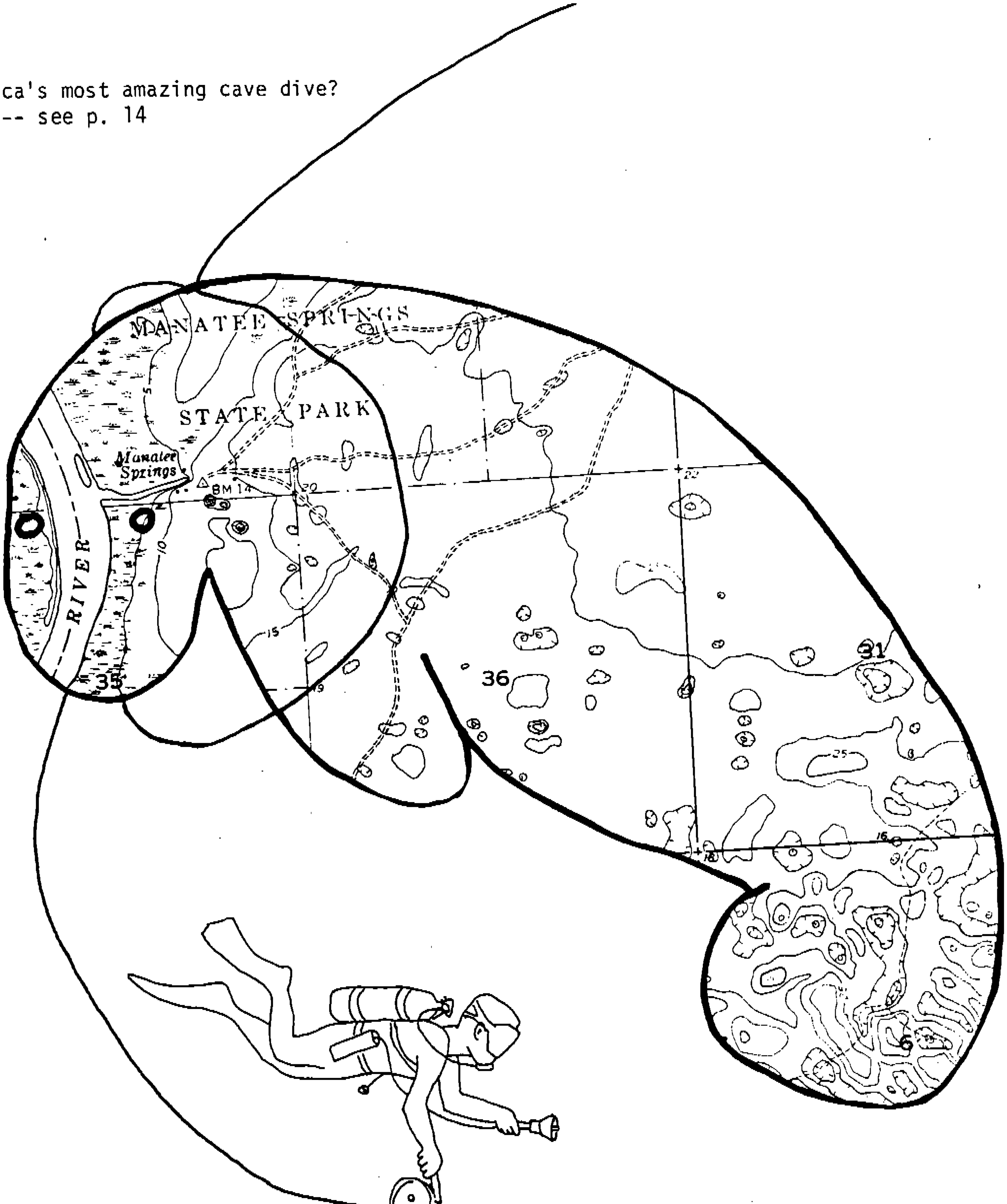
America's most amazing cave dive?
-- see p. 14



UNDERWATER SPELEOLOGY

OFFICIAL NEWSLETTER OF THE CAVE DIVING SECTION OF THE NATIONAL SPELEOLOGICAL SOCIETY vol. 3, no. 2

UNDERWATER SPELEOLOGY

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The Cave Diving Section of
The National Speleological Society

Membership in the NSS Cave Diving Section is open to any NSS member in good standing that is interested in cave diving and has paid the dues ($3.00 for 1976). Persons not wishing to join may subscribe for $5.00 per year. Checks should be made payable to "NSS Cave Diving Section" and sent to Steve Maegerlein, Rt. 14, Box 17, Bloomington, IN 47401.

