UNDERWATER SPELEOLOGY

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Rich Nicolini and Dustin Ciesi in DiePolders #2 - see exploration article page 7

UNDERWATER SPELEOLOGY

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P.O. Box 950 • Branford, FL 32008-0950

Editor: H. V. GREY

P.O. Box 12 • Nokomis, FL 34274-0012
(813) 484-7834 • (813) 484-6665 (fax)

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Magazine Submissions — We welcome all news items, articles, Letters to the Editor, photos, slides, cartoons, and other items of interest or importance to the cave-diving community from all members, subscribers, and other interested parties. They should be sent directly to the Editor (see address on left column). We can also use text processed in most IBM-compatible and some Macintosh formats. (Please contact the Editor directly for details and arrangements.)

Advertising — The NSS-CDS Board of Directors has approved the reinstitution of paid commercial advertising for *Underwater Speleology*. Advertisement of upcoming cavern, cave, and specialty courses will be offered to CDS Instructors at a special discount rate: $10 for the first class, $5 each for any additional classes advertised at the same time; starting with the next issue. This rate will apply to advertisement in a single issue of *Underwater Speleology* and will feature a standardized-format advertisement (instructor name, contact phone, name of course, date, location, brief description of course if desired, cost if desired) on the instructor roster page being prepared by the Training Chairman for publication in the next issue. Interested instructors should contact the Editor directly to make arrangements. All others, please contact the Editor for information and arrangements (see address on left column).

The NSS and Cave Diving — Founded in 1941, the National Speleological Society joins together thousands of individuals dedicated to the safe study, exploration, and conservation of caves. The first cave-diving information ever published in the United States was in a 1947 *NSS Bulletin*. In 1948, NSS divers were responsible for the first cave dives in the United States using scuba. Prior to 1973, cave diving within the NSS was on a purely local level. That year saw the creation off the NSS Cave Diving Section to provide a vehicle for information exchange. Today, with over 500 members, the Cave Diving Section promotes safe cave diving through semi-annual workshops; cavern- and cave-diving training programs; warning-sign installations; search, rescue, and recovery through the National Cave Rescue Commission; cave exploration and mapping; several texts and publications on cave diving; and the bimonthly magazine, *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 either by writing directly to its main office (National Speleological Society, Inc., Cave Avenue, Huntsville, AL 35810) or to the Cave Diving Section. Annual membership is $25.00 and includes subscription to the NSS's monthly magazine, *NSS News*, as well as voting privileges and discounts on publications and conventions.

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 who is a member in good standing of the NSS. Annual membership is $5.00 per year and includes subscription to the CDS's bimonthly magazine, *Underwater Speleology*, as well as voting privileges and discounts on publications and workshops.

Subscription — If you do not wish to join the NSS and CDS, but would like to keep current on cave-diving events, exploration and technology, you are invited to subscribe to *Underwater Speleology* for $15.00 per year.

NEW CAVE DIVING MANUAL

by Joe Prosser (NSS #24253), Training Chairman

As we compare our little community's state of affairs today, as it relates to a manual, to that faced by our counterparts in the '70's and '80's, we have both parallels and dissimilarities. Today the American cave-diving community does not have a viable cave-diving manual. Unlike past generations, current technology is growing so rapidly that any attempt to reflect fully on all aspects of American cave diving is doomed to be antiquated before it goes to press. Such an attempt could easily result in a book rivaling the Bible, and it has taken several millennia to get that into the version available today.

We also have some interesting resources available to us today that were not available in the '70's and '80's. Outside of our community many excellent educational books are available which go into great detail on subjects of interest us. These books include everything from exacting manuals on equipment design and maintenance, to sophisticated books on exotic gas uses and applications. Many of these fine works, and the experts who prepared them, are readily available to the cave-diving community.

From within our community we have available several fine manuals covering both basic information and very specific applications, either completed or in the works for release soon. We therefore do not have the need to devote many pages of our own manual to reinventing the wheel, so to speak. This can serve to not only shorten the type of book appropriate for our current needs, but allow us to devote more space to covering pressing concerns that are not discussed in detail elsewhere.

Do we need a Cave Diving Manual at all at the present time? I believe that we are all in agreement that such an exercise is necessary. For the uninformed and those just beginning their cave-diving careers, a single reference source is needed to introduce them to the basic concerns, problems, and philosophy of safe cave diving. For those with training and experience, these materials will serve as a basic reference source.

For example, we have an excellent manual on surveying. In *Basic Underwater Cave Surveying*, John Burge goes into the necessary massive detail required to describe techniques for obtaining accuracy in the development and presentation of a cave survey. While this type of detail is necessary for full-blown surveying, to present such detail to complete neophytes could very quickly overwhelm their ability to comprehend the information provided. Instead, I anticipate that John will devote about 10% of his original book space to describing the basic concepts and procedures of a survey. Later, when the new cave diver is better able to digest more complicated information, the detail of John's book will be better understood. For the qualified cave diver this summary chapter will provide a quick reference for basic concepts.

Technical subjects will also be dealt with within the limitations of the Cave Diving Manual. For example, mixed-gas use is perhaps one of the most complex fields facing today's cave diver. It is also a field pockmarked with controversy as to types, uses, advantages, and disadvantages. In our approach, we intend to introduce basic principles of mixed-gas use and a summary of its advantages and disadvantages. In a chapter limited to some 20 or 30 pages, it would be impossible to cover all aspects, but it can serve as the necessary introductory information from which the cave diver can begin to evaluate the additional materials available from a variety of resources.

This leads to the final aspect of our manual, its title. We propose to refer to the book as "An Overview." By doing so we are making the implied limitations of the book plain to its future readers. We can also insure its viability through the '90's. This book would then serve as a springboard into more complex materials better handled in single-focus manuals. I expect the final length to be some 300 pages (+/- 30 pages), which would include a variety of appendices and an index.

The following is a list of the chapters in progress for the book:

Basic Dive Table Use — Dan Lenihan. This is one of three chapters that will be used from the original cave-diving manual, with minor update revisions.

Basic Equipment — Pete Butt. This chapter is not intended to go into excessive detail about the exotic potentials available to the cave diver, or at the other extreme, to be simply a rehash of material presented in the cavern manual. It will provide a brief, factual presentation on the basic equipment of cave diving. Such topics as regulator selection and field maintenance, tank valves, lights, wetsuits, drysuits, and BC's will form the essence of this chapter.

Basic Propulsion Techniques — Jim Coke. One of the most important chapters in the book is being written by one of Mexico's most accomplished explorers and instructors. In addition to a heavy emphasis on low- or zero-impact cave-conservation-minded techniques, this chapter will also include some discussion of diver propulsion vehicles.

Biology of Underwater Caves — Jill Yager, Ph.D. One of the world's leading underwater cave biologists and discoverer of several new species discusses the fascinating fauna to be found in a variety of different cave environments. This is one of several topics that will be expanded into a separate single-topic book.

Cave Diving Communications — H. V. Grey. This will be a condensation of the existing single-topic book.

Decompression Procedures — John Crea. This chapter will outline the basic use of oxygen and computers for decompression. The main topics to be included are a discussion of equipment needs and preparation, procedures for oxygen use underwater, the need for stand-by surface oxygen, and application of decompression computers in cave diving.

Dive Planning — Jeff Bozanic. Jeff has gained logistical experience from cave diving literally around the world. His chapter will deal with the basic elements of dive planning and evaluation.

Jeff is developing a 60-80-page single-topic discussion on this phase of cave diving.

Emergency Underwater Procedures — Woody Jasper. One of our most experienced and innovative explorers will give a comprehensive discussion of strategies for preparing for and dealing with underwater emergencies.

Equipment Configuration — Mark Leonard and Lamar Hires. Two well-known and greatly appreciated experts in the field of cave-diving equipment configuration are collaborating on what is perhaps the most detailed chapter in the manual. They will present introductory material on everything from back-mounted cylinders to side-mount considerations. I am confident that a single-topic booklet will develop from their work in this area.

Geology of Submerged Caves — William L. Wilson. We have previously covered the basics of cave formation in the cavern manual, so we are not going to spend much time restating these basics. As a professional geologist and trained cave diver, Bill's job is to help the cave diver better understand what is going on inside the cave, to explain the basics of what he is seeing, and to help him better understand and appreciate the fragile nature of the cave.

Guidelines — Mark Leonard. One of our most experienced divers and instructors will talk about the proper deployment and use of cave-diving lines and reels.

History of Cave Diving — Sheck Exley. As the founder of the NSS Cave Diving Section, and its most illustrious and experienced explorer and author, no one is better qualified to present the history of cave diving.

Hypothermia — John Zumrick, M.D. The second of three chapters from the old manual which remains appropriate for reprinting, with minor update revisions by the author.

Introduction to Nitrox and Mixed-Gas Use — David Sawatzky, M.D. This chapter will discuss the problems with using compressed air at depth, and discuss the advantages and disadvantages of using mixed-gas, including special decompression needs and complexities. It will present very basic theories of nitrox and mixed-gas use.

Introduction to Sump Diving — John Schweyen. This will be a summation of information being prepared from separate, existing works, introducing the concept of sump diving to both cavers and cave divers.

Introduction to Surveying — John Burge. This will be a condensation of the existing single-topic book.

Philosophy of Cave Exploration — Joe Prosser. A discussion on safety.

Photography — Tom Young. The basic elements of lighting, exposure, and framing for both still and motion photography and video.

Psychological Aspects — Mary Brooks. This is the third of three chapters from the original cave-diving manual which has stood up to the test of time and remains appropriate for reprinting.

Recovery Operations — Henry Nicholson, Sheck Exley, and Tom Cook. This will be a recapitulation of existing materials from the original cave-diving manual and the recovery-operations manual. ■

UNTRAINED DIVERS DROWN IN MISSOURI AND TENNESSEE

Two open-water divers drowned while attempting a cave dive in Roubidoux Spring in Missouri on June 8. According to a preliminary report, the husband and wife were found approximately 400′ in at a depth of 115′. Visibility in the cold-water spring was approximately 6′.

The husband had only a single light (a rechargeable Ikelite) and an octopus second stage. The wife had only a single light (a mini C) and not even an octopus. The husband's maximum-depth indicator registered 124′, but neither had either a decompression meter or tables [the no-decompression limit for 124′ is only 10 minutes]. Both were using only single 80cf aluminum tanks. A third diver was unable to negotiate the entrance restriction and was the one to alert the authorities.

The bodies were recovered on June 9 by a team of cave divers led by Dave Porter and Curt Olson, with NSS-CDS Chairman Frank Howard coordinating topside. It is hypothesized that, in the poor visibility and with their complete lack of proper training, the divers lost track of the line, which ran along the floor in that part of the cave. It is thought that they may have drowned on the ceiling and then sunk, as one diver was found lying on a ledge about 5′ above the line and the other diver was found lying on the floor approximately 5′ away from the line. Both of their tanks were completely empty.

