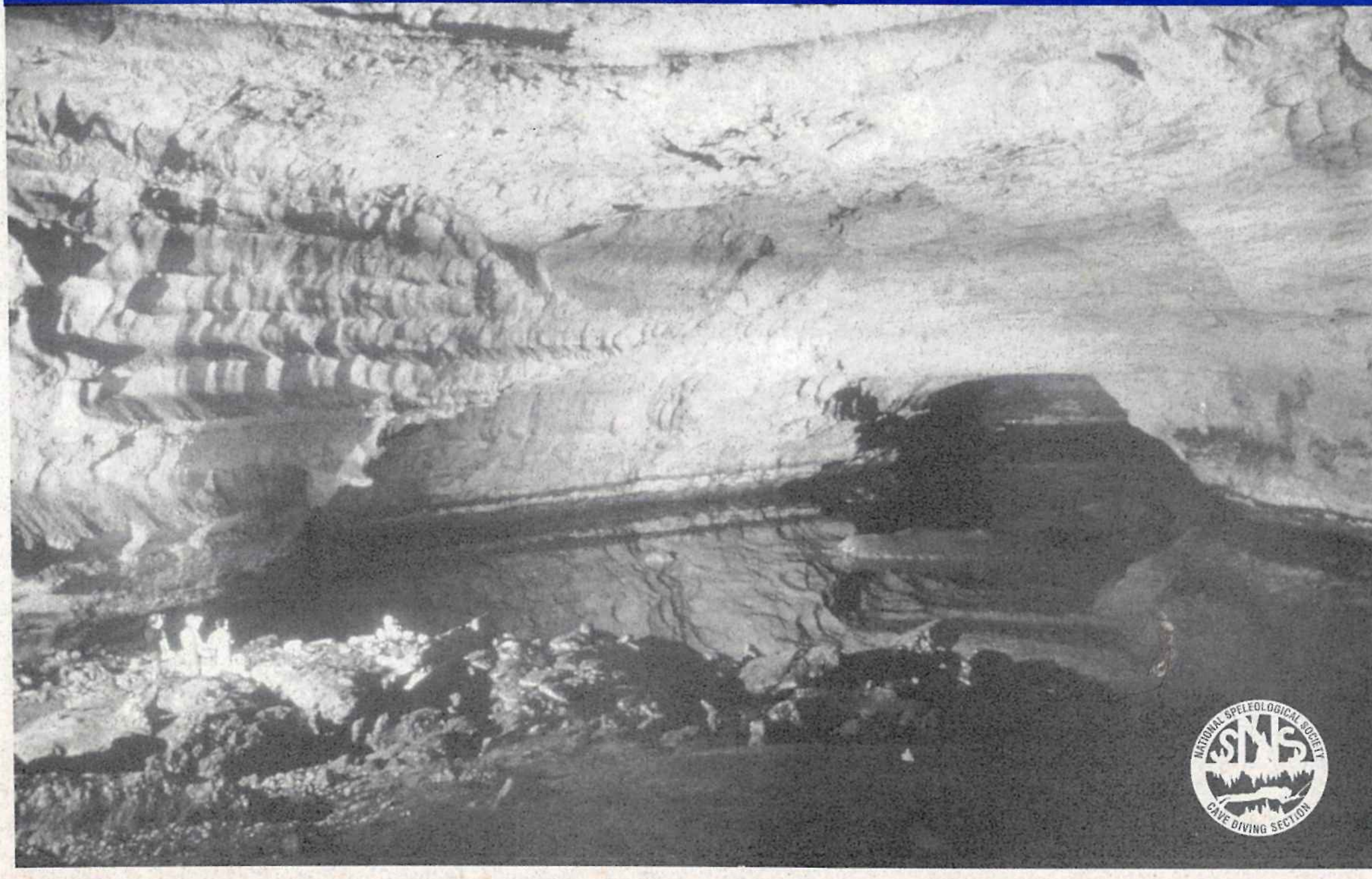
Underwater Speleology

Sept/Oct 1995 Vol 22 No 5



DOWN UNDER AUSTRALIA

Contents

Advertising–Please contact the editor to receive a rate sheet and other information for advertising in *Underwater Speleology*

NSS Membership–The National Speleological Society welcomes the interest of anyone who has a sincere concern about the safety, study, exploration and conservation of caves, wet or dry. You may join the NSS by writing to 2813 Cave Avenue, Huntsville AL, 35810 or by contacting the Cave Diving Section with a $25 membership fee. The membership includes discounts on publications and conventions, as well as the *NSS News* and Members Manual. You are also eligible to vote in all NSS elections.

CDS Membership–As a sub-organization or "section" of the NSS, the Cave Diving Section is subject to the bylaws and ethics of the NSS. Membership in the Cave Diving Section is open to anyone in good standing with the NSS. Annual membership is $10 and includes a bimonthly subscription to this publication, *Underwater Speleology*, as well as voting privileges, publications and seminar discounts. Please send membership requests to Bruce Ryan at the NSS–CDS Main Office. Make checks payable to the NSS–CDS.

Subscription–If you do not wish to join the NSS and CDS but would like to receive *Underwater Speleology*, you may subscribe to just this publication for $20 per year. Send funds to Bruce Ryan at the NSS–CDS Main Office; make checks payable to *Underwater Speleology*.

Classifieds Policy–Free Classifieds for personal dive gear are available to members in good standing with the NSS–CDS.

Submissions

UWS welcomes your submission. We assume that anyone submitting photos and/or graphics has obtained proper permission from the cartographer/photographer for reproduction of such material in *UWS*. All submissions are subject to standard magazine editorial practices. Unfortunately, we cannot publish everything we receive. If you have an idea for an article but are unsure if it is suitable, please feel free to contact the editor.

Submission Deadlines

Sept/Oct	August 20
Nov/Dec	October 20
Jan/Feb, 1996	December 20
Mar/Apr	February 20
May/June	April 20
July/Aug	June 20
Sept/Oct	August 20
Nov/Dec	October 20

UWS is printed on recycled paper.

Events

1996 Board of Directors: Look For Ballots Soon!

The nominations process will be complete by October 15 and members will soon be receiving a ballot and the platform statements of the candidates for the 1996 NSS-CDS Board of Directors. As many current Board members have stressed, this is your organization; please take the time to cast your vote!

Visit DAN on the Internet: http://www.dan.ycg.org

DAN now has a presence on the World Wide Web, thanks to a donation of technical support and expertise by Yakstis Communications Group (YCG) of Fenton, MO.

Enter http://www.dan.ycg.org to find DAN's Web site on the Internet. Presently, the home page links to areas describing DAN's benefits and services; mission statement; contact information; and DAN's Medical Line, with answers to frequently asked diving safety and medical questions published in *Alert Diver* magazine.

If you have questions or comments about the DAN Web site, contact Barry Shuster at shust001@mc.duke.edu.

UWS Moves!

Well, actually the editor of *UWS* has moved. Please note the new address and phone number for *UWS* on page two of this issue, and please accept my apology for the delay in this issue.

National Geographic Publishes Huautla/San Agustín Article

Bill Stone's article on last year's expedition to the Huautla Cave system has been published in the September, 1995 issue of *National Geographic* (Vol. 188, No. 3).

"Cave Quest: Trial and Tragedy a Mile Beneath Mexico" is a fourteen-page article containing many impressive photos by Wes Skiles and Bill Stone, a 3-D map of the cave, and a representation of the closed circuit rebreather used in the expedition. Sidebars include "Radical Breathing Gear," "To Plumb the Deepest Puzzle," and a day-by-day account of the push from Camp 5 by Bill Stone and Barbara am Ende.

Underwater Speleology readers will remember that Barbara wrote a story on this expedition for *UWS* that appeared in the January/February 1995 issue (Vol. 22, No. 1).

Volunteers (Always) Wanted

Wayne Marshall, member of the Board of Directors and Volunteer Coordinator, is continuing his call for volunteers. Wayne will serve as the "contact" person in all volunteer matters, unless otherwise stated. Wayne can be reached at the address on page two of this issue.

One project currently available is an indexing of the Board of Directors Meeting Minutes. This would be a quick reference guide for current Board members, and could also serve as a sort of handbook for being a Board member. Mainly it is envisioned as a way of confirming previous action taken by the Board on any subject.

Volunteers Are Needed For:

1) Board of Directors Minutes Book
See paragraph three of this article for a brief description, or contact Wayne Marshall.

2) 1996 Workshop
Why wait! Get your ideas in now and volunteer your time for next year's Workshop. Send ideas to the NSS-CDS Main Office, PO Box 950, Branford FL 32008, Attention: 1996 Workshop.

Calendar

November

10-12 NACD Workshop to be held at the Holiday Inn West in Gainesville, Florida. Contact Lloyd Bailey at (904) 332-0738.

January, 1996

12-14 Tek.96 in New Orleans, Louisiana, sponsored by *AquaCorps*. To register, call (800) 365-2655; (305) 293-0729 (fax); e-mail: 73204.542@compuserve.com.

May

24-27 The 1996 CDS Spring Workshop is now in the planning stages. To volunteer, please write to the NSS-CDS, PO Box 950, Branford FL 32008, Attention: Workshop 1996.

August

3-9 NSS Convention, Salida, Colorado. Contact: 1996 NSS Convention Committee, c/o Skip Withrow, 5404 South Walden St., Aurora, CO 80015, (303) 693-0997.

The Safety Line

Cave Conservation
By Wendy Short, Safety Coordinator

One of the greatest rewards of cave diving is enjoying the pristine beauty of the caves. Dramatic geologic limestone features have been carved into graceful folds and grottos over aeons of time. Gin-clear azure blue water stimulates our visual senses equaled only by a few other spectacular places on earth. We enjoy traveling through a place that not many enter, and we expect it to look untouched.

All too often, though, this haunting beauty looks anything but untouched. Heavy traffic, scooters and carelessness have caused destructive changes over a very short period of time. Often pieces of prominent features are broken off the walls and litter the floor. Hand prints, fin tracks and other marks have permanently marred some ancient serrated clay mounds. Rocks on the floor are scratched and decorated with different colored paint from numerous stage bottles being dragged along. Rocks have lateral scars where guidelines have cut into their faces. Scooter tracks mar the floors in every popular system, and rocks have been chipped out of the ceilings above where valves have scraped from impacts. The caves have taken millions of years to form, and will take just as long to eradicate the unnatural marks we leave here. If each diver just broke off one rock, or left one handprint in one system, it would not be long before that would be all there is to see. There is a definite correlation between the amount of traffic in a cave as it becomes more popular and the wear and tear on the cave.