Deadline is the second Friday of the preceeding month. Send articles and correspondence to the Editor, Sheck Exley, 1591 S. Lane Ave., Apt. 118C, Jacksonville, FL 32210.

Opinions expressed herein are not necessarily those of the NSS Cave Diving Section.

CALENDAR

June 24- July 2, 1976: NSS Convention, Morgantown, WV. (Cave Diving Session is June 29- contact Tom Cook, c/o Hallin, Alton Bay, NH 03810)

Sept. 4-5, 1976: 9th Annual NACD Cave Diving Technology Transfer, Atlanta, Georgia. (Contact NACD, 2900 NW 29th Ave., Gainesville, FL 32601)

Sept. 11-12, 1976: Cave Diving Course (free to NSS members), Branford, FL. (Contact Sheck Exley, address above)

Sept. 6-9, 1977: 3rd International Cave Diving Camp, Great Britain.

1979: 4th International Cave Diving Camp, Mexico.

COVER

The cover of this issue illustrates the recent efforts of several of our Florida members to "wrap up" the exploration and survey of Florida's unique Manatee Springs. See page 14.

APOLOGY

We apologize for another late issue of *Underwater Speleology*. For those that have been wondering, the delay is entirely the fault of the editor, who promises to do better... vol. 3, no. 3 should be ready for printing by the end of next week. We also apologize for a distinctly Florida flavor to the past two issues. However, the editor resides in that state so unless our non-Florida members send in material, this is inavoidable. SEND US MATERIAL. We'll publish almost anything, including articles, letters, poetry, cartoons and pertinent graffiti.

SPECIAL INTERNATIONAL ISSUE

The next issue of *Underwater Speleology* will be a *Special International Issue*, with news and notes on cave diving from all over the globe. Articles are planned on cave diving in New Zealand, Hungary, Germany and France, with a special report from the U.I.S. International Cave Diving Commission. The New Zealand article, which describes an improved method of cave communication, will be of special interest to our sump diving members and rescue workers. Also included will be recent correspondence to the Section from Mexico, Great Britain, Honduras, etc.

Those that missed the Annual Meeting of the Section at Morgantown, W. Va. will be particularly interested in the minutes of that meeting, as well as the revised copy of the Section's constitution including amendments passed at the meeting. A special report by Tom Cook on the role of cave divers in the new National Cave Rescue Commission will complete the issue.

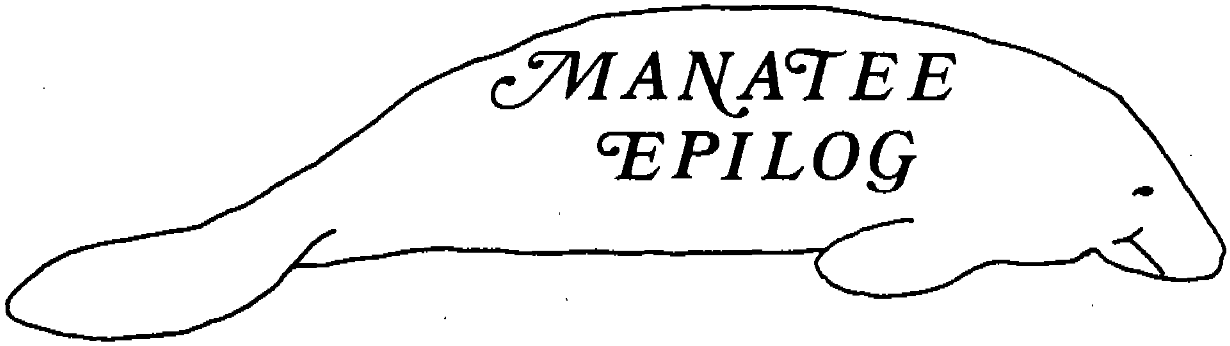
NEW MEMBERS OF THE SECTION

Doug Carter, 33 Deliti Ave., Toronto, Ontario, Canada MSM3B8

Daryle Hensel, 205 Blackburn Ave., Louisville, KY 40206

Joseph Lieberz, Box 9130, Glendale, CA 91206

Dane Sottolano, 2848 Elm Court, Allertown, PA 18103



by Sheck Exley

(For an account of investigations through 3/2/75, see "Manatee Springs Cave System, Florida" in vol. 2, no. 2 of *Underwater Speleology*, pp. 8, 11-13.)