Two open-water divers, Robert Nadich, 62, and Daniel Molter, 44, of Ohio, died June 1 while attempting to traverse a 300′-long sump in Wendal Pyel Spring near Jamestown (Fentress Co.), Tennessee. Although both were long-time NSS members and Nadich had been a CDS member since at least 1986, no record has been found of his ever having received any formal cavern- or cave-diving training. The preliminary report indicates that the divers practiced the skills they thought they would need the night before in a swimming pool.

The fatal dive did not take place until after dark. Apparently there were originally supposed to be four divers in the team, but two either thought the better of it or had not yet gotten into the water when the other divers failed to reappear. The report has it that witnesses on the surface at one point saw a light come out of the cave, and then go back in. Both divers still had air in their tanks and were found terribly entangled in some form of attempted guideline. Presumably, they succumbed to panic and drowned. ■

NEW DIVE REGULATIONS AT MANATEE SPRINGS

by Wendy Short (NSS #30802)

There have been a few changes in the rules at Manatee Springs State Park that affect cave diving. The old rule was that only one group of cave divers was allowed in the system at one time, with 100 divers (of all kinds) maximum in the Park on any given day. This could mean long waits or not diving at all if you happened to pull in right behind a team planning a long stage dive. The new rule allows for three groups of cave divers (maximum 4 per group) to utilize the system at one time, with a maximum of 50 divers (including cave, cavern, and open water) using the park on any one day. However, please note that this rule has been implemented on a trial basis only, and is subject to revocation at any time.

Part of the reason for the decision to be more flexible toward cave divers is that the state personnel feel that cave divers are highly trained and skilled, and are conservation and safety oriented. Most of the diver impact has been seen in the open-water and cavern zones. (The restrictions toward those two groups of divers are stricter now.)

Manatee has a large cave system with very strong flow and reduced visibility due to dark water and walls, with debris being blown through the water. It is equivalent to diving in a river cave. Please respect the Park rules about checking in and out, paying the fees, etc. Be courteous to the rangers. Rudeness or disagreeing could shut the door to all of us. Remember that the new, more relaxed regulations regarding cave diving are on a trial basis.

The park wants to maintain an equilibrium between users and the environment they are trying to protect. Be careful when you are there not to upset this delicate balance. ■

ACCIDENT ADVISORY COMMITTEE

by Rick Van Eldik, M.D.

(NSS #28922)

The National Association for Cave Diving (NACD) and the National Speleological Society Cave Diving Section (NSS-CDS) established a joint Accident Advisory Committee several years ago to collect and analyze accident data. This Committee has the potential to assist the cave-diving community in making cave diving safer.

Unfortunately, the Committee has not been receiving data from responsible organizations and individuals as hoped for. This is most likely due to the lack of knowledge of the existence of this Committee and its function, rather than the lack of cooperation.

The Committee is a voluntary organization presently headed by John Crea. All information concerning cave-diving fatalities or accidents is welcome. This would include newspaper articles, eye-witness accounts and, hopefully, official accident reports.

The information will be stored on computer files and access will be limited to recovery specialists and those with a legitimate purpose in this type of data analysis. It will then be used in "accident analysis," which forms the fundamentals of safe cave diving. By evaluating the circumstances surrounding cave accidents and fatalities, we can promote safe practices which will benefit all divers.

To make accident analysis effective the committee will need data from all past, present and future accidents. If anyone has any information on past accidents, this data would be appreciated. In the future, we would like to see the Committee actively pursue this data after each accident has occurred.

Please send the appropriate data to:

John Crea
P. O. Box 1906
Bainbridge, GA 31717 ■

CDS Donates Police Radio to Peacock Springs Park

Park Ranger Joe McGrath approached CDS Board members about the urgent need for a police-band radio for emergencies that might arise out at Peacock Springs State Park, since the rangers' only way of communicating with the outside world was by driving to a public phone several miles away. As the Florida government has unfortunately had to make severe budget cuts for state parks, it did not appear as if public monies for such a purpose would be forthcoming any time in the near future.

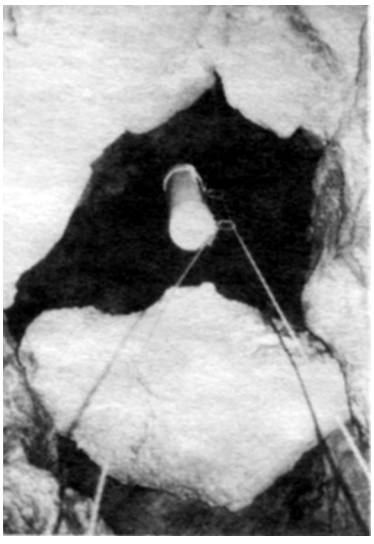
The request that the CDS donate the necessary money ($450) was greeted with enthusiasm by all Board members. Mark Leonard and Lamar Hires obtained the proper radio and completed formalities with the State. The radio was installed by Richard Brady. The Suwannee County Sheriff's Dept. has agreed to handle communications from the State Park on its official frequency. ■

TANK/GEAR CANISTER FOR VERTICAL HAULS

by John Burge (NSS #26601)

During my last several visits to Bonaire, two of my cave-diving students, Pam Teitel and Malin Kaijser, another local cave diver, Ann Louise Tuke, and I have been exploring and have begun a lengthy project to do Class 3 surveys of some of the Bonairian inland, underwater caves. None of these caves is what you would call "easy access," as all but one, so far, has required not only quite a little trek through the cactus but entry via a dry cave.

One of these, Rooi Cadushi, which is a fairly large cave in the Greco system, has a dry-cave entrance with a vertical descent of about 80'—not exactly the kind of entrance you would want to tackle while all geared up—even with a belay system. So, before taking my most recent trip down there, I fabricated a haul canister which could also be used as a storage container for all the vertical gear for the rest of the haul system (ropes, pulley, carabiners, webbing, etc.) and checked as baggage on the airline. The thought being that I didn't want to be hauling tanks up and down and dragging them through passages any more, and run the risk of breaking off a valve and livening up the day with a tank ricocheting off the walls. The system worked so well that I thought it would be worth writing up for the benefit of some of you other adventuresome sports.



Canister in use during exploration of Rooi Cadishi. Photo by John Burge.

I started with a section of schedule 3034 8" PVC sewer pipe and two end caps—one flat and one dome. The rest of the parts list were:

- 1' of 1/2" schedule 80 PVC
- 1' of regular 200psi 3/4" PVC
- eight #6 1/2" flat-head stainless screws
- one 1/4" x 1/2" round-head stainless screws
- one 1/4" x 1½" stainless detent pin
- four 1/4" brass thread inserts
- two 2" stainless D rings
- 4 large stainless hose clamps (cave diver's type)

The 8" PVC pipe was cut to a length that would allow a Luxfer 80 to fit in with a Y-valve and have a couple of inches' clearance at the top. The flat end cap was drilled and countersunk around the edges with 8 holes to accommodate the #6 screws, and matching holes were drilled and tapped in the tube. The end cap was then put in place as the bottom of the canister with the screws. Screws were used rather than PVC glue both for strength and for later adjustment in the field if it became necessary.

Rubber padding was glued into the inside of the bottom of the canister to cushion the tank. A 7/8" hole was then drilled through the sides of the canister at a height such that a section of 1/2" PVC could be inserted through these holes and would slide through the "crotch" or "V" of the Y-valve to serve as the tank retainer bar to hold the tank in place and to prevent the valve knobs from striking the top.

This dimension from the bottom of the canister will vary depending on the make of tank and the thickness of padding in the bottom. The tank retainer bar was made by cutting a section of the 1/2" PVC equal to the outside dimension of the canister and a section of the 3/4" PVC equal to the inside dimension of the canister. The 3/4" sleeve coupling was then cut in half and each half glued flush on the end of the 3/4" PVC section. The 3/4" section was held inside the canister aligned with the 7/8" holes, and the 1/2" schedule 80 section was inserted through the holes in the canister and through the 3/4" section and held in place flush with the canister walls. A 1/4" hole was then drilled through one end of this assembly through the coupling to accommodate the 1/4" detent pin. Now, with the detent pin installed, the retaining bar was held in place, thus securing the tank.

Canister with typical load of vertical gear. Photo by John Burge.

The top end of the canister tube was trimmed down so that the top (dome) end cap would fit down over the retaining bar holes. Then two 5/16" holes were drilled in the top end cap and aligned with two matching holes in the canister tube into which I installed two brass 1/4" thread inserts. The 1/4" x 1/2" round-head screws are then used

to secure the top of the end cap for storing the round-head screws when the canister was "working" and not in the shipping configuration. I also drilled a 1¼" hole through the center of the dome top to allow a rope to be inserted through the top to be fastened directly to the tank valve for perfectly vertical hauling. This keeps the weight of the tank off the canister yet allows the canister to protect the tank.

The job was completed by installing the two 2" D rings on the canister with the long hose clamps. These D rings were used to clip on a carrying strap for trekking through the cactus and then for attaching the carabiners for lowering the canister on pulleys or sliding carabiners down a haul line when the haul is less than vertical. Naturally, we had to dress it up a little bit by installing a couple of NSS-CDS stickers on the sides as well . . . just to add some sex appeal.

When used as a shipping container, I was able to stuff 150′ of climbing rope, 150′ of haul rope, 50′ of prussik rope, a couple dozen carabiners, half a dozen pulleys, 75′ of webbing, some flagging tape and some other miscellaneous junk in it, and check it on the plane as luggage. As you can see in the photos, when used as a hauling canister it worked like a bomb (well, not exactly—that's what we were trying to avoid, actually). The round dome top proved very effective as it allowed the canister to be snaked through some mighty rough passage without ever getting hung up, and the PVC dome rides right over the roughest limestone.

This device was so effective that I am fabricating another one for my next trip to Bonaire so we'll have two to save haul time. If anyone wants more details, let me know. ■

About the Author: John Burge is an NSS-CDS Cave Diver Instructor and PADI Master Scuba Diver Trainor, has served as Vice Chairman of the CDS, is the author of *Basic Under Cave Surveying*, and regularly teaches the Underwater Cave Surveying specialty course at NSS-CDS workshops. He has a second home on Bonaire and dives its caves regularly.

TEAM DIEPOLDER '91: Our Story

by Dustin Clesi (NSS #25585) & Jim King (NSS #30336)

With excerpts by Larry Green and Gordon Watkins (NSS #26609)

[The following project was sponsored solely by Florida Speleological Researchers, Inc. (FSR), and is advanced for speleological interest only. FSR does not condone the use of compressed air at excessive depth and advocates specialized training with respect to survey, staging, advanced decompression techniques, DPV use and mixed-gas technology—all of which were critical to the scope of this project. The endeavor was privately funded by the participants, who each hold ratings as certified Cave Divers and/or Cave Diver Instructors. All photos are by Florida Speleological Researchers, Inc.]