The caves are not renewable resources. Each diver needs to be aware of his/her skill level. Avoid places that may cause you to damage the cave because of your inexperience. Practice your technique in larger passages that are more forgiving until you have mastered the technique. Avoid wrapping tie-offs on fragile structures. Be careful what you grab when you pull and glide. Many rocks that look stable will crumble or break off with the slightest pressure. Be aware of sensitive geothite, the black formations that are found in many systems, and don't touch it. Challenge yourself to become the most skilled diver you can be, and then take pride in your accomplishments. Ideally you should be able to come and go out of a cave with no sign of your passage (this includes silting). If you're an instructor, be selective where you conduct your training.

We are constantly being called to preserve and conserve everything around us, and the caves are no exception. The decisions we make regarding conservation today will affect the cave diving of the future. We desire more access to more places. But as usage has become heavier, access has become more limited to protect these fragile resources.

Why destroy the environment that we came to enjoy? We can only blame ourselves, for we are the users. And we are the ones who can stop the damage. We do not want what's happening to the coral reefs of the Florida Keys to happen to our caves. Let's "cave softly" and preserve these systems for us and for the generations who will follow.❖

In Memory . . .

Grieving Corey Berggren

When you dive with a buddy, the strengths within the team are there for each other. As we grieve the death of Corey Berggren, we are buddies unto each other, offering support and sharing memories. Is there any of us who would wish to do this solo? I thank each of you who extended comforting words and your presence to me.

Many non-recreational dives or technical dives today are done solo by virtue of the dive site's conditions. And often the reality of a dive is that even given a buddy, he or she can ultimately do very little when disaster strikes.

As the accidents of those who are incredibly experienced, technically-capable divers are on the increase, is there anything we can do about human error? Are we, the experienced ones, not utilizing an opportunity for backup as we prepare our equipment, the dive plan, our minds, and finally enter the water?

Sure, we are capable, each of us, until an "accident" happens.

Would not any of us be willing to be the eyes and ears, to give the moment it takes to reaffirm another's calculations or dive readiness? Of course.

In a sport that has inherent risks, there will be accidents–whatever the cause. There will be sorrow shared, and memories recalled in tribute to Corey. He touched many lives, sharing what he loved best–scuba. We will miss him.❖

–Patti Osborn

Robert D. McGuire

Robert D. McGuire of Orlando died Saturday, July 15, while cave diving in Madison County. He was 32.

Born in St. John, New Brunswick, Canada, Mr. McGuire moved to Orlando from Camp Lejeune, NC, in 1994.

He enlisted in the Marine Corps in 1980 and served as a drill instructor at Parris Island. Later, he was promoted to staff sargeant and was assigned as an instructor at the Noncommission Officer's Academy.

He graduated from the University of Florida in 1990 and became a captain in the Marine Corps. He was a project officer for Marine Corps ground programs in Orlando. He received the Major General Wheeler Award for infantry excellence.

Mr. McGuire was an avid cave diver and videographer.

Services were held in Gainesville, FL, on Wednesday, July 19, 1995.❖

A Trip to Hungary:

by Steve Porter, NSS # 25149

In October, I was fortunate to dive in the largest natural hot water spring in Europe. Located in western Hungary, it is known as Bad Hévíz (pronounced Baud Hay Veez) or Lake Hévíz. It is situated near the northwest shore of Lake Balaton, the largest freshwater lake in Europe, and can be reached by driving approximately three hours west from Budapest. The lake covers an area of 4.5 hectares (approximately 11 acres). The average depth is three meters (10 feet), however the thermal vent supplying the lake reaches a depth of 49.5 meters, with a water temperature of 40°C (163', 104°F).

The water composition at Hévíz includes several thousand-year-old sulfurous, thermal water which is suitable for the treatment of rheumatic-locomotive diseases. The lake's bottom is covered by a mud layer several meters thick, which contains the therapeutic substance concentrated in the water. In 1913 Hévíz became the location for a state established Rheumatological and Physiotherapeutical Hospital and Spa which utilizes the curative waters and medicinal mud in a variety of treatments, including degenerative joint and disc diseases, osteoporosis, arthritis, and muscular atrophia.

Never having been there before, I was unsure if I turned onto the right road after leaving Lake Balaton. It was 9 AM, and I was to meet members of the Amphora Dive Club at their headquarters across the road from the main entrance to the Spa. Suddenly, I was engulfed in fog that rose at least 20 feet above the road and had a sulfurous smell. After a few more curves in the road, I pulled into a parking area to inquire as to the whereabouts of the dive club, and the attendant pointed to a building about 50 feet away. Entering the building we were greeted by the club's president, György Kovács, and several other divers who had come down for a weekend of training and/or data collecting. The most notable and obvious fixture in the building was a large multi-unit recompression chamber. Currently decommissioned, it serves as a "hotel" for the weekend divers who drive from Budapest. Fortunately, a diver by the name of László Ábel was able to interpret for me. While we waited for an earlier dive team to finish some work in the spring, I was given a summary of the diving activities and unusual discoveries by the Amphora divers.

Undoubtedly, there are no records of the earliest dives. However, before the end of the last century, shallow excursions were being conducted beneath the surface of Hévíz. Over the next sixty years, attempts to reach the source of the water would be hampered by the unavailability of technology and equipment. By 1960, divers thought they had found the source at a depth of 38 meters (125 feet), but it was not until 1975 that they pinpointed the area where the water is coming from. What they found was a sediment-choked opening at the base of a sandstone headwall measuring 3 1/2 meters wide by 30-40 centimeters (12-15 inches) high. Efforts to excavate the opening proved futile, as the side slopes filled in their work.

The following year two concrete block walls were installed near the center of the cross section approximately 2 1/2 feet apart. The walls not only prevented slippage of the side slopes back into the excavation, but alleviated the

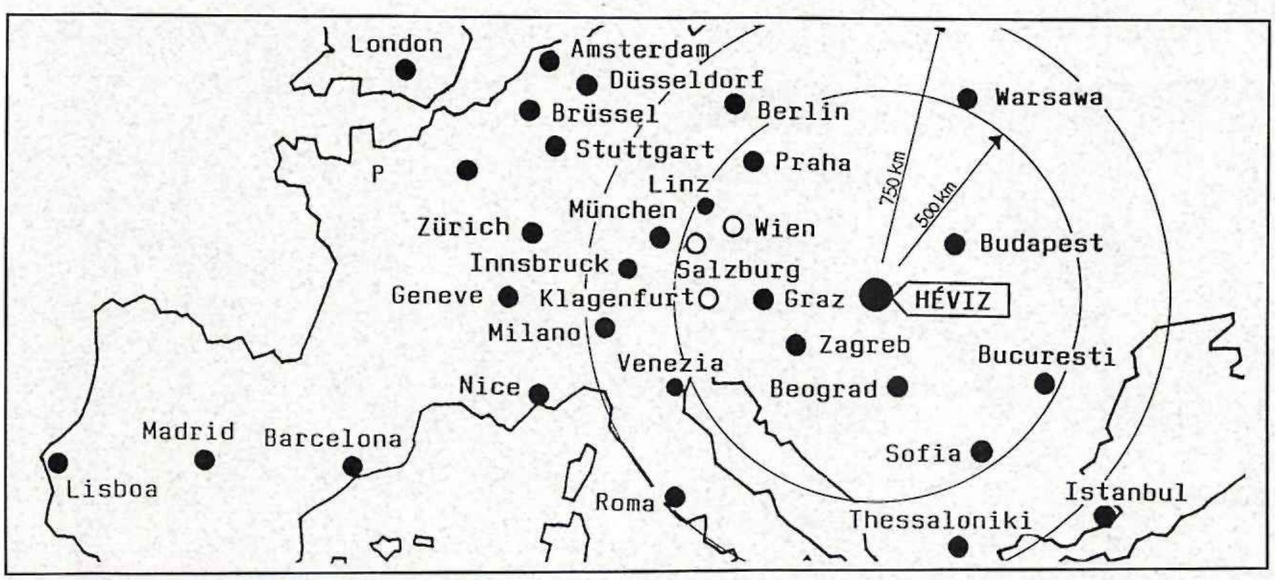
Bad Hévíz

need to excavate the entire cross section. Furthermore, a channel was created which harnessed the spring's powerful discharge and facilitated flushing of the system. The opening through the sediment plug increased to 80 centimeters wide by 60 centimeters high (31.5" X 24").

In 1977, two fatalities suspended diving activities. It was June of 1982 before permission to proceed with the project would be granted by the Ministry of Environment and the spa's owners. A massive excavation, using vacuum dredges, finally paid off, and the first divers entered the room. A survey of the room was started and systematic measurements of water temperature, clarity and composition in five or six locations in the room commenced. These measurements were repeated at approximately the same time of day, usually on the weekends, for more than a year. A typical dive to take measurements lasted 25 to 35 minutes in 40°C water; total dive duration with decompression was 1 1/2 hours. (Eventually instruments were permanently installed so a team would merely go down and read them, thereby cutting the dive time to 10 or 15 minutes.)

Using thermometers that read from 0° to 55°C in 0.2° increments, it was determined that five unique regions exist within the chamber, each with various water characteristics. Different areas contain hot water, cold water, mixed, cloudy or clear. Two types of water from entirely different sources mix in the chamber. 41°C (105.8°F) thermal water issues up from vents located near the floor, while 17°C (62.6°F) karst water (percolating in from the surface and surrounding rock as opposed to originating deep within the earth) is introduced from vents higher up the walls.