The "Nonconformist Spring"

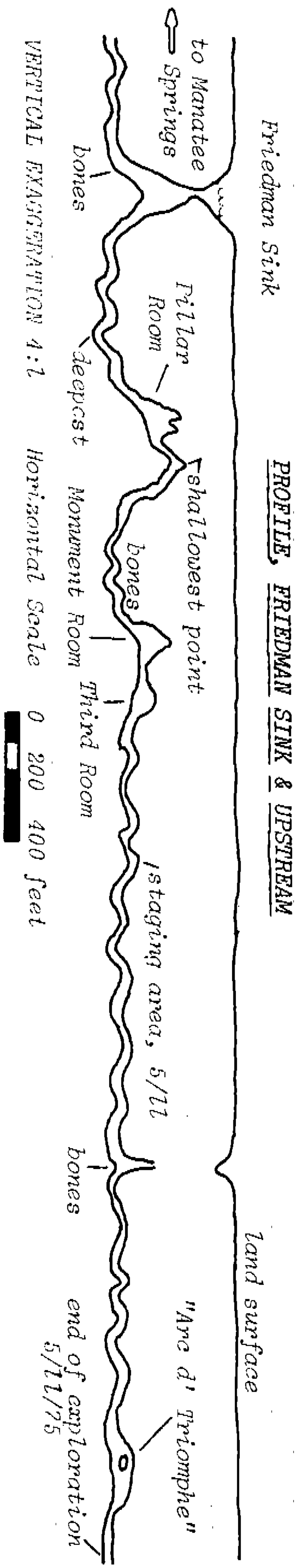
In *Karst* Jennings has made a distinction between two classes of springs: (1) *exsurgences* fed entirely by seepage waters from the karst and (2) *resurgences* supplied by the sinking of surface streams into swallow holes, ponors and the like.[1] Two examples of resurgences in Florida are Wakulla Spring[2] and Hornsby Spring[3]. One would tend to believe that the conduits of resurgences are generally longer and larger in cross-sectional area because of their association with more mature karst features such as swallow holes and ponors, allowing more solutional enlargement over a longer period of time. On the other hand, a plan of the typical exsurgence is believed to be dendritic in pattern, branching out into smaller and smaller passages to become impassable for cave divers within a short distance of the entrance. Such is true with Jennings (Jenny) Spring[4], Devils Eye[5], and even the Peacock System in Florida.[6]

However, Manatee Springs refuses to conform to the above expectations. A check of available topographical maps[7] - corroborated by several field checks - has confirmed that no sinking streams exist within at least a six-mile radius of the spring. Furthermore, using horizontal water clarity as a rough index of variations in water quality, it has been observed by the author that even heavy local rainfall has little or no immediate impact on the water of Manatee Springs, which also supports the classification of the spring as a true exsurgence.

Yet Manatee persists in retaining at least three characteristics generally associated with resurgences. First, the quantity of discharge - 181 cfs average for three measurements[8] - is much higher than most exsurgences and in fact the highest of any single outlet spring of any classification in the entire Suwannee River Valley. The second contradictory fact is the lack of a dendritic cave pattern in favor of a single major trunk passage with a basically linear trend to the southeast. Finally, the length of the passage is quite unique and literally dwarfs that of other explored exsurgences in Florida.

Recent Exploration

In May, 1975 we entered the system via the Friedman Sink entrance with a premeasured survey line (marked at ten-foot intervals against a fiberglass tape) on a reel to pinpoint the location of the sink and verify precise distances for exploration upstream. The measurement placed the location of the sink 155 feet further downstream than we had previously surmised, increasing the distance attained from Friedman Sink on the previously reported 3/2/75



dive by Lewis Holtzendorff (NSS 14831) and Court Smith (NSS 15394)[9] from 2365 to 2520 feet.

On 3/8/75 Smith and the author returned with the support of Holtzendorff and Paul DeLoach (NSS 16517) and extended exploration an additional 150 feet. No dimunition of conduit cross-sectional area nor volume of flow was noted, nor any variation in the strike of the passage toward the southeast.