May 7, 1990 was a special day. It was the beginning of what started as a fair-sized project but developed into a major undertaking. Objective: Survey and generate an accurate underwater map of the downstream section of DiePolder Sink #2, one of the largest and deepest underwater caves yet known in the Americas. Nestled in the sand hills of western Hernando County, Florida, it derived its name (along with its brothers, Sinks #1 and #3) from the former owners of the property.

After several survey dives, we found that the downstream ballroom literally ate the limited 200′ range of our small side-scan sonar unit. Out came the knotted lines and tapes, and work began in earnest—the hard way. This continued through July, section by section. The giant cave seemed to laugh at our feeble efforts. Depth limited working time but fast DPV's made some difference. Areas of the cave that we had swum by for years now took on new meaning as we penetrated for a much closer look. Features such as "The Pinnacles," "240 Rock," "The Caverns" and "The Three Kings" now appeared more impressive than ever before. Giant karst monoliths rising 35′ off the floor of the cave beckoned us to study and record further.

It was in the ledge area at the back of the ballroom, that the cave became more interesting still. This is a giant bedding plane extending 90′ inward and closing to yield two major restric-

Some of the gear at the start of the project.

Team shot, left to right, 2nd row: Dustin Clesi, Larry Green, Jim King, Gordon Watkins; 1st row: Jim Schlesinger, Rich Nicolini

tions. The "270 Tunnel" lay beyond. The restriction on the right, aptly dubbed "Sweet's Slip 'n Slide," extends 50' beyond and is very low and coated with white clay—sort of a horizontal "Potter's Delight." Some 40' to the left lies a smaller opening measuring 30" in diameter. The entrance gallery to this aperture is much higher (ceiling to floor about 5') and is much more accommodating. The beautiful white karst surrounding this area looks much like the lacy phreatic structure encountered in the Temple of Doom down in Akumal, Mexico. The silt is ever-present as well. A winter snow scene turns into a "white out" as the diver passes. It was determined. We'd go for the smaller restriction after making a few preparations.

Thoughts raced as we exited the cave. We knew that Dale Sweet was the last to penetrate into the "Tunnel" back in 1980. That very dive was also noted as the first recorded use of mixed gas in an underwater Florida cave. His line still lies half buried in the "Slide." Could this be the destination of all the water slowly flowing from the upstream? Part I of the project was about to begin: The Shallow Section.

On August 25, we geared up, looking forward to the adventure. Trimix 16/40 with single stage was analyzed and survey equipment readied. Hamilton gas tables were selected above four other sources. Due to the nature of "The Crack" (this is the vertical entrance fissure in the basin, which narrows to 2-3' wide, dropping from 40-190' depth), we had established "Zepp Depot"—a DPV parking lot—just inside the cave at 210', Nitrox #40 at 90', and pure oxygen at 30' the day before. A 40-minute dive to 280' was planned to map what lay beyond.

Dropping quickly, we approached Zepp Depot and unclipped two T-16 Aqua Zepps hanging from ceiling lanyards. Riding almost 100 lbs. of thrust across the vastness of the ballroom, we gently settled on the floor of the ledge area in less than three minutes.

The water was cobalt blue as we tied off. Swimming over the sloping floor, a second wrap was made just before the small restriction and the stage bottles were dropped. Once through, we peered across a huge room that hadn't seen a cave diver in over 10 years. Our silting hung suspended in the water at 281' as we referenced the exit. It was obvious that there was no flow coming in. It was also obvious that what was white clay only seconds before was now red clay decorating the floors and walls. "The Red Room" was so named as the survey reel sang its song to the back of the room. The end of Sweet's line was observed and our exit was slowed by more careful searching for leads.

A second dive to the Red Room was made on Dec. 5, 1990. 440' of passage was surveyed, 21' from ceiling to floor with a width of 98' recorded. At the end of Sweet's line, a black spool was recovered from the clay floor bearing his name and dated May 18, 1980. The dive was also filmed by Bob McGuire of Gainesville, Florida, using 8mm video mounted atop a Farallon Mk VI DPV. As a fellow FSR Director and DiePolder Guide, Dale Sweet was sent the spool and a copy of the film for a spectacular New Year's viewing. Beyond a doubt, Sweet was the first and only diver to wall this section out until this time—and he did so almost 11 years ago!

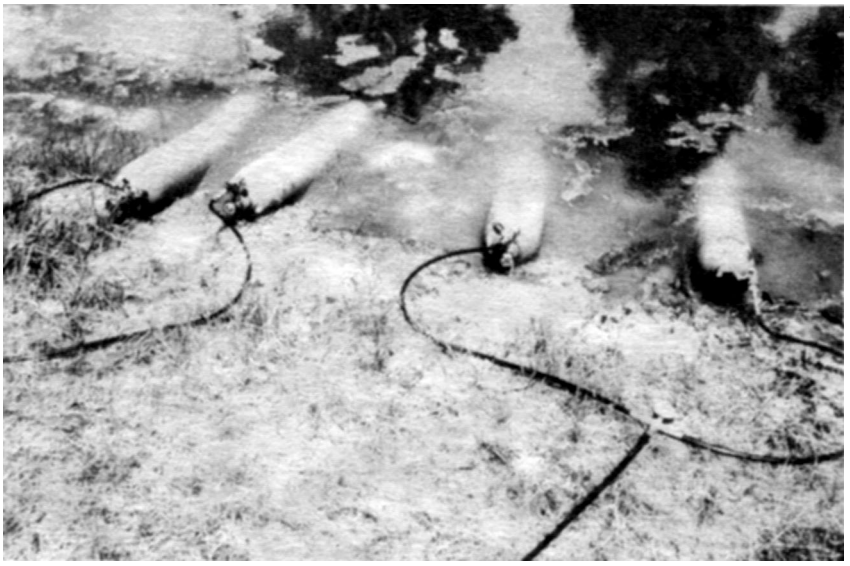
We drove away from the sink that day knowing that only one other area in the cave could provide us with the answer as to where all the water was going. The deep section now lay before us as the giant cave seemed to continue to scoff at our efforts to record its secrets. Up to this point, all survey dives had been performed by FSR Directors, Gordon Watkins and Dustin Clesi. A tremendous amount of data had been accumulated over six months of surveying. As the map began to take shape, we started to prepare for what lay ahead. No other DiePolder Guide had expressed a serious interest in participating due to various reasons. It was generally thought that the cave was totally explored but unsurveyed. Accepting this and continuing undaunted, an offer of support to assist in completing the project suddenly came from an unexpected quarter.

On the evening of Feb. 12, 1991, Larry Green and Dustin Clesi drank coffee in a truckstop on Interstate 75, sharing tales of exploring Eagles Nest Sink. Having dived together, along with Gordon Watkins and Jim King, a sense of renewed fellowship began to emerge. (Larry and Jim had walled out the upstream Nest—verified by Gordon and Dustin—and had lined the downstream to the limits of available technology, almost tripling known passage.) It was agreed. Assisted by support diver Rich Nicolini and tech/gear support man Jim Schlesinger, the six would combine to finalize the survey, finish the map and attempt to breach one of the deepest known underwater caves in the world. We had such a good time contemplating how much fun we would have that we lost all track of time. The waitress finally threw us out after five hours of 50¢ coffee. Team DiePolder '91 was born and Part III was about to begin: The Deep Section.

In the farthest reaches of the downstream ballroom to the immediate right of the ledge area lies "The Pit." This is an awesome spectacle guarded by the Three Kings—giant limestone sentinels measuring 9' wide by 5' thick, standing almost 20' tall. They appear in file as if to flank the western approaches of the funnel. The Pit itself is round with a maw almost 90' in diameter at its shallowest lip. The upper rim first appears at a depth of 260' and funnels down to an aperture of about 6' wide at a depth of 300'. From this location, the cave ceiling crowns over 120' above. The aperture drops another 15' to a silty cave floor which turns horizontal at the 320' level. Beyond this point we had no knowledge, as only one of us had been that far to date. An aura of mystique and history seemed to pervade this place. The red nylon guideline was there, trailing off into the distance, even deeper into the cave.

To our knowledge, only four men had reached or even come close to reaching the end of the red line where an American flag, with its message, had been planted: **Dale Sweet**, who had run the line and placed the flag, using mixed gas for the second time ever in the then-deepest penetration of an underwater U.S. cave; **Sheck Exley**, who saluted the flag in his extreme compressed-air cave dive; **Lamar English** and **Bill Gavin**, who most recently staged in using mixed gas in 1988 for a quick look. A report of another "crack" or vertical fissure near the "Flag Room" emerged from this latest dive. As for the message, only Sweet knew and he wasn't saying. The line reportedly ended in the Flag Room at a depth of 360'. We wondered... was the water going there also?

Our team came together quickly. The FSR Board of Directors voted unanimously to sponsor the project. All ratios and rules for diving would be maintained within our small group. The landowner assisted with the use of lodging on site to be used as a base. A timetable was developed for a four-weekend schedule. The Hyperbaric Staff at W. A. Shands Hospital in Gainesville, headed by Dave Desautels, helped formulate a contingency recompression plan just in case. Hamilton Research and Oceaneering were periodically consulted. All bottom mixes, decompression gases and decompression schedules were generated for consistency in usage among the four dive-team members. Dive planning began to take shape and it was decided that two two-man teams would rotate, i.e., one team would support the other and vice versa each day. The diver support man would work the basin and entrance fissure; the gear man would work equipment topside.



Surface-supplied Nitrox for decompression.

On Mar. 16, a stunning array of collective deep cave-diving equipment and new technology was stacked on site for a set-up weekend. Team members sweated in the rain and heat to prepare. The four-man habitat was pulled from Eagles Nest and prepared for reimmersion. Two on-site computers with electronic transponders were readied to record pertinent data. More than 10,000 cubic feet of various gases were analyzed. The best choice for a DPV workhorse was the German Aqua Zepp. Five of them were charged and checked—one would be a spare. They would be hung at Zepp Depot, remain in the cave for four weeks, and be expected to pull heavy loads to 270' depth.

"The Bar" was carried to the water's edge. It was one of two pieces of specialty equipment designed for the basin of DiePolder #2. Jim King and his workmen at Activated Metals, Inc. fabricated this 6' steel tube with telescopic ends and tested it to withstand 10,000 lbs. of stress. It was lowered into the Crack using 300-lb. lift bags, extended into double ledges at 43' depth, and dogged down. It would be dubbed "Decom #3," provide a base for the habitat, and become a virtual Christmas tree of gas bottles and support equipment. Next came the high-pressure line dropping to 80', surface-supplying Nitrox #46 for decompression at that level via a milled Y-valve with 15' second-stage whips, creating "Decom #2." At 150', eight Nitrox #30 bottles were placed, creating "Decom #1."

Inside the cave, "Safety #1" (known as HOME) was installed by placing two bottom-mix and two compressed-air bottles at 200'. Five DPV's were parked at Zepp Depot. A temporary guideline was run across the cave floor to a flat area, dubbed "Safety #2" (the EDGE), at the rim of the Pit. An additional four bottom-mix bottles were stashed here and all Zepp runs would terminate here at the 270' depth as well. Safety #2 would undoubtedly become a busy place. Provided all went smoothly, the "Safeties" would never be touched. With the habitat installed at 20', all was ready for the first two runs into the Pit. We were prepared to go in fast and stay awhile. The following week wouldn't pass quickly enough.

