
ADVANCED DIVER MAGAZINE
ISSUE 13 Fall 2002
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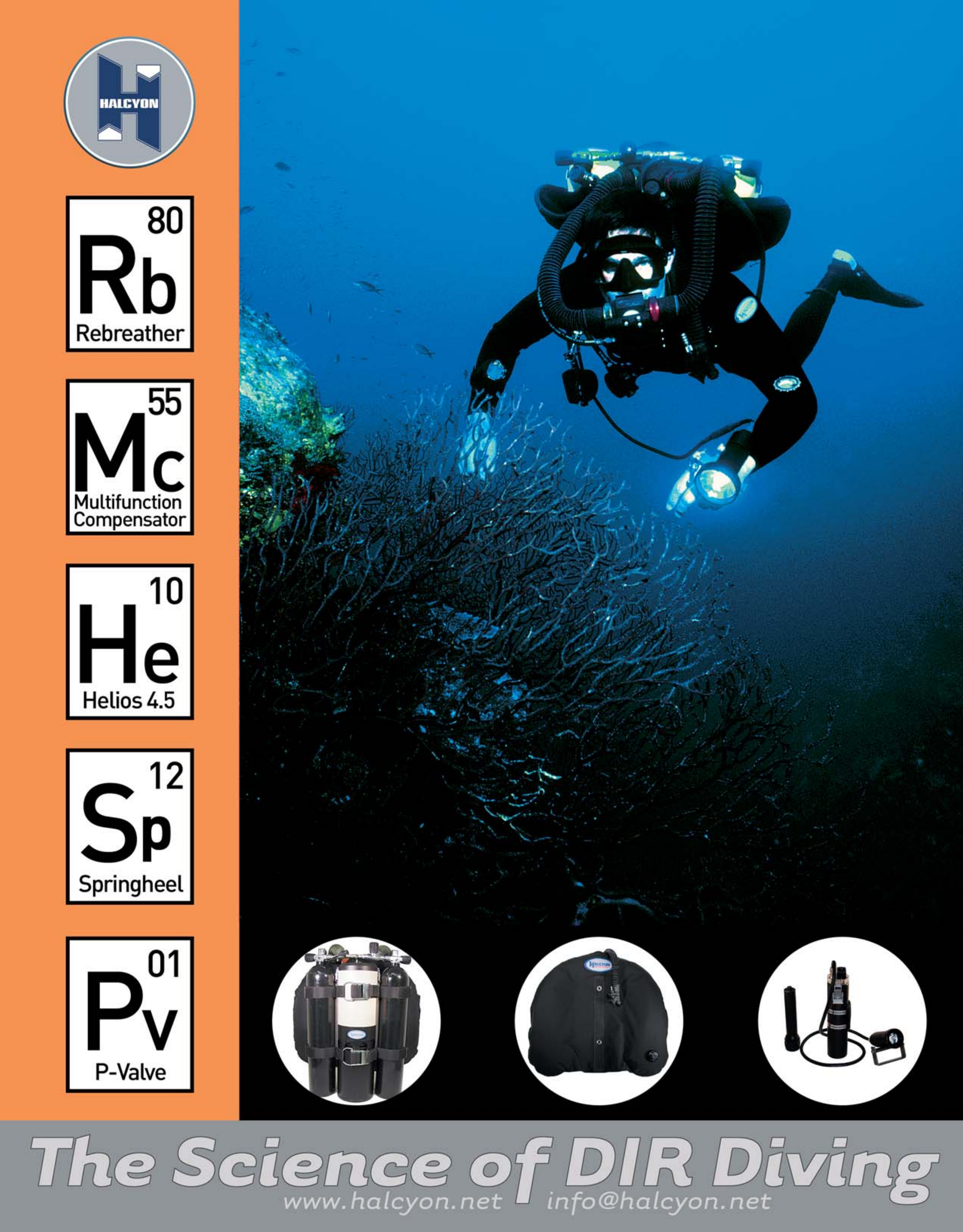
ADVANCED OPENWATER TO TECHNICAL EXPLORER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Publishers Notes

Recently, I purchased a set of underwater communication devices from Ocean Technology Systems (OTS). I had wondered if these devices could make a difference in cave exploration projects. It seemed that the ability to communicate verbally underwater would make tasks and dives go more smoothly.

The only concern I had about using the system was the transition from half mask (standard recreational scuba mask) to a full-face mask with built-in communication units. I had heard that these masks were bulky, hard to clear and wasted a lot of gas.

John Hott from OTS met me in the Florida Keys with a full box of communication toys for us to play with. These toys included diver to diver, diver listen only, surface to diver and diver to video. For the first time in many years, I was excited about doing another "boring" reef dive.

Captain Mike from Tavernier Dive Center escorted us in his 43-foot vessel, the Shadow, on a special trip to the new wreck, "Speagle Grove," off Key Largo. As we donned our full-face masks with underwater communication units, Captain Mike dropped the transducer a few feet into the water for the surface to diver unit. Once in the water we did a quick voice check between each other and the vessel and then swam down to the wreck below.

John had brought along his video camera with the communication unit cabled directly into the camera, so that he could narrate what was going on in real time voice. The dive went much smoother than I had anticipated. The full-face mask was very comfortable, it didn't waste gas and I soon overcame the clearing challenge. I saw a lot more of the wreck and kept in constant contact with my dive buddy because of the communication units, no matter where we were on the wreck.

The next challenge I faced in using the communication device was to design a redundant system for cave exploration and still keep it clean and streamlined. The only way to switch gases with a full-face unit is through a gas-switching block. However, I didn't like the idea of having my oxygen supply hooked to my gas block during the deep part of a dive. Breathing 100 percent oxygen below 300 feet would not be a good thing. The answer was the Sartek gas block. Simple and easy to use, the Sartek gas block allows the diver to use quick connect hoses. These hoses have to be manually connected to the block, preventing any accidental gas switches. I added one quick connect hose to all my stage tank regulators and marked them properly for quick and easy identification. Of course, I also left a backup second on each stage tank as well.

Staff writer Jon Bojar and I planned a nice cave dive in an offset sink called The Jewel. This typical hourglass shaped sink drops to 170 feet to a tight back mount restriction and into a deep room that drops to 320 feet. The visibility in the sink was between 0 to 8 feet, depending on the hydrogen sulfide layer we were in. The restriction visibility quickly zeroed out, but the large room on the bottom cleared to over 100 feet.

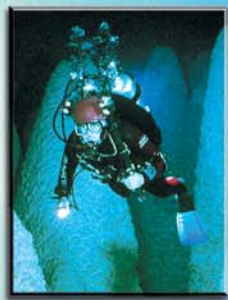
The line in this system was very old and needed to be repaired in a couple locations. The communication units made this a breeze as Jon and I quickly mended the lines. Once in the deep section the communication units allowed us to spread out, but still communicate all the way across the large cave room as we searched for any possible new tunnel.

During the exit the com units came in very handy in the poor visibility to communicate decompression obligations, depths, gas volumes, mental notes about the cave features and the obvious jabbing of each other's fin-silt techniques (or lack of them), personal hygiene or equipment strokery. The surface to diver unit also gave us the ability to relay any problems to our vessel's captain during the decompression -- or it could just be used to blab to another person in an effort to help pass the 100 minutes of decompression time a little quicker. All in all I don't know how I got along without these communications units for the last 20 years. I can't believe how much easier and fun it makes a dive if you can talk directly to your dive buddy.

You may also notice that we have expanded Advanced Diver Magazine's size from 84 pages to 100, along with a perfectly bound cover. This is a big step for the magazine and is a longtime goal that I have had for many years. Of course, this means that even more articles, photographs, diving tips and underwater adventures are at your fingertips. We hope you like our new expanded format. Enjoy the magazine!

Curt Bowen • Publisher Advanced Diver Magazine

ADVANCED DIVER MAGAZINE



Cover: The Moonpool - This large sea cave entrance on the Mediterranean island of Menorca leads to a spectacular phreatic pothole shaft.

Photo: Gavin Newman
Nikonos RS, 13mm Nikkor fisheye, Subatec 250 flashes

Backdrop Photo by Gavin Newman

Endangered Caves
BERMUDA

By Thomas M. Iliffe, PH.D.

Bermuda and its extensive anchialine (coastal marine) caves are of exceptional biological and biogeographical significance due to their isolated mid-ocean location, unique geological history, and remarkably rich and diverse stygobitic fauna. Indeed, Bermuda's caves qualify as a biodiversity hot-spot of global importance. At least 78 endemic, cave-dwelling species, mostly crustaceans, have been identified from Bermuda caves, including two new orders, one new family, and 15 new genera. In order of abundance, Bermuda's anchialine fauna includes: 19 species of ostracods, 18 species of copepod, eight species of amphipods, six species of shrimp, four species of isopod, and four species of mite. Many of these species are found only in a single cave or cave system. Due to their limited distribution, the fragile nature of the marine cave habitat, and severe water pollution and / or development threats, 25 of these species have been listed as critically endangered *(Baillie & Groombridge, 1996).*

Bermuda is a volcanic seamount that formed along the Mid-Atlantic Ridge about 100 million years ago.

Church Cave

Plate tectonics and sea-floor spreading have maintained Bermuda's location relative to North America (about 1000 km off the Carolinas), while increasing its distance from Europe and Africa as the Atlantic Ocean enlarged. Thus, Bermuda has never been part of, or closer to, a continental landmass.

Coral-reef derived limestone, first deposited as coastal sand dunes, caps most of present-day Bermuda. Approximately one million years ago, limestone caves began forming during glacial periods when sea level was as much as 100 m lower *(Palmer, Palmer & Queen, 1977)*. Later, as postglacial sea levels rose, encroaching sea-water drowned large portions of the caves. Continuing collapse of overlying rock into the large solutionally formed voids created the irregular chambers and fissure entrances that are commonly seen in Bermuda's caves. Extensive networks of submerged passageways, developed primarily at depths between 17m/56ft and 20m/66ft below present sea level, interconnect otherwise isolated cave pools. These passages, only accessible to divers, are well covered at all depths with impressive stalactites and stalagmites, confirming that the caves must have been dry and air-filled for much of their history.

The sea-level, brackish pools located in the interior and / or entrances of Bermuda's caves are classified as "anchialine" habitats. The term "anchialine" was coined by Holthuis (1973) to describe "pools with no surface connection to the sea, containing salt or brackish water, which fluctuates with the tides." Bermuda's cave pools have a thin, brackish layer at the surface, overlying fully marine waters at depth *(Sket & Iliffe, 1980; Iliffe, Hart & Manning, 1983)*. In the caves bordering Harrington Sound, subterranean waters tidally exchange with the sea through coastal springs. Caves farther inland typically contain slowly moving or near-stagnant waters. The input of food in most

Commercial Destruction

Pollution

Vandalism

Poor Environmental Control

Illegal Dumping

Cave Life Extinction

Photo By: Curt Bowen © 2002

Church Cave, previously known as Paynter's Vale Cave, contains the largest underground lake in Bermuda with an area of 1500 m^2 / 5000 ft^2 and maximum depth of 22.5 m / 74 ft.

During H.M.S. Challenger's visit to Bermuda in 1873, Wyville Thomson observed that in his opinion: Vale Cave is the prettiest of the whole. The opening is not very large. It is an arch over a great mass of debris forming a steep slope into the cave, as if part of the roof of the vault had suddenly fallen in. At the foot of the bank of debris, one can barely see in the dim light the deep clear water lying perfectly still and reflecting the roof and margin like a mirror. From the roof innumerable stalactites, perfectly white, often several yards long and coming down to the delicacy of knitting needles, hung in clusters; and wherever there was any continuous crack in the roof or wall, a graceful, soft-looking curtain of white stalactite fell, and often ended, much to our surprise, deep in the water. Stalagmites also rose up in pinnacles and fringes through the water, which was so exquisitely still and clear that it was something difficult to tell where the solid marble tracery ended and its reflected image began.

Wingates Cave GPS
N 32° 20.347   W 064° 42.215

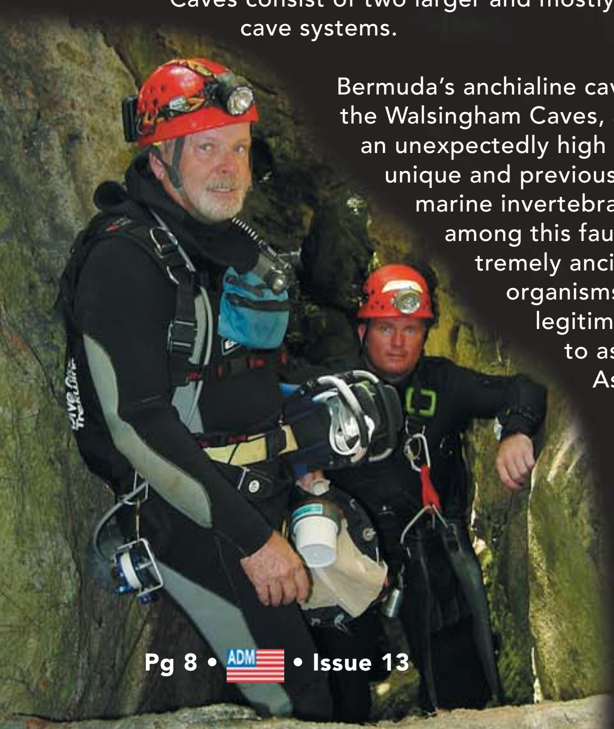
Above: Caver Andrew Mello squeezes through the only entrance into Wingates Cave.

Right: Dr. T. Illiffe and Darcy Gibbons illuminate the large cave zone just beyond the small entrance restriction into Wingates Cave. Andrew Mello illuminates the balcony entrance to the top right.

Top Photo: C. Bowen

caves is primarily derived from the sea itself, although chemosynthethic bacteria may provide an additional source of organic matter to the anchialine cave ecosystem *(Pohlman, Cifuentes & Iliffe, 2000)*.

Even on a small island like Bermuda, caves are not evenly distributed. Most of Bermuda's 150 known caves are located in the Walsingham district, a kilometre-wide isthmus separating Castle Harbour and Harrington Sound. This part of Bermuda consists of hilly, wooded terrain underlain by highly karstified limestone containing numerous caves and dolines. While most of these caves initially appear to be relatively small and end in tidal saltwater pools, diving explorations have shown them to be highly integrated. The caves consist of large, sub-sea level chambers, floored with breakdown and profusely decorated with speleothems. The Walsingham Caves consist of two larger and mostly underwater cave systems.



Bermuda's anchialine caves, especially the Walsingham Caves, are inhabited by an unexpectedly high diversity of unique and previously unknown marine invertebrates. Included among this fauna are extremely ancient relict organisms that can be legitimately referred to as "living fossils". As examples, the copepod Erebonectes is one of the most primitive of known calanoids, while the Antrisocopia agrees in many ways with the description of a theoretical ancestral copepod. Some of Bermuda's cave-dwelling species have close affinities with Old World cave and groundwater fauna, and probably colonized the subterranean habitats on Bermuda early in the island's history when the Atlantic was much narrower. The amphipod genus Pseudoniphargus, which has two species in Bermuda caves, was previously known only from caves and groundwater around the Mediterranean, the Azores and the Canary Islands. Other animals inhabiting Bermuda caves have close relatives occurring in caves on other isolated oceanic islands from both the Atlantic and Pacific. The misophrioid copepod Speleophriopsis includes cave species from Palau, Bermuda, and the Balearic Islands. Finally, some animals are closely related to deep-sea species. The order Mictacea, for example, includes cave species from Bermuda and the Bahamas, plus deep-sea species from the Atlantic and Indo-Pacific. Thus, Bermuda's cave species are providing important clues about the evolution and dispersal of present oceanic species.

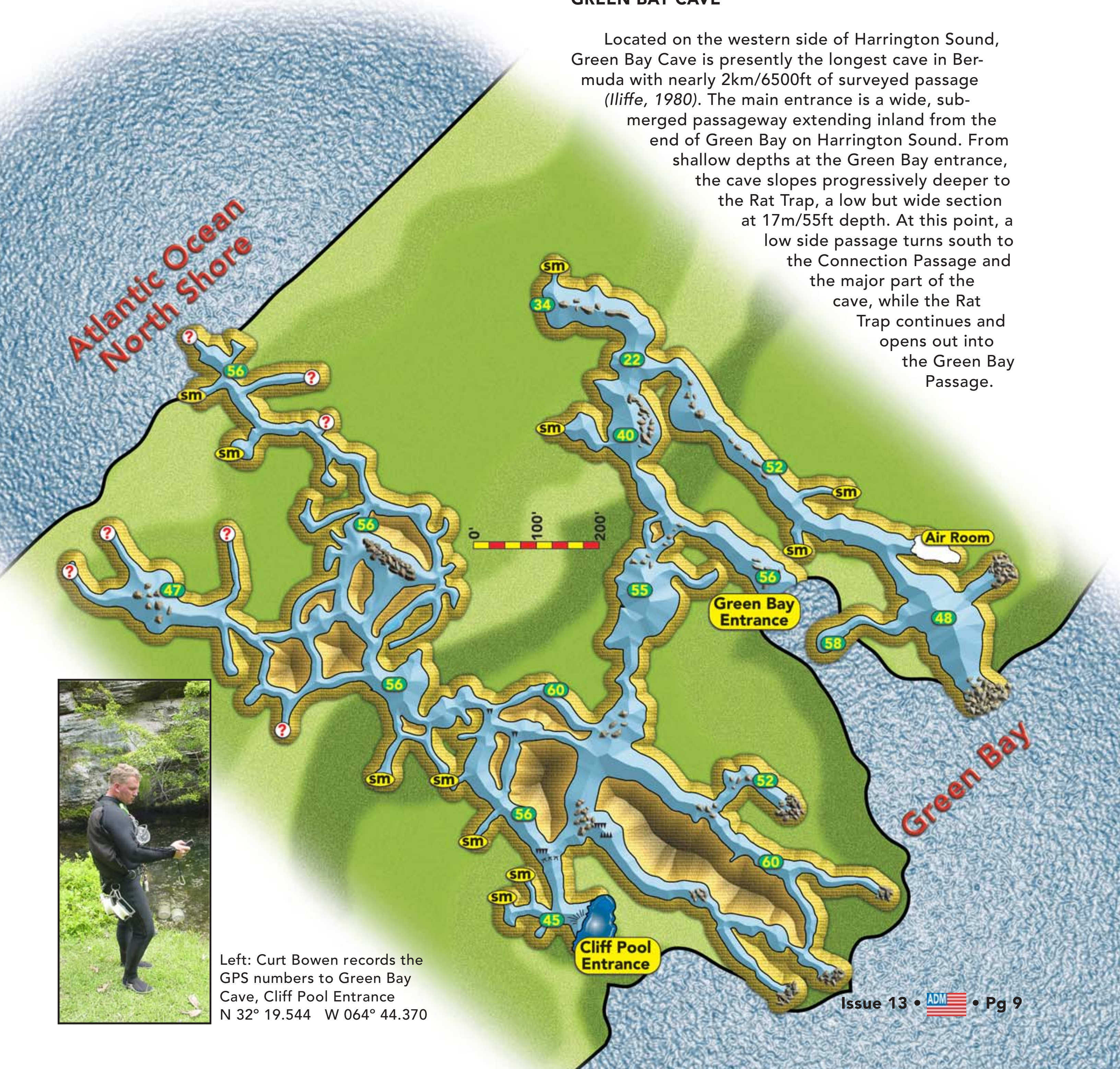
Belying the considerable age of both caves and the obligate cave-dwelling organisms that inhabit them, this environment is one of the rarest and most delicate on Earth. The potential impact of human activity on caves is profound -- over time, even just visiting of caves can result in irreparable damage. The four primary threats to Bermuda caves are: (1) construction and quarrying activities, (2) water pollution, (3) dumping and littering, and (4) vandalism *(Iliffe, 1979)*. Quarrying has destroyed numerous significant caves, particularly at Government Quarry in the Walsingham district. Construction of luxury

Fern Cave GPS
N 32° 20.876   W 064° 42.747

town homes directly on top of Church and Bitumen Caves may destroy their endangered anchialine fauna. The Karst Waters Institute twice named these two caves to their list of the Top Ten Most Endangered Karst Ecosystems on Earth. The anchialine pool of Bassett's Cave, once said to be the longest and geologically most instructive cave in Bermuda *(Nelson, 1840)*, was used by the United States Navy as a cesspit for disposal of raw sewage and waste fuel oil. Many of Bermuda's caves have been used as dumping sites. The bulldozing of large piles of partially burned rubbish into the anchialine pool of Government Quarry Cave resulted in depletion of dissolved oxygen and anaerobic production of hydrogen sulfide. Groundwater circulation transmitted this pollution to at least five other caves as much as half a kilometre or more away *(Iliffe, Jickells & Brewer, 1984)*. In these polluted caves, all stygobitic species have disappeared. Since many of Bermuda's cave species are endemic and are often restricted to only one cave or cave system, pollution or destruction of these habitats can result in the extinction of entire species. Finally, few of Bermuda's larger caves have escaped the effects of vandals maliciously breaking and removing fragile stalactites and stalagmites or defacing cave walls with their names.

GREEN BAY CAVE

Located on the western side of Harrington Sound, Green Bay Cave is presently the longest cave in Bermuda with nearly 2km/6500ft of surveyed passage *(Iliffe, 1980)*. The main entrance is a wide, submerged passageway extending inland from the end of Green Bay on Harrington Sound. From shallow depths at the Green Bay entrance, the cave slopes progressively deeper to the Rat Trap, a low but wide section at 17m/55ft depth. At this point, a low side passage turns south to the Connection Passage and the major part of the cave, while the Rat Trap continues and opens out into the Green Bay Passage.



Left: Curt Bowen records the GPS numbers to Green Bay Cave, Cliff Pool Entrance
N 32° 19.544 W 064° 44.370

This passage climbs over breakdown at the Letterbox and passes through a tight restriction between collapse blocks only to enlarge again. This further extension of the Green Bay Passage bends back toward Harrington Sound and extends to a small air bell in ceiling breakdown. To the left of the air bell, an underwater breakdown slope descends to a spacious, deeper chamber. At one end is a massive boulder choke, while at the other, the Fog Room typically contains cloudy water of unknown origin.

From the Rat Trap, the Connection Passage opens into a large silt floored chamber - the Desert - before passing under a low arch into the Trunk Passage. This is the largest passage in the cave, averaging 15m/49ft wide and 10m/33ft high. At the far end of the Trunk passage, a breakdown slope leads to the surface and a murky inland sinkhole - Cliff Pool - the second and only other entrance to the Green Bay System. On the east side of the Trunk Passage, the Harrington Sound Passages comprise two interconnecting passageways with much clearer water than adjacent sections of the cave. The Bath Tub Ring at 15m/49ft depth near the end of the Harrington Sound Passage consists of a horizontal bleached band of bedrock about 50cm/20 inches in width cutting across the rock strata. In the same area are bones of a sea turtle that apparently became lost and died in the cave at some time in the distant past.

The North Shore Passage is the longest single passage in the cave. It begins on the west side of the Trunk Passage and extends for nearly 500m/1640ft to a point beyond the northern shoreline of the island where the passage becomes too low for divers to follow. Several long interconnecting loops characterize this part of the cave. Undercut walls and the level nature of the cave at 18m/60ft depth indicate an underground stream may have flowed through these tunnels during glacial low stands of sea level. Massive stalactites and stalagmites, present in virtually all parts of the underwater cave, are another indication of the cave's long subaerial history.

Biological zonation is evident as the diver progresses farther into the cave from the Green Bay entrance. Brightly colored sponges, hydroids, tunicates and other encrusting organisms practically cover the walls and ceiling in areas close to the entrance. The density of these organisms declines with distance into the cave, due to decreasing tidal currents and suspended particulate matter. In the much clearer waters of the deep cave interior, stygobitic species predominate.

Special Note:
Most Bermuda caves are located on private or government property. Access to these caves is forbidden without the consent of the land owner. A very small group of cavers exist on the island and all access to caves must be organized through them.

Bermuda Endangered Cave Species

Mictocaris halope *(Bowman, Iliffe 1985)*
(Peracarida, Mictacea)
Species range: Known only from Green Bay, Crystal, Roadside, Tucker's Town and Wilkinson Quarry Caves, Bermuda.
Special considerations: Mictacea, a new order of peracarid crustacean, is represented by only 3 species: Mictocaris halope from anchialine caves on Bermuda, Hirsutia bathyalis *(Sanders, Hessler, Garner, 1985)* from 1000m/3200ft depths off Surinam, and H. sandersetalia *(Just, Poore, 1988)* from 1500m/4900ft in the Bass Strait, Australia. M. halope is a blind and unpigmented stygobitic species observed swimming in open water within the caves.

Typhlatya Iliffei *(Iliffe, Hart, Manning 1981)*
(Caridea, Atyidae)
Species range: Known only from Tucker's Town, Green Bay, Bitumen and Wilkinson Quarry Caves, Bermuda.
Special considerations: Eleven species are known from this genus, all being cave limited. They are found in Bermuda, Ascension Island, the Bahamas, Cuba, Yucatan Peninsula (Mexico), Jamaica, Puerto Rico, Hispaniola, the Galapagos Islands and the Mediterranean coast of Spain. Of these species, T. iliffei is most closely related to T. rogersi from Ascension Island in the South Atlantic. *Iliffe et al. (1983)* suggest that T. iliffei has its origins on submerged and emergent seamounts along the Mid Atlantic Ridge during the separation of the African and American continental masses.

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Diving the Moravian Karst

By Jitka Hyniova and Jakub Rehacek

Local 17th Century Legend

In the village of Vilemovice, which is situated in modern-day Czech Republic in the heart of Europe, there once lived a woman with her little son. She loved her boy very much. But she later married a widower who also had a little boy. The woman couldn't get used to her new stepson. He was in her way and she hated him.

One day the stepmother got an evil idea. She took her stepson into the woods to pick some wild berries. They walked close to a rim of a deep abyss far away from the village. All of a sudden she pushed the child down into the depths and walked away thinking nobody would ever find the child's little body.

But the child didn't fall all the way down. He was caught on some extending tree branches. Loggers cutting wood nearby heard his desperate cries and saved the little boy. He told them what had happened and the angry villagers punished the evil stepmother by throwing her into the very same abyss.

Since then the abyss has carried the name Macocha - the Czech word for stepmother.

Moravian Karst

The world famous Macocha Abyss has a dry pit with a depth of 138.7 meters (458 feet), making it the deepest abyss in central Europe. Underground Punkva River briefly emerges from Punkevni Caves on the Macocha Abyss bottom to form two small lakes. The Abyss originated after a Devonian limestone ceiling (approximately 350-380 million years old) of a large underground dome collapsed and the enormous shaft opened to the skies. Macocha Abyss lies in the unique Moravian Karst and Punkevni Caves. It is one of four publicly accessible caves out of the more than 1,000 caves in the area.

First descents into the Macocha Abyss were documented in the 18th century. Today, visitors can reach the top via foot, mountain bikes and cable car. As a part of the Punkevni Caves guided tour, the bottom of the abyss can be reached by foot or electric, underground boats.

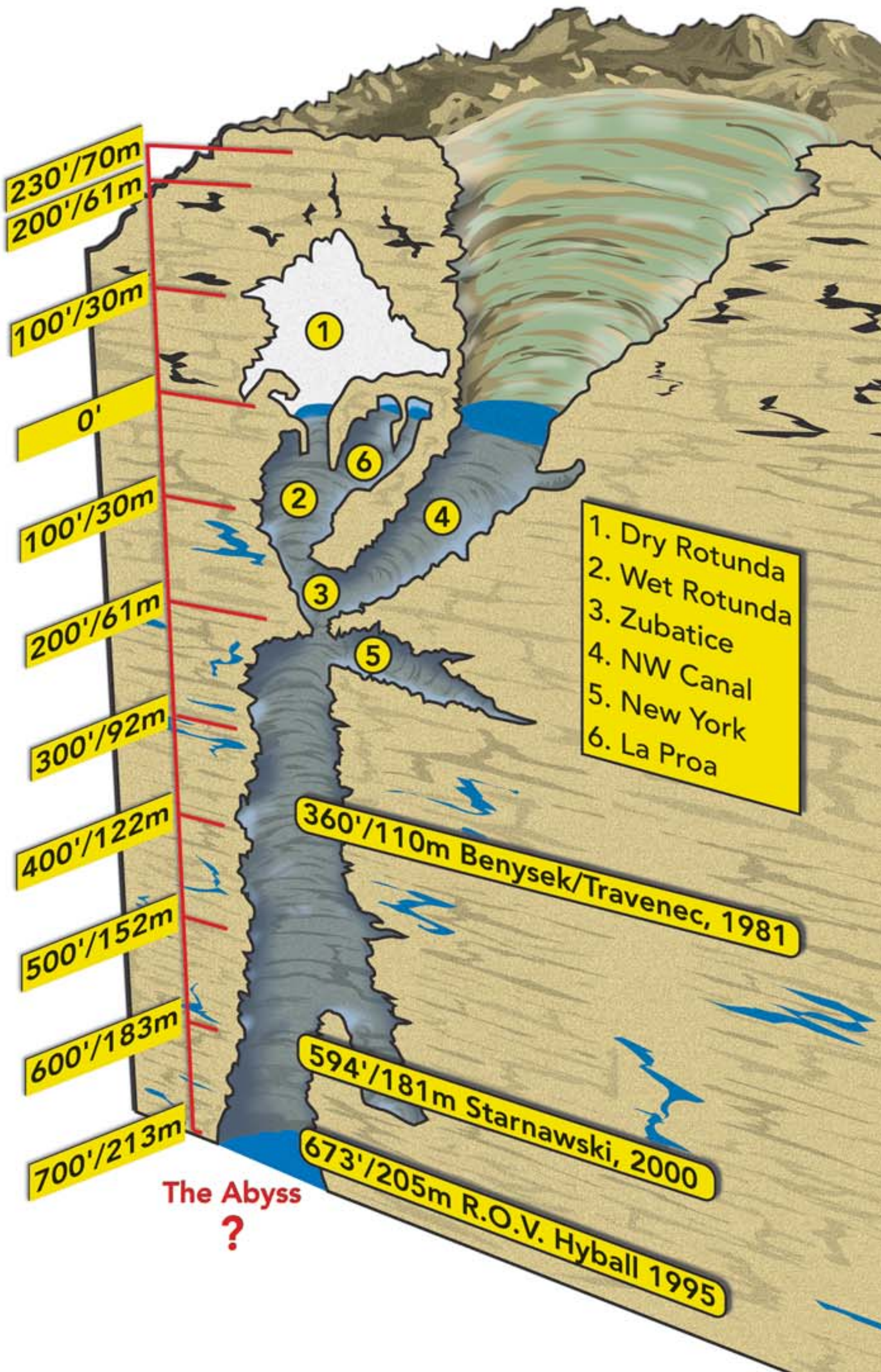
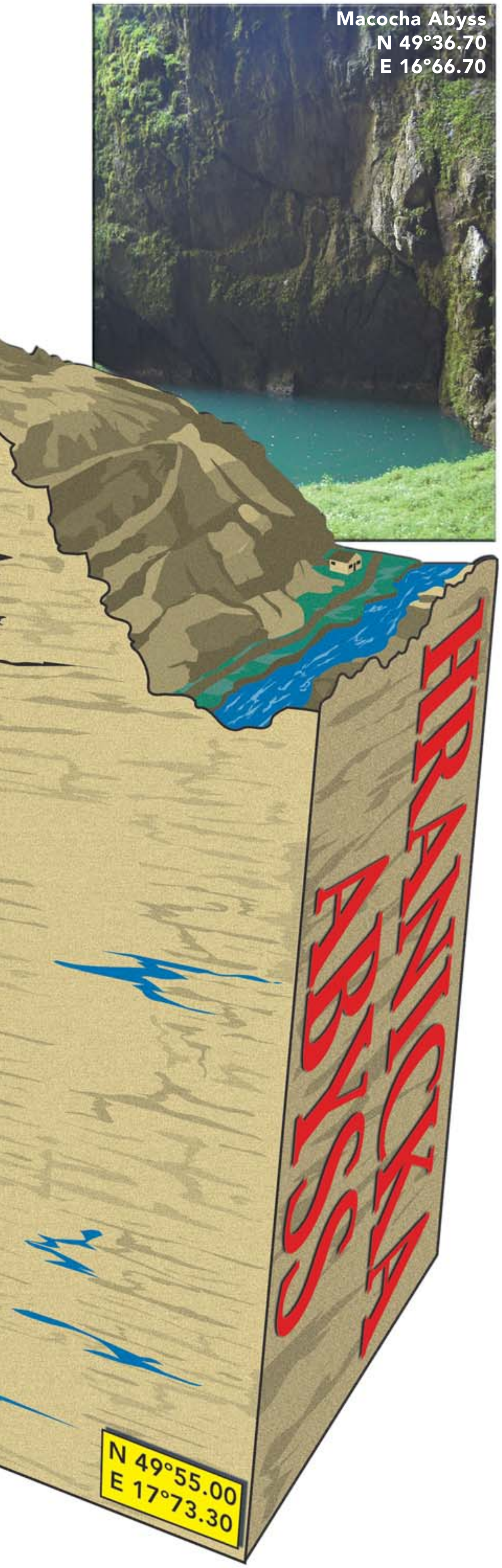


Illustration by: Curt Bowen adapted from sketches by F. Sabbath' Travenec and D. Skoumal



In addition to century's old legend about its name, the bottom of Macocha has seen its share of tragedies, since many picked the sheer vertical cliffs as means to ending their troubled lives. A huge boulder near the Lower Lake is called a Suicide Rock.