On 5/4/75. using some new cave diving procedures that have been developed[10] Holtzendorff, Smith and the author extended exploration of the unwavering trunk passage to 3956 feet from the Friedman entrance on a "double stage" dive. More fossil deposits were located and two minor breakdown areas noted. However, despite some possible side passages and a general shrinking in conduit size, no reduction in flow volume was apparent. The permanent guideline was tied off below a major natural bridge - the first such speleogen to be encountered in the cave-appropriately christened the "Arc d'Triomphe."

Finally, on 5/11/76, the most recent extension of exploration by Smith, Holtzendorff and the author ended 4110 feet (1253 meters) upstream from the Friedman Sink entrance. The technical aspects of this dive are discussed in "Advanced Exploration Procedures" on page 17 of this issue of *Underwater Speleology*.

Findings

The passage at the farthest point of exploration is remarkably uniform, with a height of 5 feet and width of 20 feet, and could be observed to be continuing at least 75 feet to the southeast in the clear blue water. Average depth remains about 85 feet below the potentiometric surface or 82 feet below m.s.l. (mean sea level). From the accompanying profile sketch of the cave (see left) it can be seen that this is a little over 100 feet below the overlying land surface. Most surprising is the fact that, despite the reduction in cross-sectional area from about 150 suare feet near Friedman Sink to about 100 square feet at the end of exploration, and the appearance of some suspected side passages, most of the flow appears to still be traveling down the main trunk from the southeast toward the northwest. This observation is supported by the noticeably increased velocity of the water in the narrower sections near the end of the explored portion of the cave. We are further led to suspect that the apparent side passages are nothin more than parallel meanders that loop back in to the main trunk, such as is the case with the bypass tunnels in the vicinity of the Catfish Hotel and Sue's Spring entrances to the system.

The Future

These explorations have shown that exsurgences may in fact have major trunk conduits conveying most of the flow over 6500 feet to the spring opening (Manatee Springs entrance). If the cave passage continues much farther in the southeast direction it will pass under the boundary of the Waccasassa River Drainage Basin in the vicinity of Otter Creek, and would prove to be a rather unusual example of piracy of one river's drainage area by another (the Suwannee River). Perhaps future cave dives may help provide the answer to this and other puzzling questions about a unique Florida spring.

References:

1. Jennings, J. N.- *Karst,* vol. 7 of An Introduction to Systematic Geomorphology, Australia: M.I.T. Press, 1971, p. 74.
2. Briel, L.I.- personal communication, Tallahassee, Florida, May 1971.
3. Fisk, D.W.- unpublished report to Fla. Conference of Seventh-Day Adventists dated March 2, 1976.
4. Hurst, W.T.- "Comparison of Two Proximate Spring Caves on the Sante Fe River," *Cave Research Bulletin,* Tallahassee, Florida: Cave Research Committee, NACD, 1975, p. 27.
5. Hillier, K.E.- unpublished map dated 1975.
6. Fisk, D.W. and Exley, I.S.- "Exploration and Environmental Evaluation of the Peacock Slough Spring System," *Proceedings of the International Symposium on Hydrologic Problems in Karst Regions,* Bowling Green, Kentucky: Western Kentucky University, 1976.
7. U.S. Geological Survey - *Manatee Springs, Fla. Quadrangle,* 7.5 Minute Series (Topographic), Washington, D.C.: U.S. Geological Survey, 1954.
8. Ferguson, G.E., et. al.- *Springs of Florida*, Tallahassee, Florida: Florida Geological Survey, 1947, p. 107.
9. Exley, Sheck - "Manatee Springs Cave System, Florida," *Underwater Speleology,* vol. 2, no. 2 (April 1975), pp. 8, 11-13.
10. Exley, Sheck - "Stage Diving - A New Resarch Tool," *Cave Research Bulletin,* Tallahassee, Florida: Cave Research Committee, NACD, 1975, pp. 16-20.

* * * * *

NEWS FLASH!!! - DISCOVERY IN MANATEE SPRINGS

Tex Chalkley (NSS 17279), Bob Goodman (NSS 17260) and Kirby Sullivan (NSS 17261), all new members of the Cave Diving Section, have just completed a significant discovery in the Manatee Springs Cave System. Traveling upstream (southeast) from the Friedman Sink entrance about 1000 feet to a point about 300 feet beyond the Pillar Room, they encountered a side passage on the right with strong inflowing current. Entering this passage, they installed 200 feet of guideline on June 12, then another 470 feet on June 13 to abruptly pop out into a passage with an unknown line extending an undetermined distance in both directions.