Mar. 23 found Watkins and Clesi preparing to penetrate to the end of the red line, laying survey line in. Green and King would support. Dustin recalls:

Trimix 12/50 was rigged for single stage. The descent went well and we interchanged fresh bottles at Zepp Depot. Mounting Zepps at 210', we punched out across the

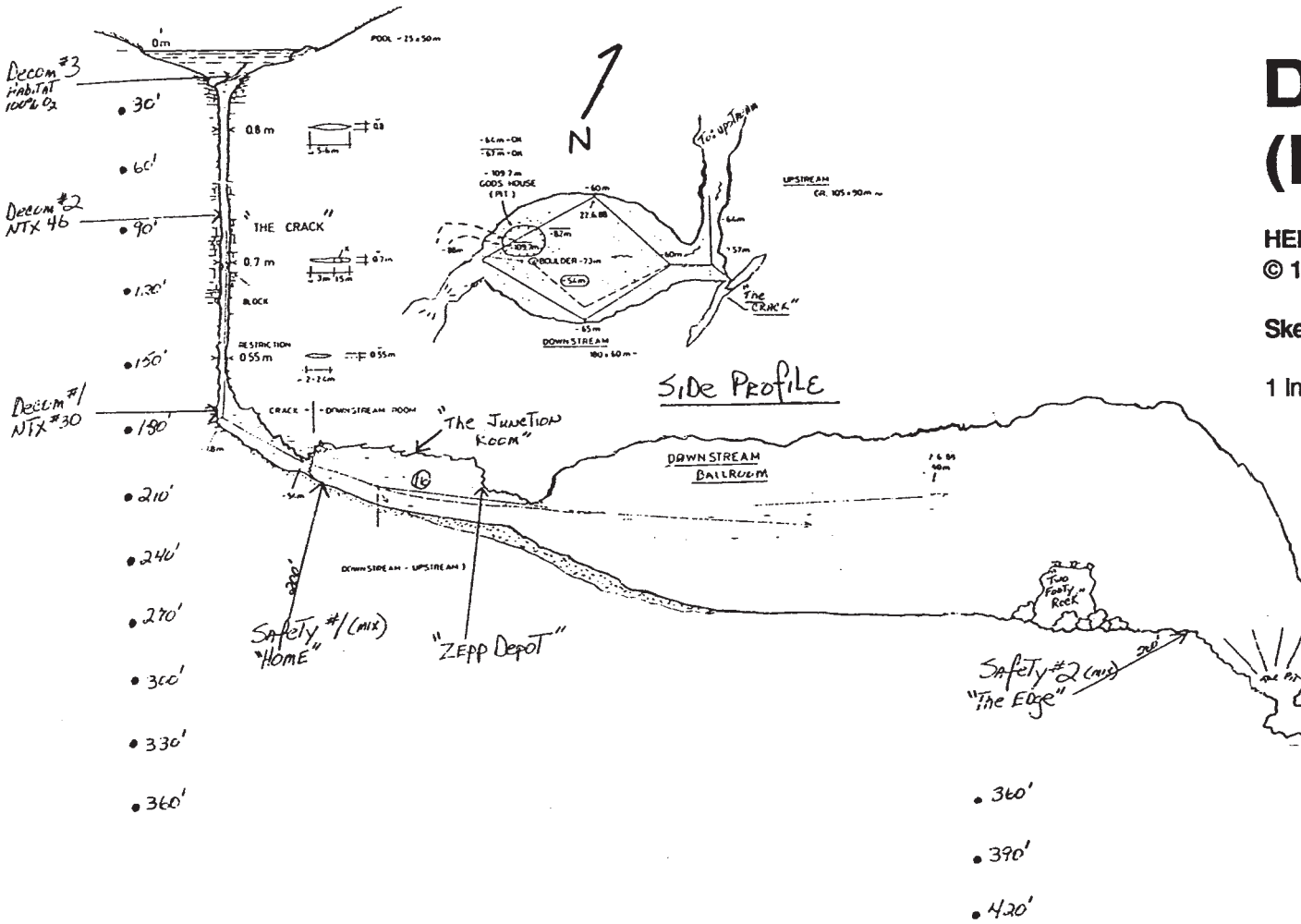
middle of the cave to settle smoothly at Safety #2. Expecting a non-event, I ran the survey line over the edge and dropped through the aperture, running parallel to the red line at 320'. Gordon's 250-watt primary illuminated the passage like daylight. At 330' the cave took on a completely new appearance—shades of Madison Blue!!! We've got phreatic development here! Clear evidence of flow—arched ceilings, sculpted rock, pits, domes and scalloped walls.

The cave widened to 80' in "Dale's Delight." Dropping to 340', we entered a small room with neapolitan walls, still paralleling the red line. The trunk passage continued low and wide, winding in a westerly direction. Clearing a minor restriction, we entered another room and saw it! The end of the line disappeared into the silt floor at 347' gauge . . . and hanging onto the line 1' above the floor was an American flag encased in clear plastic sheets. On the back was the date: June 8, 1980. Sweet was certainly busy during the summer of that year! Also there was the message: "In God We Trust." Two simultaneous salutes and we began searching for leads.

Moving to the back of the Flag Room, we encountered a low, horizontal bedding plane. Peering through, our lights dimly illuminated what appeared to be another room in the distance. Exchanging signals, I negotiated the restriction, laying knotted line carefully. Four knots later, the cave began to open up. Another 70' of line and we had going tunnel at 350' gauge!

Gordon came through and up to "The Nub," a vertical projection on the floor. The new line was secured here and it was time to go. Gas levels were dropping fast. The way was clear but would have to wait for the next team. Gordon lead out and we surveyed as we exited. 280 linear feet from the aperture to the Flag Room was laid. Another 110' through the "Run DMC" restriction to the Nub for a total surveyed passage of 390' linear.

At Safety #2 the support team was waiting anxiously. A slate was flashed: "We're laying line!" Four Zepps whined for the exit, two stopping at 230', continuing their seven-hour trek to the surface. Our elapsed time was 43 minutes. Almost four hours later, Gordon and I reached the comfort of the habitat at 20'. Off came the 104's and on went the weightbelts. While we climbed inside, our support diver, Rich Nicolini, pulled our doubles from the water and immediately removed the transponder (dive profiler) from its pouch attached to one set. Jim Schlesinger and Jim King downloaded it into the portable computer for a visual dis-



play of the entire dive profile, as Michael Menduno looked on with interest. The sun set above as we soaked on oxygen. We knew now there WAS more.

On the following morning, Larry and Jim geared up for the next dive supported by Gordon and Dustin. Jim described the dive:

After hearing details from the previous day's dive, Larry and I thought about what we would expect to do differently and formulated our plan accordingly. Without discussing it with Larry or the others, I had secretly made the decision not to extend the line laid the previous day. I felt that Larry and I were guests of FSR, and that they deserved to be the ones to lay new line.

Smooth is the best description of our dive. Our descent from the surface and to the Flag Room was quick and uneventful. As I approached the flag, I simply tugged on it and quickly placed it in my pouch without being noticed by Larry, no fanfare. We quickly reached the end of the Clesi/Watkins line, well before thirds, and turned the dive after confirming continuing tunnel.

On our way out, we were met by Dustin and Gordon. After a quick O.K., they were gone, leaving us to decompress for four more hours. Word was passed topside that Larry and I must have had trouble, since we had "come out too quickly." The truth is that it's easier to follow than to lead; laying line takes time. Fact is that we were able to reach the end of the line some 10 minutes earlier than Dustin and Gordon had the previous day.

Upon surfacing, talk turned to the mysterious flag. I casually mentioned that I had the flag. Dustin excitedly said, "You've got the flag? You got the flag?" I simply said, "It's over there in my dive pouch." Had a "foreigner" stolen the flag? Out came the object that had been a mystery for over 10 years. Cameras came from everywhere as everyone wanted to photograph this monumental event. Suddenly a group formed around the flag and you would think we had just won the Super Bowl. But soon talk turned to "We've got to put it back . . . it belongs to the cave."

On Mar. 30, Clesi and King prepared for the next dive. In an effort to probe further into the cave, more modifications were required. Nicolini and Schlesinger installed 200' of high-pressure line to a depth of 180', now surface-supplying Nitrox #30 to Decom #1. This now eliminated all decom bottles in the Crack. The pair would descend on a five-pack, interchanging with a sixth bottle at Zepp Depot, intent on dropping into the Pit with fresh double

IEPOLDER #2
Downstream)

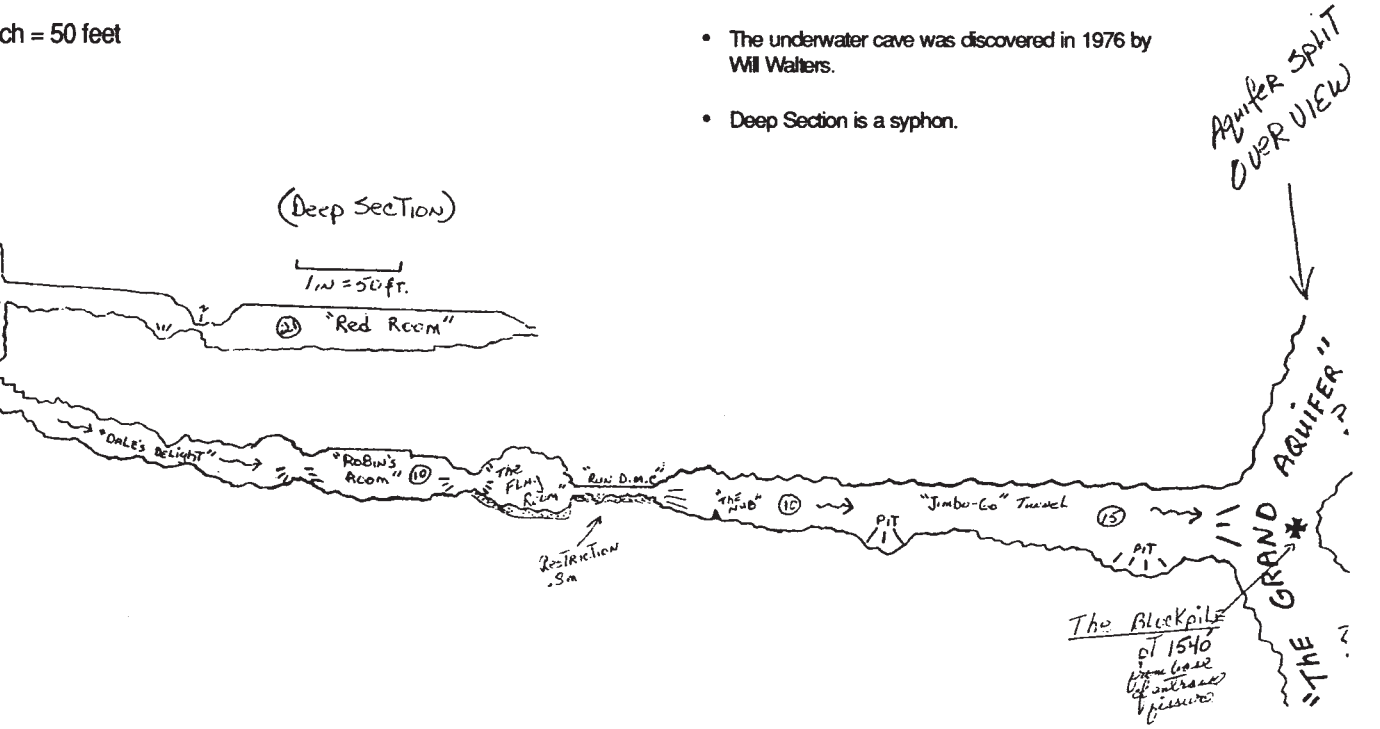
RNANDO CO.
991 Florida Speleological Researchers, Inc.