The bottom of Macocha Abyss and the two little lakes serve as a unique entrance to one of the most intriguing cave systems in the world. Exploration started in the early 1900s and after the World War II (any speleological activities in the occupied Czechoslovakia were banned during the war) well over 20 miles of underground passages were discovered up to date. Punkevni Caves are part of this large system called Amateurs' Cave in honor of the numerous amateur cave explorers working here for decades. The system has domes, galleries and corridors beautifully decorated with speleothems, deep pits, underground lakes, sumps and waterfalls and is a well-known archaeological and paleontological site.

To dive in Macocha Abyss we have to transport our seemingly endless piles of dry caving, climbing and cave diving gear onto electric boats that take us through the maze of the underground Punkva River passages to the otherwise inaccessible bottom of Macocha. The quiet boat takes us through the Black Lake Dome with its chimneys leading to upper levels of the cave, through the Fairy Tale Lake, Dragon's Gallery and by the beautifully decorated Masaryk's Dome (named after the first Czech president Tomas Masaryk). The water depth in this tunnel is mostly shallow with two deep areas called "Forty" and "Hundred," according to their respective depths in meters.

Summer air temperature at only 49F (9C) on the bottom of the Macocha Abyss doesn't stop explorers from sweating. Unloading the boats and carrying all gear another several hundred feet up and out of the dry cave passage to the open-air shaft of the Abyss and to the two little lakes is a lot of work.

From the two observation platforms that enable tourists to look into the depths of the Abyss, divers gearing up for exploration appear like ants. An indispensable piece of equipment on the bottom is a caving helmet, as many visitors try to guess the depth of the shaft by throwing coins and rocks from the upper observation platform located almost 460 feet above.

After suiting up, I climb over the safety fence that delineates the guided tour path as more tourists gather around to listen to Bach's monumental organ music played to demonstrate the excellent acoustics of the Abyss. A narrow winding path takes us by the upstream Upper Lake that leads to some sidemount passages and to the downstream Lower Lake where we finally enter the chilling 46F (8C) water. It is there that I notice the lake's bank has become the last sad destination for a small hedgehog that recently fell into the Abyss without any chance of ever climbing out.

The lake water is milky; nevertheless, after the last gear check, down we go. The narrow passage angles sharply under the Abyss' cliffs and we lose daylight almost instantaneously. Questioning the sensitivity of my already freezing fingers used to Florida's balmy waters and dressed in bulky gloves, I notice with relief that the cave line is really a rock climbing rope. But the whole two to three feet of visibility does not require a line drill. The passage is pretty much a deep narrow crack in the

Continued on page 32

VIDEO GEAR BOX • PART ONE

By Jeff Carson

For a day job, I get paid to analyze things. This involves tearing things apart and then telling my clients, in minute details, what I liked and what I didn't like about the thing that I just tore apart. So when it comes to shopping for underwater gear, I can be a little anal. First, there is the list of all of the manufacturers, then there is the data gathering about the thing that is to be researched. (In this case, I'm analyzing an underwater video housing.) This must be organized in an elaborate spreadsheet, followed by a compare and contrast analysis, and then I make the decision of which one to buy.

Ask yourself the question: Why do I go diving? Assuming that this article has found its way into the correct magazine, you are probably a technical scuba diver. Technical scuba diving has many facets including cave diving, wreck diving, deep diving, etc. For the people engaged in these specialties, every one of them has the same common thread...we would love to be able to relive many of those dives again and again. One answer to the question, "Why do I go diving," is to enjoy the underwater world by seeing things that most other people don't get to see. If you can agree with me so far, that we go diving to see cool stuff, then it makes sense that after the dive is over, it might be a lot of fun to sit back on the couch and see the entire dive again, and again and...well, you see where this is going.

The key issue in selecting a video housing for technical diving is reliability. No matter what, if your housing floods, chances are, you now own a corroding paperweight. So lets look at the aspects of an underwater housing that make it reliable. Some of the indicators of a housing's reliability are the material used in the casing, type of controls, the warranty and the depth rating.

Between A Rock and A Hard Case

The two materials most often used in underwater housings are aluminum and some form of plastic polymer such as polyurethane or PVC. To generalize, the polymer housings are typically designed to accommodate several different camera bodies. The camera typically mounts on a sliding plate and shoots through a flat faceplate. These housings are good for beginners and are less expensive. Aluminum housings are typically designed to fit a single camera body and shoot through a front port that can accommodate a variety of ports and/or lenses for macro, standard, or wide-angle shoots. These housings are typically more versatile, they are rated for deeper dives and (as expected), they are more expensive.

A quick look at the depth rating of the polymer housings versus the aluminum housings tells the tale. Aluminum housings are typically rated at 330 feet to 450 feet and polymer housings are typically rated from 150 feet to 250 feet.

You can start your own research on some of the more popular housings such as: Ikelite, UnderSea, Ocean Images, Top Dawg, Amphibico, Gates, and Light & Motion at the above URLs. If you think you may be interested in dabbling a little in underwater video (UV),

Company Name	Housing Body	Controls	Rated Depth	Warranty	web-Site
Amphibico	Aluminum	Mechanical	330′	1 year	www.amphibico.com
Gates	Aluminum	Mechanical	450′	2 years	www.gateshousings.com
Light & Motion	Aluminum	Electronic	330′	1 year	www.uwimaging.com
UnderSea	Polyurethane	Electronic	250′	1 year	www.usvh.com
Ikelite	Polycarbonate	Mechanical	200′	1 year	www.ikelite.com
Ocean Images	Polycarbonate	Electronic	200′	1 year	www.oceanimagesinc.com
AquaVideo	PVC or Aluminum	Mechanical	300′	1 year	www.aquavideo.com
Top Dawg	Aluminum and Plexiglas	Electronic	150′	1 year	www.topdawgvideo.com

and if extreme depth is not required, a polymer housing may be for you. But if UV is a definite part of your diving future, an aluminum housing is definitely the way to go.

Control Freak

Let's face it, we all like to feel like we are in control, at least when compared with being out of control. But in this case we are talking about a different kind of control. Control in this context is the way that an underwater housing allows the diver to use camera functions such as: on/off, photo, auto/manual focus, white balance and others. The two types of controls are mechanical and electronic.

Mechanical controls are stainless steel rods that have a control arm outside the housing and a soft rubber tip inside the housing, which operates the controls. The optimal design for mechanical controls is for the soft rubber tip to be operated by rotating the controller with an external arm, as opposed to pushing the rod in a plunger fashion.

Top of the line electronic controls will send an infrared beam through the housing. Other electronic controls can involve wiring that penetrates the housing. Electronic controls are very convenient, but are sometimes prone to problems. Although the Light & Motion housing is rated to 330, the push buttons can be kind of finicky past 200 feet or so. For dives deeper than 200 feet, the folks at Light & Motion will have to install heavier springs under the push buttons to solve the problem. Experienced videographers generally agree that mechanical controls are more reliable than electronic controls.

Second Fiddle

Second only to reliability is versatility. Good quality video gear should allow the user to add peripherals such as an external monitor. (These are really cool!) A good external monitor allows videographers to hold the housing in a much more comfortable position in the water without having to look through the eyepiece in the rear of the housing. A good one-stop-shopping manufacturer will also offer all of the peripherals that will allow the user to personalize the housing to their own personal needs. A good selection of video ports would include a dome port for wide-angle shots, a flat port for macro shots and a standard port for zooming in and out without loosing focus. In order to get true vibrant colors, color correcting filters for both blue and green water are needed. Finally, the housing should allow the user to configure a variety of lights and accept a variety of light arms.

The Final Analysis

We have considered the pros and cons of eight underwater video housings. In the final analysis, the most reliable and versatile housing has to have an all aluminum body, mechanical controls and lots of options for ports, accessories and filters. The body also must accept several different types and sizes of lights and light arms.

Well, there you have it. The final choice is up to you. As you can tell by the data and the photos, the Gates and the Amphibico fit the technical demands for most cave and wreck dives in the 250 feet to 330 feet of depth. However, only the Gates will take you deep enough to capture the USS Saufley at 420 feet, the USS Fred T. Berry at 370 feet, the O.L. Bodenhammer at 420 feet, the Captain Harry at 370 feet, Diepolder Cave or the bottom of Red Snapper Sink.

Special thanks to Jason Brauhn at www.bubblecheck.com for the photography.

THE DISCOVERY OF THE

SS KEILAWARRA

By Kevin Denlay

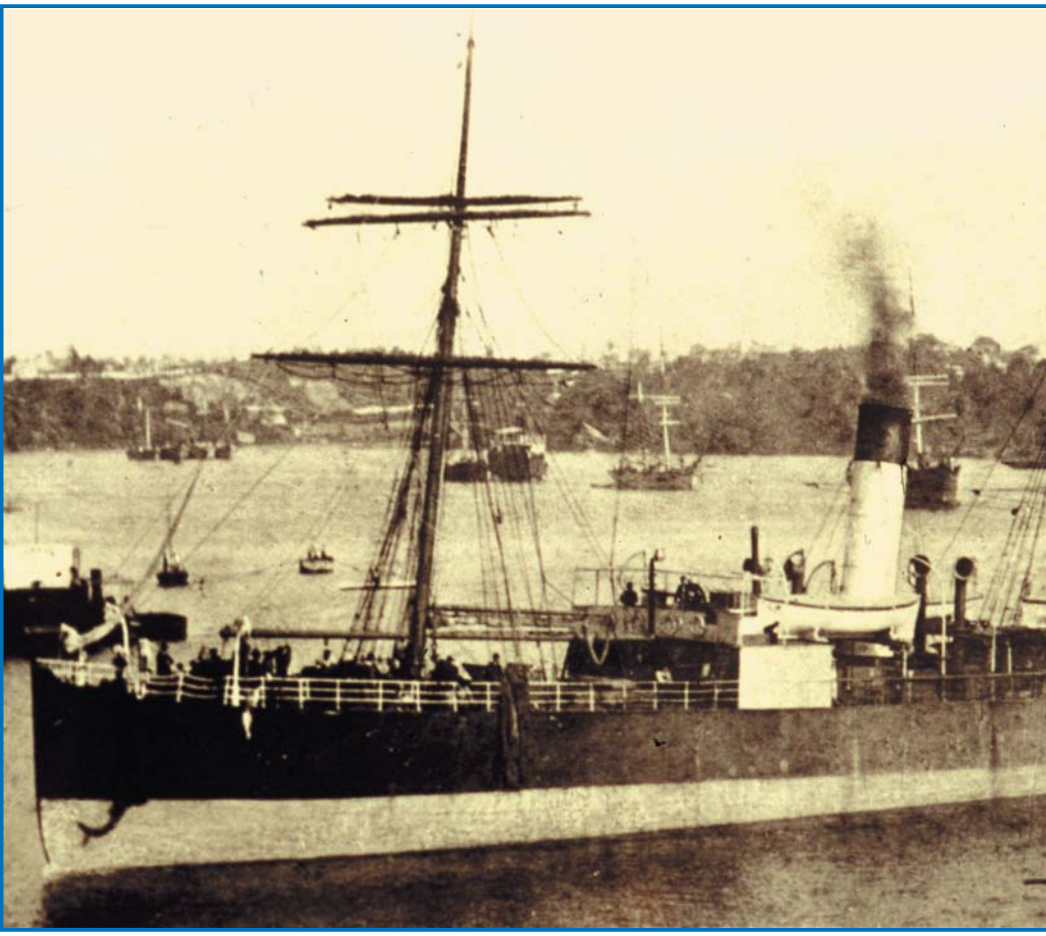
Our story begins a long time ago on the night of December 8, 1886, halfway up the East coast of Australia. It was early evening and the *SS Keilawarra*, 61m/201ft long and 748 gross tons, steaming from Sydney to Brisbane and other Queensland ports, was approximately three nautical miles north of South Solitary Island off the New South Wales mid-north coast. At the same time, heading south from Grafton to Sydney, was the much smaller steamer *SS Helen Nicoll*, 47m/150ft long and only 384 gross tons. Although she was still approximately 10 nautical miles north of North Solitary Island, as fate would have it these two iron steamers were rapidly closing in on a collision course! Less than 90 minutes later, they collided and the *Keilawarra* sank, causing one of the greatest peacetime tragedies in New South Wales maritime history.

At around 8:20 p.m. on that fateful December night, the evening calm was shattered when the bow of the southbound *Helen Nicoll* cut cleanly into the starboard forepeak of the *Keilawarra*. With a following northerly wind, thick smoke from the *Helen Nicoll's* funnel had blown ahead of the vessel, shrouding her from view and it was only at the last moment that she was sighted from the *Keilawarra*. Captain Buttery tried in vain to alter his course and avoid the impending collision but, unwittingly, steered his ship across the path of the obscured southbound vessel. With both vessels temporarily "locked" together, and with the screams of frightened passengers filling the night air, panic ensued. Several people from the *Helen Nicoll* even jumped over onto the larger *Keilawarra* thinking she would remain afloat and the smaller *Helen Nicoll* would sink. They would soon regret this rash decision. Less then 10 minutes later the *Keilawarra* would be gone and over 40 souls would perish, including some of those that had leaped from the *Helen Nicoll*.

The *SS Keilawarra* was an iron steamer of 748 gross tons, approximately 61m/201ft long, 9m/30ft wide and 6m/20ft deep, built in 1878 in Fife, Scotland. Used on the Sydney to Queensland passenger-cargo service, she was owned by Howard Smith & Sons of Sydney.

The *SS Helen Nicoll* was also a steamer and used on the Sydney to northern New South Wales coastal passenger-cargo service. At approximately 47m/154ft long, 6.5m/22ft wide, 3m/10ft deep and only 384 gross tons, she was a much smaller vessel than the *Keilawarra*. She was owned by the North Coast Steam Navigation Co. and built in 1882 in Dundee, Scotland.

Important Note: This unique archaeological site is protected by the provisions of the Commonwealth Historic Shipwrecks Act of 1976 and, as such, it is illegal to disturb or remove any objects whatsoever from the site. The SS Keilawarra is strictly a look but don't touch dive.

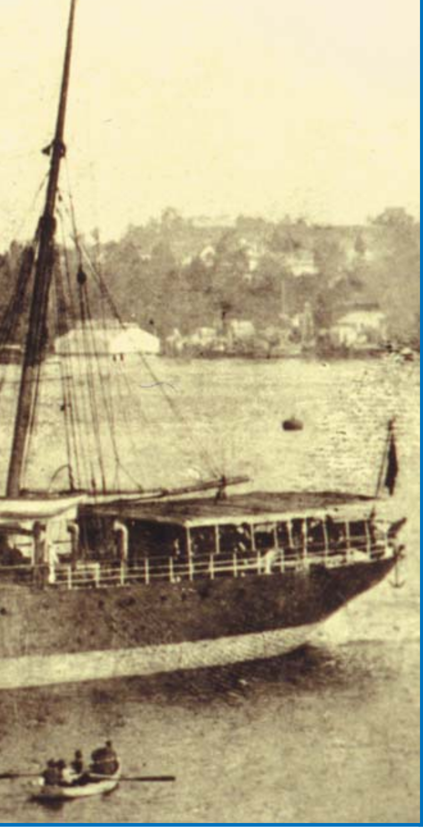


Reports of mayhem and cowardice would soon arise with the survivors' stories. One, a Reverend Grey, had tried to find life buoys for the women but they were all taken. He later said, "I saw a lot of men jump overboard with life buoys on."

Captain Buttery was even heard to cry out, "Shame on you men. Have you no thought for the women?"

Aleck Matthews, another survivor, related this horrific account. "Women rushed at me and clung to me and prayed me in God's name to save them. Little children, some quite naked, were running, shrieking with fear about the deck, quite demented, and some were clinging so tightly to their mothers that they could not be torn away."

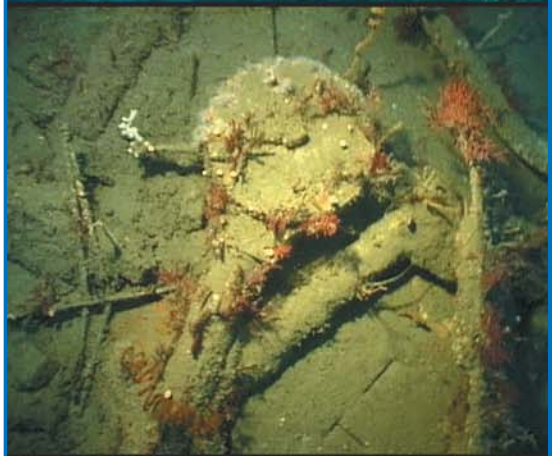
Soon in the water themselves, Mr. Matthews and Reverend Grey watched as the once proud steamship stood on her end and sunk swiftly by the bow. The *Keilawarra* was gone and all that prevailed was an eerie silence laced with the occasional cries of survivors. Although over 40 people had perished, many of them women and children, ironically most of her crew had survived, including all the officers and engineers. Captain Buttery himself, however, was last seen on the bridge and went down with his ship. Interestingly, the smaller *Helen Nicoll* was to survive the collision and slowly make her way to Sydney and into a subsequent Court of Inquiry. Today the *Keilawarra* rests peacefully on a sandy bottom, her undisturbed remains sitting upright in 75m/246ft, a priceless archaeological time capsule.

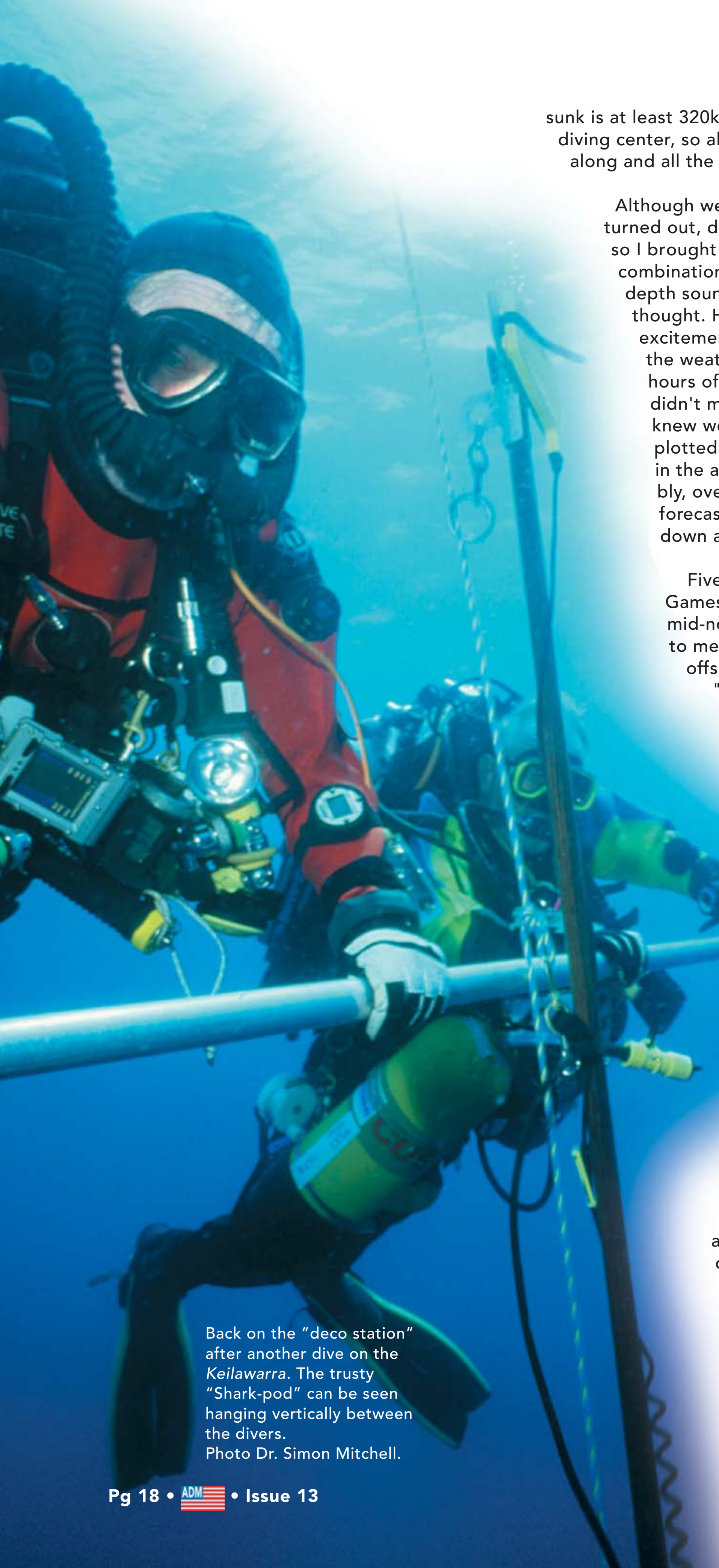


Keilawarra at anchor. Photo courtesy Mitchell Library, Sydney

The Exploration

Hidden beneath the waves for almost 114 years, the wreck of the *Keilawarra* was discovered and positively identified on September 18, 2000, in a combined effort involving two mixed gas divers, John Riley and myself, dive shop proprietor Chris Connell and fisherman Darcy Wright. Our group first combined to search for the *Keilawarra* on August 14, 2000. Three months prior to this Stan Young, from the nearby coastal village Wooli, was also looking for the wreck and had taken me to a couple of his deep 'fishing' sites, but those dives were to no avail. On the other hand, John had done considerable prior research and believed he had a good idea of the *Keilawarra's* final course and had plotted the area where he suspected she went down. His calculations would later prove uncannily accurate! We launched the Dive Quest boat, which John and I had chartered for the search from Arrawarra Beach, and with Chris along as skipper headed out to the area in question. Although we had our dive gear on board, this trip was primarily a survey mission to check depths, look for and mark possible targets. The coastal region where she





Back on the "deco station" after another dive on the *Keilawarra*. The trusty "Shark-pod" can be seen hanging vertically between the divers. Photo Dr. Simon Mitchell.

sunk is at least 320kms / 200 miles from the nearest technical diving center, so all the necessary dive gear had to be brought along and all the gas had to be premixed.

Although we had a magnetometer with us (that, as it turned out, didn't work) Chris' boat had no depth sounder, so I brought along my portable Lowrance GPS/sounder combination and had set it up on the boat. Without a depth sounder, well, it wouldn't be too productive, I thought. However, as the morning progressed and the excitement mounted as we located possible targets, the weather steadily deteriorated, and after only two hours of searching we had to call it a day. But we didn't mind. Although we couldn't dive that day, we knew we had several targets and GPS coordinates plotted and had ascertained that the greatest depth in the area was a manageable 80m/262ft. Regrettably, overnight the weather worsened and as the forecast was for more of the same, we had to stand down and plan to return at a more opportune time.

Five weeks passed and, with the 2000 Olympic Games in full swing in Sydney, we met again on the mid-north coast. In the interim it had been arranged to meet up with local fisherman Darcy Wright in our offshore search area so he could show us a "fishing mark" he had, in the chance that it might be the *Keilawarra*. Early on the morning of September 18, we set off to meet him. After a rendezvous at sea, Darcy showed us a site that produced a promising looking image on my sounder less than half a mile away from the targets we'd marked in August. As he was about to depart, we asked if he had any more marks and he subsequently led us back to another site that was now less than one quarter of a mile from the track John had charted as the *Keilawarra's* final course. When John and I saw the image of this site on my sounder, our eyes lit up and smiles crossed our faces. This one looked extremely promising and in about 75m/245ft! However, we now had four targets to dive within a half-mile radius and only John and myself onboard were capable of diving them because the depths involved required mixed gas expertise.

To make the most of our time, John suggested we eliminate them one by one and dive solo on one target at a time. I agreed. In a very democratic fashion, which he would soon rue, John decided to toss a coin to see who got to go in first on the most promising site. John tossed a 20-cent coin, I called tails and I won. Seventy-five minutes later I was back on the surface reporting the discovery of the *SS Keilawarra*, having just had the privilege of being the very first person to lay eyes on her in 114 years! Sometimes you just get lucky.

Unfortunately while underwater, the weather had again deteriorated so there were no more dives that day. Overnight, however, the weather cleared and John and I spent the next three days diving the *Keilawarra*. John surveyed and I shot digital video, retiring only when John had used up his supply of open circuit trimix gas. Because the *Keilawarra* is well beyond regular sport diving depths and is in a relatively isolated region (for technical divers, that is), she remains unique among Australian shipwrecks from the previous century -- unsalvaged, undisturbed and untouched. Hopefully she will continue to stay that way so that others can enjoy what we had the good fortune to experience on our discovery expedition.

My Recollections of the Discovery Dive

The boat maneuvers to the buoy on the down line we had already deployed. I jump in and beautiful blue water, very little current and exceptional visibility awaits me. I descend down past the Shark Pod (an electronic device for deterring overly inquisitive sharks) deployed at 15m/45ft on the down line. On my ascent I can shift it up and keep it nearby as I decompress during the final stages of my dive, as this area is renowned for big sharks! I pull hand over hand down the line and into a silent blue void. There are no sounds whatsoever, save for the rhythmic tone of my breathing and the occasional hiss of the solenoid injecting oxygen into my Mk15.5 closed circuit rebreather or CCR. Anticipation mounts as I wonder what I will see -- rocks, reef, sand or a wreck?

At 50m/164ft I start to see distinct "shapes" and at around 55m/180ft straight parallel lines come clearly into view. I immediately realize that straight parallel lines are not a natural occurrence on the ocean floor. It can't be, but it is! By 60m/197ft I can clearly see that I am descending directly above the boilers of an old wreck! I am literally dumbfounded and almost have to pinch myself to make sure I am not just seeing things. I am diving with a helium-based diluent of 10/52 (10 percent oxygen, 52 percent helium) in my CCR, so I know I am not narced. If I wasn't using this helium-based breathing mixture with very little narcosis, I might have thought that I was suffering a nitrogen-induced apparition.

Believe it or not, the down line landed just forward and slightly starboard of the two cylindrical boilers amidships. I let go of the line and settle on one of the boilers and scan around to get my bearings. Unbelievable! Stretching out before me in either direction is the unmistakable outline of the wreck -- the remains sit upright with the hull sides collapsed outward on the sand. A large donkey boiler sits just forward of the main boilers, whose now detached steam domes rest nearby. Looking forward I can see the debris field appears to end at about the limit of visibility. And the visibility is a stunning 30m/100ft or more horizontally, and the ambient light level is simply outstanding. It is hard to imagine that I am over 70m/230ft deep. As I swim forward and along the starboard side, I notice directly beneath me the structural "ribs" of the ship, to my right is a life boat davit, to my left is the rim of the ship's forward hold. Further forward I can see what looks like the first of two large winches. I soon swim over the first winch and the forward mast step, then the second winch and can now clearly see where the wreckage terminates.

Swimming on I settle on the sandy bottom just forward of the wreck and looking back can see a large anchor with the chain heaped under it. Although this forward area was heavily damaged and disfigured in the collision, it is still clearly discernible as the bow. I can now see back past the boilers, so the visibility is actually well in excess of 30m/100ft! Momentarily I allow myself to contemplate the fact that what has become a ghostly wreck site had once been a scene of bustling human habitation evidenced by the day-to-day artifacts strewn about everywhere -- dinner plates, numerous bottles and other items, even a chamber pot! It is a sobering thought. After a short spell marveling at this tragic yet magnificent site stretched out before me, I swim back along the port side still somewhat in disbelief that this is actually happening. It just doesn't get much better! I continue on past several portholes with glass still in place, all the while noticing various other artifacts, and then loiter a moment in the bridge area where the telegraph and compass binnacle are in full view.

It's now time to head aft past the boilers from where I started. About halfway to the stern on the port side, behind the rear hold casing, I cut across the wreck to starboard. I have gone far enough now to clearly make out the rudder post standing proud above the stern of the wreck, beneath which sits the rudder and a large, four-bladed propeller, behind which a huge school of Jewfish circle. Swimming back to the up line, I pass plates stacked in the silt, bottles and still more artifacts and by another winch just aft of the massive compound steam engine resting behind the boilers.

I gradually start to ascend, all the while looking down at the wreck, simply mesmerized by it. As I ascend further, the myriad shapes slowly melt back into the void and I am again left staring into a blue orb. It is as if all I had observed was just an apparition, having again been enveloped in the ocean's womb. The deep decompression stops pass uneventfully, and I'm soon up at the 12m/40ft stop maneuvering the Shark Pod, whose protective electronic "force-field" is not yet switched on, up the line with me as I ascend. I can now hear distinct chirping squeal-like sounds and look up to see three dolphins cavorting about, a mere 6m/20ft away! This entertaining interlude goes on for quite some time, but all too soon they leave and the decompression eventually comes to an end. It was a fitting finale to the very first dive on the *SS Keilawarra*, an honor made possible only by what had been a joint effort in discovering a very historic shipwreck from Australia's maritime past.

Since the initial discovery, I've returned on three separate expeditions and some of the photos accompanying this article were taken on those later occasions. Conditions at the site have differed dramatically from visit to visit and even from day to day. We've had the gamut from glassy, calm days to having the sea come up so rough and choppy once on site that it's barely able to be dived and sometimes it's not possible at all. Often there is no current whatsoever, while at other times it's a major effort just to get down to the wreck let alone move around on it and we end the dive flapping like flags in the wind during decompression. Water clarity has ranged from a crystal clear 30m/100ft plus with abundant ambient light to very dark and only a few meters/feet of visibility.

Advanced Diver Cave & Wreck Index

By Jon Bojar and Curt Bowen

The world is a very large place, especially when you're searching for a cave entrance, wreck or specific reef location no larger than a wood-paneled station wagon. Covered with hundreds of feet of sea water, thick overgrown brush or steep mountain terrain makes locating these dive sites almost impossible without the assistance of GPS technology or a couple of Mayan guides.

Advanced Diver Magazine is here to help with our new Cave, Wreck & Reef Index. Almost every other diving country of the world has an index, so we believe it is time for the U.S.A. to join the game! In each issue of ADM we will be selecting several sections of the world for which we will provide basic dive information such as name, depth and longitude/latitude numbers. Along with this information we will also include local boat charters and dive facilities that can assist your diving needs with equipment, fills and transportation to these sites.

Get a FREE listing for your facility or charter service.

Gathering all this data is difficult and time consuming, but your dive facility or charter service can help. Provide ADM with a minimum of 15 local dive sites including the latitude/ longitude numbers, name, depth and description of the site, and we will include your business information for your area.

Purpose to document

Our desire is for future cave divers and subterranean explorers to not reinvent the wheel, continually rediscovering locations previously explored. There is no true exploration without the sharing of knowledge gained through the hardship and commitment put forth while exploring these natural wonders. As one explorer said, "If you didn't survey it, you weren't there; and if you don't share the information, what was the point?"

Sharing the knowledge we spend our lives acquiring will lead to the next generation of explorers reaching beyond our accomplishments. The tale of the past drives the future. It motivates and informs. Waldo Emerson stated, "What we call results are beginnings." Modern day Explorers are an uncommon breed. In the time of fast food and television, we find fewer and fewer people with the drive to explore. The information we acquire should not be squirreled away in our heads, but shared with our peers and students.

When enough data is gathered and compiled, the index material will be published in a single book. In this book we will have room to print details and maps of many of these cave systems, wrecks and reefs. It is our hope that most divers will realize the sharing of information among our peers will not lead to the destruction of our sites, but rather advance exploration in the future.

WARNING

Advanced Diver Magazine does not condone "sneak or bandit" diving in any way, shape or form. It is against the Florida law to trespass on private property without the permission from the landowner.

Section 810.09 of the Florida Statutes entitled "Burglary and Trespass" reads:

"A person who, without being authorized, licensed or invited willfully enters upon... property... as to which notice against entering or remaining is given, either by actual communication...or by posting, fencing..."

"If the offender defies an order to leave, personally communicated to the offender by the owner of the premises or by an authorized person...the offender commits..." the offense of Trespass.

Land which is enclosed by a legal fence, and which is posted, is legally closed, and unauthorized entry is prima facie evidence of trespass. Op. Atty Gen. 057-359, Nov. 15, 1957. This does not apply to unenclosed land.

It is not against the law to wear black full cave diving equipment in the middle of the night on public property, paid hotel rooms or in the rear of personal vehicles.

DANGER

Do not attempt cave diving without the proper training and experience. Many of the caves listed here are extremely difficult and should be attempted only by those with vast years of cave diving experience.

Citrus / Hernando County N 28°40.00 to N 28°26.00

Name	Lat	Long	Depth	Access
• Crab Creek	28°43.033	82°34.544	110′	Open
• Mud Spring	28°32.826	82°37.503	210′	Open
• Little Salt Spring	28°32.780	82°37.140	240′+	Closed
Less than 1/4 mile west of junction SR50 and SR595. 100 feet south of SR50. Small spring with round shaft in middle.				
• Eagles Nest	28°33.319	82°36.559	310′	Closed
Located on SWFMD property. 2.7 miles from catefish pond.				
• Lost 40 Cave	28°32.119	82°32.561	165′	Open
• Joes Sink	28°31.892	82°32.617	75′	Open
• Mary Sink	28°31.891	82°32.641	45′	Open
• Hospital Hole	28°31.853	82°37.425	143′	Open
Located on the eastern bank of river. Heavy sulfide layer at 90′. Sink is shaped like a boot.				
• Nursery Sink	28°31.556	82°32.891	214′	Closed
• Jenkins Creek	28°31.336	82°38.059	30′	Closed
In Jenkins Creek Park on Shoal Line Blvd. Sink is 1/8 mile east of the park. Follow the creek to the basin and go to the eastern side.				
• Diepolder II	28°31.332	82°31.750	345′	Guide
Located on Boy Scout Camp off SR50, guide required.				
• Diepolder III	28°31.078	82°31.756	297′	Guide
Located on Boy scout Camp off SR50, guide required.				
• Weeki Wachi	28°31.015	82°34.395	240+?	Closed
Recreational park, closed to divers.				
• Twin D's	28°30.811	82°34.859	280′	Permit
Located on the Weeki Wachi property.				