Investigation has revealed that the trio probably connected to the side passage that splits off from the main trunk 180 feet downstream from Friedman Sink toward the Sue's Spring entrance (see line sketch, bottom of p. 13 of Vol. 2, no. 2 of *Underwater Speleology* [April, 1975]). This passage was explored to a point 520 feet from the main trunk by Holtzendorff, Dana Turner, "Dutch" Vande Noord and Sheck Exley on 3/4/73. On the way out from that dive Exley noted an outflowing tunnel in the right (northeast) wall near the end of the line, which may well be the passage connecting back into the main trunk that Chalkley's team found.

This discovery, when verified by a future dive, will support Exley's suspicions that most of the side passages are merely bypass meanders connecting back.

ADVANCED EXPLORATION PROCEDURES

by Sheck Exley

If a caver (dry land type) becomes lost in or unable to exit from a cave, he can continue to exist for days or even weeks until he dies from exposure (hypothermia) or starves to death (assuming he is in a typical cave with ample water supply). However, the cave diver's survival time in similar circumstances is generally measured in minutes - not because of food or water or even exposure[1] but because of the depletion of breathing supply. From this observation it logically follows that any practical method of increasing one's breathing supply is of paramount concern to cave divers. Furthermore, with the evolution of sophisticated nicad-powered lighting systems (see vol. 2, no. 4 of *Underwater Speleology*) lasting many hours and nonstop swims of up to 288 miles in the record books, it is also obvious that the single factor limiting the exploration of long distances in underwater caves is once again, the breathing supply. This article explores some of the alternatives of attaining longer breathing supply duration, then describes in detail what the author feels to be the best alternative that has evolved to date.

Breathing Supply Systems

For a long time in Florida our approach to attaining greater duration in underwater caves has involved combinations of hazardous breathing techniques such as "skip-breathing" (which greatly increase carbon dioxide retention and related problems) and air turnaround rules of questionable rationale, such as "half-plus-two,"[2] "half in, half out" and worse. Now it is felt that a much safer approach is to breathe normally, remain relaxed, use an air supply planning rule such as the "third rule" or even more conservative, and take a larger breathing supply into the cave. Some possible breathing supply systems are (1) semi-closed and closed-circuit scuba, (2) cryogenic scuba, (3) liquid breathing, (4) membrane breathing, (5) larger volume primary open-circuit scuba, and (6) stage diving. Let's examine each of these alternatives in terms of the numerous requirements for a breathing supply system for cave diving, some of which are (in no special order) (1)minimal weight, drag and bulk, (2) utmost dependability, (3) maximum duration, (4) reliable continuous supply monitoring system, (5) minimal expense, and for team diving, (6) buddy rescue capability.

The success of the Spanish cave divers using military Draeger semiclosed-circuit scuba is well known, and certainly points toward the possible eventual development of a similar system for widespread use in cave diving. Draegers and similar semiclosed and closed-circuit units are certainly lightweight and provide minimal bulk and drag when compared to the very long durations that one may achieve with these units. However, for the American cave diver at the present time, they are unacceptable, scoring lower in every category except the first of the six requirements mentioned above when compared to the traditional open-circuit scuba. Without going into a detailed and complicated description of the many different units available, let's look at two of the essential components common to all recirculating scubas: (1)the CO_2 absorbent, and (2) the oxygen metering device. All CO_2 absorbents now in use, which are necessary to prevent carbon dioxide buildup in recycled gas, are rendered ineffective by the intrusion of very small amounts of water. This means that the mouthpiece cannot be removed for any reason, such as inflating a buoyancy compensation device or buddy-breathing in an emergency. Some of the units have a manual overide for such eventualities, but the overide involves switching to an open-circuit scuba of very short duration, usually far to short to permit a cave diver to exit the cave safely. Also, the CO_2 absorbent becomes quite caustic when wet, generating a great deal of heat. The oxygen metering device, usually including a battery-operated oxygen measuring device responsible for ensuring that the proper partial pressure of oxygen is present at all times (which of course varies with depth), is quite susceptible to failure, for which reason the system generally includes as many as four measuring devices. It is not unknown to have all four fail in an open water situation; imagine how the chances of this happening go up in caves, where the equipment is frequently dragged along the bottom and banged against the ceiling, even when the diver is careful and has excellent visibility! While expense is certainly the least important of the considerations, it is certainly worthy of mention. The semiclosed and closed-circuit units themselves generally cost several thousand dollars, not to mention the cost of required support equipment, such as decompression facilities. Also, special training must be obtained to use such equipment - in many cases this cannot be purchased at any price: the diver must be in the Navy and cleared for such training, or an employee of the larger commercial deep diving companies.