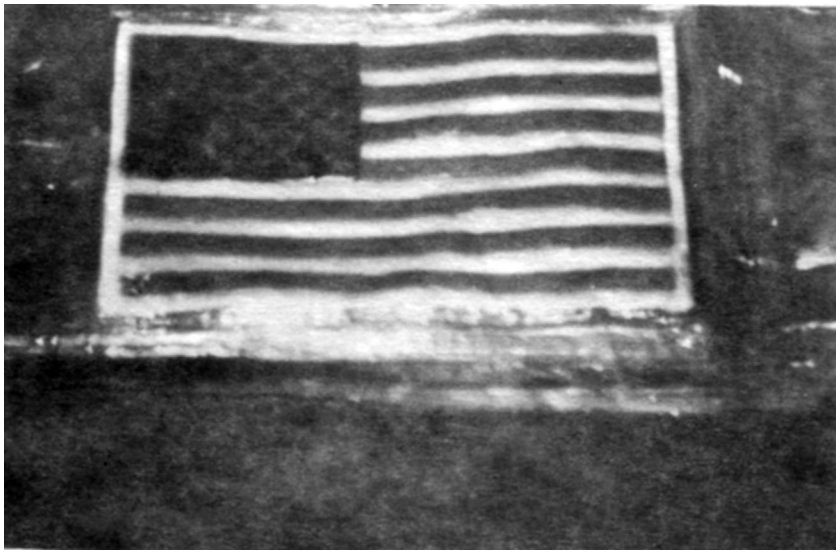
tch by D. Clesi

ch = 50 feet

NOTES:

- Cave is completely underwater.
- This cave is an advanced cave dive requiring advanced techniques due to major restrictions and to the great depths within the system.
- Open-circuit mixed gas is required to safely penetrate the lower section.
- The system has spectacular rooms with white limestone walls throughout.
- The underwater cave was discovered in 1976 by Will Walters.
- Deep Section is a syphon.





The Flag

stages. A 50-minute bottom time was planned with mix prepared to accommodate a 400′ depth. Dustin recalls:

The run went smoothly, with our support divers, Larry and Gordon, following us to the Pit. Jim led the way in, tying off new survey line at the Nub. Visibility was poor. The survey reel again went to work. The passage again became larger, heading 271°. Interchanging bottles en route, Jim unloaded 120′ and the cave veered to the right to 290°, dropping to 365′. I placed the line mid-passage and we noted four large pits flanking the tunnel. Lots of water had passed this way for sure.

Another 130′ of line was played out and we entered a large area with walls too far away to see. Continuing dead ahead, we reached a blockpile near a wall running perpendicular to our route. Looked like a split! Having reached his critical volume, Jim tied off on the line and began to survey out.

Retracing almost 400′ of passage, we again paused in the Flag Room and replaced the proud old American flag in its original position at the end of the red line. It truly belongs to the cave. We slowly ascended to Safety #2, mounted the DPV's, and motored to the first decompression stop at 240′. The safety team was long gone and we were alone with the cave. Our thoughts raced . . . "What did we swim out of . . . or into?" Gordon and Larry would have to find out tomorrow.

Finally reaching the comfort of the habitat, the two of us were subdued . . . "Do the secrets of the cave ever stop?" Suddenly, two 10-K bottles popped up from below. Bubbles appeared and a waterproof canister broke the surface along with a petite cave diver. Why, it was the "Lunch Lady" with a bunch of munchies! Using a service light to distribute the goods, Robin Phillips, R.N., cautioned us that she would be waiting topside to pull a new blood sample when we surfaced. Noting a class 4 Doppler on our last dive, we were now prime targets for a new lab specimen. The rest of the team was already viewing the dive profile on one of the computers.

The next day, Larry and Gordon geared up with five-packs. The mood was now more somber with the anticipation of what they might now discover. Gordon continues:

On the way down we anticipated bodily movement in order to negotiate the major restrictions of the Crack, difficult now with the extra gear. Entering the Junction Room, we immediately caught a view of Zepp Depot. The visibility was fabulous! Interchanging a fresh cylinder, we motored to Safety #2. Dropping the fifth bottle and DPV, we swam through the Pit with fresh double stages, leaving the safety team behind. Our goal, if time permitted, was to study this new section, punch out to the left and survey back to the blockpile.

This time, as in the Junction Room, the deep section was cobalt blue! We could see as far as our lights could penetrate. We then entered the Flag Room, making good time. Negotiating the Run and passing the Nub we were now on the new line that Jim and Dustin had laid the day before. The tunnel was now 30-40′ wide, flanked by fairly deep pits. Interchanging tanks, we swam on to the end of the line. With a quick glance at his gauges, Larry pulled out his survey reel, tied in and began to swim off to the left. Immediately, we noticed that the line had come free. Swimming back to the blockpile, Larry rewound, resecured the permanent line and installed a bowline. With nothing to do but wait, I took a closer look to the left, seeing 100′ of passage sloping off into the depths. "This system just won't quit!" To my further amazement, another gallery headed off to the right of the blockpile. "It's a split! . . . or did we tap into another aquifer, making the entire #2 system nothing more than a huge offset tributary?"

The latter is plausible. The rippling floor, widely scalloped walls and much larger passageway were promptly named "The Grand Aquifer." Larry finished up and we both called the dive simultaneously. Our usable gas was at the edge of safe limits. On the exit, both of us pondered the same question: Who would ever have known that over 100′ below the downstream ballroom lies DiePolder #2's best kept secret? What a privilege it was to catch a glimpse of this most majestic part of the cave!

We all met on the following weekend, removed all equipment and conceded that the gear had been taken as far as was practical. Further effort would increase risk proportionately and diminish return appreciably. The veritable "technological wall" had been hit. Open-circuit scuba is dead at these levels, killed by its own volume limitations. The way to future deep penetration is clear: closed-circuit mixed-gas equipment and the successes in modifying the big DPV's to withstand far greater pressures reliably.

Meanwhile, on to new horizons. DiePolder Sink #2 may continue to laugh and guard its secrets . . . for now.

ACKNOWLEDGMENTS.

Special thanks to: Air Products, Carmellan, Stuart Clough, Dudley Crosson, Ph.D., Deep Breathing Systems, Deutsche Industrie Norm., Dave Desau-tels, Dive Rite Manufacturing, English Engineering, GSD, Bob McGuire & Narcosis Video, Mike Menduno & AquaCorps, Ocean-eering, Poseidon, Pressteel, Robin Phillips, R.N., R.W. Hamilton, Ph.D., ScubaPro, Sea Hunt Dive & Tackle, Stan "Ski" Kryzanowski, Steve Straatsma, Tag-Heuer, Viking, W.A. Shands Hyperbarics, West Central Florida Council B.S.A., Will Walters, . . . and those outstanding DiePolder Guides—past and present—for making it all happen. ■

THE SAFETY LINE

by Wendy Short (NSS #30802), Safety Coordinator South

There are insufficient guidelines about how to conduct your dives between different training levels. The tendency is to push yourself too far and too fast. In our high-tech world of scooters, multiple stage bottles, and dive computers, it is all too easy to get enticed into doing dives that you may not be physically or mentally prepared for. There are some divers that have little experience to support the kind of dives they are doing.

Certification is not the same as experience, skill, or knowledge. Training does not necessarily make you a safe cave diver. It also takes practice, dedication, and a mature attitude. Where are you in your training program? If you are a cavern diver, make at least ten cavern dives before taking Intro to Cave. Perfect all the cavern skills you have learned, such as reel handling and buoyancy control, so when you do take Intro to Cave you can concentrate on learning new things. You shouldn't have to be dealing with a jammed reel, leaking mask, or other basic skills you should have already perfected.

Make at least 25 basic cave dives before taking Full Cave. Sometimes it takes almost this long to get your equipment comfortable and configured right. Try to dive in as many different caves with different conditions as you can. Each individual needs to pace himself and build up experience slowly. This doesn't mean covering a thousand feet of passage the first time you visit a new system. It means first going a few hundred feet, then a few hundred more, etc. Get familiar with the front end of the system first before venturing into deeper passages. Fine tune your techniques and practice line drills and other skills you learned in Intro to Cave. A line drill is lights out, following the line while sharing air. Line drills should be practiced so frequently that they are second nature. Then if an emergency really arises you can perform calmly and efficiently.

It is not required that you do a minimum number of dives between each training level. But why cheat yourself from getting the best possible training? Many Full Cave classes are tailored to the individual and his ability. If you are proficient in your skills when you go into Full Cave, you should be diving in more challenging systems and learning more than the individual who takes cavern to full cave in a week. And you'll be more readied to venture out and explore on your own.

It is important to remember not to dive beyond your level of training while preparing yourself. Basic cave divers tend to dive with Full-Cave-trained friends. The Full Cave diver needs to drop back and dive on the Basic-Cave level, not the other way around. And don't forsake finishing your training. Just because you may have made 35 dives by now does not mean that experience is a substitute for training. You may think that you will not learn anything new in Full Cave. This should not be the case. The exposure from training should be a great asset when you're on your own.

In a way, training never ends. It may not be a formal classroom session, but you should never stop learning in cave diving. Even if you have made hundreds of dives over a period of years, there are always new and more challenging systems out there to try.

Maybe you are not able to cave dive very often, and this approach seems unrealistic. A dedicated cave diver has made a commitment which can call for a sacrifice of time or money. Cave diving is not a sport to be done once a year on your summer vacation if you want to make advanced dives safely. You should restrict yourself to the degree that you're willing to commit yourself. If you can cave dive only one week a year, then choose easy, forgiving systems. It will be more enjoyable to you and be less damaging to the cave. Cave divers have usually been considered to be reasonable self-regulators, and we need to continue this practice.