Besides the excavation of the main chamber, 1982 saw other clean up efforts take place as well. A series of 28 dives (totalling 112 hours) were logged in efforts to clean up debris and litter introduced by the lake's visitors. Other diving activities included a thorough



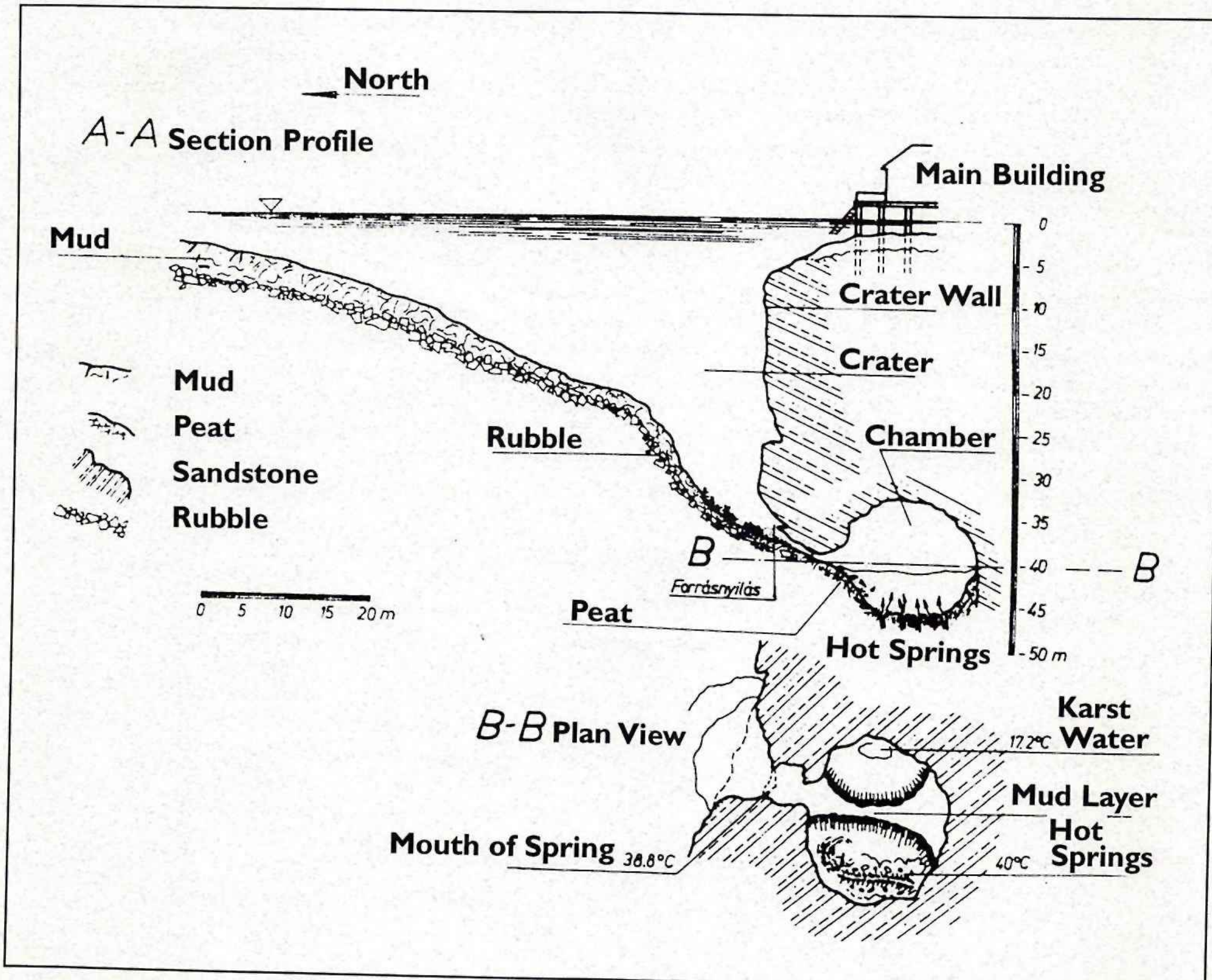
Location of Bad Hévíz

Bad

search of the lake bottom. Burrowing through one to eight meters of muck, divers retrieved ancient pottery and Roman coins dating to the first and second centuries A.D.

After the historical briefing, I was given an update of recent developments and current diving activities. Of special interest is the relationship the dive club enjoys with the Spa. Lake Hévíz is strictly off limits to diving for everyone but the Amphora Club. The club's special privilege is due to the synergetic relationship between the two interests. Not only has the club been involved in the exploration and excavation of the spring, but they also designed and installed a ten-inch diameter pipeline which delivers water from deep within the spring directly into the central bath house before it has a chance to circulate and cool

Plan & Profile View of Chamber



down in the much larger surrounding lake. This is critical to the hospital's operation, as the water must remain within a narrow temperature band to be effective in their treatments. Several years ago this became apparent when bauxite mines in the region pumped a significant amount of groundwater, greatly reducing the spring's discharge. As a result, the water temperature dropped in the surrounding lake and was not optimum for use in the Spa's bathhouses. Although Hévíz is a site recognized by the World Heritage Foundation (a United Nations organization whose aim is to protect natural resources around the world), they apparently didn't have as much influence as the bauxite mine.

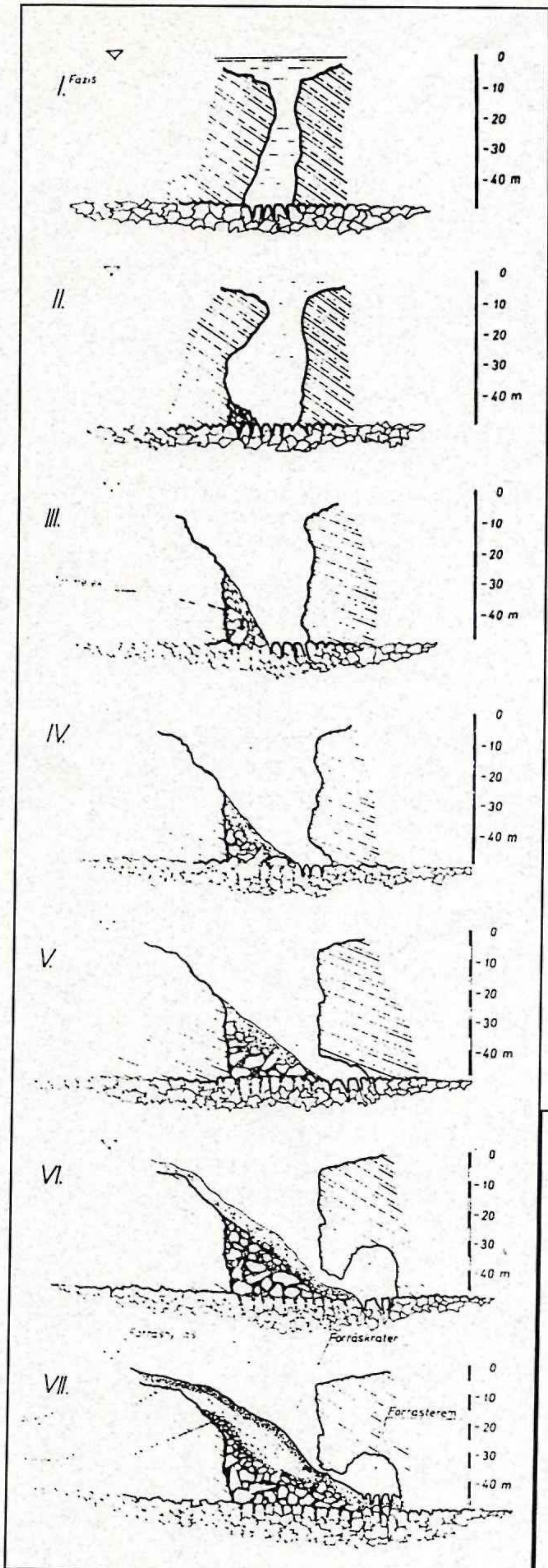
The installation of the pipeline required further excavation of the large cavern at the bottom of the fissure vent connecting the spring and lake. Because the cavern has a steeply sloping floor leading up through the vent, excavated debris was constantly sliding back into the chamber. To remedy this situation, aluminum retaining walls (water at Hévíz rapidly corrodes steel) were constructed and installed along the slope of the crater. Although this proved to be effective, debris continued to find its way to the bottom. To keep the opening from filling in again, two aluminum bulkheads were placed two meters apart and perpendicular to the concrete retaining walls at the entrance to the cavern where the water passes through a narrow crevice before rising up the vent and connecting to the lake. Each bulkhead has a "window" approximately 75 centimeters square (2 1/2) feet x 2 1/2 feet) and about three meters off the bottom to allow the water to flow out while, at the same time, creating an impenetrable barrier to the debris that would otherwise choke the entrance. Additionally, cables between the surface and monitoring instruments located at 12 individual vents within the cavern were installed, which monitor the temperature and velocity and can be directly read from the surface.

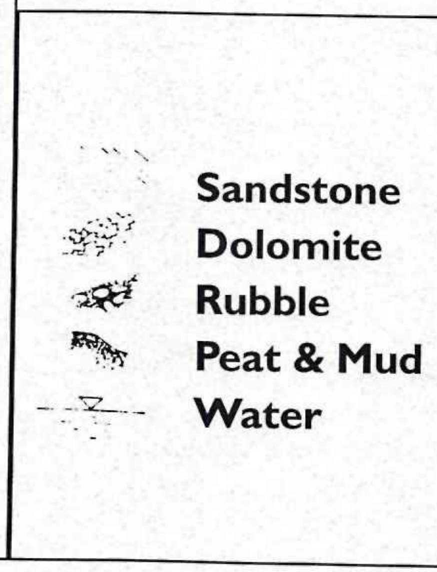
Other findings and studies have been carried out by the club with the assistance of several scientific entities and sponsors from around Budapest. They have noted a continually changing water velocity (average is 350 - 400 liters per second; approximately 100 gallons or 16 cubic feet per second) with occasional pulses that significantly increase the flow. Their observations lead to predictions in the early 1980's that the temperature in the lake would decrease, and in fact it has. Between 1980 and 1994, the mean temperature in the big lake dropped from 38.8°C to 35°C or approximately 7°F. Two species of previously unknown algae, one white, one blue, have been discovered. The entire lake bottom is made up of a jelly-like substance that has the beneficial property of encapsulating the mud, thereby slowing down its slippage into the crater. They have determined the mud slippage rate down the slope to be 1.5 meters per year with an accumulation volume of 10 -15 cubic meters per year. One theory links the jelly-like substance to the composition of the medicinal mud used in the Spa. Another discovery was near the thermal vents: small-pored sponge-like animals. They thrive near the strongest flow. When first discovered, the divers thought it to be mineral–some type of rock. However, breaking or cutting a piece off for examination revealed the outside to be brown or dark red while the inside was a lighter shade of red.

During the explanations and stories, they also showed me plan and profile maps as well as many photos. Next we discussed the tables we'd be using, which were developed specific to this spring because of the elevated water temperature.

After the briefing, it was determined that we would have

Bad





Theory of the Evolution of the Crater

about a two hour delay while the first team finished up and tanks were recharged. My companion, Eszter Varga, and I were invited to enjoy the Spa while we waited. The entrance fee was waived because we were guests of the dive club. Along with the many ailment remedies, the Spa offers a variety of therapeutic massages. For $8.00 I got a 30 minute pre-dive circulatory system refresher. After that I took a dip in one of the many baths to test the waters: very pleasant at 37°C (98.6°F).

Finally, it was time to get suited up. Everything was provided (I didn't realize I'd be diving in Hungary and hadn't brought any gear). I was given twin ten-liter tanks with manifold and J-valve, ScubaPro regulators, a farmer john (no jacket), a jacket style BC, metric depth and pressure gauges and an adequate though solitary light. Some divers wore helmets, and everyone had redundant gas supplies.