One of the more exciting alternatives is the use of cryogenic scuba. These units, invented by J. Woodberry, have been described in detail in *Skin Diver* (see vol. 16, no.6 [June 1967], pp. 22-27, 66-67; and vol. 16, no.12 [Dec. 1967], pp. 28-33). They utilize liquified gas, which is warmed up by "surge coils", then metered to the diver through specially-designed orifices. The system, which is lightweight, simple, durable and easy to use, has been actually tested in some Florida spring caves. The projected expense was much smaller than semiclosed and closed-circuit units, and not much more than the traditional open-circuit units. They could be used for buddy-breathing, and had an absence of failure-susceptible gadgets such as CO_2 cannisters and electronic oxygen metering devices. However, there were still problems. First, the user had to find someone that could fill the units (liquid gas is not widely available). After filling, the units had to be used immediately: even when insulated in the specially-constructed Dewar tanks, the gas would boil off through a relief valve within a few days. If the tanks were damaged through usual cave wear and tear, this time could be reduced drastically. One of the most important reasons for lack of suitability for cave diving was the lack of a continuous gas supply monitoring system. Only by weighing the unit at the start of the dive could the contents be predicted with any accuracy, and during the dive this would be quite impossible, making any sort of dive plan mostly guesswork. Finally, and perhaps most importantly, the company which aquired rights to the apparatus has discontinued plans for production indefinitely.

Liquid breathing and membrane breathing are both purely experimental techniques at this point in time. The former involves pumping oxygen-enriched liquid fluorocarbons into the lungs under anaesthesia, the latter using a special membrane to extract oxygen from the surrounding water similar to the gills of a fish. Both techniques are quite exciting in that they might eliminate many of the problems inherent with the use of complex breathing apparatus, and, in the case of liquid breathing, eliminate many of the physiological risks as well. However, at this time both of these alternatives are very much in their infancy, and to the author's knowledge neither has been tested in the water by human beings.

The use of open-circuit scuba in conjunction with larger volume cylinders is a commonly-explored possibility. Most of the longer explorations to date in this country have involved the use of twin back-mounted cylinders of chrome moly steel construction, each of which has a rated capacity of 100 cubic feet when filled to 2640 psig. (Sadly, even these bottles are no longer manufactured.) Cylinders of much higher rated working pressure are now on the market, but are of much smaller size so that they provide less air than the twin "100's." Certainly the use of a large volume, high-pressure cylinder of perhaps stainless steel or special fiberglass construction would provide a viable solution to the problem of longer supply duration underwater, but finding a manufacturer willing to invest in the mass production of these cylinders in this time of recession is an impossible task.

The best alternative now available for attaining longer duration in underwater caves is stage diving. Entirely an open-circuit scuba technique, stage diving consists of carrying extra scuba units (tank and regulator) into the cave in addition to the back-mounted unit. These extra units may be carried in and recovered on the same dive, or they may be staged at predetermined locations on previous dives, and recovered on a later dive. This procedure scores very high in terms of minimal weight, drag and bulk as well as duration, and provides as high or a higher score than the other alternatives in terms of dependability, continuous gas supply monitoring, buddy rescue capability and minimal expense. There are no problems in replenishing the depleted gas supply, nor the complicated decompression procedures inherent with mixed gas diving (assuming the stage diver is using air).

General Procedures for Stage Diving

In "Stage Diving - A New Research Tool"[3] the writer first discussed the apparent problems in as well as procedures and equipment required by the technique of staging tanks in caves. Since that article the technique has been considerably refined, achieving spectacular results at Devils Eye and later Manatee Springs (see "Manatee Epilog" on pp. 14-16 of this issue of *Underwater Speleology*) in Florida. Several problems reported earlier have been overcome or found not to be as serious as originally supposed (probably the natural result of caution at approaching a new technique).