If you have already finished your training, try to dive as frequently as possible. Cave diving should not be done casually. And if you enjoy doing something, if shouldn't be too hard to arrange the time to do it often. The more you do it, the better you'll get if you challenge yourself to improve on every dive. Cave diving is not the same as open-water diving. There are higher standards of training and a less forgiving environment, and more demands are placed on you physically and mentally. You must be able to accept these new standards that call for a commitment from each individual. If you follow these guidelines, you should evolve into a more confident, skilled, and safer diver. ■

Peacock 3 Relined

Cave Diving Instructor Phil Sirota reports that he, his wife, Linda, and Terry Gordon have relined the first 1300' of Peacock 3 with gold braided-nylon line. They plan to install a new warning sign and line arrows at 100' intervals. Phil says that CDS Director Jim Bowden will be installing a sign at Jacob's Well in Texas. Anyone requiring a warning sign should contact Phil at (904) 963-2904. Our thanks to all these people for their hard work. ■

Theft at Peacock

A yellow 63cf aluminum tank belonging to Phil Sirota was stolen from the head pool at Peacock Springs on Sat., June 15, while he was carrying his other gear back to his vehicle. The tank was equipped with a Sherwood Y-valve and an AMF Mark II regulator, and clearly marked as containing pure oxygen. Attached to it were a set of O_2 tables and neoprene gloves in a blue bag. Anyone with any information regarding this crime is urged to call Phil at (904)963-2904. ■

Photo Contest

Picture *your* color photo on the front cover of the new cave-diving manual for all eternity. The glory alone should be enough of an incentive for any UW-cave photography enthusiast—but no!—we're offering *PRIZES!* Front cover winner will receive a DAN membership with chamber insurance. So snap to it! Mail a *copy* (at this point, do not send any originals!) of your photo(s)/slide(s) to: Joe Prosser, 7400 N.W. 55th St., Miami, FL 33166 ■

MERRITTS MILL POND UPDATE

by Brent Booth (NSS #32089)

How many cave divers have often said, especially on a typically busy weekend at Peacock, "I wish I could find virgin cave of my own"? Those of us who listened to Lamar, Tom, and Woody at the '89 Winter Workshop certainly felt an adrenaline flow during their presentation of the Luraville-Telford connection, and for a while most of us in the audience probably felt that urge to literally "go where no man has gone before."

This past fall, quite by accident, while diving in the Twin Caves system in Merritts Mill Pond, I felt like I had suddenly come upon a virgin cave system even though I was diving a well-mapped and frequently visited system. Now that you're totally confused, let me explain: Merritts Mill Pond, near Marianna, Florida, comprises three large cave systems and several smaller ones. In the spring of last year, the Mill Pond was drawn down to preserve both animal and plant life, and then refilled in the late summer/fall time frame. We were probably not the first to dive the Mill Pond after the draw down, but it was obvious to us that not many divers had preceded us (at least in the Twin Caves system).

For those of you who had dived in the Mill Pond before the drawn down, let me share these latest observations of Twin Caves with you.

First of all, the cavern portion of Twin Caves has a tremendous amount of silt compared to before the draw down. As I was running my reel to the permanent line, it was as if I were seeing an entirely new system. The floor of the cavern was as smooth as glass (silt covered) and, of course, all protruding rocks and ledges were also heavily covered. It certainly was quite different from, let's say, the Peacock-to-Pothole run, where it sometimes appears that divers are walking as opposed to swimming through the system.

From the start of the permanent line until we reached the second drop-off, which is the end of the upper level, we encountered no signs of previous divers with the exception of the line itself and the survey-station markers left by John Burge and Frank Howard. Just as in the cavern, the floor was smooth and the walls were silt covered. At the 103' drop-off, the numerous ledges on the way down had always had the typical fine layer of silt, but nothing like it was on them this day. The drop to the 103' level was almost straight down and much more impressive than, for example, the chimney at Little River. (The map produced by John Burge and Frank Howard shows an excellent cross section of the 103' drop-off, and anyone planning a future dive to this location should have a copy. Unfortunately, the map ends at the 103' drop-off, although the permanent line continues for an undetermined distance.)

Secondly, I observed that although there were various degrees of sediment in suspension all the way to the second drop-off, visibility was still excellent and on the lower levels the visibility was crystal clear. I had never been beyond the bottom of the 103' drop-off until this dive, so I can't make a comparison to earlier conditions; however, it is obvious that a lot of additional silt is now on the lower levels.

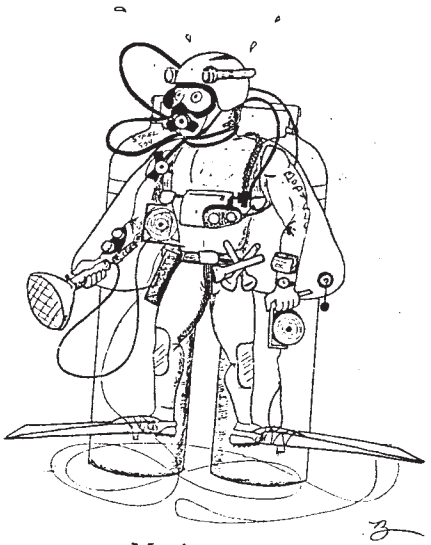
All line markers and the guideline were heavily covered in silt and in places the line disappeared for several yards through silt mounds. Two days later when we dove the same location, I immediately noticed signs of divers in the system. Imagine my dismay when I suddenly realized the signs were mine!

Twin Caves, like Little River, offers excellent opportunities to pull and glide, and that is exactly what we had done . . . all the way to the 103' drop-off. I could see my hand prints on the walls acting like a road map. So much for the "virgin" cave system.

At the Winter Workshop this past year, I talked to Frank Howard about the silt conditions in Twin Caves and his opinion was that when the draw down took place, the aquifer actually pumped harder and sucked more silt into the system than normal. Another theory is that all the caves in the Mill Pond acted like a bathtub with the stopper removed, causing the silt to settle to the lowest levels, which were the various cave systems. Whatever the reason, the Twin Caves dives were a very unique experience.

NOTE: As a follow-up to this story, Lamar Hires and I made a dive in Twin Caves on Feb. 20 of this year, and the conditions had changed considerably. The flooding in north-central Florida sent divers elsewhere looking for dive sites and it was obvious that numerous teams had found Twin Caves.

No longer was the cavern floor smooth as glass. This area, along with the floor of the main passage, had the numerous "crash-and-burn" marks of a heavily travelled dive site. The system does, however, appear to be cleansing itself. The walls, back to both drop-offs, were much whiter and the visibility was somewhat better. On the lower levels new line markers seemed to be in place and again the floor showed signs of divers having been there. It was somewhat the Twin Caves of old, which to me was a shame because I had had the opportunity to see the system as it was "before." ■



My Answer to Multiple Stage Diving

Mark Johnston (NSS #32857)

BOTTOM REACHED AT RED SNAPPER SINK

by William L. Wilson (NSS #12231 Fellow)

Red Snapper Sink is the largest, deepest submarine collapse sinkhole known on the Florida Platform. It occurs in 88′ of water, 26 miles east of Crescent Beach, Florida.

On April 26, 1991, Jim King became the first person to dive to the bottom of Red Snapper Sink. After a 10-minute descent from the ocean surface, along the south wall of the sink, King reached a generally flat sand floor at a depth of 434′. The depth was measured with a Beauchat depth gauge.

Visibility at the bottom was approximately 30′; no walls were in sight. King swam south for approximately 2 minutes, but never encountered a wall, which indicates the bottom of the shaft is undercut. He collected a water sample, and after approximately 4 minutes, returned to the surface following the appropriate decompression schedule.

The dive was made using open-circuit scuba gear. The gas supply consisted of two 104cf tanks of trimix (10% O_2 and 60% He), one 80cf tank of trimix, one 80cf tank of nitrox 30, one 80cf tank of nitrox 46, and one 80cf tank of oxygen. Two tanks of trimix, one tank of nitrox 46 and one tank of oxygen were worn by King to the bottom of the sink as a back-mounted quad-pack. In this way, his dive was self-contained in that he carried all of the necessary gas types with him. One 80cf tank of trimix and one 80cf tank of nitrox 30 were carried clipped to the front of his diving harness.

The gases were used at the appropriate depths for the appropriate intervals. The decompression schedule was custom calculated under license from Dr. Bill Hamilton. The total time in water was approximately 3 hours.

From a depth of 325′, a patch of faint blue light was visible overhead. The sink is a karst collapse with vertical over-hanging walls, so far as known at this time, with a minimum of exploration. It seems inappropriate to call the sink a cave, but it may be fair to call it a cavern. So King's dive is the deepest cavern dive accomplished in the United States, and is deeper than any cave dive yet accomplished in the U.S.

Ken Saunders and Ken Zarrillo rigged the decompression float system for King's dive. One-half of a concrete-filled barrel with four protruding pieces of rebar was used as an anchor for the boat. The anchor was dropped on the ocean floor approximately 50′ south of the sink. The divers attached a second line with a lift bag to the anchor. This vertical line was used for decompression rather than the anchor line, which tended to rock up and down with the boat. The length of the decompression line was adjusted so the lift bag was 10′ underwater. Saunders and Zarrillo attached a Dive Rite reel to the anchor and swam out over the vertical shaft in the floor of the sink; they dropped a second reel with 400′ of line, tagged at 50′ intervals, to the floor of the pit. In this way King had a marked line to follow up and down the shaft.

On the ascent, King was met at a depth of 200′ by Cory Bergen, who acted as a safety diver to monitor King's decompression. Bergen relieved King of the two bottles that were clipped to the front of King's harness. The decompression was completed without incident. After the dive, King recorded doppler echoes of his blood stream for subsequent medical evaluation of the suitability of the decompression schedule.

Bill Wilson and Rick Spechler, both of whom are geologists, dived to 160′ and circumnavigated approximately two-thirds of the circumference of the shaft in a 30-minute dive. Spechler collected water samples that he will analyze, and Wilson collected rock samples that will be used to describe the stratigraphy of the sink. Both divers observed a few widely separated corals on the limestone ledges between 134′ and 160′. Flower coral (*Eusmilia fastigiata*) and ivory bush coral (*Oculina diffusa*?) were seen.

All of the divers saw abundant large fish in and around the sink. Red snapper, grouper, barracuda, and abundant bait-fish schools were noted. Two sharks were observed. A large sea turtle was seen by all of the divers. The turtle showed no fear of divers and repeatedly approached to within arm's length at depths of 130-200′.

A Sipro dive-profile recorder, carried by King, showed that the water temperature decreased from 25°C at the surface to 23.75°C at a depth of 88′ (ocean floor around the sink), to 23°C at 334′, and then remained constant to the bottom at 434′. Water salinity increased slightly with depth, based on conductivity tests by Rick Spechler. Basically, at the time of the dive, the sink was filled with slightly cooler, more saline, denser water than the surrounding open ocean. No evidence of freshwater discharge was observed at the time of the dive.

