisms and the importance of understanding their unique evolutionary history. Because of the susceptibility of these habitats to the contamination (Hobbs, 1992; White, et al. 1995), and the apparent impacts of inundation and siltation, it is evident that caves are sensitive habitats (Hobbs, 1981). Thus, ecological and environmental impact studies are warranted when evaluating a possible dam site. Obviously the results of these investigations should be among the most important criteria in siting a reservoir.

Another important consideration in appraising an area should be the value of its natural features and resources to the local population and economy. These merits should be weighed against any possible recreational, economic, or aesthetic benefits a potential reservoir may pose.

Clearly there are many considerations when constructing reservoirs in karst areas. Over the course of this century, engineers have realized the dividends paid by proper geologic investigations and the added complications inherent to building dams in karst areas. However, engineers are just beginning to consider the ecological and environmental impacts of reservoirs in such areas. Hopefully, in the future, planners and engineers will look at a more balanced picture when contemplating the erection of dams in karst terrains.

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A Dependable Stove

by
Erin Athy

An essential part of any camper's gear is a dependable stove. A hot meal is always preferred over nuts and berries. Whatever the conditions, wind, rain or snow, a stove must provide the heat necessary heat for a meal. In the October issue of Backpacker, the article "Multifuel Stoves" tested six popular models and rated their performance on a scale of 1 (low) to 5 (high).

The MSR WhisperLite Internationale received the best overall score of 4.5. On the upside, it is light, small , and reliable. But "there is only one cooking mode: blowtorch." Other than the adjustability rate, this stove consistently scored high.

The second stove tested was the MSR XGR II. It followed closely behind the WhiperLite with an overall score of 4. The forte of this stove was its consistency. Kristin Hostetter remarked, "If I were stuck in a torrent and had one hand behind my back, I could get this stove cranking."

The Peak I Apex II also received a rating of 4. For cooking that requires a lot of simmering, this is the stove to have. It is dubbed "The Simmering King" by the judges! The disadvantage is its bulky design making it hard to pack.

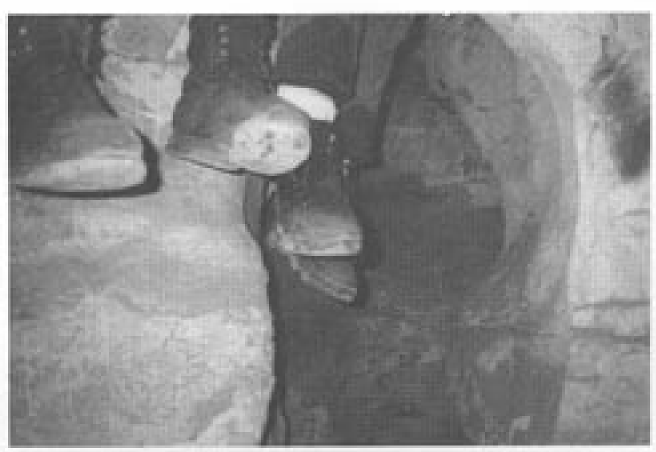
The Optimus explorer and Sigg Fire Jet didn't fare well, with overall scores of 2.5. Both had considerable lighting problems. The Explorer shot flames high enough to singe eyebrows, and the Sigg's tripod design seemed to channel the wind right into the burner.

The Peak I Feather 442 finished last with a score of 2.0. The main complaint was on maintenance. If this stove breaks down, the only thing to do is replace the generator which requires special tools. While camping, this can be a detrimental inconvenience. As the old saying goes, "Better safe than sorry."

When it comes down to it, the reliability of the Apex II, WhisperLite, and XGK make them excellent choices for any camper, and won't reduce a meal to nuts and berries.

Do you know your geography? What state is pictured here?

Kyle McCrea explores the entrance to the Moon Cave System, Carter County, Kentucky.



Where'd everyone go?!