Our dive plan was simple. I would follow György down the funnel until we reached the metal bulkheads. At that point, he would look to me to make sure I was ok and if so lead me through the two portals in the bulkheads connected by a 22 meter span of wooden planks that the divers pull themselves across. The planks serve a dual purpose: 1) as a safety net, because once the first diver goes through, the visibility drops to zero but the physical contact with the planks serves as an orientation point as well as keeping disoriented divers from slipping to the bottom between the two bulkheads, and 2) the planks provide the necessary hand grips needed to pull into the system against a force of out-flowing water equivalent to Florida's Devil's Ear Spring. Upon passing the twin bulkheads, we would have approximately 15 minutes to tour the Ginnie Spring-size cavern.

We entered the water, which was immediately warm and comfortable due to the cool air temperature. Surprisingly, the visibility was only about ten feet. As I followed György down the fissure, I went through layer

Hévíz

after layer of temperature changes. It didn't progressively get warmer as I expected, but alternated between warm and comfortable, chilly, and a little too warm. That may have had more to do with where I was in relation to the main channel of flowing water than depth or water composition. We stopped briefly at the outside of the first bulkhead where he signaled to me to close ranks. I gave him the ok signal and he proceeded through the portal. In the next moment, I saw brown water billowing out at me as though I were suspended above some huge smokestack. I started in and felt a very gentle pull on my right elbow as György, who I could not see, briefly directed me until I found the planks. I pulled myself across, and within 15 seconds, I joined him in the gin-clear water while coming on to a slight narcosis buzz.

Wow! I was euphoric. The foreign depth and pressure gauges may have played a small role, but there was more to it. After the swim down through turbid water and the swim through a "smokestack," I wasn't expecting much. Then suddenly I felt like I was in a beautiful Florida cave. György handed me his mega light, a homemade light of durable construction containing twin 50 watt lamps. With it I was able to light up nearly the entire cavern. One by one several other divers entered the cavern carrying robust, homemade, photographic equipment (strobes, brackets, arms). Swimming the perimeter of the chamber, György pointed out the various vents and inspected cable anchors for corrosion. We dropped down to the bottom, where he showed me the most promising going lead. After a short distance under a ledge, it appeared to be heading towards no-mount country. Later, on the surface, György told me of a rock collapse several years ago that had trapped him in there for the longest five minutes of his life.

During the post dive debriefing, we relaxed with a bottle of Palinka, considered a national treasure in Hungary. It's an intoxicant comparable to Mexican Aguardiente, and usually produces similar results. Everyone was eager to hear me describe my sensations of going through the bulkheads, and they jokingly referred to it as the "psychological window." I gave them my overall impressions of the dive, and complimented them on their excellent job of accommodating a foreigner. Next they began to ask questions about cave diving in Florida and Mexico. They pointed out that not only are they free to travel these days but that airfares are making their dreams of diving here more tangible. Of particular concern was if they would be able to get access and/or what kind of certification documentation might gain them access (I don't think Hungary, or many countries for that matter, have organized cave diving sections). I told them their best strategy is to contact Florida cave divers and that I would be glad to help in that area.

I anticipate Hévíz becoming the dive mecca of senior citizen cave divers who will be lured by the challenging entries, warm water, beautiful caverns, short bottom/hang times, Palinka Palinka and all the physiological benefits Hévíz is renowned for.

Thanks to Lamar Hires and DiveRite for donating some cave diving literature which I requested and subsequently forwarded to Hungary. I'm sure it will be beneficial both in terms of scrutinizing their own methodology and in planning that dream dive trip.

A very special thanks to Eszter, who made the dive and this article possible.

In closing, the hospitality was exemplary, and I look forward to returning the favor. Maybe I'll be able to be an "ambassador" to them someday. My only regret was the language barrier, which prevented us from sharing more information.❖

References: 1980, 1982 Annual Reports of the Amphora Dive Club.

TO CONSERVE

CAVE FEATURES AND

by Tom Morris, Conservation Coordinator NSS# 24256

[Editor's Note: We had hoped to be able to present photos of many of the features focused on here. Yet we do not have good photos of all of these features, and we encourage photographers to help us make a photo archive, perhaps one day for instructional purposes. We do have a few good photographs of these features, and we will run them as soon as I locate the moving box that contains them. We look forward to your submissions, and to any comments or feedback on this conservation series.]

Our caves are often referred to as conduits, and indeed they are. But they are much more than pipes that move water. They are beautiful landforms well worth protecting for their aesthetic appeal alone. In the last issue of *Underwater Speleology*, I brought up the problem of how we divers are unnecessarily trashing our caves and what we might do about it. This article is a continuation of that discussion.

Every cave diver should strive to become familiar with the cave environment, for the sake of the cave as well as one's own safety. This includes the ability to recognize the various cave features and assess their susceptibility to damage. There are two components involved in susceptibility to damage: 1). fragility (how easily a cave feature is damaged) and 2.) ability to heal (how long a damaged feature takes to heal, if it can heal).

It is possible to rank cave features based on their susceptibility to damage. The following ranking focuses on features found in Florida's underwater caves, starting with those most susceptible to damage.

GEOTHITE

Geothite, one of our most spectacular cave features, is a mineral deposit, composed mainly of iron and manganese oxides, that probably form with the aid of bacteria. Significant geothite formations form extremely slowly, probably over centuries.

Geothite comes in many forms. The black coating on the walls of Devil's Eye is geothite. The rust-colored deposits in Peacock Slough that look like hollow tree stumps or jugs are geothite. Geothite forms amorphous masses that look like dark cumulus clouds as well as crystalline-looking complexes of parallel spires. Geothite forms a black crust on clay and sand substrates, such as the large plates beyond the split in Devil's Eye, and there are even places with geothite sand. One condition for geothite formation is the presence of a stable substrate. It forms so slowly that it cannot get a good start on ephemeral substrates, such as the actively eroding rock walls of sinking point caves with their aggressive water.

Geothite is easily damaged. It is often just a fragile crust over clay, sand, fossils or rock. Massive deposits are often hollow. Damaged geothite formations *never* heal. Because of this, it heads the list of susceptibility to damage. Learn to recognize this stuff.

DELICATE ROCK FEATURES

Florida underwater caves don't have speleothems (stalactites, etc.), but there are many rock formations that are just as beautiful and fragile. Delicate erosional remnants, such as thin rock shelves, curtains, scallops and pendants, are common in our caves. Less

& PROTECT

THEIR SUSCEPTIBILITY TO DAMAGE

common are the really fantastic remnants such as huge chunks of sculpted rock held to ceilings or walls by a thin arm of rock. Unfortunately, these features are some of the first things to go after a cave becomes popular. This is too bad, because these are some of the real treats to be found in pristine caves. Just the slightest touch is enough to break off many of them, so they belong in the easily damaged class. And they do not heal.

Get in the habit of swimming your dives. Many Florida caves are formed in soft rock that is not suitable for handholds. Pull on the cave only where it is absolutely necessary, which is only in the highest flow caves. Pull and glide is not a valid technique–if you can glide, you should not be pulling, you should be swimming.

The floors of our popular caves are now littered with rock fragments that have been knocked off ceilings by poor divers. Tanks are effective battering rams, so stay away from the ceiling when moving through a passage. I prefer staying a little closer to the floor than the ceiling. It is easy to see the floor and avoid touching it, but the ceiling is hard to keep an eye on. And please, avoid using the horrible ceiling-walking (fly-walking) technique. It is hell on the ceiling, drops "crumbs" on the floor, and doesn't work well because of the irregularity of most ceilings.

CLAY FLOORS AND BANKS

Clay floors and clay banks (usually beautifully stratified) are common. They are often found in high flow areas and are usually at their prettiest in such spots because they are swept clean of silt. They persist, or even form in high flow, because of the electro-attractive forces that bind clay particles. Cave forming limestones in Florida are quite pure, so most of the clay in our caves originates outside the cave.

Clay floors and banks are very easily scarred, and such scars last a long time, probably decades. I know of a scar in the clay floor in the Big Room of Devil's Eye that is over twenty years old, and it is nowhere near healed, even under moderate flow. So, don't touch clay! That includes the setting down of scooters and tanks.

SAND FLOORS OVER CLAY

It is common to find sand floors that are underlain, usually less than an inch or two deep, by clay. They are usually found in high flow environments. The sand dunes, and indeed all the sandy floors in Devil's Eye, are good examples of this. These floors are easily damaged and slow to heal. In fact, once the surface is scarred, the equilibrium between floor and flow is upset, and the damage spreads by flow-induced erosion. So, don't touch these floors. That includes the stashing of tanks and scooters.

BACTERIAL COLONIES

Though not common, bacterial colonies occur in many caves. These colonies consist of huge numbers of individual bacterial cells, and they are held together very loosely. Because of this, they can be blown apart by a single careless fin kick. These features tend to heal, but may take months to reach their former glory. Troglobites may depend on these colonies. In several caves, copepods, which are presently unidentified and may be troglobitic, can be reliably found in bacterial colonies, but not elsewhere. Be careful around these colonies.

SILT FLOORS

Most of the silt in our caves originates outside the cave. Much of it is organic in nature, although small inorganic particles, such as clay, are often part of soft silty floors. Contrary to popular belief, silt is one of the beautiful features in our caves. It is not something to be feared, despised or abused.

Silt floors are easily damaged. Many of the silt floors in our caves are a mess, such as the once beautiful silt floors in the Crossover Tunnel and Peanut Restriction areas of Peacock Slough. Fortunately, silt floors do heal in caves that experience moderate to high water flow, although it may take several years. However, damage to silt floors in low or no flow caves may take decades or even centuries to heal. I know of one no flow cave where the silt bottom was scarred in the late 1950's, and the damage is still evident.

TRUE SAND FLOORS

True sand floors are rare. They are usually found in high flow caves downstream of a sinkhole or crack, which provides a source of sand from the surface. Coarse sand floors in high flow caves are relatively undamageable, and marks usually disappear in a matter of minutes or hours.

The shoveling technique may be used in high flow caves with sand floors. This entails sticking your fingers in the bottom to help make progress against the flow. However, it is extremely important to realize that sand floors are never continuous, but occur as a mosaic with other more easily damaged sediments, such as clay. It is also easy to confuse a sand-over-clay floor that can be easily damaged with a true sand floor. In fact it is so easy to confuse the two that I hesitated even mentioning the shoveling technique. So be very careful when touching what appears to be a sand bottom. If your first gentle touch indicates the sand floor is just a veneer, and that scar-able soft sediments are present, don't touch it again.

Here is an example of the care I take to leave no sign of my passage. Many sinking point caves have sand floors. They also tend to have lots of catfish, which leave their telltale "bites" in the sand. If I shovel in these caves, I place just two fingers right in the catfish bites, thereby leaving no new marks in the floor.