Pasco / Pinellas / Hillsborough Counties N 28°26.00 to N 27°35.00

Name	Lat	Long	Depth	Access
• Arch Sink	28°25.562	82°34.707	197′	Closed
Offset sink with two tunnels. Large room to the left of sink.				
• Jewel	28°24.479	82°40.321	315′	Closed
Located on Sun West Mine property.				
• Garden World	28°24.452	82°39.158	240′	Closed
17212 US Hwy 19 (east side of road). Located on Garden World Nursery property.				
• Isabella Spring	28°23.892	82°40.454	110′	Closed
Off Old Dixie Hwy behind the Withlacochee electric substation.				
• Wards Sink	28°23.636	82°33.762	198′	Closed
Typical hourglass shape sink, top of silt mound at 125 feet.				
• Nemesis	28°22.094	82°34.747	218′	Closed
• Palm Sink	28°21.294	82°41.964	150′	Closed
• Waynes World Cave	28°22.100	82°41.640	110/280′	Open
• BW Smokehouse	28°20.884	82°41.360	60/145′	Closed
• BW Golfball Sink	28°20.834	82°41.350	60/145′	Closed
Sink is a small pond on the Beacon Woods golf course.				
• BW Briar Sink	28°20.758	82°41.316	70′	Closed
Sink located less than 10′ off the side of the road.				
• Hudson Grotto	28°20.744	82°42.090	110′	Commercial
Training location for Scuba West.				
• BW Stratamax	28°20.658	82°41.242	60/145′	Closed
Sink is in residence back yard.				
• Beacon Woods Round	28°20.229	82°40.969	160′	Closed
Large decompression tree made of PVC is located in the sink. Gold kernmantle line throughout a large portion of the cave.				
• BW Nexus	28°20.209	82°40.967	145′	Closed
• Deep Salt Spring	28°17.578	82°43.058	330′	Closed
Entrance is restrictive. Extreme depth and very poor visibility.				
• Rock Sink	28°16.868	82°39.961		
• Howard Park	28°09.281	82°48.099	94′	Open
Located about 200 meters offshore on the right.				
• Hidden Lake Sink	28°08.660	82°46.295	240′	Ask First
1/8th a mile behind the firehouse on Gulf Road on the northeast corner of the lake behind residential houses.				
• Tarpon Bayou Spring	28°08.46	82°45.33	125′	Open
• Knight Sink	28°07.600	82°44.269	200′	Via Lake
• Tarpon Sink	28°07.598	82°44.244	200′	Via Lake
• Wall Spring	28°06.22	82°46.21		Closed
• Blue Sink	28°05.291	82°45.965	130′	Closed
Blue Sink is in the Hidden Lake subdivision of Palm Harbor, just off of Rolling Oaks Drive.				
• Crystal Beach	28°05.062	82°47.091	126′	Open
Spring located 400 meters south of Crystal Beach Park, 200 meters from shore.				
• Little Blue Sink	28°04.625	82°19.934		Closed
• Chicken Ranch Sink				
• I-75 Sink	28°04.247	82°21.207	?	Open
Located between I-75 north and southbound lanes, just north of Fletcher Ave.				
• Sulphur Springs	28°01.15	82°27.05	115′	Permit
Located just to the south of Bird and Nebraska intersection, Tampa.				
• Lithia Minor	27°51.58	82°13.52	26′	Open

Sarasota / Manatee Counties N 27°35.00 to N 26°57.00

# Name	Latitude	Longitude	Depth	
• Deep Lake - Arcadia	27°13.10	81°77.60	297′	Closed
Located on the 2x4 ranch. Pond behind main farm house.				
• Myakka State Park Hole	27°12.90	82°20.19	123+?	Closed
Located in the Myakka State Park south lake. Lots of alligators!				
• Warm Mineral Springs	27°03.579	82°15.638	224′	Closed
Privately owned, swimming allowed but no diving. 87° water temp.				
• Little Salt - North Port	27°04.30	82°14.00	210+?	Closed
Property managed by University of Miami. Archeological Site.				

Charlotte / Lee / Collier Counties N 26°57.000 South to Dry Tortugas

Name	Latitude	Longitude	Depth	
• Lehigh Sink	26°36.628	81°36.235	188′	Closed
Located on the edge of Lehigh golf course, 2-7 foot vis in sink.				

Gulf of Mexico Blue Holes

• *Jewfish Hole	28°25.76	82°42.53	?	Gulf
• *AJ Hole	TD's 14089.3	44695.1	114′-366′	Gulf
Large opening at 114′ top of silt mound at 310′ slopes to 366′.				
• *Grand Slam Cave	28°13.151	83°41.819	110′-295′	Gulf
Very small opening that drops through 3 small rooms to a large room on bottom. Hydrogen sulfide layer at 250 feet in bottom room.				
• *Green Banana	TD's 14021.6 or 7	44769.4	154′-435′	Gulf
Seafloor at 154′, hour glass center at 300′, top of silt mound at 410′.				
• *Pride Sink	TD's 14084.2	44958.3	124′-224′	Gulf
Seafloor at 124′, large opening with some small sand boils at bottom.				
• *Awesome Sink	TD's 14034.3	44692.9	155′-180′	Gulf
75 foot diameter hole, poor vis in bottom of hole.				
• *JR009 Sink	TD's 14009.3	44847.8 or 6	165′-185′	Gulf
Large sink with big undercuts and lots of fish.				
• *Glory Hole	TD's 14239.5 or 6	45316.7 or 17.0	72′-300+	Gulf
• *Donut Hole	TD's 14076.9	44741.6	?	Gulf
• *Jewfish Hole	TD's 14023.8	44712.4	?	Gulf
• *South Spring	TD's 14004.0	44684.2 or 3	?	Gulf
• *Captiva Blue Hole	26°28.900	82°44.190	90′-180′	Gulf
Large D shaped sink with one side sloping in, poor vis on bottom.				
• *Mud Hole	26°14.768	82°00.637	55′-60′	Gulf
Small warm water vents located on sea floor.				
• *Naples Blue Hole	25°50.570	82°09.114	64′-224′	Gulf
70 foot diameter hole on sea floor, top of silt mound at 185′ Heavy hydrogen sulfide in the bottom 40 feet of the hole.				
• *Chicken Pot Pie Sink	25°40.744	83°01.657	168′-198′	Gulf
120 foot diameter hole drops only 20 feet, little undercuts.				

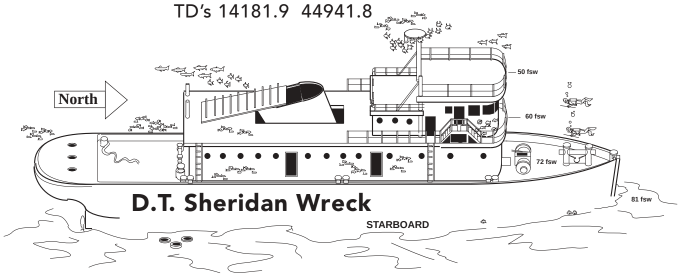
* Gulf of Mexico Blue Hole / First depth = Depth of Gulf floor, second depth = max depth in system.

? Unexplored or undetermined max depth, needs more exploration.

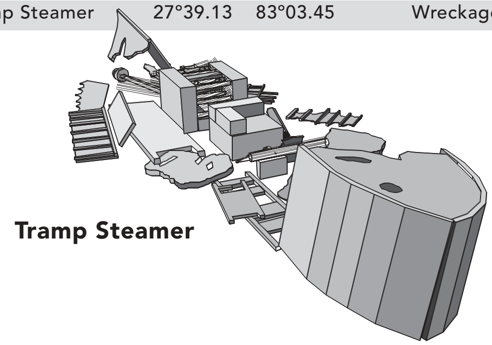
Citrus / Hernando County 28°48.00 to 28°26.00					
#	Name	Latitude	Longitude	Description	Depth
1	Reef Balls	28°47.338	83°03.547	Artificial Reef	35′
2	Lincoln Logs	28°47.352	83°03.491	Artificial Reef	35′

Pasco / Pinellas / Hillsborough Counties 28°26.00 to 27°35.00					
#	Name	Latitude	Longitude	Description	Depth
3	200′ Barge	28°17.630	83°01.090	200′ Barge	40′
4	Steel Barge	28°15.070	82°57.452	130′ Barge	25′
5	Anclote Tug	28°14.486	83°20.571	Tug Boat	80′
6	150′ Barge	28°02.976	83°00.732	150′ Barge	42′
7	Barge	27°56.145	83°01.352	Steel Barge	47′
8	Sheridan Wreck	27°52.562	83°11.180	180′ Tug Boat	80′

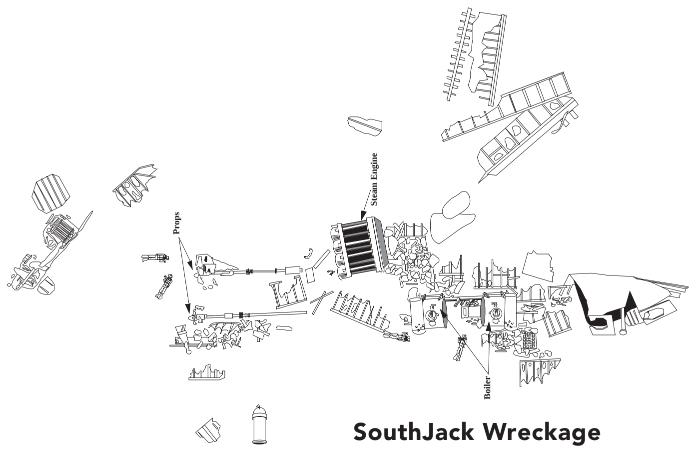
TD's 14181.9 44941.8



9	Wreck	27°42.76	82°58.28	Shrimp Boat	85′
10	Blackthorn	27°50.21	83°08.11	180′ USCG Cutter	82′
	TD's 14181.6 44943.3				
11	Tramp Steamer	27°39.13	83°03.45	Wreckage	63′



Sarasota / Manatee Counties 27°35.00 to 26°57.00					
#	Name	Latitude	Longitude	Description	Depth
12	Gun Smoke	27°33.65	83°05.06	65′ Wreck	80′
13	38′ Wreck	27°32.45	82°52.18	Wreckage	68′
14	Spoil	27°31.41	83°04.66	45′ Spoil	92′
15	Mexican Pride	27°31.37	83°24.36	220′ Wreck	124′
16	Shrimp Barge	27°22.60	83°02.01	Shrimp boat	70′
17	SouthJack Wreck	27°18.60	83°02.68	Broken Up Ship	63′



18	Barge2 / M-1	27°19.073	82°43.284	Barge	42′
19	Box Cars / D-3	27°15.770	83°07.304	RR Cars	105′
20	Box Cars / D-4	27°15.302	83°07.217	RR Cars	103′
21	North Cuda Hole	27°15.20	82°44.20	Limestone Ledge	53′
22	Table Rock 1	27°14.78	82°45.11	Limestone Ledge	55′
23	Landing Craft	27°12.345	82°48.209	Old Landing Craft	65′
24	Box Cars	27°12.537	82°48.000	RR Cars	65′
25	Shrimp Boat	27°06.33	82°47.18	Shrimp Boat	85′
26	Barge	27°02.15	82°42.56	Barge	55′
27	Barge & Hopper	27°01.13	82°55.16	Barge & Hopper	67′

Charlotte / Lee / Collier Counties 26°57.000 South to Dry Tortugas					
#	Name	Latitude	Longitude	Description	Depth
28	Steel Ship	26°49.234	82°31.961	60′ Car Ferry	55′
29	Barge	26°49.221	82°31.879	70′ Barge	56′
30	Crane Barge - D9	26°45.900	82°50.812	Barge and Crane	105′
31	Bayronto	26°45.850	82°50.870	400′ Steamer	114′
32	RR Box Cars	26°42.222	82°35.930	48 RR Box Cars	70′
33	Sea Runner	26°40.824	82°22.351	Drug Runner Boat	45′
34	Boca Grand Ledge	26°39.624	82°21.790	Deep Cut in Pass	82′
35	Twin Barges	26°37.933	82°17.161	2 Barges	30′
36	Lincoln Logs	26°36.048	82°28.253	Concrete forms	60′
37	RR Hopper Cars	26°33.498	82°43.128	18 Railroad Cars	90′
38	Pegasus	26°33.130	82°43.415	110ft Steamer	90′
39	Tetrahedrons	26°31.249	82°17.001	Concrete forms	42′
40	Barge & Crane	26°31.169	82°16.952	Barge & Crane	42′
41	Double Barges	26°29.975	82°43.478	2 FPL Barges	90′
42	Co-Op Pilings	26°24.939	82°24.816	Power Poles	45′
43	Tony's Hump	26°22.520	82°23.064	Livebottom Hump	55′
44	Fishfry Ledge	26°21.970	82°23.950	Limestone Break	65′
45	Barge	26°20.650	81°56.855	100ft barge	30′
46	Roatan Express	26°20.392	83°22.048	180′ Freighter	187′
	TD's	13916.8	44492.4		
47	Edison Reef	26°18.588	82°13.330	Bridge Rubble	43′
48	Fantastico	26°17.790	82°50.560	200′ Freighter	112′
49	Steel Barge	26°17.458	81°55.141	Barge and Crane	31′
50	W-Ledge	26°16.487	82°16.370	Limestone Break	55′
51	Stoney Point	26°10.250	82°54.480	Passenger Ferry	132′
52	Monique	26°09.069	82°12.450	Shrimp boat	58′
53	Minesweeper	26°08.850	82°02.075	Minesweeper Wreck	45′
54	Stacy Ann	26°04.122	82°18.952	Shrimp boat	70′
55	Paddlewheel	25°53.142	82°17.546	Paddlewheel Wreck	80′
56	Marco Island Reef	25°52.420	81°47.480	Steel Barge	30′
57	Kidd Wreck	25°48.439	81°51.277	Steel Barge	40′
58	"R" Tower	25°48.000	82°14.004	Radio Tower	78′
59	Baja California	25°21.590	82°31.920	200′ Freighter	110′
60	Oiler Wreck	25°01.123	82°45.375	200′+Freighter	147′

Dive Facilities

Dive Facility Web Site	Location Latitude	Phone Number Longitude
Birds Underwater www.birdsunderwater.com	Crystal River, FL N-28°53.947	ph: 800-771-2763 W-82°35.790
Coral Scuba www.coralscuba.com	Cape Coral, FL N/A	ph: 941-574-5100
Depth Perception www.depthperception.com	Brandon, FL N-27°56.562	ph: 813-689-3483 W-82°20.277
Dolphin Dive Center www.dolphindive.com	Sarasota N-27°15.970	ph:941-924-2785 W-82°31.696
Narcosis Scuba www.narcosisscuba.com	Tarpon Springs N/A	ph: 727-934-6474
Scuba Adventures www.scubaadventuresLC.com	Naples, FL N/A	ph: 239-434-7477
Scuba Quest Tampa	N/A	813-961-5262
Scuba Quest Clearwater	N/A	727-726-7779
Scuba Quest Brandon	N-27°56.288 W-82°20.277	941-745-2511
Scuba Quest Bradenton	N-27°29.754 W-82°35.704	941-745-2511
Scuba Quest Sarasota N	N-27°16.141 W-82°31.840	941-366-1530
Scuba Quest Sarasota S	N-27°16.176 W-82°31.837	941-925-7055
Scuba Quest Venice	N-27°03.041 W-82°24.400	941-497-5985
Scuba Quest Cape Coral	N/A	941-458-1999
Scuba Quest Ft. Myers www.scubaquestusa.com	N/A	239-936-7106
Scuba West www.ScubaWest.net	Hudson, FL N-27°22.516	ph: 800-475-6911 W-82°40.849

Dive Charters

Dive Charter Web Site	Location Latitude	Phone Number Longitude
Narcosis Charters www.narcosisscuba.com	Tarpon Springs N/A	ph: 727-934-6474
Spear Big Fish Charters www.mobilescuba.com	Tampa with 100 mile range N/A	
Scuba Quest Charter www.scubaquestusa.com	Sarasota N-27°20.050	ph: 941-366-1530 W-82°32.747
Ultimate Getaway Live Aboard www.ultimategetaway.com	Ft. Myers N/A	ph: 239-466-3600

GRAND SLAM CAVE

Exploration Sept 11th, 2002

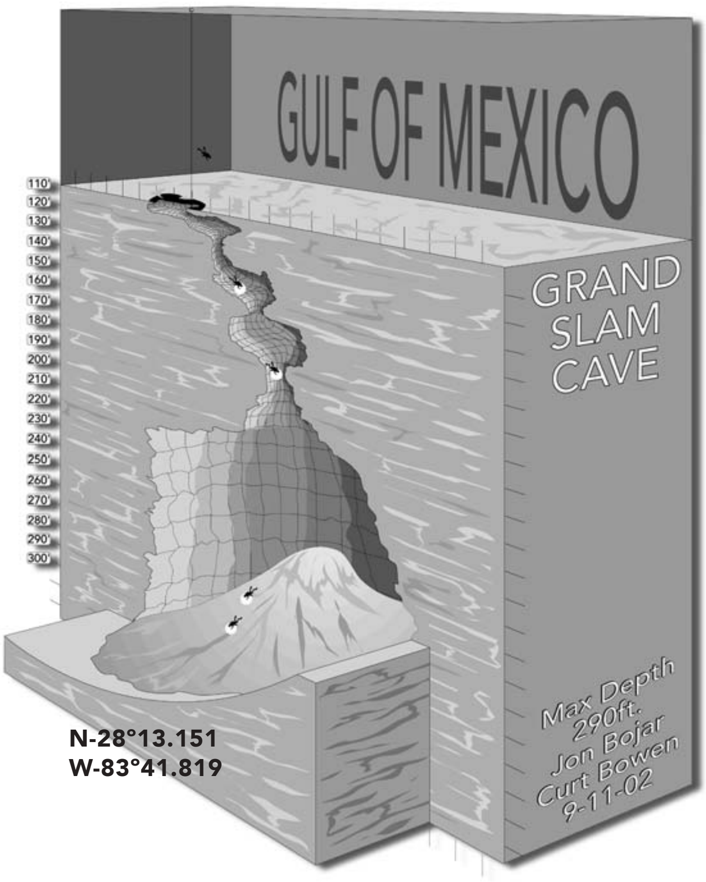
by: Curt Bowen

While searching for large grouper, Captain Chad Carney of Spear Big Fish Charters discovered a small sink in 1991. Recently, Advanced Diver Magazine explorers, Jon Bojar and Curt Bowen, set out to chart this new cave system located at 110 feet on the Gulf of Mexico sea floor.

Upon meeting Captain Chad Carney at his boat dock, the divers loaded their doubles and stage cylinders with mixes prepared for a maximum depth of 500 feet. Leaving the dock at 10 p.m. on September 10, the trio pounded their way out through two to four foot seas for four hours until they were 72 miles off shore.

The next morning Captain Chad did a quick spear fishing dive on the hole to check the anchor and location of the sink in relation to the vessel. After putting on their equipment, Jon and Curt descended down the anchor line to the flat sandy Gulf floor. A small cavern cut quickly under the ground. Two 500-pound Jewfish darted out of the cavern as Jon and Curt tied off the down line. The cavern floor sloped down to a small, three-foot diameter hole that dropped straight into a small room at 150 feet. Once again, another small hole dropped through the floor and into a third larger room at 175 feet. Another small hole was located on the floor and it dropped through the ceiling of a giant room at around 190 feet.

Visibility was about 25 feet and as the walls cut back and disappeared, the divers dropped into darkness. The silt mound below came into view and the pair hovered above it at 255 feet. Following the slope of the mound downwards, a heavy hydrogen sulfide layer was encountered at about 270 feet. Entering the sulfide layer they noticed the strong rotten egg smell and decreased visibility typical for this sort of enviroment. At a depth of 290 feet they hit the side wall of the cave and turned to the right to follow the floor and wall around the room. No new tunnel was discovered, but due to the low visibility it could have easily been missed. The team completed their decompression using a VR3 Trimix computer and returned to the surface with a new-found discovery.



DRY SUIT MAINTENANCE AND DIVE SITE REPAIR

An Interview with Steve and Marianne Gamble, specialists in dry suit repair.
By Jon Bojar

We've all had our suits leak on us. It's at best an inconvenience and at worst it's a show stopper, especially when in a foreign country and hours or days away from any access to repair materials. I've asked Steve and Marianne Gamble who conducted the Drysuit clinic at the 2002 CDS Conference and whom I've counted on to keep my ratty, worn out suits dry for the past five years or so, to share some tips on repair, maintenance and quick fixes.

How can a diver ensure that his or her dry suit will work on a big expedition?

Preventive maintenance starts way before the trip, especially if you have latex seals on your dry suit. Many things can have a negative effect on latex seals including sunlight, ultra violet (UV) light, heat, plant and animal oils, and scented baby powder. Scented baby powder can be bad for latex seals because of the oil and perfume content.

Always store your dry suit in cool dry environment. Never leave a dry suit in a garage, shed or vehicle that is not temperature controlled. Do not hang your dry suit under fluorescent lights because of ultra violet light exposure. If you store your dry suit in a bag, roll it with the natural curve of the zipper, do not bend it backward or put stress on the zipper.

So what should be done?

Latex and neoprene seals require similar care. Neoprene seals will typically last longer than latex seals. Every now and then (10 - 15 dives) wash your seals with soap and water, rinse well and dry. Spray seals with McNett's UV tech TM, surface protector and rejuvenator. Rub it in and allow the seals to dry. Powder your dry suit seals with Balkamp Tire Repair Talc or pure unscented talc.

Your dry suit zipper needs a lot of TLC (tender loving care). Keep the teeth and black plastic slide portion of the zipper well waxed. Once the plastic slide begins to wear, the teeth can become loose, and a leaking zipper is not far behind. Bees wax is recommended, as it is soft and easy to apply.

Medium weight zippers are more fragile than heavy-duty zippers. Almost all self-donning suits have medium weight zippers. Self-donning zippers typically wear out the first two inches at the top. It is a bad angle for the slide when first pulled down. When pulling on the zipper, go slow, be gentle and do not be in a hurry. Jamming your undergarment in the zipper with a hard pull could break a zipper tooth loose.

Take a dry suit first-aid kit along for the ride. You will only need a few items:

The Five Phases of a Dry Suit Leak. By: Rusty Farst (The best diver in all of Ft. Myers, FL.)

Cocky in his warm dry suit on the way to the dive site. *Annoying!*

Little concerned about the 42° water temp. *Nervous!*

Initial response after exiting the water. *Frozen!*

Trying to warm hands. *Recovering!*

Cocky in warm head gear in heated cabin. *Pansy Ass!*

1. Aquaseal™ or Aqua sure™ repair adhesive and sealant
2. Balkamp Tire Repair Talc, pure talc or hydrous magnesium silicate
3. Bees wax for zipper care
4. Cotol - 240™ urethane cure accelerator and precleaner
5. Duct tape, can be used just like a tire patch for latex seals for those unexpected pin holes and small tears. It can also mend rips or holes in shell suits.
6. Flux brush to mix and apply Aquaseal and Cotol
7. Small size paper clips to mark leaks in neoprene suits
8. Rubber bands heavy size, for dry suit leak test
9. Seal cement™ industrial strength neoprene cement
10. Sharp scissors to trim seals
11. Small spray bottle with soapy water for dry suit leak test
12. UV Tech™ Seal protector and rejuvenator

What about dive site repair?

If you develop a dry suit leak during the trip, here is how ou do a leak test.

1. Close the zipper
2. Tie off the neck and wrist seals with rubber bands.
3. Fully inflate your suit using your SCUBA regulator inflator hose attached to the dry suit intake valve.
4. Spray the outside of the dry suit with soapy water, and look for leaks (bubbles form at the site of a leak).

How can you repair a leak in a dry suit?

1. Straighten one end of a small paper clip.
2. Insert the straightened end of the paper clip into the dry suit at the location of the leak.
3. Crimp the paper clip closed with your fingers.
4. Turn the dry suit inside out and find the location of the paper clip.
5. Follow the manufacturer's directions for mixing Aquasea™ and Cotol - 240™.
6. Place Aquaseal™ and Cotol - 240™ mixture over the paper clip located inside the suit (it is preferable to have the suit dry prior to attempting repair).
7. Remove the paper clip after you are certain you have covered the leak adequately with the mixture of Aquaseal™ and Cotol - 240™. Do not allow the paper clip to cure in the Aquaseal™.
8. Let gravity assist with the leak repair, lay the suit flat and keep the repair site free of debris.
9. Allow at least two hours for the repair site to dry if Aquaseal™ and Cotol - 240™ are used. Plan on a minimum of 8 hours for the repair to dry if you use Aquaseal™ alone.

How can a latex seal be trimmed?

The number one reason latex seals rip is because when seals are trimmed the start and stop action of the scissors on the cut causes burs on the latex. When ever there is a bur it most likely will tear at the spot. Simply dimple the burs out with the scissors.

What are a few pointers you can give for during the trip?

1. The key with a dry suit and latex seals is to be aware that they are fragile. Dress and undress carefully. Fingernails and jewelry are latex killers. Keep your fingernails trimmed or they will ruin a latex seal in a blink of an eye. Also, avoid digging your nails into a seal when taking off your dry suit.

2. If you happen to be in a shipwreck that has diesel and grease still present, wash the seals with your ivory soap. The rest of the suit can wait until you get home.

3. Move the zipper evenly and slowly. If you are on one of those out-in-the-middle-of-nowhere expeditions, a backup suit could save the trip. If nothing else they give a lot of peace of mind.

Just think, you've made all of this effort and you haven't even made the trip yet!

The Connection is Made!

Beacon Woods Cave to Waynes World Cave

11,600 linear feet

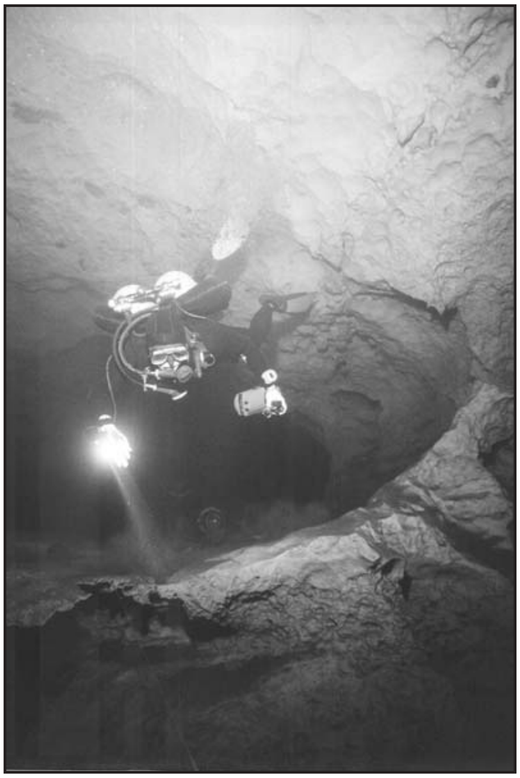
By Beth Somers and Vaughan Maxwell

The following narrative describes the latest achievements of the South East Exploration Team (S.E.E. Team). The recent connection of Beacon Woods and Wayne's World Cave Systems enlarged this system to 60,000 linear feet of explored passage, leaving many tempting leads yet untouched. The culmination of two exhausting years of work was the traverse between Wayne's World Sink and the north entrance of Smokehouse Pond, which took place on June 2, 2002. This traverse of approximately 11,600 linear feet really put an exclamation point on the team's accomplishments and leaves little doubt as to their considerable skills and seriousness of purpose.

The S.E.E. Team was conceived out of the need to organize a group of divers and explorers who shared the mutual goal of furthering the exploration and mapping efforts. Round Sink is the southernmost known entrance to the Beacon Woods Cave System and has been probed sporadically since the late 1970s. Its cave passage depths, long distances and low visibility have always presented a daunting challenge for even the most determined explorers and it was thought that by the use of support divers coupled with some new techniques and procedures that this "reluctant" cave might yield some more of its secrets.

The second season ushered in a heavy workload for many members of the S.E.E. Team. In an effort to secure access permissions from landowners, team members went on what amounted to a crusade to educate the local residents as to the importance and potential benefits of the work at hand. The results were mixed as in some instances team members were welcomed and extended every courtesy whereas in other cases they met complete opposition.

Prior to exploration of new leads and the extension of the cave, the divers decided to replace the existing line which was as much as 20 years old in some places. The relining, accurate surveying, and placement of distance markers consumed most of the second season, with team members taking turns in pushing the effort forward. The team concentrated their exploration efforts on cave passage north of Smokehouse Pond, which at that time was the northern entry point to the Beacon Woods System. With the discovery of the Eel Tunnel and the Black And Blue Room at its end, known passage was extended by 1000 feet. For the first time, the team began to think of the possibility of a connection to the Wayne's World system's southern passage. The connection was still over 6000 feet away, but both systems were going in the same general direction.

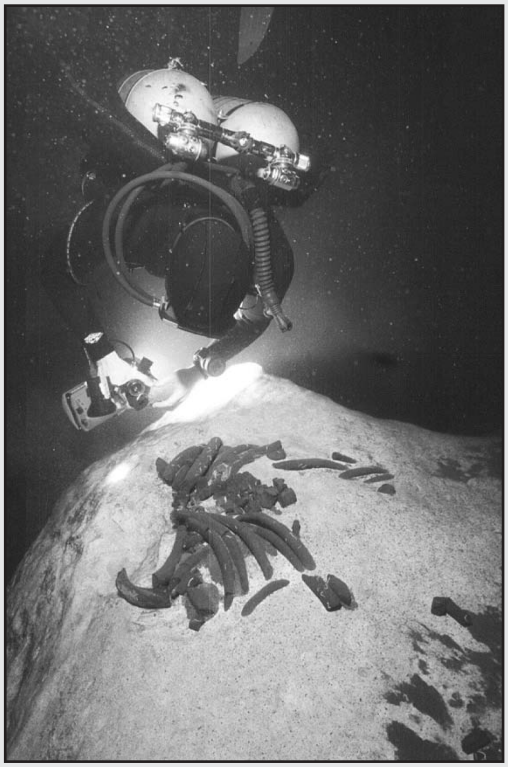


As the second season of exploration was winding down, Michael and Sherry Garman joined the team to capture cave system passage on video. With their skill and expertise in that field, the S.E.E. Team was able to acquire enough video footage to document these tremendous new discoveries. On one of the last dives of the season, Al Heck and Jakub Rehacek explored a new lead at the end of the Eel Tunnel and laid 300 feet of new line, naming it the Hope Tunnel. The passage was wide and low, about 30 feet wide, but only 18 inches high at the end of the penetration. Because of the low clearance and strong flow moving through the tunnel with each tidal change, the Hope Tunnel, at that time, was deemed to be impassable.

In the following months, S.E.E. Team turned its attention to the Wayne's World Cave System; a cave located about two miles north of Smokehouse Pond on 10 acres of undeveloped land. The Sink is located 1500 feet east of the head of Cow Creek (a saltwater, tide influenced creek) and approximately 3000 feet east of the Gulf of Mexico. The land that encompasses the sink is dotted with numerous water filled sinks and depressions with one small spring run, typical karst terrain.

Wayne's World has a single entry point to about 25,000 feet of surveyed passage. The cave extends west for 3,000 feet and south for almost 6,500 feet with many interconnected tunnels creating a maze of circuits and bypasses. At the time the S.E.E. team moved its efforts to Wayne's World, Brett Hemphill and Jon Bojar were exploring the system's southern tunnels, in an attempt to connect the cave to an offshore sinkhole.

The next phase of the S.E.E. Team's exploration efforts would be to try to make the connection to Smokehouse Pond from Wayne's World. Andy Conneen, Brice McMinn and Alex Warren did several reconnaissance dives to evaluate and begin preparation for the exploration. The team designated staging points for tank depots and replaced existing exploration line with larger diameter line. During the preparation stage, it was unclear if dives of over 7,000 feet in low (under 20 foot) visibility, through multiple restrictions and depths in excess of 170 feet could be done successfully.



On February 17, 2002, with decompression support provided by Doug Daniel, Jitka Hyniova, Jose Taboas and Jakub Rehacek and long stage support from Andy Conneen and Brice McMinn, Alex Warren embarked on a dive that took 7 hours and extended the passage going south to almost 7,500 feet. The results were somewhat discouraging. While the survey data from this dive verified that the tunnels are aligned with Beacon Woods and should eventually meet; they also realized that the logistics required to safely execute these complex dives would require more time than what was thought to be reasonable by team members. After considering all of the options, the team determined that the only prudent course of action would be to return to Smokehouse Pond to search for the passage connecting to Wayne's World.

The third season of S.E.E. Team's exploration of Beacon Woods Cave began with little enthusiasm as the divers were faced with many adversities. The logistics of furthering the exploration from Beacon Woods were almost overwhelming. Stratomax Sink was the only access point the team had to the northern part of the system. This meant that before any exploration diving could commence, the divers had to do a 2000 foot traverse to ferry stage tanks, decompression gas, travel gas, scooters and additional light sources to the far side of Smokehouse Pond. Diving with 4 to 6 stage tanks and towing an extra scooter became the standard. Dive times of 3 to 5 hours, strong currents due to tidal changes, low visibility and multiple restrictions were just some of the obstacles that the team was challenged with.