The Hand

by
Tom Stitzel

With The Hand to his back,
the bent figure was pushed against the winds,
As he threaded his way through dankly shadowed hollers,
It gripped his one remaining lung,
Threatening to rip it clean from his body.
He stooped still lower in the pain,
A pain that seared in his heart,
His thoughts,
As much as in his lung.
One remaining tear,
That which he didn't know he had,
Slipped through an eye
Half-closed with the crust of neglect,
Slithered through bark-like creases in his face,
And whipped away with a bout of face-slapping winds.
He continued to be so folded into himself
That he nearly crawled,
Caring not about the mud slurping 'round his body.
He hardly understood what it was that he was enduring.
He only know that with manipulative cruelty
The Hand forced him onward,
Determined he should not stop:
He should not think;
He should not feel;
He should only obey.
The Hand's hold on him fumbled briefly,
Only to accentuate his torture
By plunging even more deeply into his bony frame,
Engulfing his heart muscle,
Then tightening with vice-grip's power.
He collapsed.
His mind he had lost.
His life he was losing As a vestigial source,
Squeezing out of him,
Gushed through monstrous tentacle
And dribbled downward.
Down into the bowels,
Where as diarrhea,
It leaked from his body
In a spray of greenish shit-water.
He felt no more.
His abandoned lung exhaled and collapsed,
Spitting up the last ooze of its tar.
It was no more.
The Hand slackened its grip on him,
Slipped out,
And moved on.

Matt Heiss crawls out of a hole while in Tar Kiln Cave, Carter Co., Kentucky.

Dream

by
Tom Stitzel

Climbing through the dreaded dullness,
I peel off dream's dead skin,
remnants of history's child.

Look forth, I say
towards what will be,
ignoring the voices pursuing.
The conventional accuses
murder in my mind.

Leave behind safety.
The familiar. The crippling.
An antiquated acquaintance
This changeless existence.

Let go the hand
of the dead self,
a now phantom,
drifting off with a thinning thread.
It connects but does not bind.

Poise for flight,
stretching beyond memory's limits.

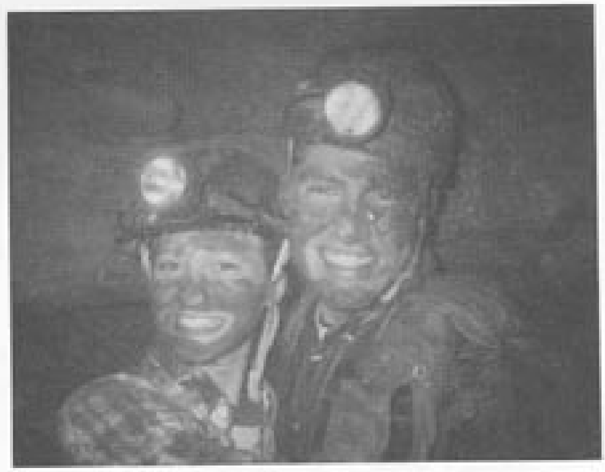
Reach for promised peaks
of conscious knowing.

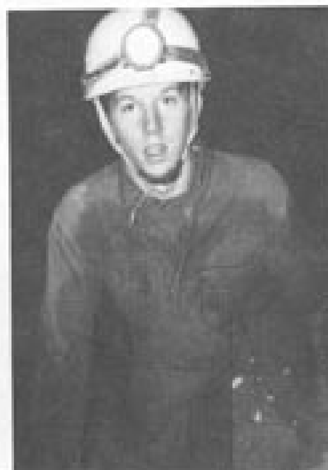
A newly reborn friend awaits the light.

Erin Athy smiles while underground.

The Muddiest
WUSSES of '96

photos by David Effron





Lee Ott, a sophomore, joined Wittenberg's Speleological Society the fall of his freshman year. After his first caving experience in Carter Caves, Kentucky, Lee had a few choice words in regards to the adventure:

"Mud, mud, and more mud! Go caving and you come back with an all brown wardrobe."

With a comment that sums everything up, Lee decided that "caving club is the coolest thing that you can do."

Steven Allen Kronk
1974-1995

WUSS 136
NSS 27645

Last year WUSS lost a dear friend with the passing of "Stevie" Kronk. Steve had been a member of WUSS for 10 years, and in that time enthusiastically contributed to countless projects. Steve was a fearless cave explorer always eager to push the black unknown. He assisted with many karst research projects, doing thankless jobs such as crawling through a muddy passage to find an endangered beetle or sloshing through a snake-infested stream to find a new species of crayfish.