The ocean floor around Red Snapper Sink consists of shelly quartz sand. At a depth of 90′, the top of the sink is approximately 400′ in diameter. The sand floor slopes into the sink at an average angle of approximately 26° to a depth of 119′ where greenish-gray clay crops out. The floor continues sloping downward to a depth of 134′ where thin beds of sandy limestone crop out as narrow ledges and cliffs. The limestone extends to a depth in excess of 180′, contrary to earlier reports that the upper part of the pit consists of unconsolidated calcareous sand and sand.

At a depth of 150′ the walls become vertical and the shaft is approximately 150′ wide from east to west, which is thought to represent the top of the Ocala Limestone (Eocene). As stated above, the bottom of the shaft may be undercut, but additional exploration and survey need to be done to establish the morphometry of this impressive karst feature.

Various maximum depths have been reported for Red Snapper Sink,

and the depths appeared to be decreasing during the 1970's:

Depth	Year	Reporting Agency
464′	1970	USGS
437′	1974	USGS & NOAA
413′	1979	USGS

The decreasing depths were attributed to sand that ocean currents were washing into the sink at an average rate of 5.7′/year. The depths were determined from boats using weighted lines and sonar fathometers. King's depth-gauge reading of 434′ seems to validate the middle reported depth of 437′. The deeper and shallower values may be simply erroneous, but further exploration may reveal corresponding amounts of topographic variation in the floor of the sink.

Other personnel on hand to support the diving activities were Jim Schlesinger, Larry Green, Richard Nicolini, and Chris Brown. The exploration of Red Snapper Sink was conducted by Deep Breathing Systems, Inc. from the 38′ commercial dive boat, *Giant Stride*, Tim O'Donnell, Captain. *Giant Stride* is berthed at the Mayport Marina, near Jacksonville, Florida.

Additional dives are planned over the summer to explore and map Red Snapper Sink, to document and describe the stratigraphy of the sink, and to document the hydrologic function of the sink.

[ADDENDUM: On June 1st, King reached a maximum depth of 482′ and discovered a siphon tunnel on the northwest side of the sink. This will be reported "in depth" in the next issue.] ■

LESSONS FROM OVERHEAD:
A Comparison of Cave and Wreck Diving
Part III - by Bernie Chowdhury (NSS #30691)

In the event of an air-delivery failure, the wreck diver switches to his alternative air source, makes a retreat from the wreck, and surfaces, stopping to make a safety decompression stop if needed. Note that some wreck divers prefer to use double tanks with a dual-valve manifold and a pony bottle, which is carried behind the doubles, affording more air and a backup to the backup! Talk about redundant . . . . Some wreck divers carry oxygen in their pony bottles, but this renders the bottle useless as a backup when deeper than 30fsw, because of oxygen toxicity.

Inside a cave, an air-delivery failure is complex and requires a well-coordinated response from the diver and his partner(s). Depending on the type of failure experienced, the diver may shut off one of his valves while switching to another regulator, or breathe off his buddy's octopus. Given the difficulty of traveling two abreast in most caves, buddy breathing is both impractical and impossible while swimming for the exit. Instead, a 5-7′-long second-stage hose is used so the diver can receive air while swimming in single file along the guideline. Should viz be limited, the need for all divers in the team to keep in contact with one another requires the use of touch-contact procedure.

Before entering a cave, the trained cave diver engages in a pre-dive ritual known as the "S-Drill." As a group, trained cave divers are among the most safety-conscious people I know. Although equipment and buddy checks are taught to basic open-water students, most pre-dive checks are far from rigorous. As T. S. Eliot would say, "Between the idea and reality falls the shadow." With open-water divers the shadow usually takes the form of a cursory questioning of one's buddy: "Ya got everything? Air on? Ya ready? Okay, let's go!" Sad to say, but this type of pre-dive check is not uncommon among wreck divers as well.

Contrast this with the S-Drill, the purpose of which is the thorough checking of each diver's equipment and ability to handle an out-of-air emergency. Given the popularity of three-diver buddy teams in cave diving, this safety check can be considerable. The drill takes place in the water. All lights are checked by turning them on and off underwater. Each diver then leans back and submerges his BC, valves, and hoses while his buddy checks for air leaks. Next, the divers submerge in shallow water, and take turns giving the out-of-air signal and getting air from their buddy's octopus. Every combination of diving-team donor/recipient is practiced. Finally, the divers ascend and calculate their "turn," which is measured in psi. Remember, the cave diver always leaves *at least* 2/3's of his air supply for the trip out of the cave. Dive depths and bottom times are also planned and calculated. Each diver dutifully records his personal information on a slate.

The differences in the almost casual way wreck divers do a pre-dive check and the rigorous S-Drill of the cave diver may be accounted for in several ways. Although air is critical to any scuba diver, the caver is most prone to reliance on his equipment for survival. When one considers that the cave diver may be thousands of feet and a half hour or more from the nearest cave entrance/exit, it is understandable that every possible precaution will be taken by anyone serious about making the return.

Wreck divers, on the other hand, have the luxury of being close to open water at almost all times. A previously mentioned point—that the wreck diver is usually not more than 30 seconds away from an exit—may be a crucial factor in the choice of air systems used and the casual approach to the pre-dive buddy check. If we take the scenario of two divers entering a wreck, it would be hard to imagine one diver successfully breathing off the buddy's tank in an emergency and exiting the wreck while doing so.

Without the benefit of a long octopus hose, the buddy team would have a difficult time trying to squeeze through most wreck passageways and

exits while side by side and octopus breathing. Each wreck diver must therefore by fully prepared to cut over to a redundant air source if his primary fails. This means that the diver must consider himself solo upon entering a wreck, especially if that wreck offers narrow passageways and entrance/exit points.

Although training agencies advocate no-decompression diving, the reality of exploring many caves and wrecks makes decompression a necessity. The ocean environment poses many hazards for the wreck diver undertaking decompression. Strong currents, freak storms bringing severe wave action, the dive boat breaking loose from its anchorage, sharks, and boat traffic make for adventurous wreck-diving experiences. Cave-diving decompression is a luxury in comparison.

Wreck divers must be totally self-reliant and, ideally, carry every piece of equipment they will need during the dive and decompression. For the wreck diver, hanging oxygen from the boat to assist in decompression will prove futile if the dive boat breaks loose from the wreck, or if the diver cannot find the anchorline. Ditto for extra air. If the wreck diver carries an oxygen pony, gas planning precludes its use during the dive. In the case of a wreck diver with a set of doubles, a manifold and an oxygen pony bottle, the diver has no real backup in the event of air failure, e.g., blown burst disk, ruptured hose, O-ring failure, etc.

The use of stage bottles is not common in wreck diving, but they have been used by some divers. For example, during some dives on the *Andrea Doria* this past summer, my buddy, cave-diving instructor Steve Berman, carried an oxygen stage bottle which we left on the deck of the *Doria* and retrieved after our penetration. This practice worked well for us, but drew comments from wreck divers unfamiliar with stage techniques. If a stage bottle is used, a guideline can be tied off to it so that the diver can find the bottle with little difficulty.

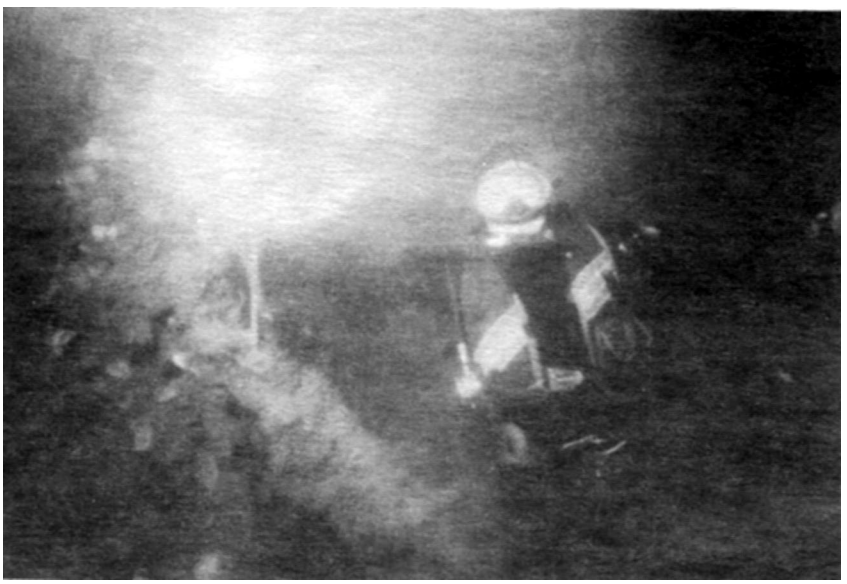
If the anchorline has broken free, the diver must still have a line attached to the wreck on which to ascend. Failure to use such a line could result in the diver being carried by the current far from the site during lengthy decompression stops. This would likely result in the diver being lost at sea. In order to overcome this situation, wreck divers carry an upline. In waters with significant current, e.g., in the Northeast, this usually consists of a reel with 1/4" sisal rope and lift bag.

The rule of thumb calls for twice as much line on the reel as the depth at which the upline will be used. This reel is typically carried on back of the doubles, to either side of the pony, and is held in place with tubing. Deployment consists of pulling the reel from the doubles, inflating the lift bag, and letting the line float to the surface while the diver strategically holds the spool. When the diver feels the bag hit the surface, he wraps the line around a firmly attached piece of wreckage, ties a knot, and cuts the spool free. Some divers construct disposable spools so they don't have to deal with carrying the reel back with them. Upon completion of ascent, the diver removes the lift bag and lets the rope fall to the bottom. Sisal rope is used because it is biodegradable.

Decompressing on an upline adds the hazard of air embolism to the wreck diver's checklist. How so? When the diver is hanging on the upline, he is attached to the bottom and not the surface, as he would be if hanging on an anchorline. This distinction is important because the diver hanging on a line attached to the surface will be carried up and down with the waves. If a diver takes a breath and feels himself pulled, he can exhale and avoid embolism. With an upline, a wave as small as 3' can create a great enough pressure change between crest and a trough for an embolism to occur if the diver has taken a full breath under the wave's crest. This occurs as water moves over the diver and his lift bag, changing the depth that the diver is hanging at.

Decompressing in caves allows the diver to place stage bottles and be reasonably assured of recovering them on the way out. Theft of bottles is the cave diver's greatest concern! Options for exiting caves being limited, the caver will be able to plan exactly where to place the bottles so that they are readily available when needed. Extra air and oxygen can be situated at the depths where they will be needed. The decompression stops can be conducted while resting against the cave, on a ledge or a convenient tree. Books may be read, magnetic chess played, candy bars eaten, all without threats of freak storms or sharks looking for food. (Ocean blue holes may present many of the same hazards of decompressing as found in wreck diving.)