On initial dives, strong correlation between flow, tides, rainfall and low visibility were noted. The tannic water in Golf Ball Sink was not present in the Smokehouse Pond passages only 300 feet away. The rainfall compounded the tidal influences and strong siphons were experienced more often than spring flow. The connection tunnel had to be found. The S.E.E. Team methodically rechecked every passage, wall, nook and cranny without success. As a last ditch effort, Alex Warren pushed through a 150-foot long restriction at the end of the Hope Tunnel and emerged into a large cavern with an incline of 110 to less then 70 feet in depth. The restriction was named the Crawl Space and the cavern the Slope Room. At the top, huge slabs of limestone created a mountainous structure with an opening in the middle. The outgoing tunnel was about 4 to 5 feet high and ran for another 1000 feet. With support provided by Jose Taboas and Alex Warren, Andy Conneen further explored this passage on the next dive. At about 2600 feet of penetration he discovered a room that extends for 400 feet at 105 of depth. This room contains many caverns with fissures in the floor and ceiling, and many offshoot tunnels that quickly pinch off. The room is almost completely devoid of silt or sand and the floor is littered with fossilized bones and unusual mineral formations. Vaughan Maxwell, one of the original explorers of the cave system, later named the room "Andy's Room." On a subsequent dive with no flow in the cave, Alex Warren was unsuccessful in finding a way past Andy's Room. Because of heavy rain earlier in the week, visibility had decreased to less then 10 feet. Discouraged, Alex turned to exit. Suddenly he noticed a small room with crystal clear water just off to his right. As Alex approached the far end of the room, he came upon a hole in the floor. The passage through the hole presented an awesome sight when Alex illuminated the crystal clear blue water and powdery light brown silt with his light. It looked like a "child's waterslide". At the bottom, 50 feet deeper, an arch shaped tunnel ran across The Slide, giving Alex the sensation of being in tube half filled with silt. Straight ahead, another room appeared, which lead down to about 170 feet in depth. The room was small but highly decorated with antler like limestone spears protruding from the walls and the ceiling. Noticeable water flow was coming through a crack in the floor, which though about 6 feet long, was only 10 inches wide. Looking down through the crack, Alex could see the floor of another room, possibly 30 or 40 feet below. On that dive, the divers found answers to some of the mysteries of the Beacon Woods Cave System, but the S.E.E. Team was no closer to making the connection. Andy Conneen later explored the lower passage that he named the Blue Horseshoe because it initially headed south then gently turned north.

The real break in the search for the connection came on one of the setup dives for Andy Conneen's attempt to extend the Blue Horseshoe Tunnel. Alex Warren noticed a strong spring flow coming out of the restriction at the end of Andy's Room. The restriction was only 25 feet long and the sandy bottom posed no hazard of getting stuck so Alex pushed through. The tunnel behind that restriction ran for 1200 feet at depths between 110 to 120 feet and lead to another great cavern with no visible floor at the very back of it. Down through Cathedral Passage, as it was named, divers descended to another level at 150 feet, where the first traces of salt water were found. The connection was just around the corner. The cave was cooperating, and as the ever so slight flow of water pointed the way, suddenly, there it was, the line laid from the other side.

The connection was made. This seemingly impossible feat was done, on May 4, 2002, after 5000 feet of explored tunnel and countless hours of planning and preparation. A new entry point was added to the Beacon Woods Cave System, the Wayne's World Sink. It is now the most northern entry point of this great cave and the rest is now history. The divers were met with some unexpected surprises. The connecting tunnel ran from the west, not the east as expected. The connection was accomplished within 100 feet to the north of the Super Room, a 300 foot deep void filled with salt water on the bottom and a fresh water interface flowing in its upper 50 feet to its ceiling of 100 feet of depth. The Super Room with its 150 feet width is an incredible sight and truly lives up to its name.

After all of the excitement of connecting Wayne's World Sink to the Beacon Woods Cave System, the S.E.E. Team members found themselves hard at work planning and preparing for the traverse. Wayne's World Sink was chosen as the entry point and the divers would surface in Smokehouse Pond after about 11,600 feet underground at an average depth of 140 feet, with the deepest part being 170 feet. After making this historic traverse, the divers would then have to travel another 2000 feet to exit in Stratomax Sink. Andy Conneen and Alex Warren teamed up to tackle the traverse while Brice McMinn and Doug Daniel supplied support at Wayne's World Sink. Jose Taboas, Jitka Hyniova, Al Heck and the team's guest diver Cindy Butler provided support at Smokehouse Pond. Tony Hyatt and John Schuchman were able to lend a hand as surface support.

The dive unfolded without any problems and was conducted almost entirely on stage tanks, with back gas reserved for emergencies. The scooters and lights had ample redundancy and burn time. It took 135 minutes to complete the traverse with another 110 minutes of obligatory decompression. While Alex and Andy decompressed, support divers removed all of the empty tanks. This allowed them to enjoy the final leg of this incredible dive, the traverse to Stratomax Sink and the exit.

Plans for future exploration are already in progress. The goals are to locate the connections to the Gulf of Mexico, Bear Creek Sink and to possibly find passage to the deep aquifer. We strive to ultimately make the Beacon Woods Cave one of the largest underwater caves systems in the USA. This goal will be achieved so long as the S.E.E. Team continues to grow in strength and its members maintain their deep desire to explore.

Three Days Underwater: A Record Breaking Event

On August 6, 2002, Jerry Hall set out to accomplish a monumental feat. He was out to break the world's record for the longest submergence on scuba. Accompanied by Norman Cooter and Greg Sluss, Jerry made the drop at precisely 7 a.m. to 33 feet for a 30 minutes before rising to 10 feet, where he would spend the next 79 hours, 39 minutes and 40 seconds. After spending more than three days underwater, Jerry emerged as the clear world record holder -- far overshadowing the existing record of 60 hours and 24 minutes set by Daniel Misiaszek of Texas last September.

Jerry, along with Norm, his diving supervisor, together began working on the logistics of the dive nearly seven months before the feat was attempted. (Norm had previously been working on the dive for another two years before Jerry came into the picture.)

"The logistics are astronomical! You must plan for everything you can imagine, and then so much more," reflected Cooter. "Besides the obvious things like oxygen exposure, nitrogen accumulation/saturation, you must allow for hypothermia, food, dehydration, body wastes, summer storms/weather, equipment malfunctions, lighting, massive gas supplies, topside support, u/w support, logging of all aspects of the support dives and supporting the support team itself. There aren't a lot of people you can go to for answers when undertaking a dive of this magnitude, although DAN and Advanced Diver Magazine's decompression physicist, Bruce Wienke was very helpful in providing answers about depths, saturation and more."

79 hrs 39 min 40 sec

Conducted at Laurel Marina on South Holston Lake near Bristol, Tennessee, the dive required a lot of special preparation. Laurel Marina was a major contributor in offering help and support to the team. They built a specially prepared platform that could be cranked up and down. This way, Hall would have a "bottom" to rest on -- although he was in 103 feet of water and exposed to open water on all four sides. Lighting was suspended from the marina, and Smoky Mountain Divers, located about 30 miles away, supplied the breathing gas. Everything went off without a hitch. Jerry had a follow-up physical the same day he surfaced and everything was completely normal, except for his snow-white hands, which were anticipated and pinked-up pretty quickly, and a slightly lowered protein level, which the doctor said was completely normal for what he had been through.

The underwater support team consisted of Billy Baxter, Kim Salts, Greg Sluss, Casey Johnson, Doug Vance, Amy Cooter and Norm Cooter. The event was covered by the local CBS and NBC affiliates and was also covered on NBC's Today Show. In addition, the Chicago Tribune ran articles about the event and a brief paragraph appeared in Sports Illustrated.

DIVING THE MORAVIAN KARST
Continued from page 13

limestone, similar to what we see above the water. My partner pauses to show me a side passage leading to a different part of the cave called Key Hole, but we follow the main line down deeper. I notice that the end of the line is just loosely coiled on a rock outcropping, but the tunnel levels out at 150 feet and soon we arrive at its end. Ahead is now impassable restriction that is plugged with tree branches, rocks and even a lawn chair probably sucked in during the spring floods. To clean the restriction and penetrate further will be a task for somebody else. We turn around, and I lead to get out of the numbing cold water.

Moravian Karst is considered a cradle of modern speleology. Extensive archaeological excavations have revealed finds dated to the early and late Stone Age, the Bronze Age and the early and late Iron Age. Paleontological finds include bones of extinct cave hyenas, bears, rhinos, tigers and many other vertebrates and invertebrates. Many professional and amateur explorers, cavers and cave divers were involved in surveying and mapping thousands of feet of passages in extremely difficult conditions. Cold to freezing water and air temperatures, regular floods, rock and soil collapses and gear transport issues are only some of the obstacles the explorers face. Their successes wouldn't be possible without tremendous passion, skills, knowledge and the proverbial "golden Czech hands".

Hranicka Abyss

We are drenched in sweat as we crest the hill and a spectacular view opens before us. The 70-meter deep chasm of Hranicka Abyss is lying at our feet. The view is breathtaking. Sheer limestone cliffs form the three sides of the chasm over 230 feet (70m) deep. The fourth side is a 45-degree slope with a pool of green water at the bottom. We will have to rappel down the slope with all our dive equipment, as the winch on the rusty old cable trolley works only occasionally and today isn't our lucky day.

The Hranicka Abyss is quite unique in its morphology. It is a sinkhole located on the top of a hill. The hill is a part of a buried cockpit karst, characterized by a field of cone-shaped hills several hundred meters in height. Original characteristics of this dive site are intimately linked to the way it was formed. The majority of caves and sinkholes in karst regions around the world are formed by rainwater percolating from the surface and dissolving limestone along its way down. The Hranicka Abyss was created by CO_2 rich warm mineral water rising from depths of 2,300-3,300 feet (700-1000 m) along fissures and dissolving limestone on the way up. The temperature of the mineral water (61 to 75°F/16 to 24C), actually a weak carbonic acid (H_2CO_3), significantly accelerates the dissolution process. Once a large enough void is created, the overlying roof collapses, creating a sinkhole.

These unique features present new challenges to spoiled Florida cave divers. Instead of driving right up to the sinkhole, we had to park our cars at the foot of the hill. For each diver there are at least two helpers, since all the gear must be carried several hundred vertical meters to the top of the hill and then again rappelled down over a 45-degree breakdown slope to the water.

The diving presents another set of challenges as well. The dissolved CO_2 forms a layer of noxious gas above the water, so all in-water preparations must be performed breathing through the regulator. Once submerged the CO_2 causes tingling on exposed skin and eventually divers' lips lose all sensitivity, which makes swapping regulators a little more interesting.

The dive itself is spectacular; we first descend to 164 feet (50m), to Zubatice, where we take a water temperature reading, then ascend up to Rotunda. There we break up the water surface to see the dry portion of the cave. The atmosphere is almost pure CO_2, so regulators must stay in place. A short swim through a vertical fissure reveals magnificent geyser stalagmites, formed by deposits from hot mineral water spouting through their center. From there we turn into another set of vertical fissures called Nebe. The water here is crystal clear and one can enjoy beautiful aragonite formations as well as the black void of the bottomless pit below.

As the dive progresses Jakub suffers symptoms of a CO_2 poisoning. The dive is turned, but the only way out is to descend back to 164 feet (50m) and clear the Zubatice before we can reach the ladder and start the decompression. The symptoms subside and we get a chance to visit the SW Tunnel as a detour to kill the time on deco. The dive is far from over when we reach the surface. Now we have to carry all the gear back up the 45-degree slope and then down the hill to the cars. There is a reason why local divers nicknamed this dive site a "Bend-o-Matic" (loose translation). Heavy exertion of pulling hand-over-hand on the rope on the way up the slope carrying bags of dive gear or twin tanks associated with helium-rich breathing gases threatens every diver with possibility of decompression sickness. Fortunately, our friends have arranged excellent support, so divers make only one trip and carry lighter loads.

Another peculiarity of this site is the way the gases that are expelled by divers react with the mineral water. After each dive the visibility in the entire system is reduced to zero for several weeks. Use of closed circuit rebreathers is a preferred method for latest exploration and mapping. The Hranicka Abyss is closed to the diving public. Explorers on open circuit can dive here in intervals of three weeks or longer.

To this date the Hranicka Abyss has no bottom, although the first divers broke the water surface in 1961. By 1968 divers reached depth of 289 feet (88m) and that was a practical limit for air dives in this CO_2 rich water. The first dive on Trimix was accomplished by Lubomir Benysek and Frano 'Sabbath' Travenec on May 2, 1981, to depth of 361 feet (110m). The deepest dive to date is by Polish diver Krzysztof Starnawski, who in December of 2000, reached a depth of 594 feet (181m) on a night sneak dive.

There were several attempts to find the bottom using ROVs, but technical difficulties and logistics obstacles did not bring the expected results. The deepest point the ROV reached was at depth of 673 feet (205m), but video and sonar data indicate that the abyss continues further down. Dry and underwater cave explorers in the Czech Republic are organized under Czech Speleological Society (visit their web site at www.speleo.cz), founded in 1978 as an umbrella organization for Czech and Moravian cavers. Due to the character of their caves, most cave divers there are dry cavers and explorers in the first place. Cave diving methods allow extending the penetration beyond the sumps and discoveries of many unknown areas are still to be expected.

We would like to extend our thanks for support and collaboration to our caving partners, Radek Husak, Radek Jancar, Jiri Stetina, David Skoumal, Jirka Kanka and their teams.

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Xtreme Diving Helmet

Text & Photography by Gavin Newman

When it comes to extreme diving, be it commercial or technical sport diving, there comes a time when the use of a dry diving helmet has to be considered. Whether it's used for the comfort and warmth of keeping a head dry, a lack of contact with contaminated water or the ease of use with communication systems, dry diving helmets make a lot of sense. However, for all their advantages there are also certain limitations, especially when compared with using a standard half mask and regulator combination.

A full face mask, such as the AGA mask, offers a halfway house with easy donning, good visibility and comms capability, but still lacks the comfort and safety of the dry dive offered by a full helmet or the ease of regulator switching offered by sports systems. The big problem with the commercially used hard helmets, such as the Kirby Morgan Superlite 17, is size and weight. Were the name "Superlite" spelled differently, it could easily offer grounds for a complaint under the "Description of Goods" act! The problem lies in the need to have a large neck opening enabling the diver's head to enter the helmet. Consequently, the helmet ends up with a large volume that requires a lot of weight to sink it. Ever noticed that commercial divers have neck muscles like Arnie's biceps? One side effect of the large volume is that the diver's face ends up further away from the faceplate resulting in reduced peripheral vision. Regulators are fixed, offering limited possibilities in the event of equipment failure. While this might not be considered a huge problem in the commercial world where the diver is always tethered and in constant communication, for the extreme sport or military diver things are rather different. Often diving alone in hostile environments, such as caves, deep wrecks or even war zones, a regulator failure could prove fatal -- making this type of equipment unsuitable in spite of the obvious advantages to dry diving.

Extreme Swiss solo cave diver Olivier Isler has probably spent more time underwater than most people will spend sleeping in

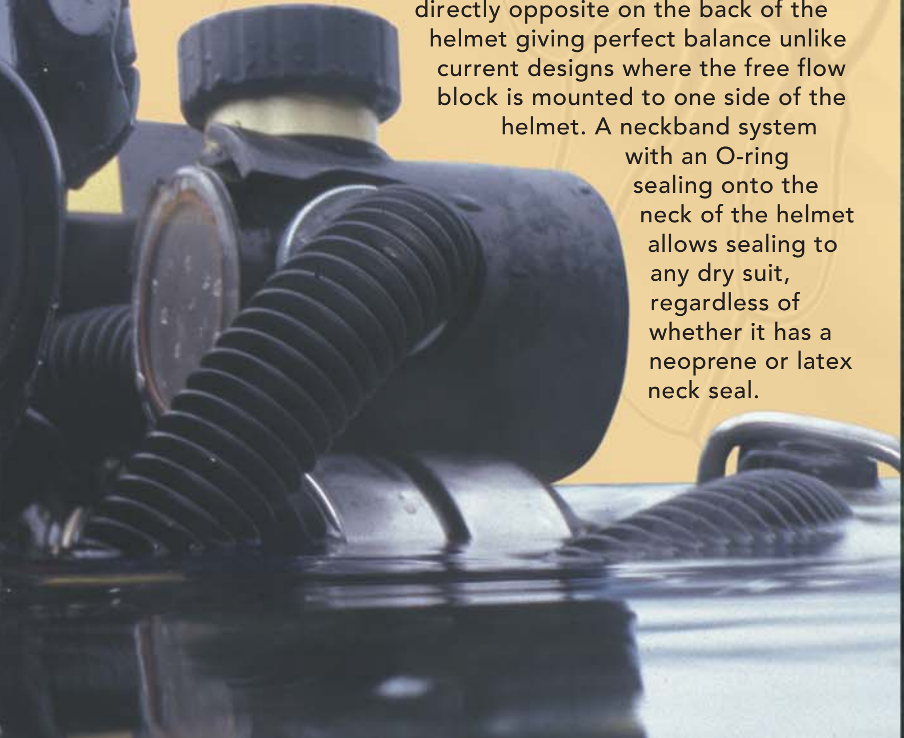
DARTH ISLER...

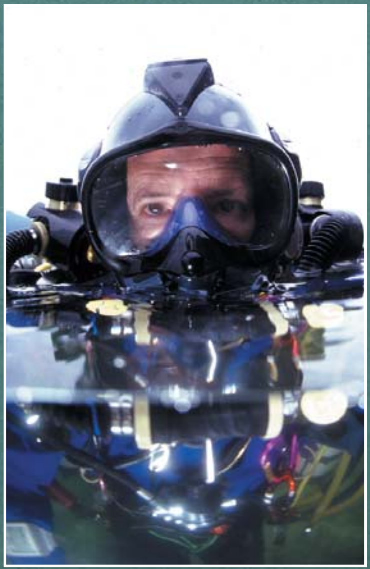
their lifetimes! Regularly undertaking 12-15 hour long dives in his cave explorations, he's had plenty of thinking time on long decompression stops to redesign most of the world's diving equipment and once back in the workshop has made a pretty good job of doing so. The RI2000 re-breather, designed along with his friend, French electronics engineer, Alain Ronjat, is still the world's only triple redundant re-breather system designed specifically for cave diving. This, along with underwater decompression habitats, scooters and a host of other "toys" all built with typical Swiss attention to detail, has allowed him to set a host of diving firsts.

Olivier might have given up his record-breaking cave dives these days, but his quest to perfect the equipment divers use goes on unabated. The latest piece of equipment to get the "Isler treatment" was the dry diving helmet. Its redesign is so radical it wouldn't look out of place in the latest Star Wars movie.

Isler's goal has been to produce a helmet that is as small as possible, comfortable for a long duration and still safe and versatile enough to be useful to both commercial and technical sports divers. To keep the size down, the helmet is in two parts, hinged at the top and sealed when closed by an O-ring along the joining edge. The result is that the neck ring can be just a few centimeters larger than the diver's neck, and the overall volume of the helmet is greatly reduced. The frontal plate of the helmet is ergonomically shaped to give the best vision possible and the regulator mounting point is angled downwards to avoid any restriction of vision downwards. The result is good angle of vision and a greatly reduced weight. Most standard helmets weigh in at around 26 lbs. /12 Kg to 30 lbs./14Kg (about the weight of a diving cylinder!), whereas the Xtreme Diving Helmet (or XDH) is a much more neck friendly at 18 lbs./8.5Kg.

In addition to being more comfortable, the reduced weight allows a diver to easily turn his or her head -- an action further eased by another of the helmet's unique design factors. The inflow for the breathing gas is mounted centrally on the front plate as usual, but the free flow valve is directly opposite on the back of the helmet giving perfect balance unlike current designs where the free flow block is mounted to one side of the helmet. A neckband system with an O-ring sealing onto the neck of the helmet allows sealing to any dry suit, regardless of whether it has a neoprene or latex neck seal.





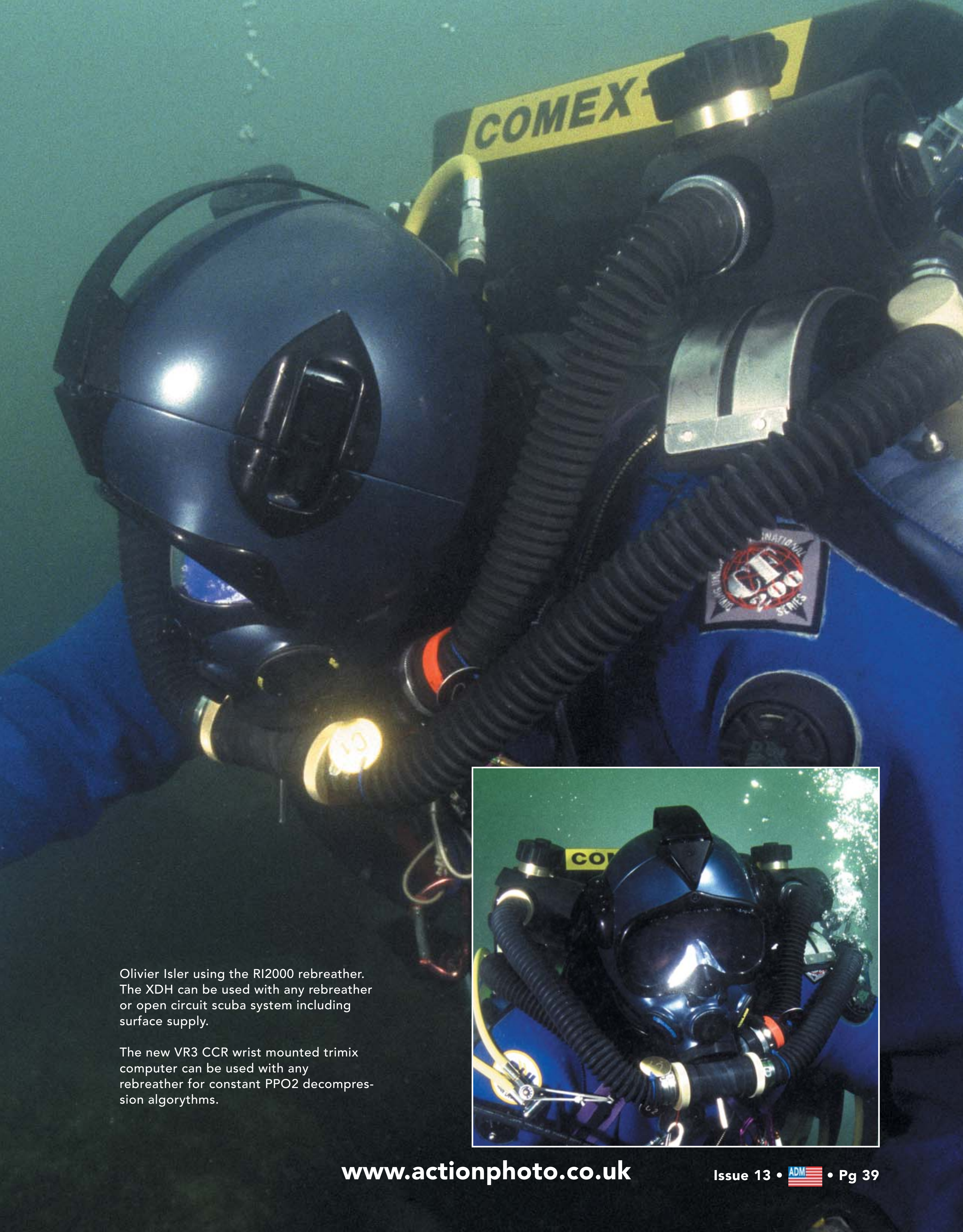
Most helmets are not designed with free swimming in mind, but the XDH is designed for exactly that and so offers total redundancy in the event of regulator failure. The XDH has no fixed regulator but has a unique regulator change system. The mask features a conical shaped orifice, while a second cone shaped connector fits to the regulator or re-breather hose replacing the rubber mouthpiece. The conical nature of the fitting means that precise alignment of the regulator to the mask is not required, alignment is achieved automatically as the regulator is pushed into the faceplate. A quarter twist bayonet assures the final lock once the regulator is in place. The system is very simple and quick to use even in total darkness and allows the diver to use multiple open circuit regulators or re-breather hoses as required. This interchangeable system also has another advantage unique to such helmets in that it allows the diver to drink while underwater, something that's vital during long decompression stops. A specially modified open circuit regulator with drinking bag attached allows a diver to switch at the turn of a valve between receiving gas or liquid through the mouthpiece.

Internally, the oral nasal cavity of the mask is fitted with its own mouthpiece for use with re-breathers where maintaining the integrity of the loop between re-breather and lungs is vital to gas conservation. A lever system is planned to allow the diver to remove this mouthpiece, allowing easy speech through a comms system and returning it to the mouth after speaking. For use with open circuit regulators, the mouthpiece can be removed and the oral nasal mask used on its own. A drain valve on the front of the mask fitted with a one-way valve can be opened to drain any water that may enter during regulator changes. In the event of an emergency during valve changing, a free flow valve allows gas to be fed through the mask and out the open front, giving a head-down diver gas at ambient pressure while he or she sorts out the problem.

All in all, the XDH is a radical departure from any other solid diving helmet and even though it's still a prototype, the potential for film cameramen, photographers and numerous other commercial applications is obvious. In the sports diving world, the safety, communications and comfort offered by the XDH promises to make many re-think the way they dive or even what it is possible to dive in the same way that re-breathers have over the last few years.

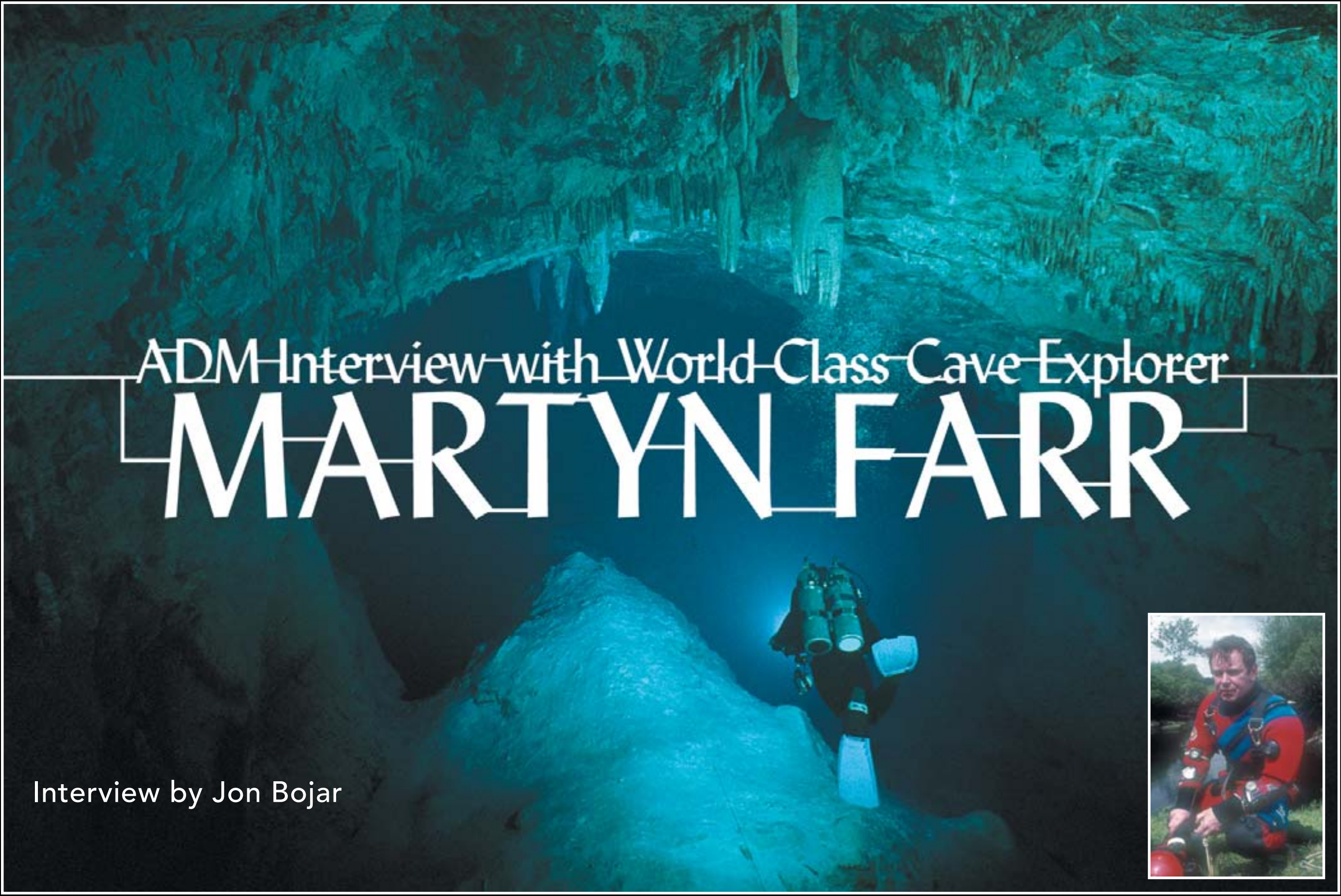
The XDH is at present a one off design, but far from being a wishful thinking prototype, the helmet is fully functioning and dived regularly. And Olivier is prepared to share his design with the rest of the diving world and is currently seeking a company prepared to undertake the manufacturing and distribution of the XDH into the wider diving market.

As for the Darth Vader look -- well, Star Wars is currently making a big comeback. And knowing how divers like their diving toys and that dive kit design is so style driven, it won't be too long before the Darth Diver look becomes the next big thing.



Olivier Isler using the RI2000 rebreather. The XDH can be used with any rebreather or open circuit scuba system including surface supply.

The new VR3 CCR wrist mounted trimix computer can be used with any rebreather for constant PPO2 decompression algorythms.



ADM Interview with World Class Cave Explorer MARTYN FARR

Interview by Jon Bojar

Martyn Farr, born in Wales, has been a world class cave explorer for roughly 30 years! Having explored many regions, from Iran to Mexico and Turkey to Brazil, Martyn has had the opportunity to experience the various cave diving techniques used by people around the world. Publisher of seven books, including The Darkness Beckons, Darkworld, and Underground Wales, today Martyn trains divers out of South Wales to explore in the overhead environment. He has recently developed a standard sidemount harness for sump exploration. I have found that in general, United States divers remain somewhat isolationist in their practices; and therefore, I decided to interview Martyn in an effort to gain knowledge from the pioneers across the pond.

- **How did you first begin cave diving and where did you start?**

For me cave diving sprung naturally from caving. I started dry caving in 1961 when my father took me to some sporting caves here in South Wales. The '60s was a "Golden Age" of discovery in Britain. There were immense, beautiful cave systems uncovered in a short space of time. Spear-heading the explorations in South Wales were the cave divers, so it just seemed natural that I could find a new, original cave myself if I became a diver. So, by 1970 I was caving regularly with some of the leading explorers of the time and got to make my first dive that year at a place called Ogof Ffynnon Ddu -- Cave of the Black Spring.

- **What would you consider to have been your most epic trip/expedition?**

Now that's a difficult one. To me the word "epic" has connotation of extreme but also close associations with near death encounters. Most all of these are well documented in the books such as Darkness Beckons - The History & Development of Cave Diving, or better still, the Great Caving Adventure (an autobiographical account of my early cave diving exploits).

To choose just one is impossible, as I am still involved in such diving today. Only the other day, on the first of September, I revisited a cave that no one had been to since my last (solo) trip there in 1978. This is a grueling, extremely flood-prone system with huge potential. I had an epic in there -- although broken lines and nil visibility are now things for which I am fairly well prepared. Well, we got to the end of the cave and got some distance further.... If you were to ask me what historical landmarks spring quickly to mind then perhaps I would have to mention the depth records in Wookey Hole in 1977 and 1982, the traverse of Llangattock Mountain in 1986 (which is still the longest and deepest caving through trip in the British Isles) and 2001-2002, with its cave dives in Australia, Brazil, Italy, and Ireland.

- **In your opinion, what does it take to become a great cave diver/explorer?**

That's an easy one: dedication and determination, and perhaps a fair amount of physical stamina. From the age of 10 all I ever wanted to be was an explorer. If one can hold the focus, the health and fitness will follow. Experience and all the contacts are equally essential in this day and age.

- **What are the most notable changes you've seen in cave diving over the years?**

In 1970 it was common for people to dive on a single cylinder, a single demand valve and a single light (i.e., there was little or no thought of redundancy). For me all that changed in 1971 when my single set failed completely, on exhalation, in a cave called Dan yr Ogof. To this day I cannot satisfactorily explain how I survived, but I certainly breathed water for a couple of minutes! The near-death experience was not the overriding concern as far as I was concerned. It was the sense of shame that I felt. I was determined to rectify the deficiency in the equipment (and myself) and to that end I resolved immediately to adopt a redundant rig from that point forward. Perhaps a measure of how close things were that day can be gleaned by the fact that neither of the two other divers, who were involved in a stand-by capacity that day, ever dived in a cave again. I quickly got hold of their gear though!

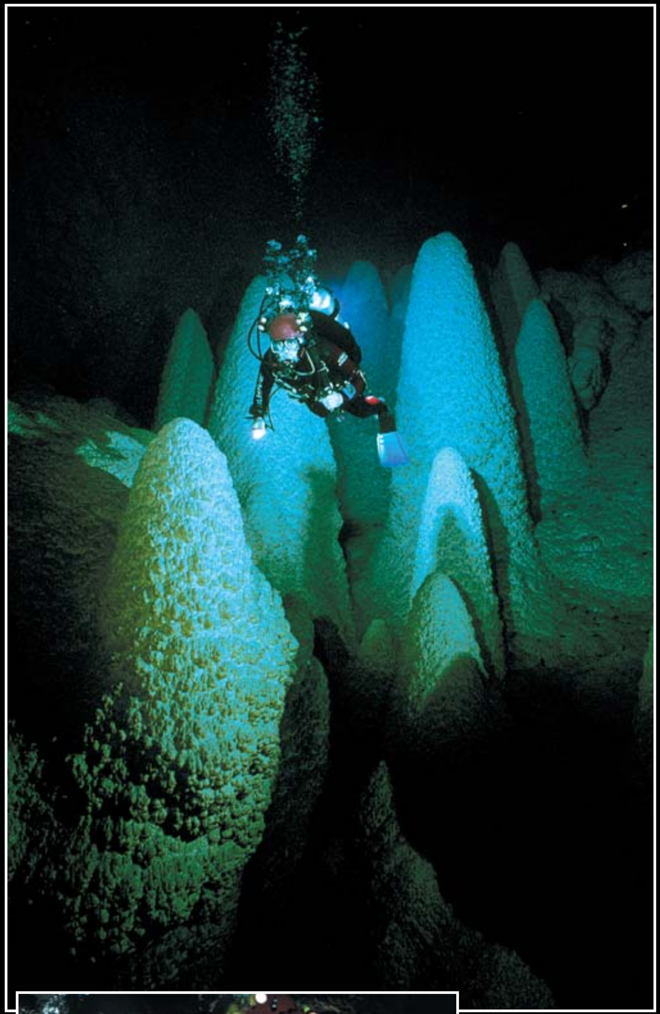
Over the years equipment and techniques have improved beyond all recognition. Equipment is far more reliable, which is the prime prerequisite, and just about everything these days is commercially available. Today, professional training is available, unlike the '70s when people like myself were self-taught, learning to survive by simple trial and error. There were no dry suits in the early '70s, virtually no foreign travel and no sponsorship. All things considered, it was amazing that so much was achieved.