Although he never seemed to fit into the traditional academic setting, Steve was driven to learn by the same curiosity that motivated him to cave. He read avidly and fervently delved into educating himself about his interests in nature and the environment. Steve was a passionate dreamer with a grand vision, and he would certainly want to be remembered for that optimism.

Steve's refuge seemed to be the Old Timers Reunion. OTR is a sanctuary for the free spirit, and perhaps Steve was never more at peace than around the bonfire at three in the morning on Labor Day Weekend. Stevie will always be a part of that bonfire and a part of the peace that we all feel in the warmth of its flames.

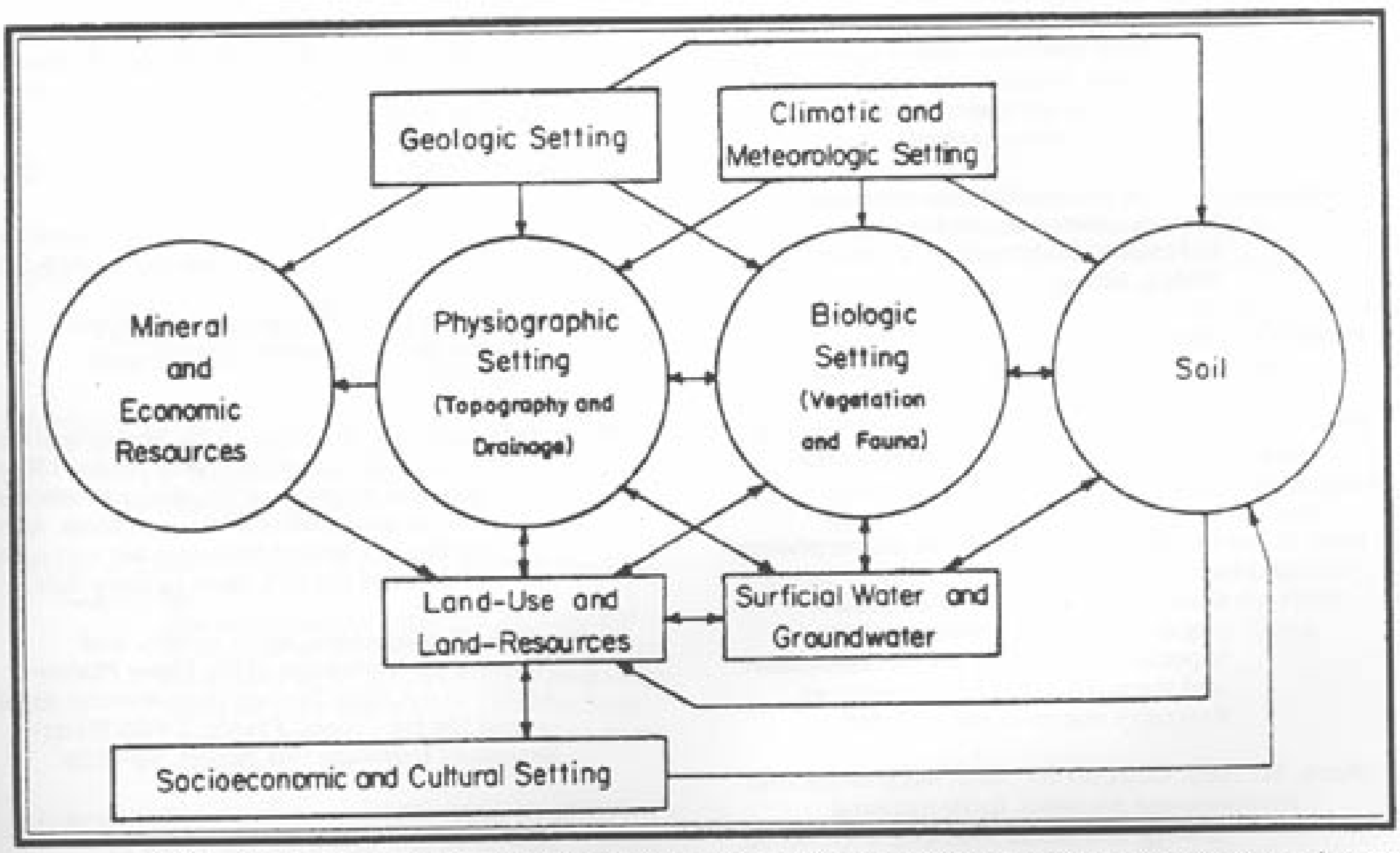
Toby Dogwiler

Environmental and Engineering Hazards of Karst

by
Megan Porter

Karst refers to any terrain where the topography has been formed chiefly by the dissolving of rock. Landforms associated with karst include sinkholes, caves, sinking streams, springs, and solution valleys. Because of the unique geologic and hydrologic features associated with highly developed subterranean networks, the scope of problems related to the karst environment is large. Karstic landscape is particularly sensitive to environmental degradation, with the depletion and contamination of groundwater supplies being among the most severe.

Karst features pose unique environmental and engineering hazards. In order to understand and prevent each hazard, an understanding of karst systems must be obtained. To this purpose, a bibliography of related papers has been assembled on the "Environmental and Engineering Hazards of Karst Terrain".



Cause-and-effect relationships among geologic, biologic, geographic, and human factors in karst terranes. Arrows portray directions of effects (Kastning, 1989).

General Background

Assaad, F.A. and H. Jordan. 1994. *Karst terranes and environmental aspects.* Environmental Geology, 23(3): 228-237.