COARSE ORGANIC DEPOSITS

Deposits of leaves, stems and other debris often accumulate near cave entrances. They often become peaty with age. Old deposits may be of scientific interest. A peat bank several hundred feet inside Devil's Eye was radiocarbon-dated to about 1800 years B.P. (Bill Wilson, personal communication) and is probably the best evidence for dating a great flood in the Santa Fe River Valley. Peat deposits are not easily damaged, but if they are torn up, they are shot for good.

DEBRIS CONES

These are generally cone-shaped piles of rock, sand, clay and other material that has fallen into a cave from above. They are often found under surface depressions or on the floor of collapse sinks. These are very striking features and may be of paleontological interest. The coarser deposits are not easily damaged. Debris cones should be dug into for scientific purposes only.

FOSSILS

Fossils should be left where they are found. There seems to be a strong tendency for divers to take these things out of caves. The scientific value of fossils is often lost when casually removed, and many of the fossils, particularly bones, crumble when they dry. Also, by removing fossils, you have denied others the thrill of discovering these things themselves in their natural setting. There used be a huge fossil sand dollar sticking out of the wall in Devil's Eye. Unfortunately, some clown went to the trouble of removing it with a saw, and now none of us get to enjoy it.

SUMMARY

You may have noticed that most of the features listed above are easily damaged, and many never heal. So get into the habit of not touching the cave, particularly its geothite, clay and delicate rock features. Situations do arise where you may do less damage if you stabilize yourself by touching the cave. In such cases, go for the nearby feature that is least susceptible to damage, and keep your touch light. Better yet, work on your diving skills until you are such an accomplished diver that the need to touch the cave is a rare occurrence.

I hope that all our instructors are pointing out the wonderful features in our caves to their students, and their susceptibility to damage. This is extremely important. Without a knowledge of cave features, a diver is basically unconscious of the cave environment and cannot possibly dive in our caves without destroying the very things we come to see. Pristine underwater caves are a non-restorable resource.❖

About Arch Sink

by Frank Lavallee, NSS# 27829

Arch Sink is located in northwest Pasco County near the Hernando County line. The sinkhole basin is located on the east side of an oblong, curved, shallow pond. Exposed limestone around its rim mark its location.

On the west wall of the rim at a depth of 15 feet is an arch-shaped opening which allows access into the sinkhole basin. This formation is what gave Arch Sink its name.

A permanent line starts on the right wall underneath this arch. It runs horizontally and then drops down almost vertically to a tree on top of the debris mound at a depth of 42 feet. This tree serves as the junction point for three permanent lines which run off into three different cave openings.

The first line leads slightly northwest and down through a low breakdown area to the beginning of a long, wide room at a depth of 84 feet. This room runs northwest for 220 feet. Maximum depth is 96 feet.

The floor in the first half of this room drops away to a depth of 130 feet, then slopes down and east under the upper wall for 95 feet to a restriction at a depth of 180 feet. Beyond this restriction, the tunnel continues southeast around a silt mound for 40 feet and terminates at a major restriction at a depth of 190 feet.

The ceiling in the second half of this room rises up to form a large dome. Cave divers refer to this area as the "Dome Room." Some dark-colored manatee bones are embedded in the ceiling.

At the northeast section of the room, a very low, rust-colored silty tunnel runs northeast for 50 feet before terminating at a major restriction.

The second line runs northeast into a large tunnel, which runs northeast for 110 feet and then turns almost due east. Some very unique and fragile ceiling formations are present.

A restriction near the end of this tunnel leads into a picturesque room with a low ceiling. Visibility remains relatively clear in this room year-round, regardless of the conditions in the rest of the system. This tunnel is 265 feet long. Maximum depth is 62 feet.

The third line runs southwest into a short tunnel which runs southwest for a distance of only 75 feet. Maximum depth is 50 feet. Survey and rising air bubbles indicate that this tunnel runs underneath the sinkhole arch.

Visibility in this system varies. The sinkhole basin suffers from near zero visibility during the warm months because of heavy algae bloom. During the cool months, it tends to clear up nicely. Visibility of 15 to 20 feet is considered normal inside the cave system for most of the year. At times, it can drop to near zero, and at other times, it can exceed 50 feet.

If you have never dived this system before, or if it has been a while since you dived it, it would benefit you to check on the diving conditions with a dive shop in the area, or with someone who dived it recently.

I recently completed a survey of this system and have a Grade 2C bird's-eye view map of it. Anyone desiring a copy of this map need only send me a legal-size self-addressed stamped envelope to PO Box 380, Plant City FL 33564-0380.❖

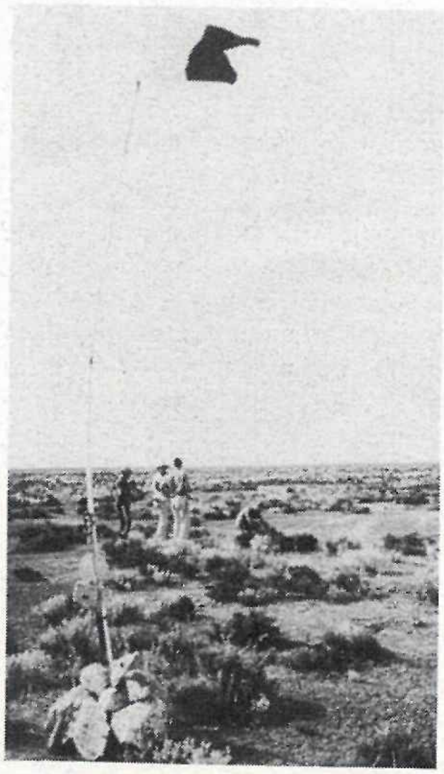
Cocklebiddy Cave:

Text and Photos By Greg Bulling

The arid Nullarbor plain of south central Australia is the backdrop for the world's longest multiple-sump cave dive. In 1983, a group of Australian cave divers reached a distance of 6,000 meters (19,685') from the entrance of Cocklebiddy Cave. At this point, the cave narrowed down and one of the divers removed his equipment and pushed a single aluminum cylinder another 240 meters (790') to set the current mark of 6,240 meters (21,060') from the entrance. The combined underwater distance of the three sumps now stands at over 5,000 meters (16,400').

The cave begins as a large degraded doline, on a vast treeless plain. The initial part of the cave consists of a large talus slope that leads to a muddy lake, approximately 200 meters (650') from the entrance. The cave is characterized by huge 30 meter x 30 meter (100'x100') clear tunnels, with no appreciable flow.

Divers Below!



At a distance of 1,000 meters (3280'), a large 20 meter x 50 meter (65'x165') collapse is encountered, which requires all equipment to be hauled up and over a steep and slippery rockpile. Once on the other side, the tunnel continues underwater, uninterrupted, for 2,500 meters (8200') before reaching the second air chamber known as "Toad Hall." To traverse this rocky chamber requires a strenuous walk of some 400 meters (1,310') over huge boulders, in warm and very humid conditions. In the third sump, the line continues for a further 1,740 meters (5,740'), until it reaches its present end.

Due to the logistics involved in diving in such an isolated place, the number of large-scale expeditions mounted to explore Cocklebiddy have been limited to some degree. In 1992, I organized an expedition to Cocklebiddy, not to break new ground but to film for the first time the further reaches of this impressive cave. In all, eight divers were involved, with three of us pushing to Toad Hall. We planned to remain there for three days, exploring, filming and surveying this isolated section of cave.

The expedition began like most, with countless hours of preparation and physical training. We had decided against the use of scooters, due mainly to the prohibitive cost of several large AquaZepps, which were the only suitable option at the time. This meant that the physical fitness of the divers was of prime concern.

With the large clear tunnels afforded by the cave, we chose to use a type of equipment sled originally designed for the early record attempts. It consisted of an aluminum frame which contained 25 liter (seven gallon) hard plastic containers at each end, which are filled with air via a cylinder on the sled.

These buoyancy chambers also incorporate dump valves so the diver pushing the sled can control the up and down movement of each chamber via two levers positioned at the rear.

The plan was for all eight divers to swim to the first 1,000 meter (3,280') mark, using back-mounted triples. Of these three cylinders, two would be used as a normal twin set (twin singles, as manifolds are not used in Australian cave diving) and the other simply "carried" along, to be used in the second sump. The sled would be loaded to capacity, with 18 cylinders, along with food, water, camera gear, spares and other associated gear.

Once at the rockpile chamber, three sets of fresh triples would be carried over, along with all the equipment from the sled. With all the gear set up on the far side, all the divers would come out for a rest day before the three push divers headed off to Toad Hall.

So after many months of preparation, we finally headed off from Adelaide, our home city, and traveled the 1,600 kilometers (1,000 miles) to Cocklebiddy. Due to the isolation of the Nullarbor, the drive there can be an epic in itself. The temperature of the area varies significantly, with summer highs of 120°F not uncommon and winter lows below freezing. Water and gas are also a problem, with no really reliable sources of fresh drinking water and isolated gas stops, where you pay as much as $4 a gallon! Add to this the large number of huge trucks (we call them roadtrains) and the danger of hitting kangaroos, emus, and wombats at night, and you find diving can be the safest part of the trip!

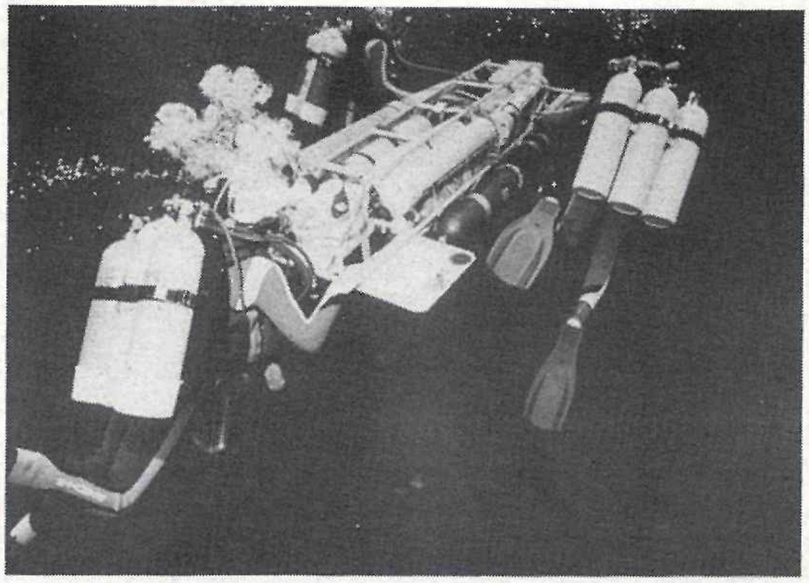
Once on site, we erected a "tent city" before setting up a flying fox cable from the surface to the lake's edge. This enabled easy movement of equipment in and out of the cave by using vehicles to raise and lower the gear. Power and telephone lines were also installed from the lake to the surface, to give us plenty of light and reliable communication.