- **What countries have you done cave diving expeditions in and which ones hold special places in your memory?**

I guess I have been privileged in many respects. Britain is fairly small compared to North America, so our cavers and divers have always had to be outgoing. The legendary Ken Pearce, an early hero, twice set world depth records by passing the sumps at the bottom of the Gouffre Berger, near Grenoble in France. In 1975, I found myself at the bottom of the same sump and it was very evocative to see some of Pearce's tanks, still there eight years later... that was one hell of a feat by Pearce!

I have dived in many European countries, Turkey, Iran, China, Japan, Malaysia, Australia, Brazil, Mexico, Bahamas and, of course, Florida.

Continued on Page 80



M ysteries surrounding the infamous shipwreck *RMS Lusitania* drift far beyond anyone's imagination, including my own. As a deep wreck photographer, I joined a team of technical divers from the United Kingdom challenged with the task of probing just some of her secrets -- only to discover that the time for our explorations may indeed be running out!

Lusitania is a name well-known in the world of wreck diving, often referred to by the technical community as the "ultimate of all wreck dives." For decades historians have been baffled by the endless mysteries locked deep within the Celtic Sea. Today British technical divers have been working to unravel just some of them. Since the day the Lusitania sank, she has been shrouded in political controversy. Her story is one of conspiracy, greed, courtroom battles, ambition and obsession.

Since the summer of 1999, UK-based diver Mark Jones and his team have worked closely with the *Lusitania*'s owner, Gregg Bemis of Sante Fe, New Mexico, in preparation for a forensic investigation of the ship's sinking, which is planned for 2003. In recent years tech divers have begun to reach depths historically reserved for commercial and military professionals supported by hundreds of thousands of pounds in equipment. Taking advantage of this fact, Bemis, who is 73, has utilized Jones' team to extensively survey the present condition of the wreck with video and photographic evidence. But while Bemis' 2003 expedition will use elaborate and highly expensive saturation diving equipment usually associated with oil and gas exploration, Jones' tech divers simply used closed circuit re-breathers alongside conventional scuba. In the case of Lusitania, the tech divers are operating at nearly 95m, this is between two and three times the depth attainable with mainstream scuba equipment.

With a terrific sense of excitement as to the wonders that lie below, my mind still concentrated upon a safe descent as I fell beneath the ocean's surface. Whether using a revolutionary closed circuit or simply the plain, "old fashioned," traditional open circuit, the key tool that unites both and allows us to explore this type of wreck at such a depth is mixed gas. Dropping through my first gas switch depth at 98ft/30m, I began to breath a mixture of HeliAir

The splendour of the first class dinning hall and lounge shows Cunard's Lusitania was dazzling even in the glory of 20th century affluence.

Return to the LUSITANIA

By Leigh Bishop

11/47 (11% O^2 / 47% he) concealed in my back-mounted, twin 20-litre cylinders. I had a lot to think about as I fell 305ft/93m into the Celtic Sea, even though I was descending down to the decks of one of the most famous shipwrecks in the world. The new gas mixture was designed to see me safely to the wreck; however, before I descended deeper a brief moment was spared to safely isolate that previous gas supply of nitrox which was vital for my return journey. Dropping deeper through the 30m thermo cline, unpredicted Atlantic tidal currents around the old head of Kinsale blessed me with only 5m of visibility. Still, the task at hand was to bring back as many images of the old liner that would best describe her present condition to the rest of the world.

In 1995 a cultural preservation order was placed on the site designating *Lusitania* an historic shipwreck. Rumors that there could well be several old masters paintings among the wreckage concealed in lead tubes by the likes of Rubens & Monet were enough to convince Minister Higgins of its worthy status. If such paintings were recovered, they could well be of national importance as well as a controversial debate of to whom they would actually belong. As far as local government is concerned, the wreck lies in territorial waters and is therefore under the jurisdiction of DUCHAS, the national heritage service.

The "Ultimate of all Wreck Dives"

The 'Lucy,' as she is often referred to, took her maiden voyage in 1907. Both she and her sister ship, *Mauretania*, would become hallmarked into history as the most luxurious liners of their day. On May 7, 1915, tragedy struck the *Lusitania*, securing the great ship a permanent place in 20th century maritime history -- a tragic shipwreck story that would become common household knowledge. While on a return journey from the United States, she was struck by a torpedo off the old head of

Queen of the seas, Lusitania quickly became the very pride piece within the board game of international rivalry.

Kinsale, fired from the German U-boat *U-20.* The *Lusitania* sank in only 18 minutes, resulting in the loss of 1,198 lives, a loss that would reverberate around the world. Along with the staggering death toll, a national treasure was lost. The 123 Americans lost aboard the ship eventually helped draw the United States into the Great War.

As the Lusitania slipped beneath the waves, she took with her many mysteries -- although one such mystery has singled itself out from the rest, baffling maritime historians for decades. Shortly after the *U-20s* torpedo slammed into her starboard bow, she was rocked by another mysterious explosion, an explosion that was large enough to send her down. In theory the *Lusitania* was too big to be sunk by a single torpedo. Historians have speculated as to what she was carrying that would result in such an explosion. Conspiracy theorists claim the most provocative in that that she was carrying an illegal cache of ammunition for delivery from America to the allies. Others put claim to a coal dust explosion or even a sudden release of steam pressure. While there is frequent disagreement over the source of the secondary explosion, there is one point that those familiar with the ship agree on: *Lusitania's* wreck may be hiding an answer to one of history's most fascinating mysteries. It is a mystery Bemis is determined to solve.

Above: In the wake of inhuman outrage, Lusitania's dead are buried in mass graves.

Right: Kapitanleutnant Walther Schwieger, the man who sank the Lusitania from the German U-Boat, U-20.

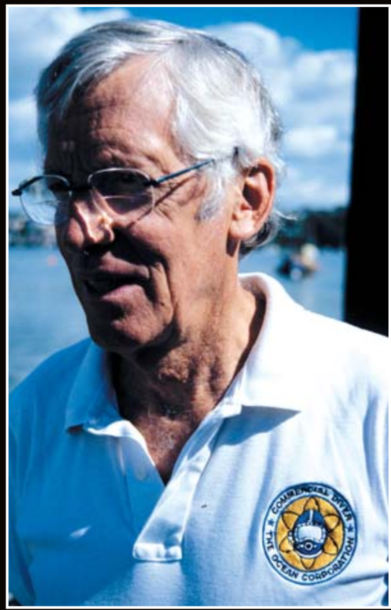
Below: British wreck diver, Bob Hughes puts scale to the docking bridge telegraphs.

Lying at 305ft/93m the wreck was deep, big and complicated, due to the considerable collapse throughout the ship. As darkness descended upon us, my partner, Chris Hutchison, and I fired up 200 watts of light between us and within the next few minutes our eyes adjusted and we were ready to begin exploring. It is true to say that taking into consideration the shattered state of the wreck, it's possible to count on one hand individuals that positively know their way around the entire site. With an obvious amount of navigational artifacts in the area, we considered our first drop positive for what was to become the start of a planned video survey of the wreck. If all went well our goal was to run a guide line from the bow to the very stern, then at strategic points run branch lines off at pre-determined positions in order for designated teams to search and film. In all we hoped to have an end result of the first true video mosaic of the entire wreck -- footage that historians could use to resolve unanswered questions. DUCHAS, on the other hand, each day monitored the operations, and as events unfolded, a nearby Navy frigate watched over our site activities. The wreck work was taken quite seriously and imposed legislation had even prevented Bemis himself from undertaking controlled work over what in theory is his own property.

The wreck lies on its starboard side at an angle of approximately 30 degrees, with the keel taking an unusual curvature, one that is not of obvious construction. Much of the superstructure was gone, thus taking with it integral strength which may give reason as to the hull's slumping appearance. The beam in this location had collapsed from its original 27m to approximately half of that and all of the funnels were missing, presumably due to deterioration. The bow location of the wreck was by far the most prominent section of the wreck. It remains intact and shipshape which, in turn, makes navigation simple in respect. Swimming aft of where the bridge would have been, the wreck then becomes seriously complicated, from here on with little visibility veteran divers of the wreck may benefit, but newcomers will simply become lost.

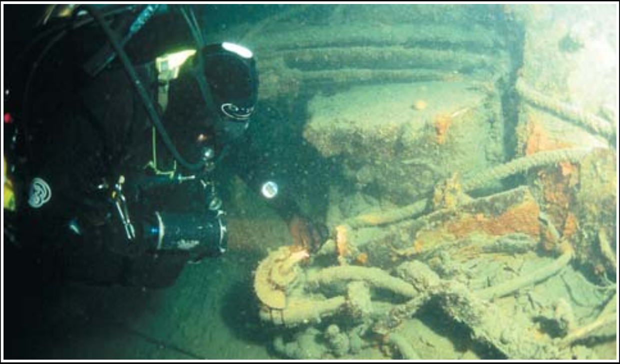
As this was the first dive of our third expedition with no positive destination as such, we moved off in a direction toward the stern. Our first location was an area of covered mosaic-tile flooring found in the vestibule and located in first class where passengers entered from the boat deck. Further along and immediately beyond the first funnel void were three main fresh water tanks still housed in their original location -- the working valves appeared readily recognizable. My attention was now distracted by the beckoning flash of Hutch's torch and on reaction I discovered he had found a rare example of a tropical porthole. Lying free from its fixing, a small amount of netting drifts on before we took time to photograph this rare artifact.

After a period of severe weather, our team returned to the wreck. However, over the next period of dives, we concentrated on the stern section of the wreck. This is where I saw more damage than elsewhere around the site. During the summer of 1982, the giant salvage company, Oceaneering, recovered three of Lusitania's four props by blasting. Accompanied by extensive depth charging during World War II, the damage soon became explanatory upon my dives. The

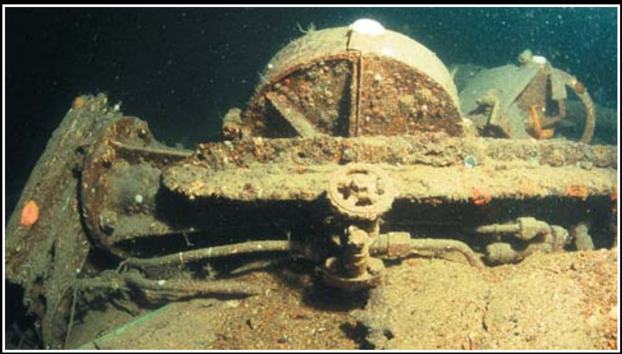


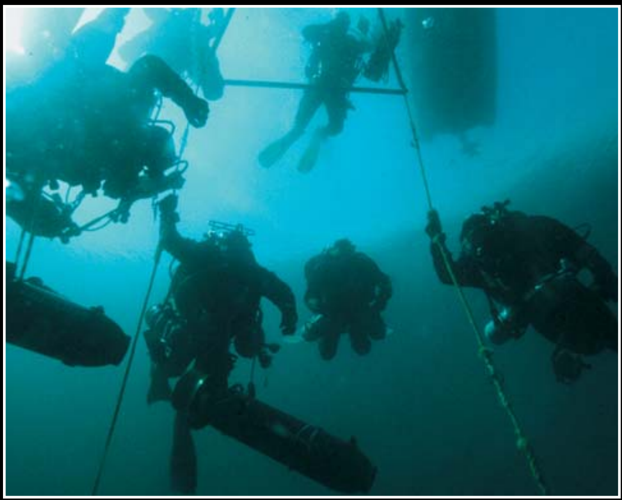
Above: After numerous years of courtroom battle and expense, Gregg Bemis now officially puts claim to Lusitania's outright ownership.

Below: Expedition leader Mark Jones looks on at the remains of a window and electrical light fitting that once embraced the covered promenade deck.


Deep inside Lusitania's holds, divers find all manner of machinery and cargo still lashed into position.


Huge chain links on the bow of the wreck can be seen running into their foredeck hawsers.


The stern docking telemotor that once hydraulically steered Lusitania into harbour.


The 2001 dive team decompress in comfort as their deco station free-floats in the fast Atlantic tidal current.

Lusitania's once proud counter stern was no longer apparent, while the entire docking bridge now rests over the starboard seabed among a huge debris field. Here, within twisted sections of the superstructure, lies her docking telegraphs alongside the main docking bridge telemotor. Elsewhere, as I made my way through the debris field, numerous types of windows were seen -- many displaying ornate filigreed that detailed the very affluent standards of the early twentieth century. The main bridge itself had also collapsed down to the seabed, and it is here that I found even more intricate, turn-of-the-century navigational equipment. Moving on, a first class bath tub lies aft, still immaculately intact complete with its original brass shower framework. A few meters away, I saw the *Lusitania's* beautiful tripe chime whistle.

Each year the dive team has been based at the nearby town of Kinsale, although the 2001 expedition was based from Baltimore, which makes for a boat journey of some two hours out to the wreck. John Kearney's Baltimore dive center was more than adequate to deal with the huge turnover of gas filling each day. A fixed Rota determined when each video team dove to the wreck and which days they stayed ashore to mix the following day's gas supply. The gas supply of Helium and Oxygen was shipped in "Quad packs," then craned into position. A system of partial pressure blending is then undertaken to transfer the gas to the diving cylinders. As the gas levels lower, they are then boosted by the aid of a Haskel pump which effectively sucks the remaining low pressure gas from the Quads, boosting them into the diving cylinders. With 50 percent of the team using closed circuit re-breathers, the gas filling process took considerably less time which, in turn, meant there was more time for team meetings and further discussions of the day's events.

Despite the fact that the archaeology community has repeatedly defined archeologically interesting wrecks to be those over 100 years old, they nevertheless seem unable stay away from *Lusitania*, a wreck that sank only 86 years ago. This community has also in general been fiercely opposed to the raising of artifacts from shipwrecks by anyone except archaeologists, arguing that only they are capable of understanding the full significance of the unique arrangement of these artifacts on the seabed. Some archaeologists even object to there own kind raising artifacts because "that would be destroying the unique arrangement for future generations of who may also wish to carry out their own excavations and studies."

A factor in this difficult debate that often does not seem to be taken into account is that the bottom of the sea is not a benign environment where a shipwreck's remains will stay perfectly preserved forever. This is especially true with the *Lusitania*; the exposed position of the wreck makes her particularly vulnerable to the often-strong Atlantic under currents and swells. Added to this are the highly corrosive forces of nature and the almost acid bath of seawater itself. The scouring action of currents and sand movements and the pounding of wreckage/artifacts against rocks/wreckage are clearly perils for wrecks in shallow water. But even wrecks in deep water, such as the Lusitania, are subject to slow destruction through the activity of bacteria eating away the ferrous metal of the hull, thus creating deposits of rusticles. For deep shipwrecks of this vintage, rusticles remain the main enemy in removing .1 of a ton of iron from the steel construction everyday; therefore, the estimate would suggest a time matter of possibly 90 years until the wreck biologically implodes, collapses into itself and simply becomes an iron ore deposit on the floor of the ocean.

The *Lusitania's* hull was indeed in poor condition and appears to be folded in on itself, whether this was due to collapsed deck levels with no internal strength or simply previous salvage attempts, I do not know. Just how much strength the hull plating has in order to remain in its present condition may be determined through forensic analysis. The strength of the rivets naturally will determine the life of the present hull configuration, thus an analysis of rivets of a specific collective trend could quite possibly determine a given life span. A cross sectional analysis of rivets to measure the quantity of slag will give an indication as to whether the original construction contained the optimum quantity within the wrought iron. Through an analysis of this nature, it may be possible to estimate the wreck's time span from its present state. The wreck lies along a bearing of almost 230 degrees southwest to northeast, and it is in a position of fast currents that will not help to preserve her condition in any form.

On no occasion did any member of the team witness any such artifacts within the wreckage that may be recognized as those of national treasures. It is possibly quite important to encourage that fittings and fixtures of *Lusitania*, including navigational equipment, be viewed as such treasures for future generations and most certainly should be used for some form of preserved educational purpose. As it stands the heritage service will not grant a license for the recovery of artifacts unless they are done so within the parameters of an archaeological pattern. While DUCHAS does not have the means to carry out this kind of work, time and time again the subject results in the question of funding. Indeed if this site has become a national site of interest, then I believe it should undoubtedly be treated as such. The *Lusitania* is one of the first wrecks less than 100 years old to have such a preservation act placed upon it. Since this is the case, then I believe she surely should also become one of the first wrecks to have her artifacts preserved before it is too late.

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http://website.lineone.net/~britannic98/

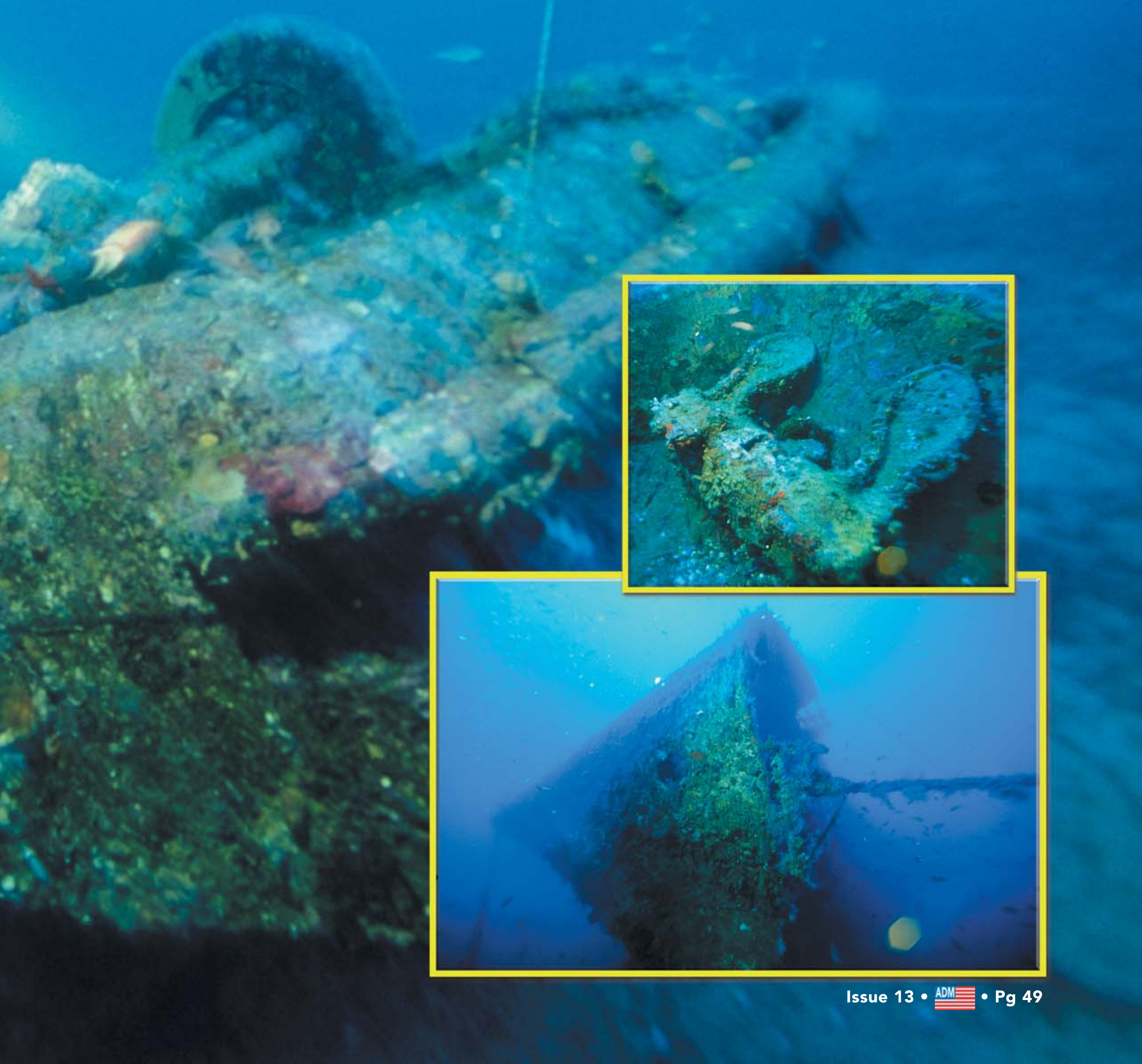
Driving my station wagon filled with 200 kg / 450 lbs of diving equipment, I notice the signpost which indicates "Marina di cala Galera." I have finally arrived on the Argentario headland, situated in Toscany, a splendid region in the center of Italy. My final destination is the diving center, "Dive in Cala Galera," at the marina of the same name. It is on the quay in front of the diving center's boat. Massimo Corsetti, the owner, welcomes me with his usual kindness and takes me off to visit his center that has recently been renovated. It now has three big rooms. The principle one serves to welcome the divers and to expose the diving material and the latest equipment that can be tried for free. On the right is the compressor room, with two $27m^3$ compressors equipped with the latest modern equipment for blended mixed gas, near the maintenance unit. The third room is a changing room where the divers can equip each other near the marina restrooms and showers.

After these minutes dedicated to the visit, I can't curb my impatience and ask Massimo if the weather allows diving on the Nasim. He responds with a big, enthusiastic, "Si!" The meteorological conditions are perfect and the boat is waiting for my diving equipment. I unload my diving equipment from my car and embark on the 11-meter journey. It can accommodate 12 divers in addition to the crew. We are only two and take pleasure in spreading our equipment all over the deck. Our pilot carries us near the Giannutri Island in a half an hour. It is a magnificent island that belongs to the Toscan Argentario's archipel. It's now a Nature Marine Reserve.

The Nasim II was a merchant ship under the Panamanian flag. On February 12, 1976, it left Livourno for Alexandria in Egypt, but it never made it to its destination. At the end of the Piombino canal, while the meteorological conditions were good and all was quiet on board, the ship's Captain Fanciulli retired to his cabin, leaving his second in command. He was to be relieved at 4:00 a.m. by first officer Mondello. Just before 4 a.m., a "force one" Sirocco wind struck the vessel, which was doing 12 knots.

NASIM II

by Aldo Ferrucci



Within view of the Argentario headland, the ship entered a rain wall that plunged it into darkness. The visibility was zero. At the Giannutri level, just after 4:30 a.m., the boat that needed to pass east of the island smashed into the Cala Maestra reefs, probably between Punta Secca and Punta Scaletta, although the exact impact point is still unknown. The vessel was listing terribly and began losing its precious cargo: 49 cars intended for the North African market, including 12 Fiat, 35 Peugeot, two Mercedes, 23 on the deck and 26 in the holds which also contained 16 trailers and three fork-lifts. Therefore, the 23 cars on the deck "unloaded" in an orderly manner and were "parked" on the sand at 60m / 196ft depth! The 17-person crew was all saved before the ship sank hundreds of meters off the coast.

The dive on the Nasim II is one of the most researched by wreck divers. For years it was almost impossible to make because of the depth and its location was known only by a few people. So a "Nasim group" was created which included the rare divers that could accomplish these types of dives.

Modern diving techniques, mixed gas diving in particular, now allows divers to go down to 60m / 196ft with limited risks. Nevertheless, it is not the depth alone that makes this dive accessible only to experienced divers. In fact, the site is near dangerous shoals and is submitted to violent currents.

Arriving at Giannutri, we move carefully a few meters and anchor at the Cala Spalmatoio reefs. The depth is about 30m / 99ft on a rocky bottom. Fortunately the wreck is just outside the Nature Marine Reserve where diving is, of course, forbidden.

We decide to breathe a bottom mix of TRIMIX19/35, and Nitrox 50 for the decompression. We have programmed our dive by V-Planner on PC and recorded our profile on the dive slate fixed on our right forearms. The plan is to stay 25 minutes at 65m / 210ft and make our first decompression stop at 42m / 137ft, for a total time in the water of 67 minutes. For security we also record on our slate the profiles corresponding to a longer time on the bottom, a loss of the decompression mix and a deeper dive.

Once equipped we enter the water and, after a last check, we go descend along the anchor rope. At a depth of 33m / 110ft we see a gripping spectacle: a car is sitting on a rock in front of us! Its body is in good condition but completely invaded by marine life. Then, following the wall, an incredible and unique panorama opens before us: cars are "parked" on the sand, one next to the other, like in a parking lot, which is the name sometimes given to this diving site. We distinguish the dark mass of the Nasim's hull. Good visibility allows us to entirely see the 70-meter wreck. The ship lies on the left side and the view from the bow is surprising. It seems that the vessel is suspended in the sea. Its entire surface is invaded by marine life and each crevice is inhabited.

The visit of the wreck is interesting but dangerous because the holds are partially collapsed and full of stones and cables. However, the biggest interest of this dive is the exploration of the cars scattered around the sea bottom. They are all over the sand, sometimes turned over, in ruins or intact. They are completely covered by concretions, but it is still possible to read their make: Mercedes, Peugeot, Fiat and others. Some cars that are entirely intact still have their tires, windows and seats inside. Sometimes an accessory is missing, often a speedometer, maybe removed by an unscrupulous diver wanting a souvenir of his dive. Conger eels or enormous scorpionfish sitting behind the wheel seem to have passed their driver's license exam with success. We settle down in a car before being chased away by a big vindictive spiny lobster, then go back to the wall and cross the wreck again. Its enormous left anchor is still in its place. Suddenly, a big scorpionfish stands in our way and furiously opens out its long menacing spines. We skirt around it quickly and the 25-minute bottom time soon expires. We grudgingly go back to our rope because we have just begun the exploration of

the site. At the decompression stop a school of young ceriole visit us - allowing us to finish this magnificent exploration in beauty. We spend the following decompression time daydreaming while suspended at the trapeze sets under the boat. And, once on the surface, Massimo and I aspire to the next dive on the Nazim - a wreck that never seems to lose its fascination.

About the Author

Aldo Ferucci, an Italian born 44-year-old, has been diving for over 20 years. He is a diving instructor on the French Riviera near Saint Tropez. Aldo specializes in Tech diving and was one of the first persons to have introduced this technique in France. He provides training courses and diving sessions along the Mediterranean coast and is also a NAUI Technical Workshop Director. In this capacity, he covers technical Nitrox, staged deco, extended range, technical wreck penetration, mixed gas blending and training of oxygen service technicians and Trimix level I.

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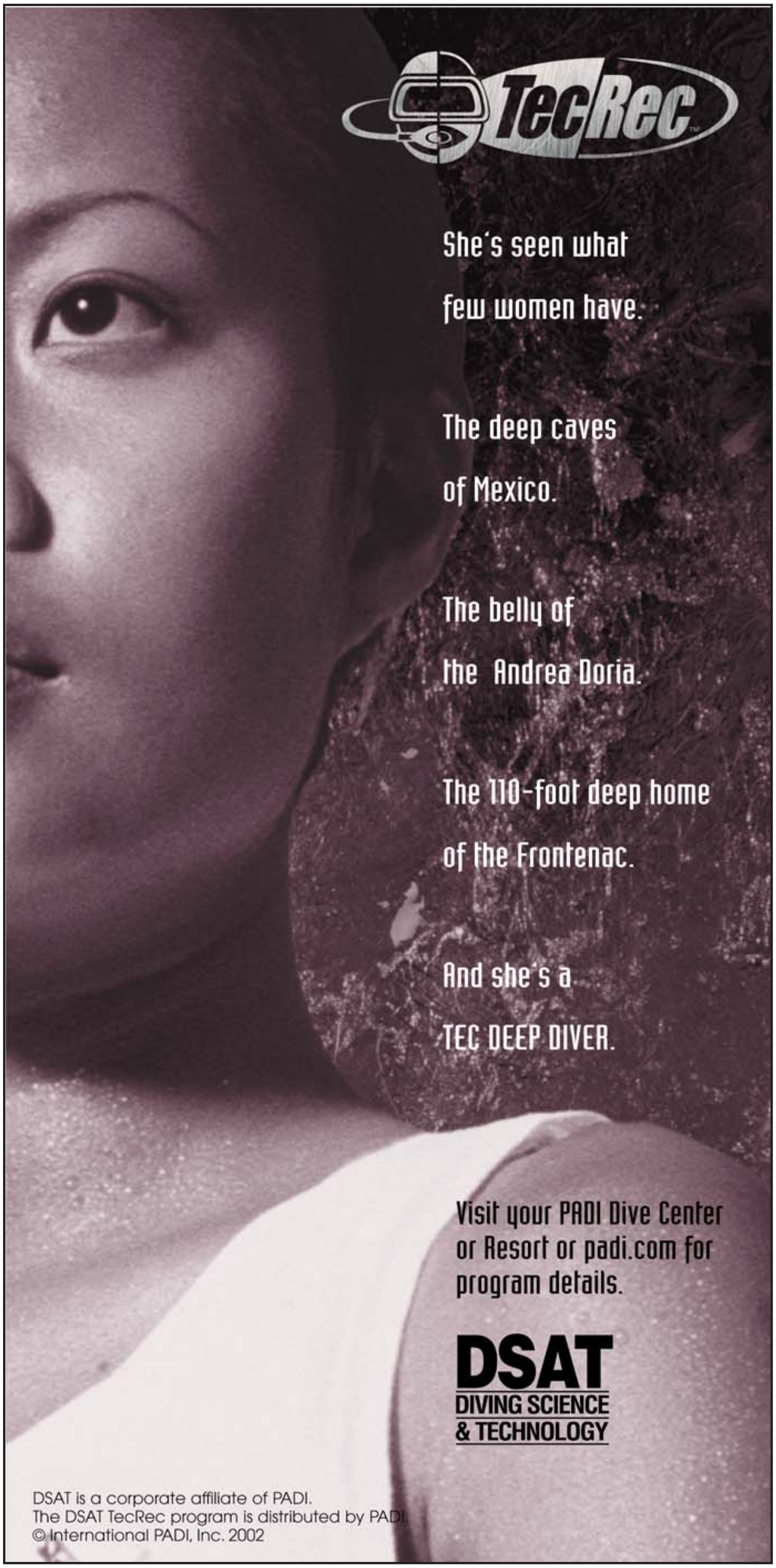

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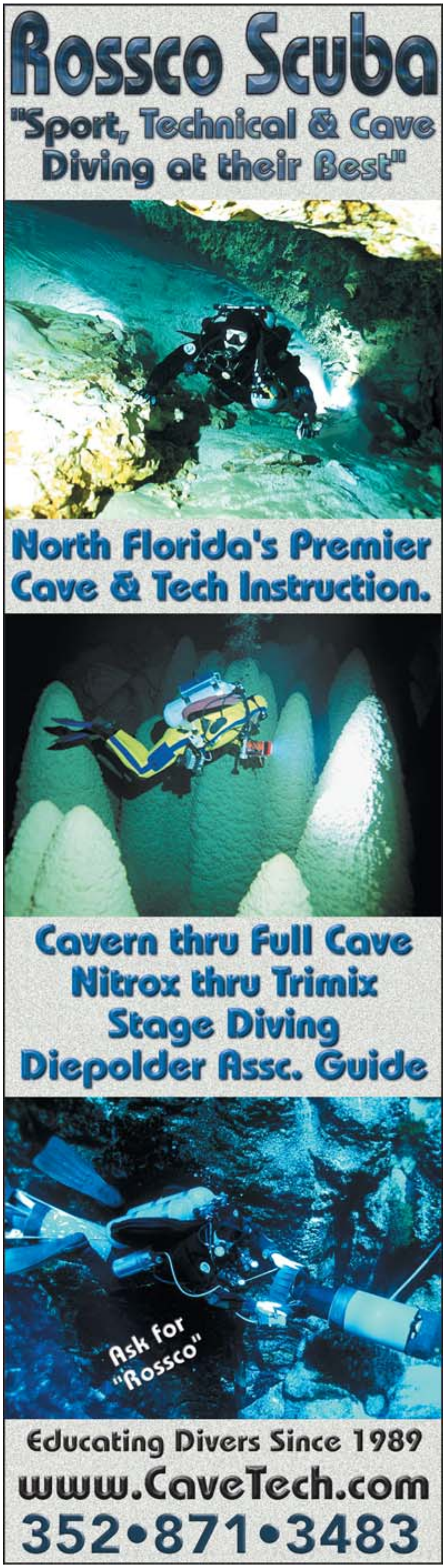

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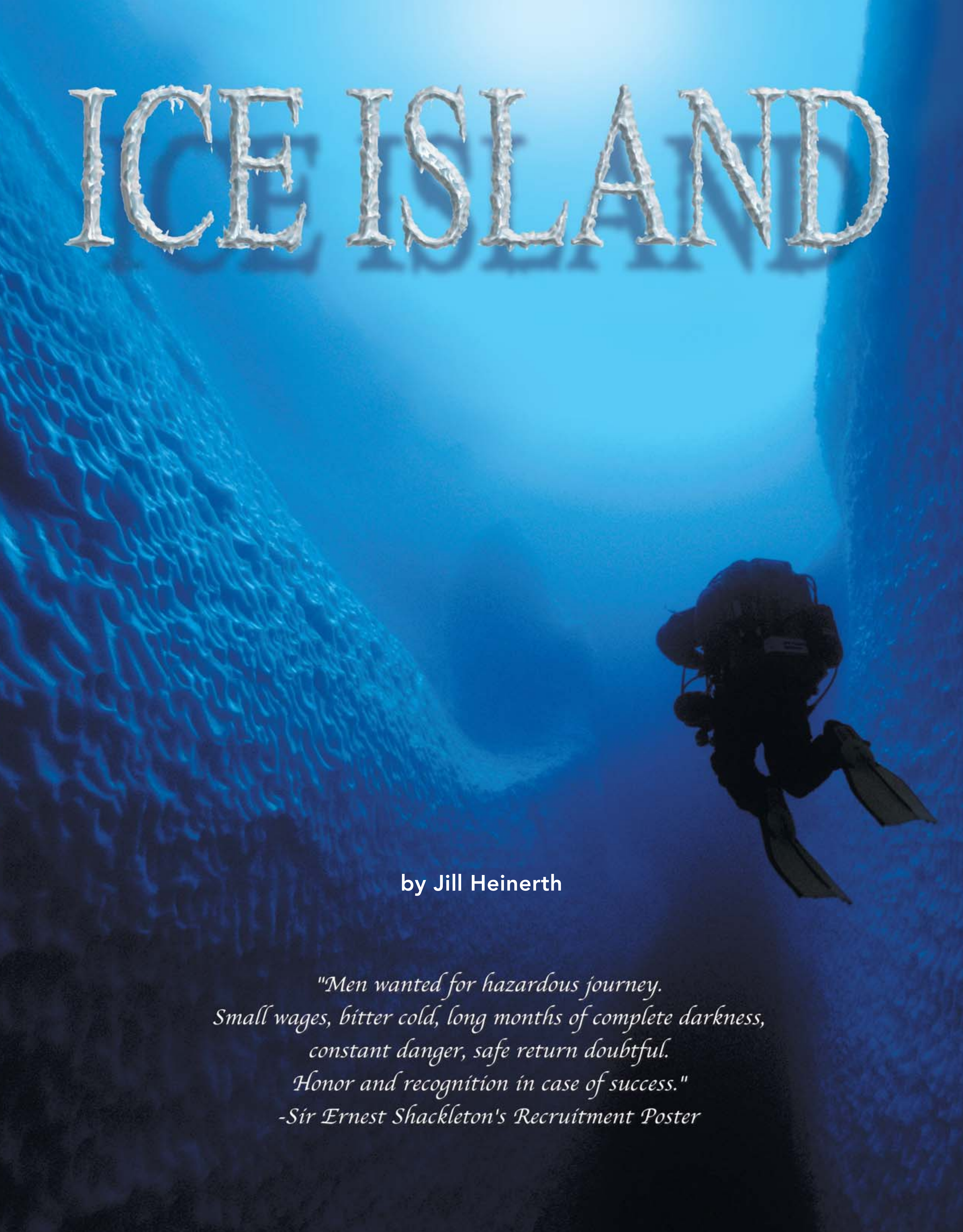

ICE ISLAND

by Jill Heinerth

"Men wanted for hazardous journey.
Small wages, bitter cold, long months of complete darkness,
constant danger, safe return doubtful.
Honor and recognition in case of success."
-Sir Ernest Shackleton's Recruitment Poster

Above Photo: It took the expedition team 12 days to reach the Ross Sea from their departure port of Lyttleton, New Zealand. While most of the team were getting sick in their bunks, Wes Skiles managed to capture this image of the seas that peaked at 60 feet.