Examines the reasoning and need for protection of groundwater in karst against pollution. A discussion of the use of tracer methods in karst regions is included.

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A collection of papers on a wide range of hydrologic problems related to karst. Each paper provides reference on the specific topic discussed making this a valuable reference source.

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Environmental Hazards of Karst

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GROUNDWATER DEPLETION AND CONTAMINATION

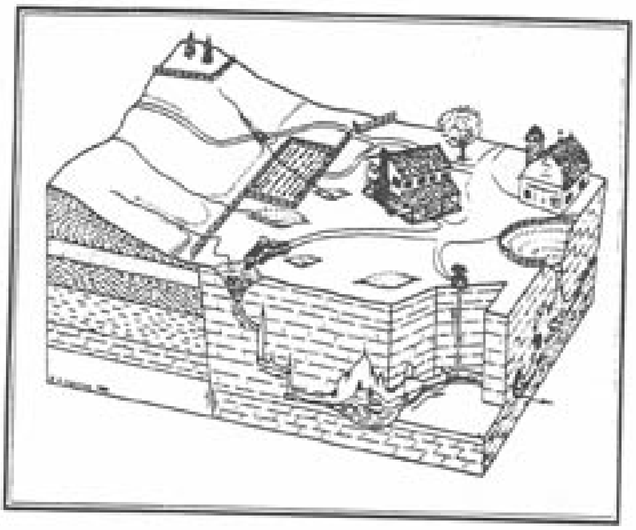

Figure 2: Groundwater contamination in limestone terrane. Pollutants enter the karst system through improper waste disposal and form surface runoff through fertilized cropland. (Kastning and Kastning, 1989).

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After a pump test on a groundwater supply well resulted in lowered farm pond water levels, development of a sink hole, and water level decreases in residential wells, an assessment study on the impacts of lower design yields was performed. Impacts evaluated include: sinkhole development and potential damage to homes, loss of water in residential wells, and water-quality degradation. The resulting implemented mitigation plan is discussed.

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W U S S GATHERINGS

Past and present members of WUSS at 15th Annual Reunion, May 1995.

WUSS campsite at 1995 NSS convention, Blacksburg, Virginia (photo by H. Hobbs III).

Happy WUSSes at Crawlathon 1997 (photo by H. Hobbs III).

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SPELEOLOGICAL SOCIETY

Descent into Elkhorn Mtn. Cave, Grant Co., WV (photo by H. Hobbs III).

Rick Olson exiting Buffalo Creek Cave, Edmonson Co., KY (photo by H. Hobbs III).

Viewing the "pretties" in Elkhorn Mtn. Cave, Grant Co., WV (photo by H. Hobbs III).

Collecting amphipods in Dillion Cave, Orange Co., Indiana (photo by H. Hobbs III).

Climb out of Roadside Pit, Pocahontas Co., WV (photo by H. Hobbs III).