The set-up dive started poorly, with almost two hours spent loading the sled in the cold muddy water of the lake. The water in the lake consists of a 1-2 meter (3-6') layer of cold (56°F) fresh water which washes into the cave during heavy rain. Under this lies the clear brackish groundwater that has approximately half the salinity of salt water, but with a much more comfortable temperature of 70°F.

After traversing the 150 meter-(490'-) long lake, the trip to the rockpile chamber was quite eventful, with the heavily-loaded sled taking quite an erratic path from floor to roof on numerous occasions. The problem was that we had overloaded the sled in order to get all the equipment to the rockpile chamber in one trip. This meant that it was just floating with full buoyancy chambers, so when it started to sink down, inertia took over and it was difficult to bring it up to a level heading.

Once at the rockpile chamber, we unloaded the sled and manhandled it all over. Conditions here are not really conducive to strenuous exercise, with high CO_2, temperatures in the 70's and almost 100% humidity. In the end, all was done and we were out again after an 18-hour excursion underground.

With a rest day behind us, it was soon time for the dive to Toad Hall. The leisurely swim to the rockpile chamber with only twins seemed so easy compared to the effort of the previous dive. Once there, we left our partially-used twins and walked over to our fully-charged triples and sled. We had chosen to use back-mounted triples, as we had calculated that we could return from the farthest point with three full cylinders if the sled had to be ditched.



Loaded Sled

With a much leaner sled, the dive progressed without incident, although the speed was not shattering (approximately 750 meters/hr or 40 feet/min). The addition of bulky camera housings and lights meant the sled was not as streamlined as we would have liked.

At the 1,000 meter (3,280') mark past the rockpile chamber, we stopped and had a rest, taking a drink from modified intravenous drip bags stored in our vests. At around the 2,000 meter mark, the cave reaches its deepest point at approximately 18 meters (60'), and we had a little trouble equalizing our ears. Finally, after 222 minutes underwater, we reached Toad Hall and spent some time decompressing on oxygen before surfacing.

For the next few days we spent our time exploring Toad Hall. Of special interest was the discovery of an extinct bat skeleton (a cave diving species, perhaps!) located near our "bedroom" rock. The high CO_2 and humidity made conditions difficult, but at least we ate well! With the use of a special radio, designed and made by Tony Carlisle, one of the lead divers, we were able to keep in touch with our surface crew by transmitting through the 90 meters (295') of rock. There is probably no sound more distressing than that of full beer cans being opened on the surface while you listen on the radio below—especially when it is your beer!

The return journey from Toad Hall was long, but generally uneventful. The sled became more difficult to control towards the end of the dive, as it had become quite buoyant due to the large amount of air breathed from it during the dive.

Finally, after three days underground and a total swim in and out of 7,000 meters (23,000'), we surfaced to the fresh outside air.❖

Incident Report:

by Mary Bricker NSS# 40550

The accompanying article is a detailed incident report from my recent trip to Florida, where my buddy suffered an unexplained DCS hit at the end of a dive. The striking thing about this serious hit was that it could not be explained. For me, it was a good, but painful, reminder about the risks of scuba diving, and the fact that no matter how hard we might try to limit the risk, in the end we cannot control it.

In spite of the "unearned" nature of this hit, there is still some stigma around "getting the bends," as if it describes some personal weakness. I applaud my friend Mark, who is the safest diver I know, for his willingness to be open about this incident in the interest of educating others to the fact that it can happen to anyone. There will be those who read this and look for blame. I see this as an effort to distance oneself from the possibility of death. I encourage the reader to use this as a reminder that we cannot experience the passion and joy of diving without realizing that we must also face the possibility of death.

Incident Report

On Memorial Day, Monday, May 29, 1995, cave divers Mark Thomas and Mary Bricker, both from the Columbus, Ohio area, set out for a dive at the Devil's Ear system at Ginnie Springs. Mark, 35, is an experienced diver with 20 years of diving experience and 13 years of cave diving experience. Mary, 38, has been cave diving for a little over a year. Both divers are accustomed to diving under harsh conditions, including cold water and ice diving. The two were familiar dive buddies, diving together for four years. Both divers were very familiar with the Devil's system and had planned an easy and nonstressful dive.

Both divers were well rested and looking forward to the dive. Mark is a videographer and planned to shoot video during the dive, which was planned to Hill 400 and the Bat tunnel. The weather was overcast and humid, but not particularly hot in the cool of the morning. They arrived at the dive site around 8:30 AM, and spent about two hours in prep time, getting cameras and gear ready for the dive.

Mark was diving with double 121's and was carrying an 80 cu ft tank of EANx 32, which was left hanging at the deco stop. Mary was diving with double 95's and carried an 80 cu ft stage tank of air, and an 80 cu ft tank of EANx 32 to be left at the deco stop. Mark was wearing a semi-drysuit, and Mary wore a wetsuit. Mark also carried a videocamera. Both divers were wearing Aladin Pro computers.

Mark had done one dive the previous day, Sunday, to a depth of 70 ft in Peacock with no decompression, approximately 24 hours previous to this dive. Mary had done two dives the previous day, the first with Mark in Peacock, and the second, a short decompression dive at Little River, to a depth of 90 ft. Neither diver had been in the water on Saturday, as they were attending the NSS-CDS workshop.

The dive was easy and unremarkable. While the videocamera in the current of the cave may have added some stress for Mark, it was not a significant stressor as he is quite accustomed to carrying it under a variety of conditions and has filmed in this cave a number of times. The divers turned the dive as they approached thirds, and enjoyed riding the current out of the cave. When the divers exited the system, they noted a bottom time of 75 minutes. At that point, the air computers called for 52 minutes of decompression, 10 minutes at the 20 foot stop and 42 minutes at the 10 foot stop. As Mary ascended to the 20 foot stop, Mark lingered at 30 feet to shoot video and slowly ascend.

Shortly after arriving at the 20 foot stop, Mark ascended briefly to 13 ft to retrieve the EANx tanks. Both divers began breathing nitrox, and continued breathing nitrox for the 57 minute duration of the decompression, several minutes beyond the directive of the computers.

Mark began to notice symptoms shortly after reaching the 10-foot stop, which was actually done at about 15 feet. First symptoms were experienced as stomach and lower abdominal pain. Mark initially felt that these were intestinal cramps due to breakfast or some other "bug." He loosened his gear and put more air in his drysuit in an attempt to become more comfortable. He also began to notice shoulder pain, but continued to try to distract himself from the pain in the belief that it was simply an upset stomach.

His buddy was unaware of Mark's distress, though she was within reaching distance. When Mary signaled to Mark that she was almost ready to surface, Mark signaled back that he wanted to move out of the cave entrance and do five more minutes of decompression near the exit, an area which is about 5-7 feet deep. Mary was mystified by this unusual request, but agreed to follow him there. There were many other divers and swimmers in this area and the visibility was low; Mary could not see Mark and surfaced to see him swimming toward the steps to exit. When Mary surfaced beside Mark at the steps, he indicated that he had bad stomach cramps. He placed his nitrox bottle on the steps and put his camera on the deck and proceeded toward his truck. Mary removed her extra tanks, and was three to four minutes behind him in exiting the water.

Mary arrived at the truck to find Mark in severe distress with breathing difficulty. Other divers gearing up had helped him out of his gear, and were helping remove his drysuit. They had also signaled for Ginnie Springs officials to call for a medic. Mark was gasping for breath and coughing and seemed to be in great pain. Mark quickly progressed to the following symptoms: severe pain, mottled skin, difficulty breathing (aka "the chokes"), distended stomach, loss of feeling and reflex in his right leg and foot, numbness and tingling in his left foot.

DAN physicians and other DAN personnel who happened to be at Ginnie came to attend to Mark. Decompression sickness was quickly diagnosed and oxygen administered. The EMT's arrived, an IV was started and the decision was made to transport him by helicopter to Shands Hospital in Gainesville. At the emergency room at Shands, Mark was given a diagnosis of Type II DCS.

Within three hours of Mark's exit from the water, he was in the hyperbaric chamber on a Table 6 protocol. At depth (60 ft), Mark experienced immediate relief of some of the most serious and painful symptoms. After a six hour chamber dive with several extensions, Mark was admitted overnight. The following day, he was extremely fatigued, and had eliminated most symptoms except some dizziness, unsteady gait, and a sense of motion with side to side and up and down head movements. A decision was made to do another Table 6 chamber dive.

Following the second chamber dive, Mark noticed immediate improvement in the dizziness and side to side head motion tracking. He continued to have severe fatigue and some slight dizziness with up and down head motions. His gait was unsteady. He was discharged with the condition that he would return to the hospital in the morning for another check-up. Following a good night's sleep, Mark felt much better. Slight symptoms remained, but Mark made the decision to make the road trip home to Ohio to complete his recovery there. No changes were noted in the symptoms during the trip home, and his recovery since that time has been good.

Following an analysis of the dive profile and other facts, the DCS incident was described as an "unearned hit." There were no predisposing medical conditions which were felt to be related to the DCS hit. Although Mark was taking medication for hypertension, neither this condition nor the medication was thought by attending physicians to play a role in the DCS. Mark is in good physical condition and is not overweight. There was nothing about the dive profile which would suggest that a DCS hit was likely; strictly on the issue of dive profiles, Mary would have been a more likely candidate for DCS. While Mark had consumed some beer on the previous day, it was not an excessive amount. Some dehydration may have contributed to the risk of DCS. On the other hand, it is thought that the use of nitrox on an air table during decompression may have lessened the severity of the hit. In short, the best guess of the cause of this DCS hit is "Bad Luck."

The hyperbaric chamber staff believe that the quick response of assisting divers, medical personnel and EMT's was an important factor in the positive prognosis for Mark. They were also assisted by the accurate records that the divers had of their dive profile.❖

Cannonball Distress:

By Bob Foster, NSS# 36921

The first time I was in Cannonball was the weekend before Thanksgiving in '92, but it was a repeat experience of sorts. All I could see was my finger loop around Hermerding's line, and an occasional flash of a fin cutting through the silt-shortened beam of my Neutralite. I was assured I had left the muddy lake bottom and entered a spring by the need to pull through high flow and low overhead which restricts the entry, but the visibility was only a little better than in the lake. Once in, we clipped a reel to a "permanent" line, went about 500 ft and called the dive. His fins are boring! The line we found drooped in places, crossed over jump lines, and sometimes laid loose on the floor. Not the kind of mainline that gives you confidence in the skills of prior visitors. We left the spring, crawled up the muddy lake bottom for a safety stop, exited the water, then made the climb we would soon learn to dread.