Assembling the stage unit is simple (see illustration on next page). A relatively inelastic strap (such as the crotch strap from a military style tank harness) is attached tightly to a steel 71.2 cu. ft. cylinder using a loop of nylon at the neck of the cylinder and two large (size no. 120, which is 22 inches in length and available at most auto parts supply houses) metal radiator hose clamps. Two "D" rings are placed on the strap, one fixed near the tank neck, the other so that it can slide up and down the strap near the clamps at the base of the cylinder. Two "snap links" (two-headed snaps) are used to attach the stage unit via the "D" rings to the diver's underside - one to the chest strap, the other to the waist strap of the diver's back-mounted tank harness. If the unit is to be breathed from at that time, a single hose regulator with submersible gas pressure gauge is attached to the stage unit with the tank valve orifice facing down (away from the diver) so that the regulator hose comes to the diver in a natural manner without kinking. It is also best if the SPG is fastened to the base of the tank using a quick release elastic band to prevent its dangling down and snagging on rocks, etc. A shorter-than-normal hose connecting the SPG to the first stage of the regulator isn't a bad idea, either.

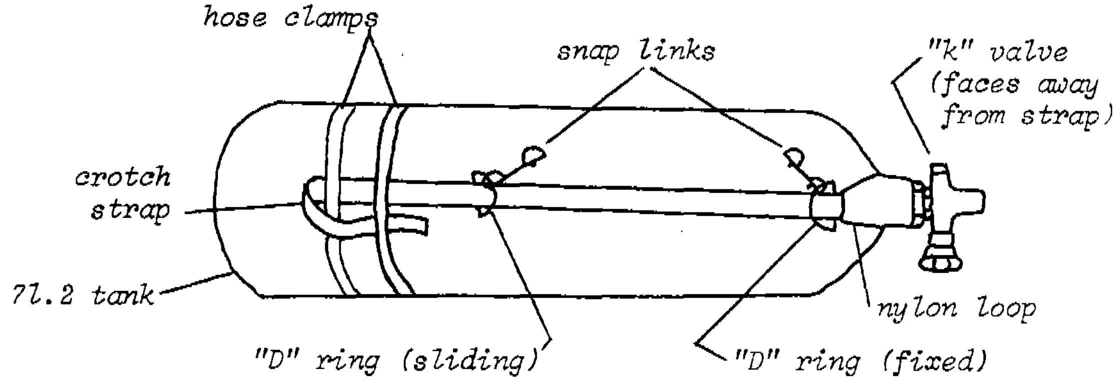


FIGURE ONE: Stage tank without regulator, showing components

Planning for a team stage dive is greatly facilitated if each diver uses stage tanks of the same size filled to the same pressure. Also, to preserve the buddy assist concepts of team diving, it is imperative that all divers stage and discard their tanks at the same location at the same time. In this manner the key concept of tapering the dive plan to the abilities of the least capable diver is preserved.

Single Stage Dives

The simplest of all stage dives is the single stage dive in which the stage units are breathed from the entrance until the first diver completely depletes the gas supply in his stage unit. Then all units are discarded, air shut off (to prevent leakage) and second stages of the regulators placed mouthpiece down (to prevent free flow and keep sediment out of the regulator). The stage units are then snapped to the guideline to make sure that they are located on the return. The divers then switch to their back-mounted units and proceed until the first team member reaches his turnaround on air, then they return to the surface. In keeping with the "third rule," the air turnaround is calculated so that each team member has at least 1/3 of his original air supply as a reserve for emergencies. For example, if the stage bottles contain 70 cu. ft.and the back-mounted units contain 200 cu. ft., then the team turns back as soon as the first diver depletes his back-mounted unit to 180 cu. ft.The fatigue problems discussed in the earlier article from staging against a current have been found to be easily overcome by a slower rate of travel. If the team so desires, it can make a traditional "third rule" dive on its back-mounted units, and carry a stage unit for additional reserve air, as we do in our Hornsby dives. The original method of single stage diving, which consisted of breathing each unit in and out on the "third rule," has been discarded because of its complicated nature and special need to monitor the stage unit's gas supply.