There were no contrails in the sky. The hum from the neighboring highway was conspicuously absent. There were no refuse heaps in the landscape or endless loops of world news whining away on a television. We were veritable specks in the landscape, pressed between the whiteness of the ice and menacing sea. Completely separated from the technological buzz of the modern world, we found ourselves living the adventures of the great polar explorers Ernest Shackelton and Robert Falcon Scott.

After enduring several weeks of seasickness, lack of sleep and poor nourishment, I developed a new appreciation for the brave pioneers that sailed the Southern Ocean in wooden ships. Each day was filled with the terror of the roughest waters in the world - the Roaring Forties surrendered to the Furious Fifties and culminated with the Screaming Sixties. Thirty-foot waves hailed down on our 100-foot boat, leaving my mind wandering to apparitions from the Perfect Storm. My muscles were sore from trying to hold myself in my tiny bunk. My legs were bruised from moving around the ship.

But, as with most things in life, perseverance justifies the reward. Antarctica is a magical place. In the seemingly endless Austral Summer, there is no time to sleep. The skies and seas are a continual parade of life and color. The environment changes by the minute as the sun tracks around the horizon. To sleep is to miss a transient moment when you might see a seal lounging on the ice or a skua swooping down on a penguin chick or an iceberg that looks like a modern art sculpture.

Immersed in this hostile yet stunning world, I realized that even in the simplicity of the Antarctic environment, we could only survive under totally artificial means. In every aspect of our travels we needed technology to ensure a synthetic environment to keep us warm and safe. We were much more connected to the world I had left behind than to the physical existence of Shackelton. Dressed in dry suits, heaters and rebreathers, we looked like androids in the wilderness.

Everything in Antarctica relates to the wilderness of water. In hundreds of textures and forms, water distinguishes the environment as different than any other place on the planet. Rare moisture in the atmosphere crystallizes in the sky and creates magical multicolored clouds. Wispy vapors fall as snow on the continent and rise to ice sheets that are so immense, they crush our globe into a pear shaped earth.

Snow builds up on ice sheets, and ice sheets flow forth as glaciers. Rivers of ice make a tedious march back to the sea. On the continental fringe, the glaciers pile up to form towering bluffs over the ocean. These ice shelves are filled with monumental cracks and menacing crevasses. They create a barrier for life. A few birds fly over the hindrance and some creatures swim below it, but no species with the exception of man attempts to live on it. And never in history had there been an attempt to swim inside of this terrain. But to explore caves in Antarctica is to strip exploration to its most elemental form. Studying the ice becomes a game of strategy with Mother Nature and sometimes, a simple matter of survival.

As ice sheets forge into the sea, huge cracks enlarge and the hinges to the continent weaken. Almost 350 km3 calve from the frozen continent each year. Once

Above Photo: The dive team of Jill and Paul Heinerth and Wes Skiles used Cis-Lunar rebreathers for all of their ice dives in Antarctica. The added warmth and ability to deliver extremely high gas volumes during heavy physical exertion added to the safety margin for the team. Submersion times of three hours in 28°F (-1.6°C) water were achieved with relative comfort.

free from their parent, icebergs begin a new maritime existence. They drift north and get carried in the circumpolar current. Most bergs travel at a rate of around 12 km per day and take years to dissolve back into the sea. As bergs age, they gain character. Cracks are broadened by the scouring winds and sea caves grow from the carving surge. Stress builds within the massive fronts and currents try to wrench the bulk apart.

For almost two months, we stared in awe at the magnificent parade of individual bergs and floes that passed and scraped along our boat. We landed on bergs, walked on them, set up tents on their shelves, ran boats through them and dived on the ice walls that dropped endlessly to the depths of the sea. We collected marine life samples and examined the racing currents that streamed in their wakes. But, it was at Cape Hallett where my husband Paul and I jumped into the crackling blue water to explore the inside of a grounded iceberg.

We cautiously entered a collapsed area to find a gaping fissure that extended out of sight. It reminded me of Stargate Cave in Andros with its sheer white walls that drop interminably in a narrow crack. We swam into the fracture a good distance and drifted down to the sea floor. As we hit 130 feet we discovered a secret and dazzling world of colorful tunicates, sea stars and curious creatures. Brilliant reds cast a glow on the underside of the ice just a few feet over our heads. The allure of the teeming life entranced us to swim beneath the great berg and explore the expansive cave environment.

We slipped silently through the underbelly of the berg with our rebreathers, hearing only the occasional fire of the solenoid valve. We found tiny columns and ridges that glued the berg in its current position. The forces of great currents carved conduits and passageways through the berg and brought life-giving nutrients to the plentiful life. Large scallops textured the walls like dimples on a giant golf ball. We were in some sort of thermo-karst; caves created in a blink of geological time with bold yet transient features.

We had penetrated a full quarter of the berg when we called the dive. I sensed a faint moaning reverberate around me. Not recognizing the sound, I carefully inspected my rebreather displays. Finding nothing awry, we turned to swim back to the waiting Zodiac.

As Paul and I hovered at our decompression stop, I noticed the terrain had changed. The entrance looked significantly different than when we began our dive. I looked up to our waiting boat and saw Wes Skiles and first-mate Matt Jolly giving each other "high-fives." On the surface I learned that they had been frantic. During our dive, a deep and frightening groan issued forth from the berg. A large piece of ice in the opening calved and rolled sending them on an eight-foot swell up and a sixteen-foot headlong crash back down again. They were happy to see us alive.

Skiles later recalled, "I thought you and Paul had died. Matt and I were in the Zodiac up inside the crevasse on the surface when suddenly we heard a blood curdling noise and our little Zodiac was lifted up in the air and dropped down in the crevasse as large pieces of ice fell around us. We had experienced a

calving...what would be equivalent to a small earthquake on land, and you and Paul were down inside of that iceberg when that happened. Our first and most immediate thought was that certainly you could not have survived that event and the very thing that I watched you go down in had closed up completely. To me, from my point of view, there was no way you could have come out of there."

The following day Paul and I opted to explore the same fissure but swam under the larger and seemingly more stable half of the berg. Again we discovered wondrous life and magical vistas. Decompression obligation and current prevented us from an easy return to our starting point, so we swam the length of the berg and surfaced on the far side. Lucky for us, Wes was on watch and spotted our tiny heads bobbing on the distant horizon. Exhausted but jubilant, we shared stories and our tape with the crew.

On the third day, Wes joined us for a HiDef Film shoot of Ice Island Cave #4. I heard him yelp with excitement at the beauty that he finally experienced first hand.

He later recalled, "Nothing could have prepared me for the immensity of the crevasse. It was like a huge fault inside of a cave system and you have this crystalline white blue ice and this amazing deep abyss of azure water that you are peering into. Looking up you see light coming down through giant blocks of ice and you are falling and gliding deeper and deeper into this canvas of beauty that escapes definition."

The current was escalating at a horrifying rate during the dive. When we called the dive, it was because of the torrent of water that bore down on us. Getting out of the cave became a frightening fight for our lives. There was nothing that enabled a handhold. We needed to get off the floor but the walls were slick ice. We could only inch forward at 130 feet, and every time we rose off the floor we would get sucked back into the giant. Decompression was mounting.

Tiny thumb sized ice-fish burrows were the only source of respite. They were just large enough to insert a single digit and pause briefly before fighting forward again. I moved up, finger by finger, evicting the resident fish out of their dens, sending them into the siphoning

Top left: First Mate Matt Jolley assists Jill Heinerth aboard.
Photo: Porter Turnbull
Second photo down: The sea floor beneath the icebergs was littered with life, including hundreds of mating pairs of these strange looking isopods, *Glyptonotus Antarcticus*.
Left photo: Paul Heinerth emerges exhausted after the gruelling dive that almost trapped Skiles and the Heinerths within an ice cave.
Below: The Heinerths descend into the entry fissure that dropped to the sea floor where they discovered a garden of life in tunnels below a grounded iceberg.

cave. Paul helped Wes drag the bulky camera housing an inch at a time, and we finally got in the lee of a formation at 90 feet.

Our rebreathers had given us the luxury to breathe hard without failure. Our extra gas supplies and the ability to dive with optimized oxygen in the loop, had given us the comfort of time to solve our problems. We were cold and tired after our decompression, but at least we were alive. A diver in open circuit gear would not have survived the ordeal. They would have run out of gas or suffered from irreversible free flows. If the equipment didn't kill them, then the lengthy decompression would have ended with hypothermia.

We watched the current rip for most of the next day but were determined to get one more chance to shoot film. Floes and bergs whipped by our vessel at a staggering rate, but we were captivated. After carefully charting the mysterious tides, we planned an ultimate assault on Cave #4.

The final dive was uneventful. We experienced less current, but also lost the visibility. The cave was determined to keep us from capturing images. Greedily, we wanted to try again.

That night under a full moon, Wes and Paul worked on a new strategy. We would complete our photo shoot and make a through-trip under the berg with the siphoning current. While the two guys sifted through tide charts, I prepped my rebreather and laid out thermals so I could be ready to dive at a moment's notice.

As I drifted off to sleep, our vessel was torn from the anchorage outside the cave. Surprised, the Captain decided to relocate to a safer spot a couple of miles distant. While he was moving the ship, I was awakened by a shrill scream that echoed through the boat. There was no mistaking that this was a call for everyone on deck.

Our aging berg had been strained from rolling ocean swells and waves relentlessly beating its extremities. A vibration began to build within the tired ice. The rhythmic cadence spread through its mass and warned of cataclysmic forces soon to be unleashed. The yawning tremor crescendoed into a sonic boom. From the center outwards, the berg began to crumble. The larger half of the behemoth heaved up and rolled on its side. Then like a screeching voice that shatters a crystal glass, it disintegrated - leaving only a wake of crumbled shards drifting in the sea. Silence returned and all that was left was a battlefield of ice lumps and a stunned crew.

By morning, the grease ice began to solidify into large pancakes, and we realized that Mother Nature had given us ample warnings of her force. The sea was rapidly freezing northward at a rate of about three miles a day. It was time to escape the winter freeze that could easily trap us for a season. As we skulked out of the Ross Sea, I was reminded of a fitting quote from explorer Robert Scott's biographer.

"And I tell you, if you have the desire for knowledge and the power to give it a physical expression, go out and explore. If you are a brave man you will do nothing: if you are fearful you may do much, for none but cowards have need to prove their bravery."

Mother Nature's gift reminded us that good explorers need to know when to cut and run, regardless of the rewards that await total success.

Right: Paul Heinerth searches for an opening in the ice after a dive that yielded samples of unusal jellyfish and krill in the middle of the Ross Sea.


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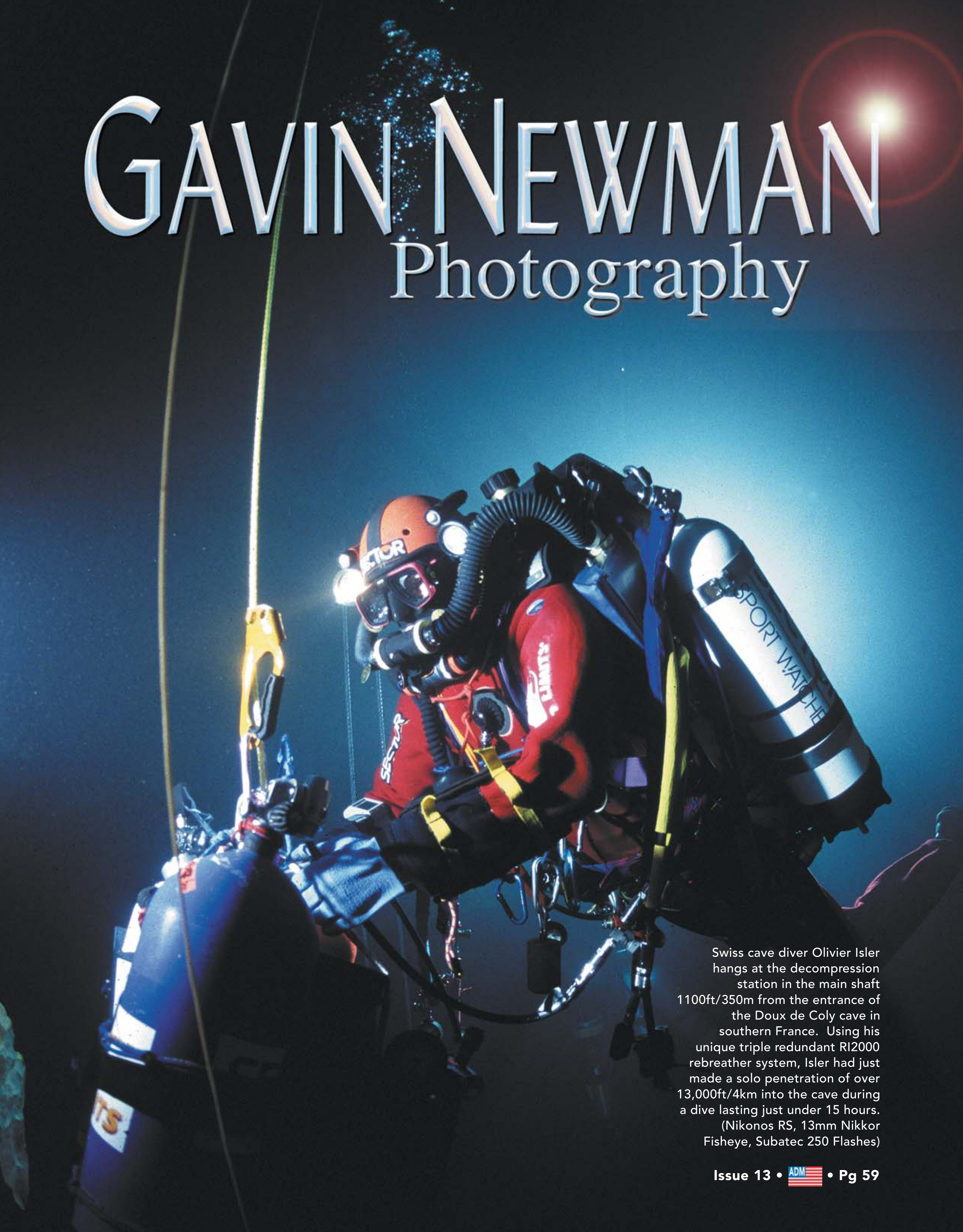


Swiss cave diver Olivier Isler hangs at the decompression station in the main shaft 1100ft/350m from the entrance of the Doux de Coly cave in southern France. Using his unique triple redundant RI2000 rebreather system, Isler had just made a solo penetration of over 13,000ft/4km into the cave during a dive lasting just under 15 hours. (Nikonos RS, 13mm Nikkor Fisheye, Subatec 250 Flashes)

Gavin Newman is a freelance adventure sports photographer and film maker based in the United Kingdom. Specializing in caving and cave diving photography and filming, his work also covers a range of other action and environmental subjects.

A highly experienced diver, cave diver and cave explorer in his own right, Gavin has been involved in numerous expedition projects, providing a wealth of material for filming and photography.

Top Left: Troglobitic Crayfish photographed at Wakulla Springs, Florida - These totally albino cave dwellers live in total darkness and have lost all need for pigmentation to protect themselves from the harmful radiation effects of sunlight. (Nikonos V, 35mm, Subatec Flashes)

Left: Decompression stops at the top of the shaft in the Doux de Coly cave system in France - This photo of support diver Mike Thomas was taken during Olivier Isler's solo exploration of the cave reaching a point over 13,000ft/4km from the entrance.

With his own exploration projects in the Picos Mountains of Northern Spain and as a joint leader of many expeditions to China, Gavin has been actively involved in the discovery and mapping of numerous new cave systems as well as their visual documentation.

Having worked with the BBC and other television production companies for many years, he recently ventured into producing his own films. His first two productions, one on cave diving at Wookey Hole in the United Kingdom (UK) and the second on Cave Exploration in China, are now nearing completion and seeking broadcast deals.

Graduating with a degree in photography, film and television from Harrow College in London, Gavin's life has always revolved around photography and filming. A major part of this work over the last couple of years has been for the environmental group Greenpeace, which has led to a whole range of adventures. Some of these have included diving on Nuclear waste pipelines, camping on the frozen arctic sea ice and chasing pirate fishing vessels across the vast southern ocean.

Gavin started caving when he was 16 years old, after several family holidays to the UK's Yorkshire Dales and a series of caving films on television prompted his interest. Starting with a short, one-day introductory course in caving at the UK National Caving Centre at Whernside Manor in Yorkshire, this led to joining a caving club in London while in college. While pursuing a degree in photography, his senior-year project was based around cave photography and his tutors soon became accustomed to all the college's camera equipment coming back from weekends away sporting a strange layer of mud and the odd unexplained dent!

Later moving to Bristol and joining the South Wales caving club brought him into contact with many of the UK's top expedition cavers, and he was soon asked to join these projects as expedition photographer.

After taking up open-water diving alongside his interest in caving, it was inevitable that cave diving should beckon. He soon developed a very personal style based heavily around creative lighting effects while reveling in the challenge presented by photographing the small, cold and inhospitable sumps of the UK.

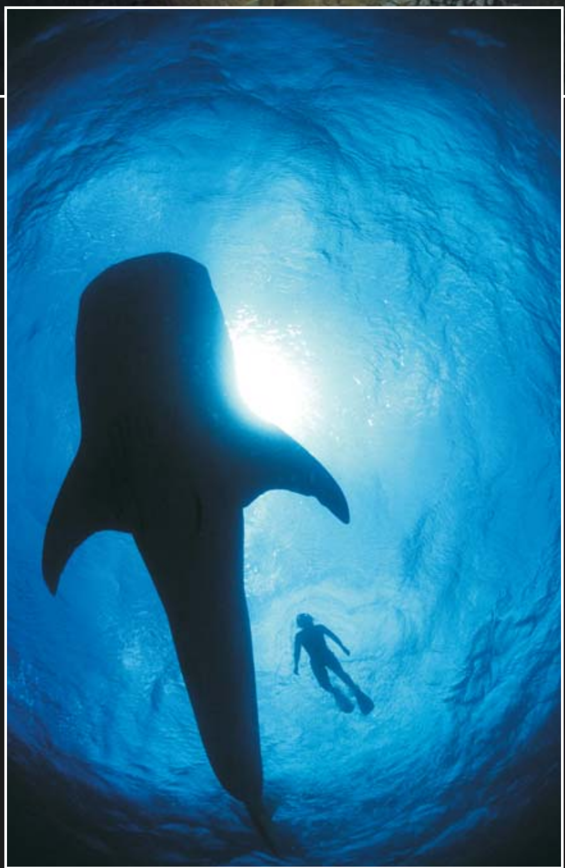
Background: British cave diver and technical diving pioneer Rob Palmer hangs in the vast empty chamber of Ben's Room in the Lucayen Caverns cave system of Grand Bahama island. (Nikonos V, 15mm Nikkor UW, Ikelite Flashes)

Right: Geoff Crossley, typically accustomed to the small confines and murky waters of British sumps, admires the clear waters of Peacock Spring, Florida. (Nikonos V, 15mm Nikkor UW)

Invited by UK cave diver Rob Parker to join Bill Stones' 1987 Wakulla Springs project, he worked on the film of that ground-breaking project and provided many of the images used in the project book. Since then, numerous expeditions have followed, including nine that explored the caves of several regions of China from where he has recently returned.

His current favorite camera systems are all 35mm Nikon and Nikonos cameras for still photography work, while Sony DV, DVCAM, & Digital Betacam are his choices for video work. Lighting is provided by Subatec and Sea & Sea flash units for still photography and Kowalski and Satchler lighting systems are the favorites for video projects.

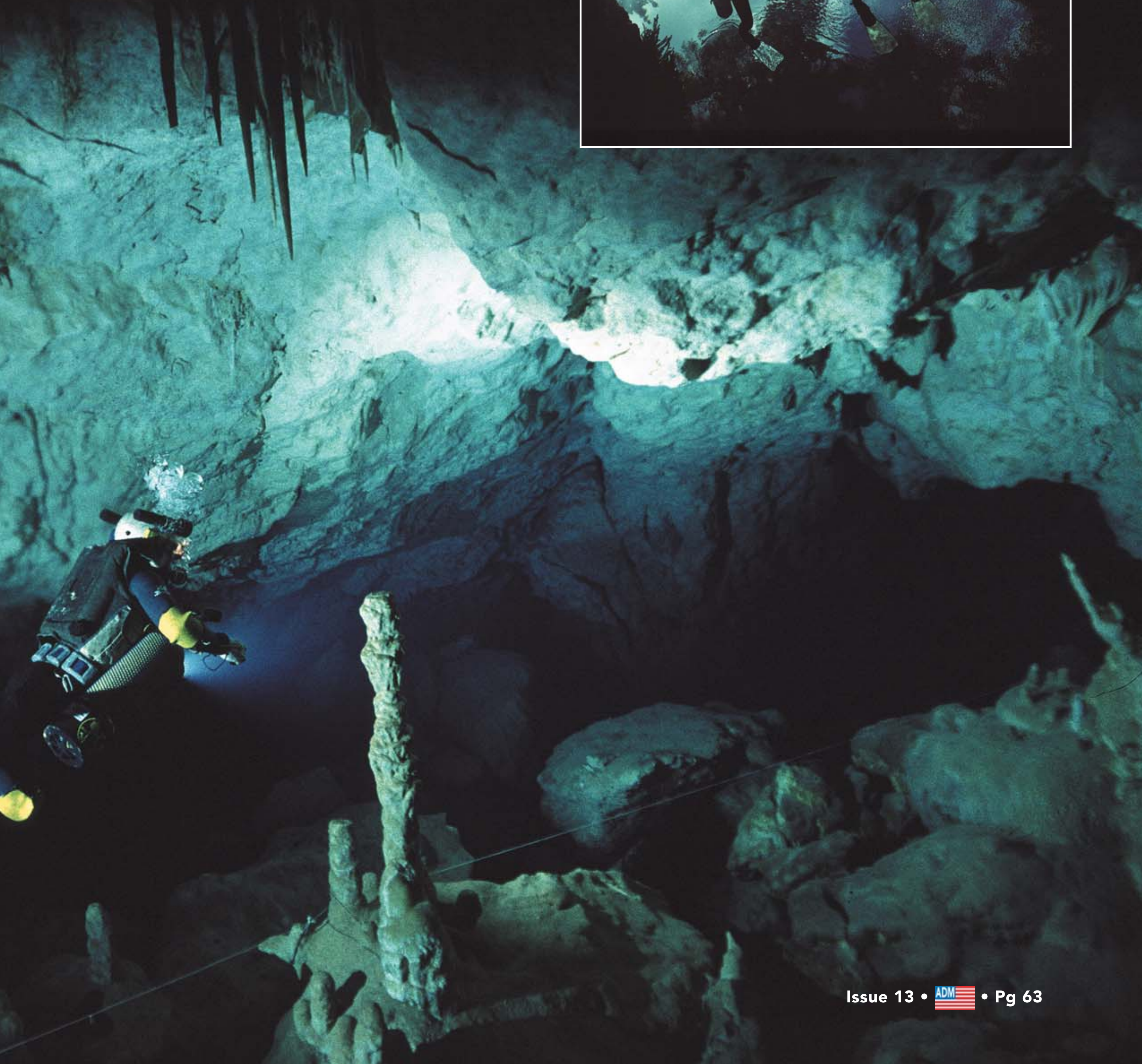
More of Gavin's work can be seen on his web site at www.actionphoto.co.uk, and all the images in this feature and many others are available for purchase as prints. Visit the web site or email
gavin@actionphoto.co.uk
for further details.



Top Left: Sump 2 of the Fontaine de Truffe in southern France is a small winding tube through spectacular fretted rock. Water levels in the cave can vary as much as 15ft/5m depending on weather conditions and in drought conditions much of this sump can have airspace.
(Nikonos RS, 13mm Nikkor Fisheye, Subatec 250 Flashes)

Left: Whaleshark - Photographed off the East coast of South Africa, the Whaleshark is the world's largest fish. Once quite common these harmless plankton eaters can grow to a length of 16m but heavy overfishing increasingly endangers their survival and encounters these days are rare.
(Nikonos RS, 13mm Nikkor Fisheye)

Right: Ginnie Springs, Florida - Photographed against the sunlight, two divers prepare to descend into Devil's Eye Spring. The clarity of the water reveals the trees and clouds above the divers.
(Nikonos V, 15mm Nikkor)



Background: This sea cave on the Mediterranean island of Mallorca offers several short sumps containing submerged stalagmite and stalactite formations leading to a series of dry cave passages that lead to a land entrance.
(Nikonos V, 15mm Sea & Sea lens)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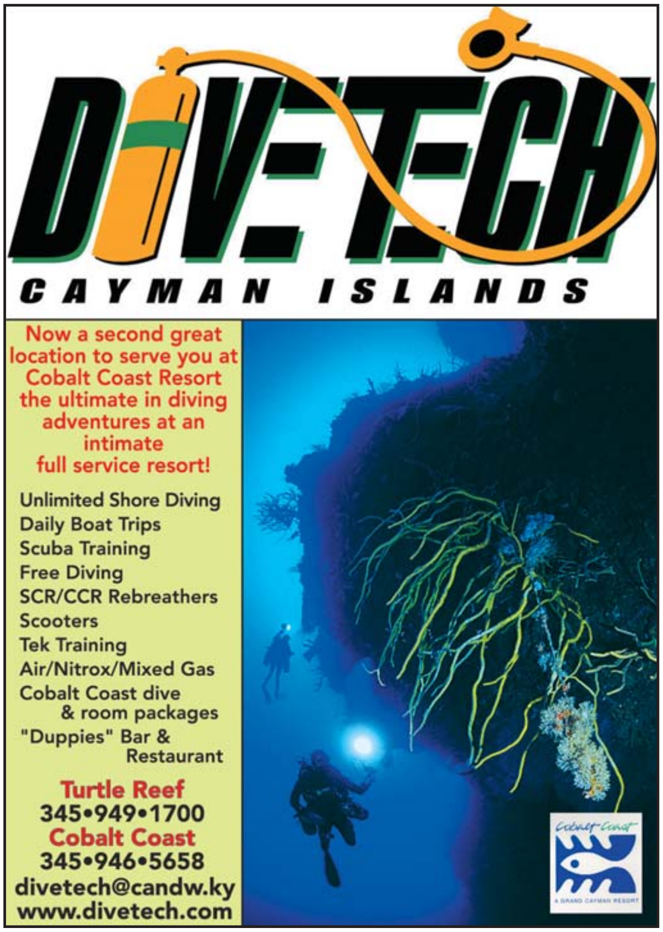
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Diving into a 72 Year-Old Mystery

Photo: NPS-ONP

Story and Photos by John Rawlings

Dan Pontbriand is a very determined man. Some people might even regard him as stubborn. He has a streak of curiosity within him that sometimes- well, sometimes it just seems to consume him. Dan is also the Lake District Ranger stationed at Storm King Ranger Station on the shores of Lake Crescent in Olympic National Park. For six years, until recently, he was the Dive Officer of the Olympic National Park Dive Team established by the National Park Service to handle emergencies and other situations calling for the use of divers in the park. Since arriving at the lake almost 12 years ago, Dan has become fascinated with its history, both natural and mysterious, and has made numerous dives there to both satisfy his curiosity and to prove points.

About a year ago, Dan met another very determined man, who also was consumed with curiosity. His name was Bob Caso, and the difference between them was that Bob had been consumed with curiosity regarding the same mystery for almost 50 years. Now 77 years old, he had been a member of a team of divers that explored the lake back in the 1950s searching for the answer to a riddle that no one had yet been able to solve. Upon meeting Dan, Bob started telling him about such things as a mysterious disappearance, logging camp rumors, a missing vehicle and orphaned children that all somehow tied in to the deep, cold waters of Lake Crescent.

Within minutes of meeting Bob Caso, Dan was hooked. His curiosity was piqued. Determination set in. His mind started to swirl with possibilities. It was now only a matter of time.

The Mystery

Russell and Blanch Warren had moved to Washington from Idaho in the mid-1920s in search of work in the then-thriving timber industry. Russell had been hired on at a logging camp near the Bogachiel River; and together, he and Blanch were building a future on a homestead there along with their two young boys, Frank and Charles. On July 3, 1929, Russell

Its shattered headlight providing mute testimonial to the violence of its tragic end, the Warren vehicle lies on its side deep in the frigid waters of Lake Crescent.

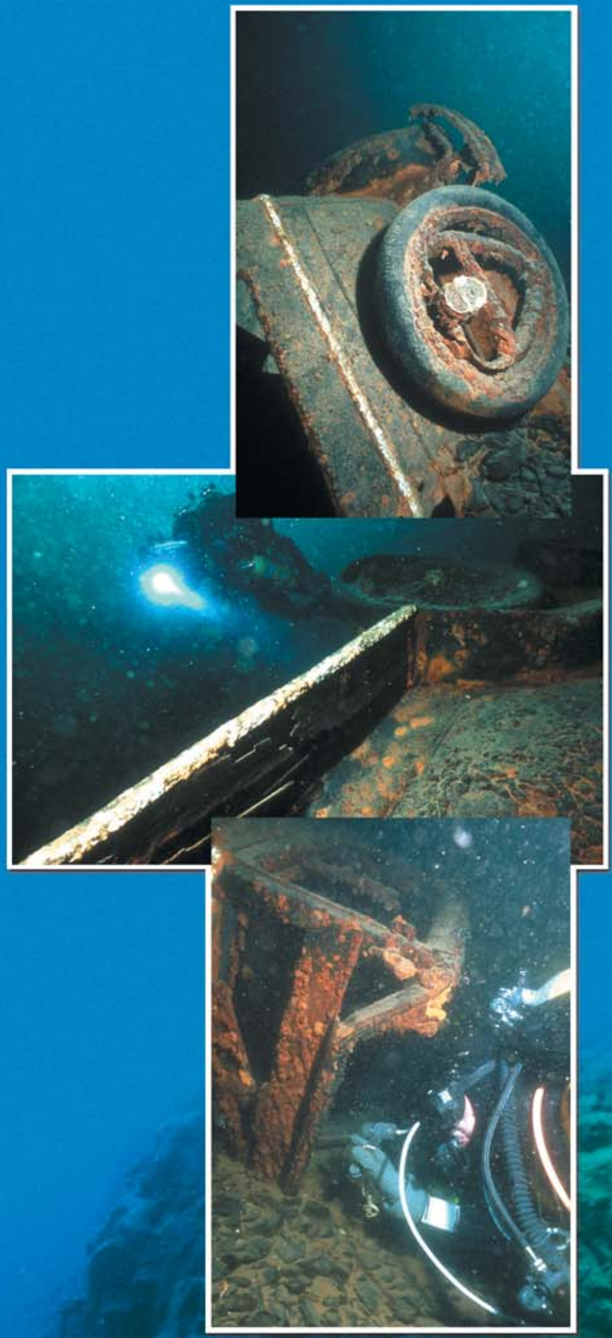
Warren drove his 1927 Chevrolet into the town of Port Angeles to pick up his wife, who had briefly been at a local hospital. After picking up Blanch, the two of them did some grocery shopping for the family, made two months' payment on their car loan and then made a major purchase - a new washing machine to make their life in the camp a bit easier. Before he had left the logging camp that morning, Russell Warren had told his boys that together the family would celebrate the 4th of July the next day at the famous Solduc Hot Springs. The entire family eagerly looked forward to the fun and festivities. After securing the newly purchased washing machine, the Warrens turned their car West and headed home toward their boys.