The demands placed on the diver conducting a wreck or cave dive are many, and require thorough preparation. Advanced training is a necessity. The differences between cave-diving and wreck-diving training programs are considerable. Many dive shops do not want their instructors taking students on penetration dives for reasons related to liability. Many instructors, faced with this kind of situation, engage



Diving on a German U-Boat

in penetration dives with students only as part of an independent course that is not shop sanctioned or affiliated. This is a disservice to the diving community because most students are trained in shop-sanctioned and -promoted courses. If training can save lives, why don't more shops offer training—both theoretical *and* practical—in penetration diving?

Cave-diving courses are extremely demanding in terms of skills required, physical fortitude, and mental attitude. The diver who wishes to become certified as a "Full Cave Diver" must be well versed in the rudiments of basic cave diving and have excellent buoyancy control and techniques for moving through the cave. As a rule, cave instructors scrutinize their students very closely and often recommend extra training dives.

It should be noted that the Cavern, Intro to Cave, and Apprentice Cave Diver courses are prerequisites for the "Full Cave" class. Students who are curious about cave diving will find out whether this type of activity is meant for them when they take the Cavern class. In it the student's equipment is modified from that adequate for the open-water diver to that of a cavern diver. Skills are worked on both in open water and inside a cavern so that the open-water diver gets a taste of what is required to move through this new environment. Bad diving habits must be overcome at this juncture for the diver to be able to negotiate caves properly. In many ways, the Cavern course is the vehicle that shows both student and instructor whether the former is ready to progress to more demanding aquatic scenes. The emphasis is on preventing divers who are not physiologically and psychologically prepared from entering a very unforgiving environment.

Contrast this to the theme of many open-water certifying agencies that stress that "everybody can dive." Again, the open-water environment is much more forgiving than any overhead situation. When we think that wreck diving is defined as diving "around and in wrecks," and see that many wreck courses do not include actual penetration dives, we realize that wreck-diving training is, often, little more than an extension of the open-water diving philosophy that "everybody can dive." We know that this is simply not true when it comes to overhead environments. Some divers should not be encouraged to dive in wrecks or caves. Those who possess good basic diving skills, and are physically and mentally capable, should be given the opportunity to experience the thrill of wreck penetrations gradually, under the tutelage of a seasoned instructor.

By definition, a non-penetration wreck course is far less rigorous than a "Full Cave" course. Perhaps the difference in training arises from necessity: we have seen that the wreck diver is usually no more than 30 seconds from an exit, whereas the cave diver may be a half an hour or more from the exit! In the latter case, every discipline of emergency training would be required if an air failure occurred at the furthest point of penetration. At worst, a wreck diver should be able to do an emergency swimming ascent from inside the wreck beginning with a horizontal swim that would carry him to open water. Of course, a wreck diver should switch to his redundant air supply when experiencing primary air failure, thus making his exit almost mundane.

Although everyone is not mentally and physically equipped to dive in wrecks or caves, for those with the inclination and special training, the experience can be most fascinating. Any manmade object will disintegrate underwater, while caves form over periods measured in thousands or millions of years. Both environments are starkly contrasted with one another in such things as material composition, and marine life. Wrecks become a haven for aquatic life and literally teem with activity, while caves have far fewer marine organisms because of the harsh environment and the need for life forms to adapt to the lack of sunlight.

The intricate patterns that caves form make the experience of cave diving very rewarding for many divers. The need for conservation of caves is understood and is the foundation of responsible cave-diving organizations, such as the NSS-CDS and NACD. The issue of wreck conservation is controversial, especially since wrecks disintegrate because of the forces of water and marine organisms. Organizations such as ASDA are contesting new shipwreck laws and assert that divers have a right to remove artifacts, citing Admiralty Law and also the U.S. Constitution. Other organizations, such as SOS, believe that only individuals with state licensing and approval should remove and preserve artifacts.

Diving techniques required to deal with caves and wrecks are similar, the object being to avoid stirring up silt and to find one's way out of the overhead environment safely. To effect a successful retreat if an emergency occurs, cave and wreck divers make sure that they carry redundant air supplies and a guideline appropriate to the site. Special training is required for the diver to become well versed in emergency procedures. Because wreck diving may be carried out without actually going inside a wreck, training is less rigorous than for cave diving.

To engage in any type of diving activity safely, one should be in good mental and physical condition. Through training, a diver may develop the skills necessary to dive in a variety of environments. Because of the similarities between wreck diving and cave diving, a diver trained in one may think he is also trained in the other. The differences in the two environments are significant, however, and warrant caution and training specific to the wrecks or caves. After training is completed, the diver must still exhibit sound judgment and a healthy respect for the dangers and the uniqueness that is entailed by diving in overhead environments.

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CROAKER HOLE DISCHARGE MEASUREMENTS

by William L. Wilson (NSS #12231 Fellow) and Rick M. Spechler

Croaker Hole is a spring in the floor of St. Johns River at an enlargement of the channel known as Little Lake George, Putnam County, Florida. Little Lake George is approximately 3 miles south of Welaka, Florida, and 6 miles north of Lake George. The spring is located in the southwest corner of Little Lake George, approximately 700' north of Norwalk Point at a point approximately 800' northwest of channel marker 58 and 1000' southwest of channel marker 56. Croaker Hole was previously described by Rosenau and others (1977) and DeLoach (1983, p. 83).

The object of this article is to describe the spring in more detail and present the results of a recent measurement of the discharge of the subriver spring. Croaker Hole was visited on Feb. 24, 1991 by William L. Wilson, Diane C. Wilson, and Rick M. Spechler, all of whom participated in underwater measurement of the spring discharge.

Although Croaker Hole discharges a significant amount of water from the Floridan Aquifer, the discharge is not usually strong enough to cause a slick on the surface. The water that discharges from the spring is usually colder and more mineralized than the river water, thus moving downstream along the bottom as a density current. This is probably why no boil was observed at the surface. Poles near the spring, reported by DeLoach (1983), and buoys that may have been placed at the spring, are no longer present as of Feb. 1991. The spring is very difficult to find without a fathometer. A 45'-long anchor line is helpful for sounding for the spring, but is inconveniently slow.

The water is approximately 20-22' deep in the vicinity of the spring. On the east, west and north sides of the spring, a series of ledges drop steeply to a depth of approximately 41-45'. The ledges are 1-5' high and are composed of greenish-gray claystone. Configuration of the ledges was determined by groping in the low-visibility water.

The floor of the spring pool is approximately 15-20' wide and generally at least 30' long from north to south. Gravel, made of small phosphate and chert pebbles and broken fossil shells, covers the floor of the spring. A steep gravel slope extends up the south or southwest side of the spring. The slope is thought to rise to the floor of the river channel, but this was difficult to confirm in the low-visibility water. Water discharging from the spring ascends the gravel slope, but the flow from the spring spreads out and at a distance of 30' from the vent is less than 1' thick.

At most times, the river water has a visibility of 1-2' and completely blocks all sunlight below 5-10'. DeLoach (1983) reported clear water at a depth of 20', but we found dark river water to depths of 38-40'. Lights, as reported, are an absolute necessity for diving at the spring.

At a depth of 40', on the north of the spring basin, DeLoach reported "a horizontal cave entrance, 25' by 12'." The cave entrance is somewhat smaller, measuring 15' wide and 8' high at its mouth. Approximately 12' inside, the passage constricts to 8.5' wide and 7.5' high. At the constriction, the passage is approximately rectangular in cross-section. This point was selected as the best available station for measuring the spring discharge, which will be discussed below. The passage extends approximately 50', rather than 100', as commonly reported (DeLoach, 1983), and ends at a collapse. Claystone boulders block further progress. The ceiling rises 5-6' at the terminal collapse.

The cave is very unusual in that it is developed principally in nonsoluble material. The upper 4-10' of the passage are developed in the base of a greenish-gray claystone that may be as much as 24-26' thick. The lower 3-5' of the passage walls are composed of light, grayish-brown dolomite. The contact between the claystone and the dolomite is at a depth of 46'.

The dolomite is underlain by at least 4' of white, fine-grained limestone (biomicrite or cacilutite wackstone) with tan or orangish-brown fossil sand dollars and foramenifera that may be *Lepidocyclina* (species). The contact between the dolomite and the limestone is at a depth of 51'.

The greenish-gray claystone and the underlying 5'-thick dolomite are correlated with the Penney Farms Formation, Hawthorne Group, of Miocene

tion, Hawthorne Group, of Miocene age, as described by Scott (1988). The underlying white limestone is tentatively correlated with the Ocala Limestone of Eocene age. The depth to the top of the limestone very closely corresponds to the elevation of the top of the Florida Aquifer mapped by Scott and Hajishafie (1980).

Water discharges from between the boulders in the terminal collapse, but the main water source is on the east side of the passage at the toe of the collapse. A major portion of the spring flow discharges from a solutional passage approximately 1' high and 4' wide, developed in the Ocala Limestone at a depth of 54-55'. Approximately 30' of passage can be seen, but it is too low to enter with back-mounted tanks. The passage extends in an approximately south-southeasterly direction.

Water velocity at the constriction in the main passage is approximately 1.5' per second. The cross-sectional area of the passage at this point is 56.2 ft^2, so the discharge on Feb. 24, 1991 was 83 ft^3/second (cfs). This compares well with a discharge measured by the U.S. Geological Survey, on Sept. 17, 1981, of 80cfs. Both discharge measurements were made during droughts and probably represent low-flow conditions.

Wilson and Skiles (1989) estimated the discharge of the Croaker Hole to be 360cfs and classified the spring as first magnitude (average discharge in excess of 100cfs, as defined by Meizner, 1923). Their estimate was erroneously large because it was based, in part, on DeLoach's description of the spring vent dimensions and their visual estimates of the water velocity.

However, Croaker Hole may yet be shown to be a first-magnitude spring. If the two available discharge measurements represent low-flow conditions, then the average spring discharge might be 50% larger than the first two measurements. But the available data are insufficient to prove that the spring is first magnitude. Additional measurements should be performed to determine the extent of seasonal variability of the spring discharge.

The water velocity was measured with a Price AA current meter (a stainless steel, pinwheel type of meter). Usually, 30 revolutions were counted in a period of 41-46 seconds. One of the cups on the pinwheel was painted with a spot of red lacquer to make counting the revolutions easier.

A team of three divers was required to perform the velocity measurements quickly and conveniently. One diver held the meter at the proper height on a wading rod. The second diver counted the revolutions and used a wristwatch with a stop-watch function to time the revolutions. The third diver held a light for the other two, and helped position the pole.

The velocity was measured at stations one third of the passage width, on both the left- and right-hand sides of the passage, and at the middle of the passage (three stations total). The meter was held at a height that was one half of the distance between the ceiling and the floor. Two to three velocity measurements were made at each station. All of the velocities were very nearly the same, which is probably the result of the turbulent flow, which creates a rather flat velocity profile across the passage. Eight velocity measurements were completed at three stations in approximately one half hour. The time required at a depth of 45' and the work load, in the strong current, were sufficient for each diver to use one 80cf tank of compressed air.

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(Make check or money order payable to "NSS Cave Diving Section" — Thank You!)