Double Stage Dives

The procedures for double stage dives are more complex than single stage dives. We fill our back-mounted twin steel 100 cu. ft. tanks to 3000 psig, then carry the stage units (71.2's filled to rated pressure) in on a typical 1/3 rule dive. The tank valves are covered with duct tape to prevent intrusion of foreign matter into the orifice as well as "O" ring loss. We stage the tanks unused as soon as the first team member reaches 2000 psig remaining air in his back-mounted unit. We have invariably found that this point is well within the proper distance of the entrance. On the dive itself we breathe in fresh stage units until either the first man totally depletes the gas supply in his fresh stage unit, or the previously-staged tanks are reached, whichever occurs first. In any event, all team members discard their units in the same place at the same time so that the team stays together at all times. At this point the dive plan shifts to a simple "third rule" dive on the back-mounted units. When the previously-staged tanks are reached, the tape is carefully removed and the regulators from the stage units breathed in attached to the tank valves of the previously-staged units and checked for operation and air supply. Then the air is shut off, mouthpieces positioned, and as soon as everyone is ready, the team proceeds into the cave.

The exit from the above dive is much safer than the typical cave dive in that for a substantial amount of the trip out the team will have several extra regulators, making the possibility of a regulator failure jeopardizing one's safety virtually nil. Usually, as on the Manatee dive, we have enough air left upon reaching the previously -staged bottles that we really don't need them. However, it is of course best to go ahead and breathe them out.

This is not to say that stage diving does not have problems, it does. On our Manatee dive our swimming bottom time was 128 minutes, which put our decompression (90 foot depth) onto the less-reliable exceptional exposure table. It is also of course imperative to locate the stage tanks on exit, though this is no more complicated than finding the entrance of the cave, and thus far we have not really needed the previously-staged tanks. However, stage diving is somewhat more complicated than normal cave diving, and the author would recommend that anyone contemplating the use of the technique practice in open water first.

In summary, until a safe and practical method of adapting semiclosed-circuit, closed-circuit, cryogenic scuba, liquid breathing or membrane breathing to use in cave diving is found, or diving equipment manufacturers produce a new generation of ultra high pressure tanks of great capacity, stage diving is the only acceptable method of attaining larger breathing supplies.

Footnotes

1. The advent of the "Unisuit" and similar dry/wet (or "bubble") suits in recent years has all but eliminated the exposure problem in cave diving. Advertisements for the "Unisuit" describe a test in which a diver remained totally immersed in 28°F water for 12 hours without substantial chilling.
2. The most reasonable air planning rule in use prior to the "third rule" is "half-plus-two." This involves beginning the exit from the cave as soon as the first diver's air supply reaches half his original gas supply *plus* 200 psig.
3. Exley, Sheck- "Stage Diving - A New Research Tool," *Cave Research Bulletin*, Tallahassee, Florida: Cave Research Committee, NACD, 1975, pp. 16-20.

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BLUE SPRINGS, FLORIDA

By latest count there are 27 "Blue Springs" in Florida, which does not include separate vents in the same spring group. There are 19 Blue Sinks and 17 other Blues.

GOODENOUGH SPRINGS, TEXAS

In July, 1968, the Army Corps of Engineers did its thing and inundated a major spring under 150 feet of dark Rio Grande water. Once Texas' third largest spring, Goodenough is now located in the northeast corner of the sprawling 67,000-acre International Amistad Reservoir 12 miles southwest of Comstock, Val Verde County, Texas.

The rich history of the area, including the presence of Spanish explorers as early as 1590 as well as rumors of underwater "Indian cave paintings" recently brought a team of cave diving archaeologists to the area. Dan Lenihan, whose excellent article on "Resource Potential of Submerged Caves and Suggested Procedures for Safe Exploration and Study" is in the recently-published *National Cave Management Symposium Proceedings*, was one of the participants.

Reports of 15 to 35 foot horizontal visibility proved to be somewhat exaggerated... descending to 120 feet, the divers encountered 2 foot visibility at all levels. It was hoped that Goodenough, which once had an astounding momentary flow of 1350 cfs, would have a sufficient potentiometric head to still have outflowing clear water. Apparently such is not the case, although the divers are not certain that they located the spring vent.

It was reported to the divers, however, that at times a "slick" of muddy water appears over the spring area. Perhaps the potentiometric surface has been elevated by the reservoir to the point where heavy local rainfall would make such a phenomena possible.

Major And Historical Springs of Texas (Brune, 1975) notes that apparently the flow of certain springs below the Amistad Dam has increased since the creation of the reservoir. One such spring is San Felipe Springs one mile north of Del Rio (see map below), which since the inundation of Goodenough has supplanted it as Texas' third largest spring. Carl Fowler, a well-known Georgia cave diver, observed these springs a few years ago, noting that they were quite clear, deep and discharging a large volume of water. The depth of the spring pools and volume of discharge suggest that there may well be a diveable cave in the spring.