They never made it.

The First Search

The search for the missing couple commenced almost immediately. Search teams combed the roadside and surrounding forest between Port Angeles and the Bogachiel River. The search continued for months with all avenues being explored and all clues, no matter how bizarre, being followed. Common sense, however, placed the emphasis of the search at the shores of the deep, bone-chilling Lake Crescent. Unlike today, the highway paralleling the shore of the lake was a simple dirt road with very little guardrail. Six weeks would pass before the first tangible clue would be found. In mid-August, a local resident found broken glass and marks on a log in shallow water and on shore, causing searchers to concentrate their attention on a location then known as "Madrona Point" as the most likely location of the tragedy. A cap was found near shore that Russell Warren's oldest son, Frank, identified as belonging to his father. Sounding and dragging operations took place down to 100 feet with the only result being a visor recovered from a ledge at about 40 feet. Surface-supplied diving equipment was obtained from Seattle, allowing a diver to drop down to 78 feet in his search. He reported "scarring" on the bottom that to him clearly indicated the plunge of a car down the slope toward deeper water. A reward was posted for the recovery of the vehicle but, over the months and years, it was never claimed.

In the absence of hard evidence, gross speculation made its ugly appearance. Those with nothing but fertile imaginations



Team member Jerome Ryan checks his deco status during one of many such stops. Seventy two years ago the Warren's automobile plunged down the underwater cliff shown behind him.

concocted bizarre stories as a means of getting their names in the papers. One woman claimed that she had seen "a white man and some Indians" come up to the back porch of the Warren homestead and "hold a drinking spree" on the day the couple disappeared. The story took an even stranger twist when supposedly a mysterious, hidden grave was found near the home. When excavated it proved to be simply where the family had planted and dug potatoes. Another suspected "gravesite" was found to hold the remains of a dead cow.

While all this was going on the two Warren boys endured the cruel taunts of their schoolmates and the pitying glances of those who believed their parents had simply abandoned them. The boys would eventually live out their lives not knowing the truth, but apparently believing that their parents had simply left for reasons they would never fully understand.

Divers search for the wreck in the 1950s. Team member Bob Caso is shown on the left. Photo courtesy Bob Caso.

The Second Search

In the 1950s new possibilities of underwater search and recovery opened up with the advent of SCUBA. As a young navy sailor stationed in the area during World War-II, Bob Caso had listened to the stories and heard all the rumors. Now, he and a team of friends believed that they had the necessary equipment to search the lake and solve the mystery. For months they plunged into the lake, combing the waters near the shoreline for clues that would help solve the big mystery some of them remembered from their childhood. Everything they found and every lead they followed proved to be a dead end, but still they persisted, diving to the depths they could on compressed air with the equipment then available. Gradually, as the months went by, the team members moved away, embarked on careers or lost interest. That is, everyone but Bob. Knowing that eventually the mystery would be solved as technology improved and the ability to dive deeper came, Bob wanted to continue to be part of the search. He turned from diving to archiving - painstakingly researching newspaper records, talking with those who had participated in the search in 1929, taking notes and collecting any and all information that could help future searchers. Literally, Bob became the Warren's historian.

It was with this bundle of information, enthusiasm and a gleam in his eye that he approached District Ranger Dan Pontbriand in April of 2001.

The Third Search

With a similar gleam in his eye, Dan began searching immediately. Assembling a team of divers from within the Ranger staff in Olympic National Park, they began to scour the depths along the shoreline of the huge lake, looking for anything out of the ordinary. A problem had arisen - over the years as logging operations halted, Highway 101 was built and paved, and Olympic National Park was created - the names of various locations at the lake had been altered or completely changed. "Madrona Point" no longer showed on any available map. This situation forced the dive team to dive on and investigate every possible point of shoreline that a vehicle could have careened off of into the water. Not only had the trail grown cold, it had significantly broadened.

The team expanded as a small group of volunteer civilian divers joined the Rangers in their quest. The father and son team of Bill and Joe Walker devoted their weekends for months searching for clues, while others such as Jerome Ryan and myself contributed deep-water skills whenever possible. The excitement of the team grew as first one and then another old car from the right time period was discovered, only to have our hopes dashed as they proved to both be Ford Model A's.

Frustration was forgotten and the team continued their search. In December of 2001, things started to happen. An old map predating the park was discovered that indicated that "Meldrim Point" and "Madrona Point" were one and the same. To the team, it was like finding a treasure map! Having found a place of high probability to search, a chain of artifact discoveries was made that led in virtually a straight line from a slight curve in the road down into progressively deeper water. Recovered were such items as a black flower vase, a tire pump and a rusted car step. Most importantly, the lid to a late 1920's Norge washing machine was found that could possibly have been of the same make and model as that purchased by the Warrens on that last fateful shopping trip. The following month, still more evidence was recovered - the remains of a wooden grocery box and some Mason jars along with a still full bottle of White Ace shoe polish. Again, the recovery was in a direct line with the other artifacts leading down from the curve in the roadway. The trail was so hot it was screaming. Amidst all of the excitement, Dan happened to notice that the curve was located at a small point at which a lone Madrona tree was growing - further proof, if any more was needed, that "Madrona Point" had finally been found. Over the years its name had been altered to "Meldrim Point," but locals and the Park Rangers now refer to it as "Ambulance Point."

Volunteer search and recovery experts, Gene and Sandy Ralston of the Innerspace Exploration Team Company, now provided their services as part of the search, scanning the bottom within the now narrowed search area with side-scan sonar. Their "towfish" emitted sound waves from two window ports on either side of the device as Gene slowly piloted their search vessel back and forth across the area leading downward from the point. At 188 feet an image of what appeared to be a washing machine came through clearly on the side scan and the stage was set for the advent of the next part of the team - the deep technical divers.

The Discovery

The day following the side-scan discovery of the washing machine, my partner, Jerome Ryan, and I were tasked with dropping down from the small flotilla of boats to the washing machine and then marking it with a line and buoy for possible recovery later. Following that, the plan then was for us to slowly drop down to 220 FFW in a search pattern looking for any signs of the missing car or additional wreckage. Each of us wore our beloved doubles with additional stage bottles carrying our decompression mixes beneath each arm - each filled with high percentages of oxygen to decrease our deco time. Our planned bottom time was 20 minutes, but with our decompression time we would be under the frigid waters (44 degrees!) of the lake for over an hour. Acting as tenders, a pair of Rangers assisted us with our gear, and with a nod to each other we strode off the stern of the NPS dive boat and sank quickly into the clear blue depths of the lake. As we dropped through a thermocline enroute to the bottom, I could feel the cold on my face. It was a sensation much like touching dry ice.

We were dropping down next to a thin yellow nylon line that was attached to the "cage" made of copper tubing that Gene Ralston had used to mark the location of the washing machine based on his side-scan readings. The "cage" was supposed to be within 10 feet of the artifact, so as we plummeted down our eyes were fixed directly below us. Visibility that day was at least 70 feet, but at the depth to which we were descending that would still be based on the quality and quantity of our light beams. As we approached 170 FFW something caught the corner of my eye and I looked out toward the side of the massive rocky underwater slope. A rectangular shape that could only have been man-made was lying buttressed up against the slope at a steep angle. I paused briefly and swung my light in that direction while, unaware of the situation, Jerome continued down. Within two slight kicks I was within clear sight of the object and it became obvious that this was the goal that hundreds of people had been seeking for over 72 years. A 1927 Chevrolet lay before me in clearly recognizable condition. After all the photographs we had seen of '27 Chevys there was absolutely no doubt in my mind.

With a loud "Woo-Hoo!" into my regulator, I flashed my light at Jerome, who had paused to determine my location. Within seconds he was by my side and "high fives" were exchanged several times. He tied the buoy line to the front bumper of the car and sent it up. Upon seeing it bob to the surface, our teammates in the boats simply thought that we had found the washing machine and that another piece had been placed into the puzzle. They had no idea that down below we had found (as Dan would say later to the television news cameras) the "Holy Grail."

The car was lying on its left side, with its nose facing slightly down slope. It was at an angle with its roof facing down and the parts facing the surface had numerous stones on them, probably the result of tumbling down the steep underwater slope all of those long years ago. We believe that this is why the car itself had not been readily noticeable on the side-scan (although once we were able to state with certainty where it was Gene was able to dimly pick out the shape on his screen). Placing one of my computers within the body of the car, we recorded its depth as 171 FFW, and then Jerome and I circled the car slowly, attempting to log its features in our memory so that we could adequately brief those at the surface. When our computers showed that we were approaching the end of our bottom time, we began our long ascent. We were absolutely DYING to tell our teammates on the surface about the discovery, but our deco obligation kept us from rushing to do so.

Team members Sandy and Gene Ralston deploy their side-scan sonar within the narrowed search area off Meldrim Point. Photo: NPS-ONP

Photo courtesy National Park Service - ONP

Team Members
1. **Jerome Ryan** - Technical Diver
2. **John Rawlings** - Technical Diver - Advanced Diver Magazine Staff
3. **Dan Messaros** - Dive Officer - National Park Service
4. **Dan Pontbriand** - Team Leader and Diver - National Park Service
5. **Joe Walker** - Diver
6. **Bill Walker** - Diver

* **Bob Caso** - Historian
* **Rob Edwards** - Diver - Clallam County Search and Rescue
* **Mark Heilberg** - VIP Diver - Helicopter Pilot - US Coast Guard
* **Gene Ralston** - Side Scan Sonar Expert - Innerspace Exploration Team
* **Sandy Ralston** - Side Scan Sonar Expert - Innerspace Exploration Team
* **Paul Seylor** - Diver - National Park Service

* Not shown in above photo

OLYMPIC NATIONAL PARK DIVE TEAM

Forty-six minutes later we broke the surface and I yelled out to the boats, "We found the car!!!!" Every boat horn in the small "fleet" blared and I could swear that I saw Bob Caso leaping up and down in his excitement. The only bad thing about the moment was that neither Dan nor Bob could have been there at the moment of discovery.

Since then, descendents of the Warrens have traveled to Lake Crescent and have met with members of the dive team. It appears that the family has decided to leave the car and whatever remains it might contain in the lake, believing it to be a "beautiful, fitting resting place." The National Park Service has begun the procedures necessary to have the location declared a gravesite and a private memorial is currently being planned. As each of us on the team met the grandchildren and great grandchildren of the couple who had been missing for so long, our emotions were strong as we saw the mixture of both joy and sorrow within the eyes of the family members. Several members of the family sought the right words to use in thanking the team, while Ranger Dan Pontbriand summed up our thoughts most poignantly, "You're most welcome," he said. "It has been a labor of love."

Author's note: Numerous additional dives have been made on the wreckage by members of the dive team since this article was written. At the request of the Warren family, several artifacts have been recovered. Additionally, a small amount of what is believed to be human remains has been recovered and is currently being analyzed by the FBI laboratories, where it is being compared with blood samples taken from living relatives to confirm a DNA match. On July 3 of this year, members of the family and the dive team held a memorial service for the long lost couple on the shores of Lake Crescent adjacent to the dive site. It was an incredibly moving day.

By B.R. Wienke and T.R. O'Leary
NAUI Technical Diving Operations

Helium Misfacts:

God gave us helium for diving, but the devil replaced it with nitrogen. At least he tried replacing it and giving it a bad name.

Helium is a noble gas for deep diving, but was not always thought so. In the early days of technical and recreational diving, the use of helium for deep diving was discouraged, indeed, really feared. Based on misinformation and a few early problems in the deep diving arena, helium acquired a voodo gas reputation, with a hands off label.

Unjustly so.

Some misapprenhension stemmed from the Hans Keller trajedy on helium mixes in 1962, some from misconceptions about isobaric switches ala light-to-heavy gases, some from tales of greater CNS risk, and some from a paucity of published and reliable decompression tables. Some concerns arose because 80/20 heliox no-deco time limits (NDLs) for short and shallow dives were longer than air limits. So people assumed helium decompression was longer, and more hazardous, than nitrogen.

In short, helium was getting a bad rap for a lot of wrong reasons.

It was also religion that switches from helium bottom mixtures to nitrox or air should be made as early as possible, and that so doing, would reduce overall deco time the most.

Not exactly so, at least according to modern decompression theory, and even classical Haldane theory if deep stops are juxtaposed on the profile. If helium and nitrogen are decreased in roughly same proportions as oxygen is increased until a big isobaric switch is made in the shallow zone to an enriched nitrox mix, deco differences between early switches to nitrogen versus riding lighter helium mixes longer are small. Small according to modern decompression theory and practice, but more important, such helium protocols leave the deco diver feeling better. As witnessed under field conditions, the collective experiences of technical and scientific diving operations support that assertion today. And so do modern decompression theories that have seen field testing, like the RGBM, and ad hoc deep stop protocols used by saavy divers.

Indeed there may be no need to switch to nitrogen mixtures at all. Riding helium mixtures to the surface, with a switch to pure oxygen in the shallow zone can be deco efficient, and safer too. So much so, that NAUI Technical Diving Operations has built a training regimen for divers and instructors based on helium for technical diving, and even offers a helitrox (enriched heliair) course. And a full set of RGBM Tables supports helium based training and tech diving.

In the same vein, the operational experiences of WKPP and LANL dive teams underscore many years of safe and efficient helium based deco diving. And that couples to a modern revolution in decompression theory and practice. In fact, WKPP exploits on helium could fill a book. LANL too. NAUI Tec Ops has been utilizing helium-based training for the past four years, or so, without problems. All this means many, many 1000s of tech dives with helium based mixes.

Today, helium is proving its worth as a safe and reliable technical mix. Its use is changing technical and exploration diving. Exit deep air, and enter deep helium and deep stops. It seems about time. Plus time for modern decompression theory to flush the dissolved gas theory entrenching diving for a hundred years.

Let's look at why. And begin with comparative gas properties as they affect divers.

Helium Properties

Nitrogen is limited as an inert gas for diving. Increased pressures of nitrogen beyond 130 fsw can lead to euphoria, reduced mental awareness, and physical dysfunctionality, while beyond 500 fsw loss of consciousness results. Individual tolerances vary widely, often depending on activity. Symptoms can be marked at the beginning of a deep dive, gradually decreasing with time. Flow resistance and the onset of turbulence in the airways of the body increase with higher breathing gas pressure, considerably reducing ventilation with nitrogen-rich breathing mixtures during deep diving. Oxygen is also limited at depth for the usual toxicity reasons. Dives beyond 150 fsw requiring bottom times of hours need employ lighter, more weakly reacting, and less narcotic gases than nitrogen, and all coupled to reduced oxygen partial pressures.

A number of inert gas replacements have been tested, such as hydrogen, neon, argon, and helium, with only helium and hydrogen performing satisfactorily on all counts. Because it is the lightest, hydrogen has elimination speed advantages over helium, but, because of the high explosive risk in mixing hydrogen, helium has emerged as the best all-around inert gas for deep and saturation diving. Helium can be breathed for months without tissue damage. Argon is highly soluble and heavier than nitrogen, and thus a very poor choice. Neon is not much lighter than nitrogen, but is only slightly more soluble than helium. Of the five, helium is the least and argon the most narcotic inert gas under pressure.

Saturation and desaturation speeds of inert gases are inversely proportional to the square root of their atomic masses. Hydrogen will saturate and desaturate approximately 3.7 times faster than nitrogen, and helium will saturate and desaturate some 2.7 times faster than nitrogen. Differences between neon, argon, and nitrogen are not significant for diving. Comparative properties for hydrogen, helium, neon, nitrogen, argon, and oxygen are listed in Table 1. Solubilities, S, are quoted in atm 1 , weights, A, inatomic mass units (amu), and relative narcotic potencies, p, are dimensionless (referenced to nitrogen in observed effect). The least potent gases have the highest index, p.

Table 1. Inert Gas And Oxygen Molecular Weights, Solubilities and Narcotic Potency

	H_2	He	Ne	N_2	Ar	O_2
A (amu)	2.02	4.00	20.18	28.02	39.44	32.00
S (atm^{-1})						
blood	0.0149	0.0087	0.0093	0.0122	0.0260	0.0241
oil	0.0502	0.0150	0.0199	0.0670	0.1480	0.1220
p	1.83	4.26	3.58	1.00	0.43	

The size of bubbles formed with various inert gases depends upon the amount of gas dissolved and hence the solubilities. Higher gas solubilities promote bigger bubbles. Thus, helium is preferable to hydrogen as a light gas, while nitrogen is perferable to argon as a heavy gas. Neon solubility roughly equals nitrogen solubility. Narcotic potency correlates with lipid (fatty tissue) solubility, with the least narcotic gases the least soluble. Different uptake and elimination speeds suggest optimal means for reducing decompression time using helium and nitrogen mixtures. Following deep dives breathing helium, switching to nitrogen is without risk, while helium elimination is accelerated because the helium tissue-blood gradient is increased when breathing nitrogen. By gradually increasing the oxygen content after substituting nitrogen for helium, the nitrogen uptake can also be kept low. Workable gas switches depend on exposure and tissue compartment controlling ascent.

While light-to-heavy gas switches (such as helium to nitrogen) are safe and common practices, the reverse is not generally true. In fact, all heavy-to-light switches can be dangerous. In the former case, decreased tissue gas loading is a favorable circumstance following the switch. In the latter case, increased tissue gas loading can be disastrous. This is popularly termed the isobaric playoff.

Mixed gas diving dates back to the mid 1940s, but proof of principle diving experiments were carried out in the late 1950s. In 1945, Zetterstrom dove to 500fsw using hydrox and nitrox as a travel mix, but died of hypoxia and DCS when a tender hoisted him to the surface too soon. In 1959, Keller and Buhlmann devised a heliox schedule to 730 fsw with only 45 min of decompression. Then, in 1962, Keller and Small bounced to 1,000 fsw, but lost consciousness on the way up due to platform support errors. Small and another support diver, Whittaker, died as a result. In 1965, Workman published decompression Tables for nitrox and heliox, with the nitrox version evolving into USN Tables. At Duke University Medical Center, the 3 man team of Atlantis III made a record chamber dive to 2250 fsw on heliox, and Bennett found that 10% nitrogen added to the heliox eliminated high pressure nervous syndrome (HPNS).

Nice work, guys.

All the above properties favor helium for deep diving, but what do divers report after actually using helium?

Helium Vibes

Consensus among helium divers is that they feel better, less enervated, and subjectively healthier than when diving nitrogen mixtures. WKPP, LANL, and NAUI Technical Operations strongly attest to this fact. Though a personal and subjective evaluation, this remains very, very important. Physiological factors cannot be addressed on first principles always, and for some, just feeling better is good justification and works for many. Postdive deco stress on helium appears to be less than postdive nitrogen stress.

Another positive benny about helium diving scores the minimum-bends depth (MBD), that is, the saturation depth on a mix from which immediate ascension to the surface precipitates decompression sickness (DCS). For helium mixes, the MBD is always greater than that for proportionate nitrogen mix. For instance, the MBD for air (80/20 nitrox) is 33 fsw, while the MBD for 80/20 heliox is 38 fsw. This results from helium's lesser solubility compared to nitrogen as it affects deeper and longer diving.

And (coming up last) helium decompression is efficient and fast. In fact, many helium deco dives are not possible with nitrogen mixtures. That should give us all good vibes.

On most counts, helium appears superior to nitrogen as a diving gas. Helium bubbles are smaller, helium diffuses in and out of tissue and blood faster, helium is less narcotic, divers feel better when they leave the water after diving on helium, and helium MBDs are greater than nitrogen MBDs.

That, plus efficient and maybe less deco time, are strong endorsements. Great. But how does this translate into actual diving practice? Here's how.

Helium Staging

Helium NDLs are actually shorter than nitrogen for shallow exposures, as seen comparatively in Table 2 for 80/20 heliox and 80/20 nitrox (air). Reasons for this stem from kinetic versus solubility properties of helium and nitrogen, and go away as exposures extend beyond 150 fsw, and times extend beyond 40 min or so.

Table 2. Comparative Helium And Nitrogen No Decompression Limits

depth (fsw)	heliox (80/20) NDL (min)	nitrox (80/20) NDL (min)
30		
40	260	200
50	180	100
60	130	60
70	85	50
80	60	40
90	45	30
100	35	25
110	30	20
120	25	15
130	20	10
140	15	8
150	12	5
160	10	4
170	8	3

Helium ingasses and outgasses 2.7 times faster than nitrogen, but nitrogen is 1.5 to 3.3 times more soluble in body aqueous and lipid tissue than helium. For short exposures (bounce and shallow), the faster diffusion rate of helium is more important in gas buildup than solubility, and shorter NDLs than nitrogen result. For long bottom times (deco and extended range), the lesser solubility of helium is a dominant factor in gas buildup, and helium outperforms nitrogen for staging. Thus, deep implies helium bottom and stage gas. Said another way, transient diving favors nitrogen while steady state diving favors helium as a breathing gas.

In addition, modern decompression theory (like the RGBM) requires deep stops which do not fuel helium buildup as much as nitrogen in addressing both dissolved gas buildup and bubble growth. And helium deep stops, like nitrogen deep stops, usually couple to shorter and safer overall deco. Nice symbiosis, and just one more reason to use helium.

That is another topic, so suffice it to close here with a comparison of helium versus nitrogen deco profiles. These are not academic, they have been actually dived (WKPP, LANL, NAUI Tech Ops). Profiles were generated with the RGBM/ABYSS software package, Abysmal Diving, Boulder). RGBM staging is always deeper, but shorter overall, than Haldane staging with Buhlmann ZHL or Workman USN parameters.

The first is a comparison of enriched air and enriched heliair deco diving, with a switch to 80% oxygen at 20 fsw. Dive is100 fsw for 90 min, on EAN35 and EAH35/18 (nitrox 65/35 and tmix 35/18/47), so oxygen enrichment is the same. The deco profile (fairly light by tech standards, but manageable and easy for training purposes) is listed in Table 3. Descent and ascent rates are 75 fsw/min and 25 fsw/min.

Table 3. Enriched Air And Heliair Deco Profile Comparison

depth (fsw)	enriched heliair EAH35/18 stop time (min)	enriched air EAN35 stop time (min)
100	90	90
30	2	4
20	5	7
10	12	11
Total	119	122

Overall the enriched heliair deco schedule for the dive is shorter than for the enriched air. As the helium content goes up, the deco advantage for enriched heliair increases.

This may surprise you. Now check out corresponding USN or ZHL deco requirements for these dives. In the enriched heliair case, ZHL deco time is 39 min versus 19 min above, and in the enriched air case, ZHL deco time is 33 min versus 22 min above. This not only underscores helium versus nitrogen misfact in staging, but also points out significant differences in modern deco algorithms versus the Haldane stuff of some 40 - 100 years ago. Recall that Haldane staging only addresses dissolved gases, while modern models track both dissolved gases and bubbles in staging.

Ludicrous differences? Maybe not so bad since differences are on the safe side.

Lastly consider a deep trimix dive with multiple switches on the way up. Table 4 contrasts stop times for two gas choices at the 100 fsw switch. The dive is short, 10min at 400 fsw on 10/65/25 tmix, with switches at 235 fsw, 100 fsw, and 30 fsw. Descent and ascent rates are 75 fsw/min and 25 fsw/min.

See Table 4.

Table 4. Comparative Helium And Nitrogen Gas Switches

depth (fsw)	stop time (min) 10/65/25 tmix	stop time (min) 10/65/25 tmix
400	10.0	10.0
260	1.5	1.5
250	1.0	1.0
240	1.0	1.0
	18/50/32 tmix	18/50/32 tmix
230	0.5	0.5
220	0.5	0.5
210	0.5	0.5
200	0.5	0.5
190	1.0	1.0
180	1.5	1.5
170	1.5	1.0
160	1.5	1.5
150	1.5	2.0
140	2.0	1.5
130	2.0	2.5
120	4.0	4.0
110	4.5	4.0
	40/20/40 tmix	EAN40
100	2.5	2.0
90	2.5	2.0
80	2.5	2.0
70	5.0	4.0
60	6.5	5.5
50	8.0	6.5
40	9.5	7.5
	EAN80	EAN80
30	10.5	10.5
20	14.0	14.0
10	21.0	20.5
TDT	123.0	116.0

Obviously, there are many possibilities for switch depths, mixtures, and strategies. In the above comparison, the oxygen fractions were the same in all mixes, at all switches. Differences between a nitrogen or a helium based decompression strategy, even for this short exposure, are nominal. Such usually is the case when oxygen fraction is held constant in helium or nitrogen mixes at the switch.

Comparative calculations and experience seem to suggest that riding helium to the 70 fsw with a switch to EAN50 is good strategy, one that couples the benefits of well being on helium with minimal decompression time and stress following isobaric switch to nitrogen. Shallower switches to enriched air (EAN) also work, with only nominal increases in overall decompression time. Just a suggestion.

Helium Bottom Line

Helium has been a mainstay, of course, in commercial diving. But its emergence and use in the technical diving community has been more recent, within the past 10 years or so. Some of this is due to cost certainly. It's not cheap to dive helium. But a lot of it is due to misconception. The activities of a very knowledgeable and vocal technical diving community are changing both.

Bruce Wienke is a Program Manager in the Nuclear Weapons Technology/ Simulation And Computing Office at the Los Alamos National Laboratory (LANL), with interests in computational decompression and models, gas transport, and phase mechanics. He authored Technical Diving In Depth, Physics, Physiology And Decompression Theory For The Technical And Commercial Diver, High Altitude Diving, Basic Diving Physics And Applications, Diving Above Sea Level, Basic Decompression Theory And Application, and some 200 technical journal articles. Most importantly he writes for Advanced Diver Magazine.

Back plates -- Tools of the Trade

By Scott Carnahan

Back plates and harnesses are possibly some of the simplest pieces of technical diving equipment found in a technical diver's dive bag. Their purpose together is of great importance and has been accomplished through a simple and straightforward design that has lasted the test of time. Currently in the recreational diving market, there have been great changes in the design of the Buoyancy Control Devices (BCDs), but the technical diving harness system has prevailed as a necessary tool, kept simple, to meet the great demands placed upon the equipment by technical and cave divers. In addition to technical divers using these harness-style systems, there are open-water, single-tank divers enjoying the simplicity and long lasting ruggedness as well.

A back plate is the solid piece of aluminum, stainless steel, or ABS plastic that sits against the technical diver's back while diving. Back plates are held to the diver by a harness of nylon webbing. The importance of the back plate is that it allows divers a strong, secure and comfortable place to attach their tanks and to take the weight load of the generally heavy technical diving equipment. Back plates, no matter which material they are made from, are purchased pre-drilled in various locations to allow the quick attachment of tanks and heavy specialty items (some divers may attach battery canisters or argon bottles straight to their back plate). Some divers find that the predrilled holes do not match what they need; these divers may re-drill the back plates, being careful not to weaken the structural integrity of the unit. The greatest choice a diver must make is the type of material that they are going to use for their back plate. Stainless steel is more negatively buoyant than aluminum, while both are more negative than the ABS plastic version. The reason that one will choose one material over another depends on the environment, other equipment and personal choice of the diver.

The harness is the term that is used to describe the webbing (straps) that physically holds all of the equipment to the diver using it. The harness is generally two shoulder straps, a waistband and a crotch strap with an option of a chest strap. This harness is made from three-inch-wide webbing that surrounds the diver (much like backpackers pack) and is connected through the back plate. Different manufacturers have different harness designs depending on divers' needs, for varying sizes of people and for varying environmental conditions. To close the harness generally you will find a standard buckle like those found on weight belts of divers all over the world. Many accessory parts are needed to make a harness work in the diving environment, and these parts are generally included when you purchase your equipment.

One very important piece added to the webbing are some stainless steel D-rings. D-rings are moveable half circles of metal placed on the shoulder straps, waistband and possibly on the crotch strap. These rings are added to enable the attachment of necessary additional tools such as reels, stage bottles, lights, scooters, or slates to name a few. D-rings are also used to assist in the streamlining of items such as pressure gauges and low-pressure inflator hoses. The proper placement and spacing of D-rings allows technical divers to keep equipment close, streamlined and easy to access and inspect. In addition to standard D-rings many divers add a small pouch (for smaller items) to their harness waist strap. Manufacturers may also add a quick release clip to one of the shoulder straps, which can make removal of equipment easier at the cost of adding a failure point to the entire system. More is not necessarily better when you are adding to your harness system. Keep in mind that there are simple and effective ways to achieve a comfortable and effective harness/back plate system.

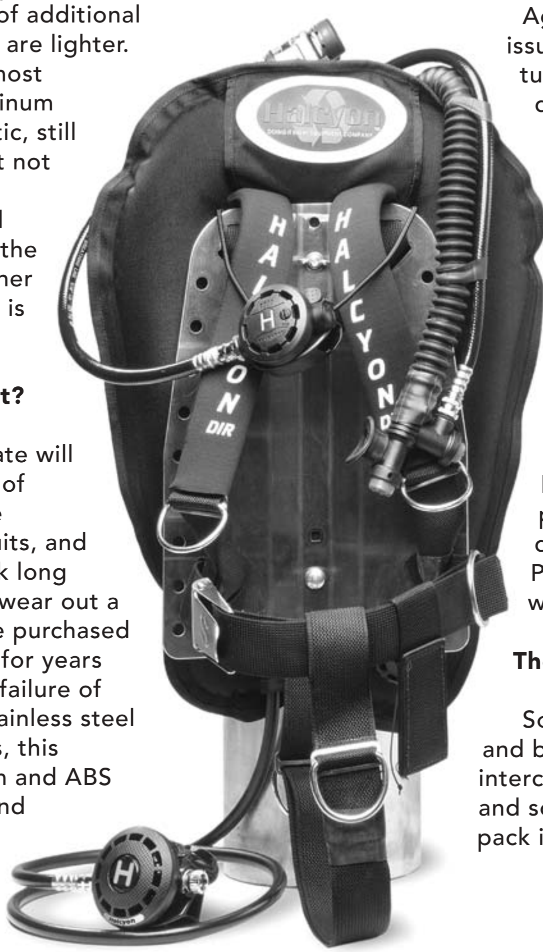
Once a technical diver assembles their harness together with the back plate it stays as a unit and rarely do most divers make any changes to the now complete system. With this now complete harness / back plate unit a diver has everything he or she needs to connect the diving equipment to his or her self. (Note that the diver is still missing a flotation device.)

Remember that this is literally the backbone of the equipment a technical diver will use; it is the direct contact point to the diver and bears the majority of the weight.

Commonly Asked Questions

Why are back plates made of different materials?

Back plates are made of different types of metals and plastics for a number of reasons, but the primary reason depends on the diver's need. Divers that need more negative buoyancy (those diving in dry suits in salt water) will choose a heavy plate where those diving without the need of additional weight will choose those which are lighter. Steel back plates provide the most negative buoyancy (sink). Aluminum plates are more rigid than plastic, still provide negative buoyancy, but not that of stainless. All back plate materials provide the structural support needed to accomplish the connection to the tanks and other devices but the buoyancy issue is the most important difference.



How long will a back plate last?

A technical diver's back plate will outlast most every other piece of equipment in the dive bag. The harnesses, wings, masks, wetsuits, and pockets will wear out and break long before you will bend, break or wear out a stainless steel back plate. Once purchased these plates will remain usable for years and years without a worry of a failure of any kind. (As a note, if using stainless steel wing nuts and bolts on doubles, this material will wear out aluminum and ABS plates if a diver is not careful and doesn't use washers.)

So which manufacturer makes the best back plate?

Most back plates are very similar in design. Weight is the biggest factor with the price being more than likely the second factor. A diver's first back plate is generally bought in combination with a harness and possibly a wing. This package is where one is more than likely to get the best price. Almost all of the back plates on the market today are interchangeable with wings of various manufacturers, so there is not a requirement (other than financial) to purchase everything in a package from one company. You can purchase a back plate without the harness and other accessories as well.

So what are the differences between back plates?

Again negative buoyancy becomes an issue, but of course with any manufactured product one should look for quality. Quality craftsmanship as it pertains to a good finish, clean drilling, smooth edges and service will lead the diver to the best back plate. Depending on the way the harness was meant to lace through it, there is a difference in the way back plates are made. Some back plates are designed to have the harness cross behind the neck; others come straight over the shoulders, while some can go both ways. This difference will need to be experimented with and is a personal preference either way. No design is correct or incorrect. Personal comfort should dictate which way one a diver chooses.

Then what are soft packs?

Soft packs take the place of the harness and back plate combination and are interchangeable to work with your wings and some other technical equipment. A soft pack is a system that does not use a solid

back plate or the same webbing system as a standard harness. The purpose here is not to talk overly much about these types of systems, but they do exist and they are worth some divers looking into. Generally, one does not have the variety of options and changes one can make when using soft packs, but they work well for a certain number of jobs. Soft packs will be a topic on their own in a future article.