It was cold, wet, and gray that November weekend in south Missouri, and had been raining for a few days. We packed our gear and started the drive back to our motel in Poplar Bluff. It was about noon. We were tired, wet, muddy, and about nine hours from home. The only dive in the vicinity was terrible. A bar near the motel beckoned.

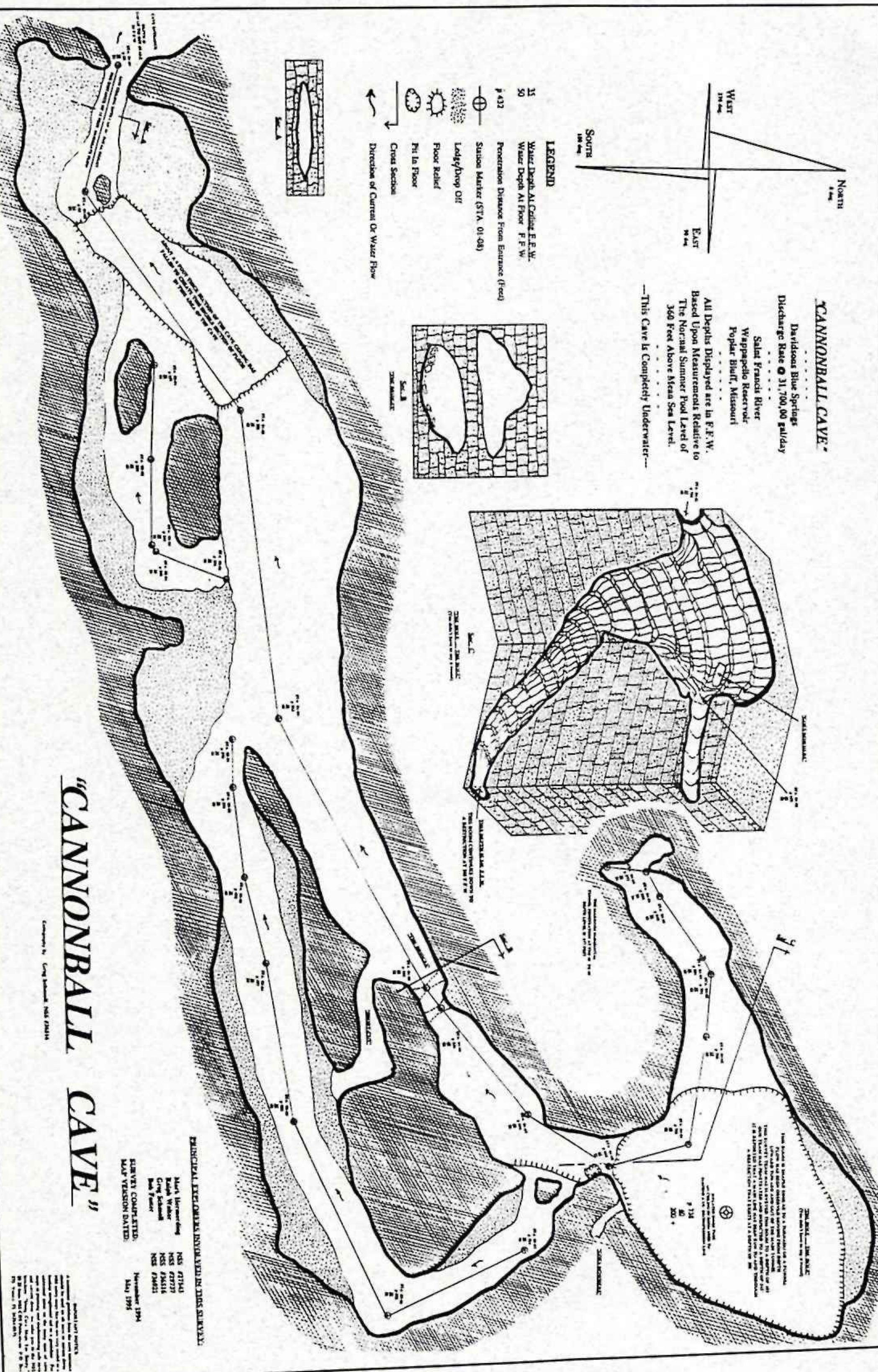
On our way from the dive site we passed the dam and a U. S. Army Corps of Engineers office. We then made one of the better decisions of the weekend; we went in and introduced ourselves. We soon learned why the spring was so silty. The lake, Lake Wappapello, was being brought to the higher "winter pool" level. Knowing this, we concluded that the rain, in conjunction with the altered hydrology, was rinsing the summer's accumulation from the recently reactivated cracks and crevices of the aquifer. Our host at this facility, the Wappapello Lake Management Office, was Park Ranger Dan Camden. He welcomed us as tourists, happy to tell us about his work there and equally anxious to learn about cave diving and specifically about our dive that morning. He proceeded to tell us about the lake, its origin, and maintenance. We left Dan's office with an arm load of brochures and maps, including current and pre-construction topographics, which have been quite useful.

Lake Wappapello is a public flood control reservoir administered by the U. S. Army Corps of Engineers. The lake is located on the St. Francis River in southeast Missouri and is surrounded by 44,000 acres available for public use and recreation. The dam construction was completed in 1939, controlling the drainage of 1,310 square miles. Before the dam, a spring named Davidson's Blue Hole created a hillside pool and short creek to the river about 100 yards to the west. The spring was located about midway between the dam site and the town of Greenville. More precisely, it is in Blue Spring Hollow, about halfway between Lost Creek and Possum Creek, two other tributaries to the St. Francis River. This location is presently about 35 ft. below "summer pool" water level. The U. S. Army Corps maps of estimated flow of approximately 31.7 million gal/day. In subsequent visits and phone requests for maps, water table data, and general information, we have been assisted by Ranger Doug Nichols who also provided a daily water table history.

And so the project began. Earlier in the fall, before Mark Hermerding and I made our November '92 dive, he and Ralph Walter had made the same dive with exactly opposite experiences. An easy dive. Great visibility. Manageable entry flow. This variation was the first hint of the significance of rainfall and water table management on the dive characteristics of the spring. Our fourth, Greg Schmoll, joined Mark and Ralph for a dive weekend also in the fall of '92. In the summer of '93, after the visibility impact of spring rains and water table management had subsided, we again traveled to Cannonball. In the day of diving, the conversation turned to next dives, plans, trips, and the like. We gravitated to the fact that Cannonball was closer to home, less expensive, and easier to schedule than our Florida trips. It seemed we were just looking for a reason to do it more often. None of us had seen a map of this place. The little info we had about this dive had come verbally from Dee Burke, a cave diver who owns The Boiling Springs Dive Shop in Licking, Missouri. The few others we knew who had dived it hadn't seen maps either. Before we realized it, need, motive, and opportunity all came together in a plan to survey Cannonball.

On a very calm day, the "boil" of turbulent spring water can be seen on the surface of the lake,

Four Guys Working Off Their Azimuth!



Map of Cannonball, in Missouri

but typically Cannonball is located by surface swimming to the cooler water and dropping within it to the spring entrance some 35 ft. beneath the lake surface. The entry is in an eroded pocket of a onetime hillside, now part of the lake bottom. Immediately above the entry is an eight to ten foot vertical stone wall which reflects the erosion of the area around the "above ground" spring, and subsequent fracture of the sedimentary stone above the spring arch as support beneath eroded. The entry remains a shallow arch, about 30" in the center, about 10 ft wide, with loose stone covering the floor.

Once through the entry, the larger, wider path is to the right around a large boulder. Immediately past this boulder is a very wide room with a low ceiling and two distinct floor levels, the higher to the right. Upon further inspection, it is apparent that the floor section on the right was once the roof. The step to the left side of the floor matches a step in the ceiling. Entry is possible to the left. From there, it is possible to rejoin the main line on the upper level to the right. The spring continues a southeasterly course for about 800 ft at depths ranging from 40 to 55 ft. There are parallel passages, accessible by jumps, on the right inbound. At about 500 ft a stone bridge about 8 ft wide divides the cave horizontally. Passage is possible above or below the bridge, but some of the stone appears to be fractured and resting precariously above the lower passage. At about 800 ft this basically horizontal passage ends in a large tornado vortex-shaped room about 150 ft across at the top, descending and, we are told, tapering to a horizontal restriction at about 290 foot depth. In the latter stages of our survey, this room shape was observed, measured, and confirmed to 240'.

It was apparent that if we were going to spend any significant time in this cave, safety dictated a proper mainline. And, if we were going to reline it, we could do that with a knotted survey line. So the first task of the project was defined. With the first task came the first decision. Even though we thought the present line poorly placed and not maintained, it wasn't ours to alter, relocate, or remove. It had another group's name on it, but no way to contact anyone. How should we go about our tasks, tasks to benefit all future visitors to this spring, without offending those who had been there first? To assure that none could criticize, we repositioned their original line, properly secured and placed it, and then parallel-placed our knotted survey line beside it. The main line is now attached to a rebar pin that we drove in the floor outside the roof of the spring, but within the springwater pocket. So much for visitors protocol.

We then needed to agree on a numbering convention so we could identify stations, substations, landmarks, jumps, etc. But it isn't obvious how to assign numbers. For example, should the starting point be a "zero" point or station "No. 1"? Should we get into a multi-line numbering convention right off the bat so we could take the natural next step into jump line numbering and jump line station identities? These decisions weren't show-stoppers, just things we hadn't considered until we faced the task. We all pledged to brush up on our survey skills, review our training manuals, and come to the planning meetings prepared. We all made sincere efforts to do just that.

We were so prepared, we overtasked ourselves from the start! It sounded so reasonable for a three-man team to pull a tape measure across the survey line, at a right angle to it, from cave side to cave side recording a maximum width at the spool end, and have the center man record a reading at the line on his slate, in the proper blank for the knot number/station number. While waiting for the outside guys to get in position, the centerline guy can catch the ceiling and floor depth readings. We had already scoped some of the side measurements to be in the 60 to 80 ft range. We had light signals to move the outside guys into proper perpendicular tape position. We had signals to move the tape to the next survey line knot. We had tape "tug signals" to commence light signals. Can you believe this? The list of things that can go wrong in this scheme is material for an HBO comedy special!

Simple question number one: Where is the side of the cave? Is the side of the cave the farthest penetration in which a diver can navigate? Is the side of the cave the furthest niche or cranny you can stick the tape into? We found areas that were overhead restricted for a diver with conventional doubles where we could see another twenty feet. Should

Four Guys Working Off Their Azimuth!

we approximate and map it, or make the judgment call that since we couldn't get in there, nobody needed to know? Does it really matter?

What occurred was at least one "lesson learned" every dive. We even found that two divers attempting the same task, more often than not, get different results. Judgment, skills, and technology all contribute variation. The most effective solution for the judgment and skills variation is to have two team members "buddy" on a task and both document the result. Variation and difference can usually be explained and resolved after the dive. Gauge and equipment differences contribute the technology variation. Like the old Arabic expression, "A man with a clock knows the time; a man with two clocks is never sure." We agreed to record data from one specific set of gauges, one tape, one compass and level survey slate, and get multiple sightings on common equipment at critical locations.

Water table variations altered depth readings. An example of this has occurred in recent years with as much as a 24 ft. change in consecutive months, and even greater change in three month and multi-season periods. This condition is not key to our survey integrity, but was an often bothersome variable. Consequently, depth gauge readings were used for relative reference during a dive, and were not included in the published product.

During the two-year information gathering period, we made thirty-two logged dives as two and three man teams and a few more, too. The number of dives is a bit of a gray area in that some unlogged entries were shallow, brief "confirmation peeks" at a reference point, short trips to replace a tag or reset a marker, or to retrieve equipment left briefly for redundant tasks. After placing our knotted line, we had what we considered to be a Grade 3 "stick map" from the entry to the top of the deep room in our first few dives. The rest of the dives were committed to sidewall definition off the main and three jump lines, and the configuration of the deep room. Our early attempts to map the vertical room were really complicated by the main line position down one side and our ability to make precisely horizontal measurements over great distances. To cope with this condition, we anchored a float in the top center and suspended a weight. This became a centerpoint reference from which sidewall location at predetermined depth and azimuths were recorded. More experienced surveyors could, I'm sure, complete this map more efficiently, in fewer dives, with less redundance. Expedience, however, wasn't one of our requirements!

The number of dives completed takes on a whole different perspective in the context of locale and logistics. The dive site is a few miles down a fire trail from paved roads, and about forty-five miles from "town" and a compressor. Although we were able to get in some three day weekends, we typically drove from our Indiana homes late Friday or early, early Saturday to arrive at the dive site Saturday morning. "Dive and drive time" for air fills was always key to the daily dive plan. After the first dive, we would drive an hour to fill doubles at the Aquascapes pet shop. It took their compressor about 45 minutes to top off a set of 104's. Sometimes we brought multiple sets of tanks to avoid some fill time and travel, but the luxury wasn't always available. The fill trip worked out to about a four hour turn-around for two sets of twins. We couldn't wait for more than two sets of tanks on the first fill trip and make the day plan work: Hustle back to the dive site, do the second dive of the day, stash the dive gear and head to the pet shop again. We had to get late day fills for the next morning dive since the pet shop wasn't open Sundays.

Inconvenient as it was, we couldn't complain. The people at Aquascapes were friendly and accommodating. We handled our own tanks, operated their compressor, and ran our own fills. Some evenings, if we were running late, they would close the shop with us inside completing our fills, and lock up later. Nice people. Great hospitality!

With the publication our map, we close a chapter. It was a challenge for us to stay focused. Some trips were memorable, some just a blur. We had a lot of fun, and a lot of laughs. The discomfort of cold wet gear in November, the "burn" in the legs from the climb out after the dive; the screw-ups and omissions and oversights: these are all mellow, now in the past. Memories of good times remain.❖

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Accident Analysis Revisited

From the NSS-CDS Instructor Training Bulletin, By Lamar Hires

The traditional wording of the five rules of accident analysis must be reviewed with the recent fatalities. I feel accident analysis still applies to the most recent deaths of two of our peers, Bob McGuire and Corey Berggren. The traditional wording of the five rules does not apply today with the use of gas mixtures other than air. The analysis did not include gas switches during the dive. The Section does not formally teach Nitrox or Mixed Gas, and I feel that we should leave the teaching of these specialties to other agencies and continue our focus on cave diving, applying all tools at our disposal.

The proposed wording, as suggested by Harry Averill, is as follows:

1. **Training:** Not only be trained for cave diving and cavern diving, but remain within the limits of both training level and experience.

2. **Guideline:** Maintain a continuous guideline to the cave entrance. Whether to make your primary tie-off in open water or at the entrance or just inside the entrance will depend on factors such as openwater and cave diver traffic, entrance configuration and the likelihood of visibility loss at the entrance or the adjacent open water basin.

3. **Air/Gas Management:** Keep a minimum of two thirds of your starting gas supply to exit the cave. Increase this minimum whenever conditions are less than perfect. All cylinders should be clearly marked with the contents and maximum operational depth if using anything other than air.

4. **Depth and Time:** Remain within the operational limits of your training level and the gas you are using. Maintain as wide a safety margin as possible to help avoid CNS and Pulmonary Oxygen Toxicity, Inert Gas Narcosis and Decompression Illness.

5. **Lights:** Carry a minimum of three battery-powered lights.

Cave divers are technical divers. We may not have wanted to be included in this description, but we certainly are now with the open and widespread use of Nitrox and Mixed Gas. Some say we should not allow the use of gas mixtures in cave classes. I disagree. If the instructor is trained to teach Nitrox, then he can apply it for his own use during class and teach it to his students during a cave class. Our job is to make cave diving as safe as possible and ensure our students are introduced to all the tools at our disposal to make cave diving safe.❖

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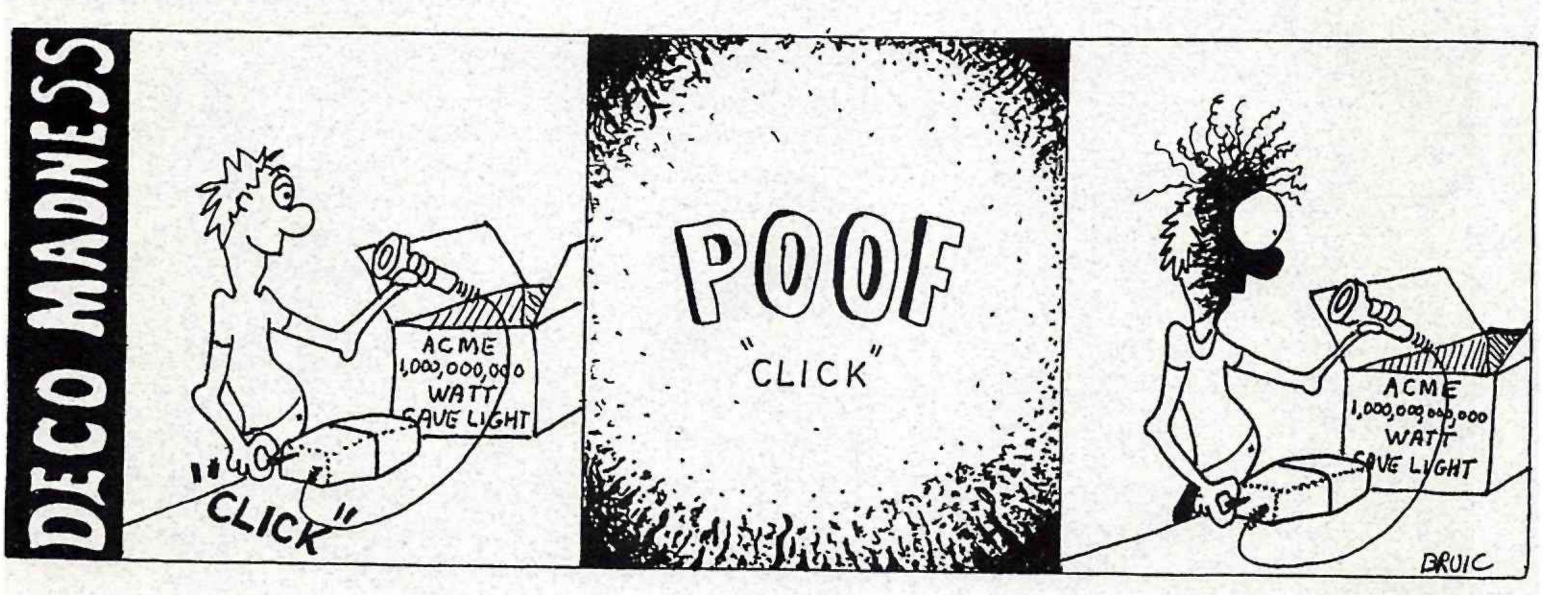

Accident Report

Submitted by Kay Pozda Walten

[Below is an accident report on two deaths in the Maya Blue system in Yucatan, Mexico, that were originally reported on in the May/June 1995 issue of *Underwater Speleology* (Vol. 22, No. 3). At that time, it was assumed that one or more navigational errors were the cause of the fatalities. This appears to have been the case, according to the recovery report submitted with these observations–ed.]

The following is the accident report on cave divers Dwight Fuqua and Dan Johnson. I would like to make the following remarks:

After repeating their dive, I could see how they could take a wrong turn at the "T" of the B&E lines. Unless you look directly at the T, you could, at a glance, miss it, even though the E-line and B-line had the appropriate arrows at the junction.

The passage they turned on to is substantially smaller with minor restrictions, unlike the main section of the B tunnel they entered on. If they had referenced the cave on entrance, they could have easily seen the difference.

When they reached the end of the line, and A-line was a ten-foot gap in front of them, they should have remembered they did not encounter a gap when they entered the cave. They visualled the gap and followed arrows in a direction.

Why didn't they turn around before they did the visual? There were two teams of divers that were going to head out shortly after they turned. They did not swim back or look for the lights of the others, also indicating that they had made a wrong turn. If they had turned when they had reached the end of the B-line at A, they probably would have met the other divers on their exit.

The error at the B-E junction was the catalyst in this accident. Unfortunately, they had several indicators of this error but did not make the correction and turn around.

We have changed this intersection into continuous guideline from B to E. And, we have extended the main line in the A tunnel to where a diver can see light at the end.❖

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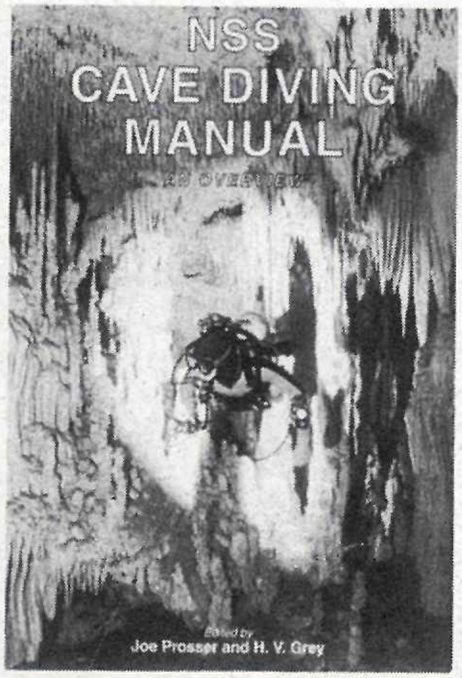

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