In the end, all back plates currently available on the market do the exact same job, provide similar comfort and are simple in design. Therefore, don't be too concerned with the brand name. There will always be the perfect tool for the job, but divers diving in a number of different environments may have to have more than one back plate or choose a way to make one work in all of the environments. Back plates are the least complicated piece of equipment you will need in technical and cave diving, but a certain degree of thought is required before you purchase a unit.

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DPlan

Portable Decompression Software for the Palm

On a boat, in the woods or on the side of a mountain... GUE's DPlan software for PalmOS devices allows divers to compute decompression profiles with greater convenience and portability.

By Curt Bowen

Basic Features

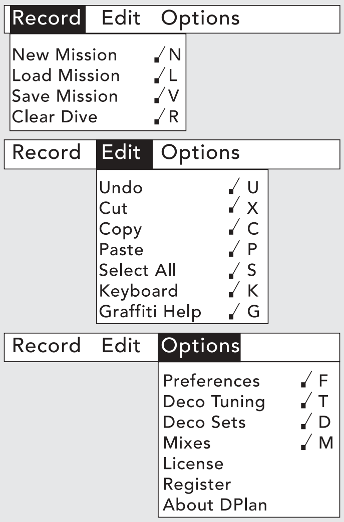
DPlan is fully functional decompression software, based primarily on models published by Albert A. Bühlmann M.D, and includes the following features:

- ZHL-16B (1b)
- Gradient Factors
- Metric or Imperial scales
- Altitude calculations
- Range plans
- Repetitive dives
- Easy access to standardized dive and deco mixes

DPlan requires PalmOS 2.0 or a later version to run.

Menus and General Info

DPlan provides three menus that are accessed by tapping the menu icon in the lower-left corner of the silk-screened part of the display. Alternately, recent versions of PalmOS also allow you to access menus by tapping the title area of the application.



Record accesses features that allow you to save and manipulate multiple dive missions.

Edit is a standard PalmOS menu that is helpful when entering text.

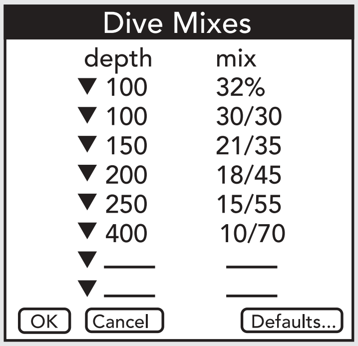
Options allows you to configure various features of the program and to access information about the program. As with all Palm applications, shortcuts are provided to reduce the number of taps necessary to activate all commonly-used menu options. Users familiar with Graffiti will find this to be a time saver, but new users can still access all available features through the menus themselves.

Registration

Your registration key will be provided by GUE when you purchase DPlan. It is linked to your HotSync ID. Registering is required for the software to work and to allow you access to upgrades.

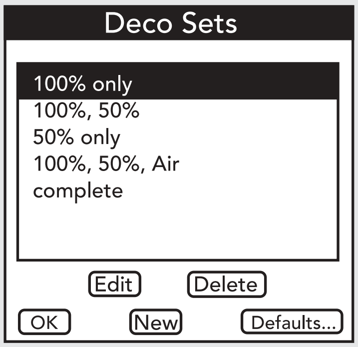
Mix Definitions

You may select up to eight depth/mix combinations. This list of gases will populate the pull-downs on the dive entry screen and is referenced if you have Autopick enabled in the preferences. The default settings match the current GUE gas recommendations at the time of this release of DPlan.



Deco Sets

You may select or change up to eight deco set combinations. These sets can be



quickly accessed through the pull-up menu for each planned dive. Defaults will return the list of deco sets to its original setup.

Deco Tuning

Deco Tuning

Imperial | Metric

GF% Low: 30
GF% High: 85
Altitude:▼ (ft)
Descent:▼ continuous
Ascent Rate: 33 (ft/min)
Descent Rate: 99 (ft/min)

OK | Cancel | Defaults...

Pressing the small "i" button on the top of the Deco Tuning window will bring up a screen with tips on using Deco Tuning and on the meaning of some of your choices.

- Imperial or metric
- Gradient Factor
- Percentages GF percent low & GF percent high

* Altitude
* Ascent Rate
* Descent Rate

Preferences

Preferences

Autopick Mixes: enabled
Range Plan: enabled
Final Stop: 10 ft
Dive SAC: 0.6 (cf/min)
Deco SAC: 0.4 (cf/min)
Bailout Time: 5 (min)
Min Switch Stop: ..... (min)

OK | Cancel | Defaults...

Pressing the small "i" button on the top of the Preferences window will bring up a screen with tips on setting Preferences and on the meaning of some of your choices.

Autopick Mixes Enabled or Disabled.
Range Plan Enabled or Disabled.
Final stop value of either 10 or 20 feet.
Dive SAC rate or the Deco SAC rate.

Plan a Dive

DPlan

Mission: Eagles Nest

#	depth	time	mix
1.	130	5	30%
2.	275	25	15/48

Add | Del | Plan   100-50-30

A mission is a series of one or more dives. On your first use of DPlan you will be in a New Mission. Subsequently, when you enter DPlan you will see your last mission.

Your mission is initially untitled.

Pull-down menus appear for Depth, Time, and Mix for segment #1. The segment number indicates the portion of the multilevel dive that you are currently planning. You may enter the depth, time, or mix by using the pull-downs or by entering your own value. When selecting depth via the pull-down, when Autopick is enabled, the mix for that segment will be automatically selected from the list of mixes you entered in the Dive Mixes form. You may override the Autopicked mix by using the mix pull-down or by entering your own value manually. Enter your expected dive time by using either the pull-down menu values or entering your own value.

You can enable the deco set that applies to your dive by accessing the Deco Set pull downs in the bottom right hand corner of the screen. On the initial opening of DPlan, the default deco gas is the active back gas. You can then choose an appropriate deco mix using the pull-downs accessed through the small arrow to the left of the sets. You can modify the deco sets through the Preferences menu. The Add button allows you to add additional segments to your dive.

DPlan

Mission: Eagles Nest

fsw	min	run	mix	PO2
130	5	5	30%	1.5!
275	25	30	15/48	1.4
160	2	35	15/48	0.9
150	1	36	15/48	0.8
140	2	38	15/48	0.8
130	1	39	30%	1.5
120	1	40	30%	1.4
110	2	42	30%	1.3

Report | Redo Deco | Add Dive

Now you can press the Plan button to compute your deco. A Processing window will open and display the progress of computing the deco calculation. This window will close when it is completed and your deco plan will be displayed.

If the dive requires more than nine stops including your bottom time, the additional stops can be accessed through the scroll bar on the right or through the handheld's scroll buttons. If you have entered a gas that will cause you to exceed the PO2 limits, you will be alerted with an exclamation point next to the offending PO2.

You can access further information about your dive by pressing the Report button. Press Redo Deco to modify your dive parameters on the Mission Planning screen. Press Add Dive to plan a repetitive dive.

Dive Report

Dive Report

Times
Dive: 30
Deco: 99
Total: 129

Dive Max
PO2: 1.5!
END: 130

Deco Max
PO2: 1.6
END: 130!
Stop: 210

Params
GF%: 30-85

Gas Used (cf)
30%: 32
15/48: 151
50% 32
100% 25

OK

The Dive Report window provides a summary of key information regarding the dive.

Under Times you will find a summary of the total bottom time, total deco time and total dive time. All times are in minutes.

Beneath Dive Max there is a display of the highest PO2 reached during the dive, excluding the decompression portion of the dive. The highest END (Equivalent Narcosis Depth) of the dive is also displayed. This value assumes that both oxygen and nitrogen are similarly narcotic.

Deco Max will indicate these values for the decompression portion of the dive. The value for Stop is the "deepest possible stop," the point in the ascent where the leading compartment begins off-gassing.

In the two sections above, PO2s are in units of atmospheres absolute (ata) and END and Stop are displayed in feet or meters of salt water. If the inspired PO2 exceeds 1.4ata or if the END exceeds 100ft at any point during the dive, an exclamation point will appear in the report to indicate the violation. Similarly, violations are reported in the deco portion of the dive above a PO2 of 1.6ata or an END of 120ft.

Under Params you will find the display of the Gradient Factors (GF) you established in the Deco Tuning. These are the GF percentages used when planning this dive.

Gas Used shows a summary of each gas used during the dive, including deco gas. These are based on the SAC rates you established in the Preferences. These are displayed in units of cu-ft/min or liters/min.

Repetitive Dives

After planning your initial dive, use the Add Dive button to plan a repetitive dive.

Multilevel Dives

The segments in each dive may be used for planning multilevel dives. Each segment can have a different depth and time and gas mixture. This might be used when there are points of interest at different depths or when the profile of the dive environment requires depth changes during the dive, for example, in a cave system where the depth changes in different sections of the cave. When planning a dive, you may add segments to or delete segments from the end of the list by tapping the Add or Del buttons.

The Meaning of Time

DPlan divides the dives into three phases: bottom time, initial ascent and decompression. In each phase, the underlying algorithm computes fractional times that would be a little confusing if they were to be presented directly, so DPlan (like most decompression software) rounds these values to whole minutes as described below.

Bottom Time

DPlan defaults to a "continuous" descent at 99ftmin, which means that it applies the Shreiner equation to compute compartment loading that occurs over the 1.5 minutes it takes to descend. This descent time is included in the bottom time. DPlan then uses the standard Haldane equation to compute 38.5 minutes at a constant depth of 150 ft. Alternately, if the user would have opted for an "immediate" descent, the Shreiner equation would not have been applied and the full 40.0 min would have been computed at 150. The effect of this would generally be to increase compartment loading somewhat.

Initial Ascent

DPlan computes the ascent to the first decompression stop. This isn't quite as simple as computing the "ceiling," since the compartments would continue to ongas and offgas during the ascent, which can shift the ceiling either up or down depending on the particulars of the dive. Thus, DPlan ascends at a default of 33 ft/min in increments of 10 ft, looking for the first deco stop.

Decompression

DPlan's deco calculations are based around run time. As such, the first deco stop is fractional, rounded up in length to make the run time at the end of the first stop be a whole number of minutes. Deco stops are in whole minutes and never less than a minute.

Algorithm Details

All pressure calculations in DPlan are done in units of either fsw or msw.

DPlan implements ZHL-16B, with the "1b" values for the first compartment. Dry air is assumed to have 79 percent N2. DPlan uses a respiratory quotient of 0.9, because it falls in the middle of commonly used values ranging from 0.7 to 1.0. This results in a reduction of alveolar pressure by 1.848fsw (0.567msw) from ambient pressure. (Bühlmann was somewhat less conservative with a value of 1.0).

Repetitive Dives

DPlan computes compartment off-gassing during a surface interval using a simple Haldane (constant-depth) formula. It's no different than a segment of the dive, except that it's 79 percent N2 breathed at the surface pressure.

There is definitely more to conducting repetitive dives than the dissolved gas models can explain. Bubble models like VPM and RGBM may do a better job with this, but it's still pretty early to tell. Clearly in repetitive diving it becomes even more important than usual to avoid pushing the M-values during the ascent (by doing deep stops) and to slow the ascent (especially the final ascent to the surface) -- not only on the repeat dive, but on the previous dive.

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Interview with Cave Explorer Martyn Farr
Continued from page 41

- **How (or what led you to) make your living through cave diving. What makes your teaching style different from a typical U.S. cave diving course?**

From the very beginning I always wanted to be an explorer, but everyone always said that caving and cave diving would never be able to sustain a person financially. So I chose to teach, at first in schools (which presented generous holidays!) and later in a specialist outdoor education center. I feel at one (at peace) in the outdoors, but throughout my career working in education, I always aspired to being a professional caver and cave diver. So, starting in 1975, I started taking photographs (I purchased my first Nikonos in California in 1975) and writing books. Then, in 1997, I set up my cave diving training business, named Farrworld (**www.Farrworld.co.uk**). As you can imagine, environmental conditions for divers in Britain are quite different than to that of Florida. I think it is true to say that if divers can achieve competence in the cold, murky waters and frequently restricted sites so typical of the UK, then they are fit to dive just about anywhere else in the world with safety and confidence.

What makes my courses so different from others is that I instruct overhead environment diving from a generic basis. First and foremost, I am training for the British and European environment, but I believe that all divers must be given the global perspective. They need to know how things differ in other regions, as British divers travel extensively. They will understand that 25 degree (77 F) warm cenote water is bliss, but they need to respect different environments every bit as much as the adverse cave diving in UK, because there are other, less obvious, factors involved. In Mexico, for example, one can dive for kilometres in a shallow, clear water tunnel, but the complexity of the tunnel and potential for silting can be considerable. It all comes back to personal attitude and a healthy respect for the environment.

- **I have read most of your books. They have a vast amount of historical information about not only diving in England and the rest of the world, but on the history of the land as well. What led you to decide to begin writing cave diving books and what were the main obstacles in publishing?**

I decided to write the book subsequently entitled The Darkness Beckons in 1974 purely because of the incredible feats and the amazing adventures that had taken place. At that point in time I was training to become a teacher, but the primary intention was to tell a good story. Implicit in the subject matter is the whole psychology of the sport and pointers to good practice. The manuscript was rejected by a couple of publishers as being too specialized, but eventually the book found its niche with Diadem Books (today Baton Wicks) and the first edition appeared in print in 1980. The second edition appeared in 1991 and was soon acclaimed worldwide as the definitive book on the subject matter.

At present I am preparing something more along the lines of a cave diving manual, a basic global introduction to the subject. This outlines the variety of approaches that might be adopted, depending, of course, upon the environment being dived. So between the training, photography, writing, lectures and exploration there's never a dull moment!

For more information on any of Martyn's books, courses, or photos, please visit his web site at **www.farrworld.co.uk.**

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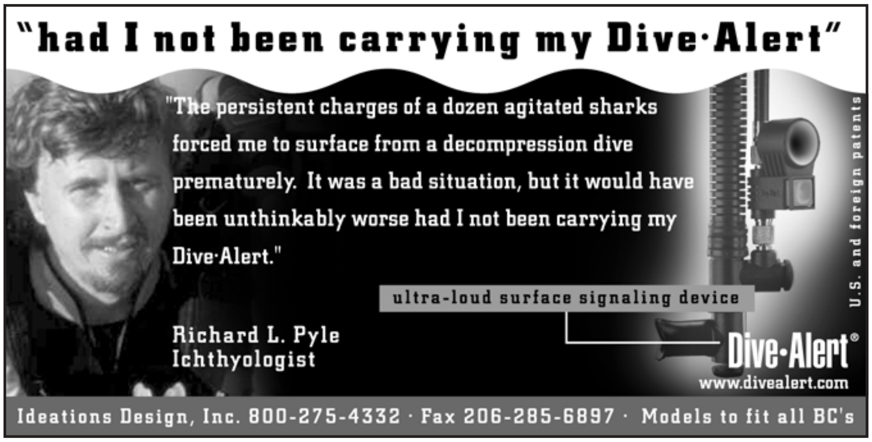


By Robert and Jan Underhill

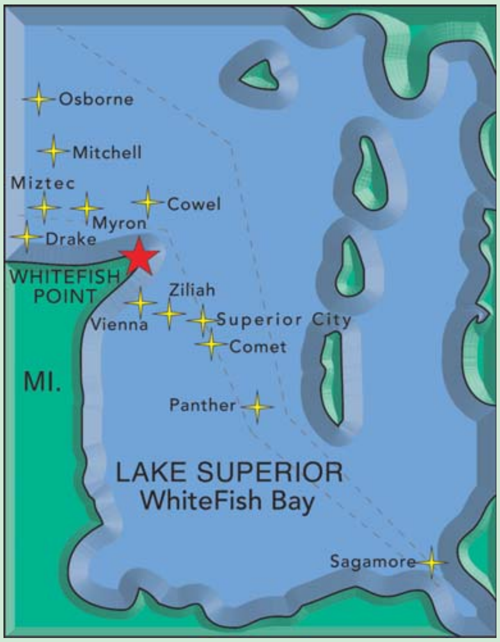
The Steam Barges of Whitefish Point

The steam barge occupies a short chapter in the history of Great Lakes shipping. Designed to carry grain or iron ore, it sailed for a short period of time between the era of bulk, cargo-carrying lake schooners and the steel lake freighters still used today.

Before the steam barge, lake schooners almost exclusively carried bulk cargo. The large deck hatches of the schooner were better suited to loading and unloading bulk material. The typical passenger steamer, with upper cabins, required cargo to be loaded through the side of the ship.

The first steam barge, the R. J. Hackett, was built by Eli Peck of Cleveland in 1869. The Hackett was a wooden vessel, 211 feet long, with the pilothouse forward, single engine aft driving a single propeller and a long open deck with large hatches spaced to match for unloading machinery then in use at the ore docks along the Lakes. The ship also carried three masts with a cut down lower sailing rig (no topsails) as used on the schooner barges towed behind steamers on the Lakes during the late 1800s.

In 1882, the Globe Iron Works of Cleveland launched the Onoko, the first steam barge with an iron hull. By 1886, Globe Iron Works also launched the first steel-Sault Locks -- which connects to the Saint Mary's River and the Lower Lakes. Whitefish Point is now designated as one of Michigan's underwater shipwreck preserves. No artifact collecting is allowed. Of the approximately 16 shipwrecks in the preserve, three of them are steam barges, probably the largest concentration of this rare vessel type in the Great Lakes.



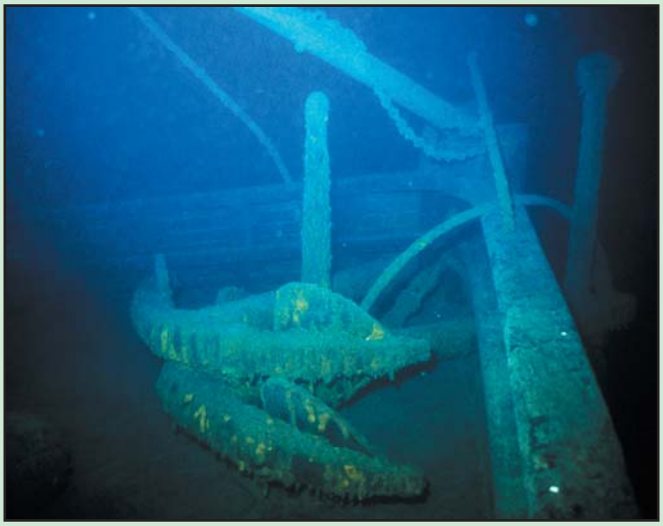
The Vienna

Quale & Martin of Cleveland built the 191-foot-long Vienna in 1887. The up bound steamer Nipigon, under clear conditions, struck the down bound ship on September 16, 1892. Both Vienna and Nipigon were towing barges at the time of the collision. Tow lines to the barges were dropped and the Nipigon attempted to beach the sinking Vienna. The effort fell about a mile short of the shore, with Vienna sinking in about 145 feet of water just south of Whitefish Point.

The shipwreck was discovered in 1974. Because of its location only a mile from the harbor of refuge at Whitefish Point, it is the most visited shipwreck in the Whitefish Point Underwater Preserve. Because the wreck was discovered before the current era of shipwreck preservation, many of the artifacts have been removed. Thankfully, some of them are now on display at the Shipwreck Museum at Whitefish Point. The museum has ship models and displays artifacts from every wreck in the area. One of the more impressive displays is the carved wooden pilothouse eagle from the Vienna. With some of the gold paint still on its wings, the eagle is on display just inside the door of the museum.

The Vienna is an excellent dive. The main hull is intact up to the bow, which is split open allowing the deck to collapse into the first level of the hold. Dropping into the sand at the starboard side of the bow, a diver can find the remains of the octagon pilothouse next to the forward mast. The forward anchor locker has the main deck collapsed into it. The anchors were salvaged in the '70s. Aft of the bow area, the main hull is intact. Divers discovered one of the lifeboats out in the sand a few years ago, and placed it on the main deck next to the broken stump of one of the masts. The area around the engine and boiler are open, but it is possible to squeeze into a couple of small storage rooms aft behind the engine. The back cabins are gone with a large portion of the hull open above the crew area. The remains of the privy, a capstan, and the large towing bit (used to tow one or two loaded barges) can be seen in this area. Below the stern is the rudder, propeller and load marks still visible after 110 years underwater.

The John M. Osborne



Osborne Bow: Twin anchors stowed on the foredeck. Stocks are outside the hull and their chains lead to a locker in the bow, one deck below.

The 178 foot John M. Osborne, hull number 76307, was built in 1882 in Marine City. Down bound with a load of iron ore, the Osborne was struck from behind by the steel steamer Alberta on the evening of July 27, 1884, while traveling in fog. The Osborne was towing two barges at the time of the collision. A passenger aboard the Alberta was lost with two of the Osborne's crew when he tried to save them from the fire hold, where they were trapped.

The Osborne was located about eight miles from Whitefish Point in Lake Superior in 1984. The ship rests upright in 160 feet of water, with a little over 170 feet of depth possible inside on the keel. The collision left one-third of the wreck broken up. The upper deck and cabins are gone, leaving the engine deck and engine open. The engine is quite interesting, with a wood water jacket and main steam line insulation. The painted red base with white graphic decorations is intact after almost 120 years underwater. The boiler has unshipped its original location, now lying aft of the engine on the starboard side. The propeller and structure at this end are heavily damaged.

Forward of the engine area, the Osborne is intact. Masts are draped over the deck and over the side. Much of the rigging and ratlines are still bolted to the side of the hull. At the bow, the capstan has collapsed on deck, but the twin anchors with handling equipment are still in place.

Osborn Below Deck: A small stove mounted in the crews quarters below deck just aft of the chain locker in the bow.

Below the forward deck area, a small stove still remains bolted in the crew area. Forward is the anchor room with a large chock for stopping chain. Equipment blocks are found still hanging from hooks on the side of the hull.

The Samuel Mather

Protected by the cold, clean water of Whitefish Bay, the 246-foot-long shipwreck of the Samuel Mather is the largest, deepest, most preserved steam barge in the Underwater Preserve. Upright in 180 feet of water off Ile Parisienne with two of its three masts still standing -- one reaching to within 90 feet of the surface -- the Mather is probably the favorite wreck dive among regular divers in the area.

Within seconds after the Nipigon's bow cut deep into the Vienna's forward port side, icy cold water flooded her forward holds causing the Vienna's bow to sink first. Like a torpedo the vienna's bow struck the lake bottom causing her pilot house and much of her forward rigging to be thrown onto the lake floor in front of the ship. This impact was so great that the bows decking was actually ripped free from the haul and now lies completely separated.

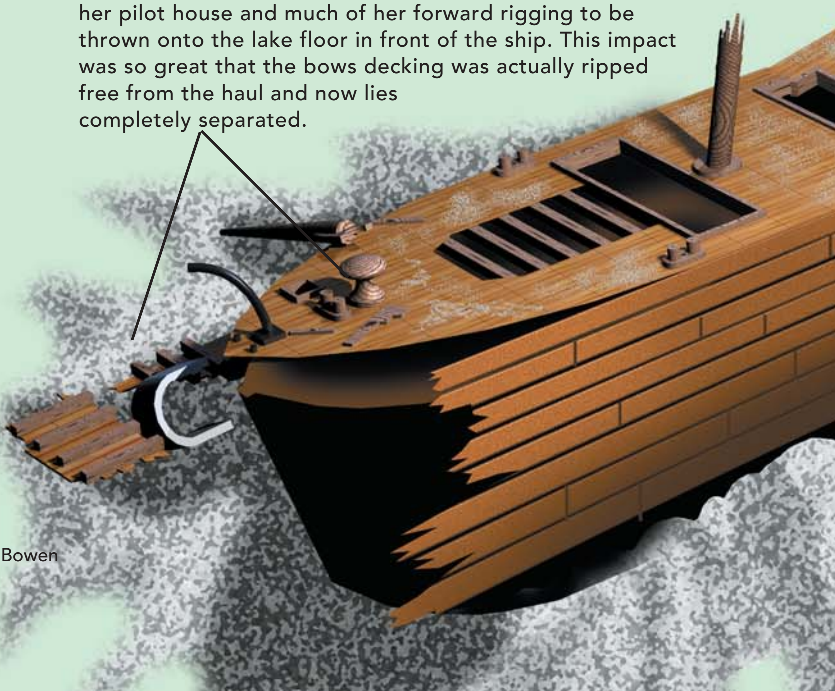


Illustration: Curt Bowen

Mather Deck: An intact mid mast on the main deck. Some paint is still on the base of the mast and fife rail.

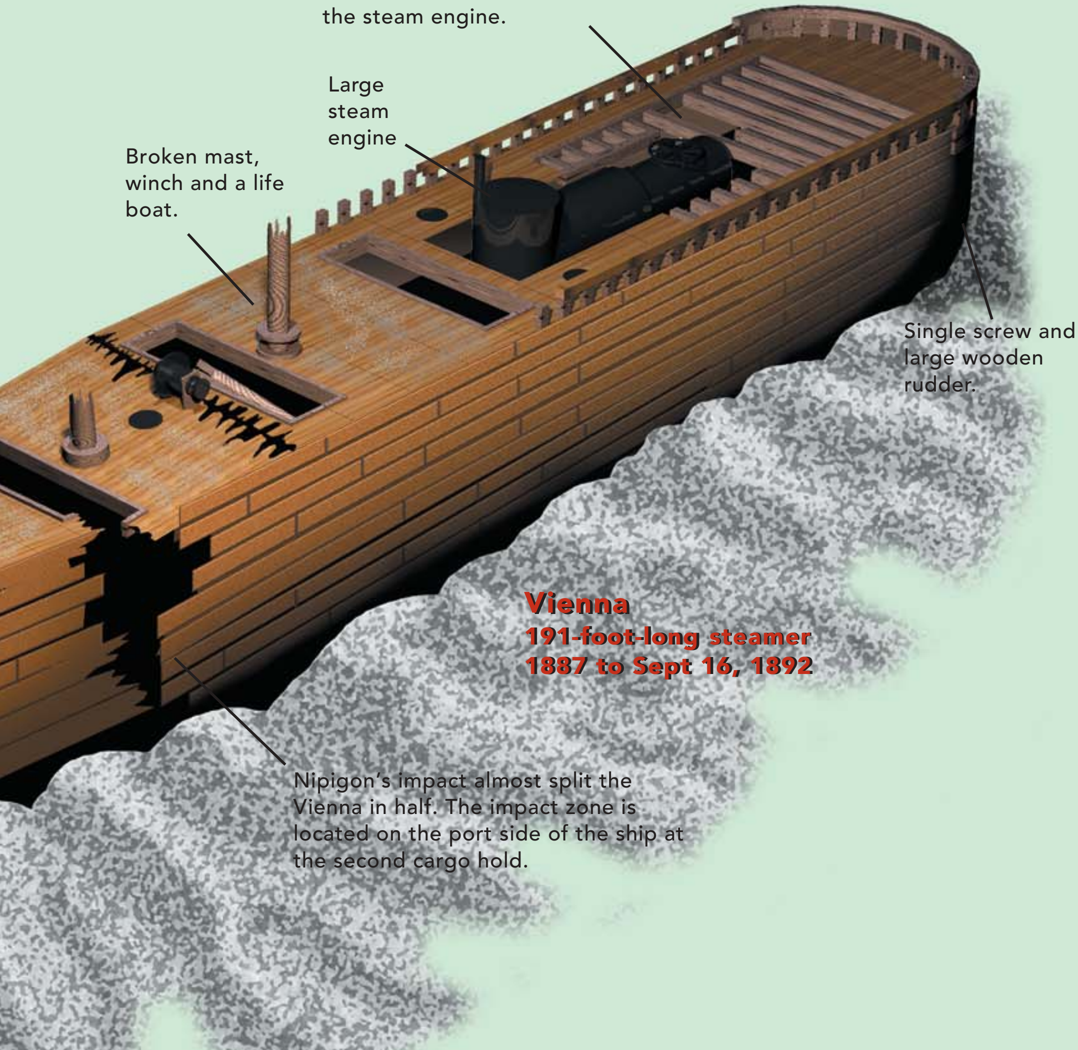
Built in 1887 in Cleveland, the ship was struck near the bow on the starboard side by the steamer Brazil on the foggy night of November 22, 1891. All hands were rescued and taken aboard the Brazil. Tom Farnquist, Executive Director of the Great Lakes Shipwreck Historical Society, discovered the wreck in 1978. Many of the artifacts were removed and are on display at the Shipwreck Museum at Whitefish Point.

The wreck is about a 17-mile run down Whitefish Bay from the harbor at the point. Any wind from the South tends to put a nasty chop on the bay. Charter boats generally will only make the run in good weather. Because the shipwreck lies directly in the shipping lane, keeping a mooring on the wreck is difficult. It is not unusual to make the long run only to find the buoy missing. Clearing these hurdles rewards a diver with one of the best wreck dives in the Great Lakes. The aft cabin area is mostly intact -- a rare find on any wooden steamer shipwrecked over 110 years ago. The mooring is often tied to a boiler vent on the cabin roof.

Dropping on a clear day, a diver can see the tip of the aft mast at 90 feet. Continuing down, one will see the cabin roof with a water tank funnel opening and an intact vent. The stack toppled onto the deck just forward of the cabins. Two of the standing masts, one with rigging still attached, have some of the paint still visible around the fife rails and base. The cargo hatches lead to the typical double bottom cargo hold, which could carry packaged freight as well as bulk cargo. The bow area is damaged from the collision. It has two unusual folding navy-type anchors. The bow mast is not standing and hangs over the port rail.

Whitefish Wreck GPS #s

Wreck	Type	Depth	Latitude	Longitude
Alex Nimick	Steamer	D-20ft	N 46°45.82	W 085°13,00
Comet	Steamer	D-240ft	N 46°43.04	W 085° 51.98
Edmund Fitzgerald	Steamer	D-535ft	N 46° 59.06	W 085° 06.06
Eureka	Schooner	D-50ft	N 46° 50.08	W 085° 10.80
Indiana	Steamer	D-116ft	N 46° 48.66	W 085° 01.60
John B. Cowle	Steamer	D-220ft	N 46° 48.29	W 084° 57.84
John Mitchell	Steamer	D-150ft	N 46° 50.05	W 085° 04.81
John M. Osborne	Steamer	D-180ft	N 46° 52.06	W 085° 05.15
Miztec	Steamer	D-50ft	N 46° 48.19	W 085° 04.43
M.M. Drake	Steamer	D-50ft	N 46° 46.75	W 085° 05.87
Myron	Steamer	D-55ft	N 46° 48.60	W 085° 01.60
Niagra	Steamer	D-120ft	N 46° 49.31	W 085° 07.45
Panther	Steamer	D-100ft	N 46° 38.40	W 084° 48.29
Sadie Thompson	Barge	D-115ft	N 46° 42.55	W 085° 59.83
Sagamore	Whaleback	D-70ft	N 46° 31.27	W 084° 37.78
Samuel Mather	Steamer	D-180ft	N 46° 34.32	W 084° 42.26
Superior City	Steamer	D-268ft	N 46° 43.45	W 084°52.41
Vienna	Steamer	D-146ft	N 46° 44.46	W 084° 57.91
Zillah	Steamer	D-250ft	N 46° 42.60	W 085° 59.81



Back on the main deck alongside the cabin area, turned posts rise from the rail supporting a full roof over the deck. At the rear deck is a large Samson post used for towing barges. It is possible to enter the crew area in the stern through an open hatch on the outside of the hull just below deck level on the starboard side. Inside is a double stairway leading to the main deck above. The opening is now covered by the partial collapse of the roof over the rear deck. The crew area is aft. Forward is the engine room, with control levers mounted on the starboard side. The gauge panel was removed and is on display in the museum.

All three of these vessels lived during the short time when technology was swiftly changing transportation on the Lakes. As they lived and died, Lake Freighters would lose sails, hulls would become steel instead of wood and electric running lights would replace the oil lamp. Sailing during the most dangerous time of transportation on the Lakes due to the heavily-traveled approach of the Sault Locks and St. Mary's River, it is not surprising that these three steam barges sank within 20 miles of each other. The cold, clear waters of Lake Superior and Whitefish Bay provide a unique opportunity for divers to discover an era when America was just beginning to feel its power as an industrial nation.

www.GreatlakesUnderwater.com

Above: Vienna Below Deck, The rear capstan in the area of the aft towing post one deck below the main hatch deck.

Left: Mather, The aft deck, starboard side, next to the boiler house.

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Canada's Barkley Sound

A Photographer's Paradise

Story and Photos By John Rawlings

In mid to late summer of 1787 (the exact date is lost), Captain Charles William Barkley sailed into a huge, previously undocumented sound on the west coast of what is now Vancouver Island, British Columbia, in search of Sea Otter pelts. Although British, Barkley was sailing under the Austrian flag as a ruse in order to trade for furs in the area, despite the fact that he had no legal authorization to do so from the East India and South Seas Companies. He had been successfully trading for furs in Nootka Sound, further north, when the discovery of his subterfuge caused him to sail southward in an attempt to avoid problems with other captains and ships that were legally trading there. Finding the new area to be rich in both furs and timber, the Captain chose to name it "Barkley's Sound" after himself and named numerous bays, coves, islands and peaks within it after family members and members of his crew as well. Thinking only in terms of the financial aspects of the fur-trade and able to see only what was visible on the surface of the sound, Barkley and his crew were completely unaware of the true treasures that would someday be found beneath its deep, green waters.

Today, Barkley Sound is a cold-water dive destination that, in beauty, rivals that of any location on Earth. Numerous pinnacles and rocky reefs grace the bottom of the sound -- each of them literally enshrouded in color and an abundance of life both large and small. Within seconds of arrival on the bottom, a photographer realizes that the problem lies not in finding subjects to photograph, but in fact lies in the need to be selective due to the sheer quantity of photo opportunities available.

At the beginning of June, 2002, I traveled to Barkley Sound as part of a group of 10 friends, the majority of whom were underwater photographers. Only a few in the group had been to Barkley Sound before, and they had convinced the rest of us to sign on with tales of wonderful marine vistas and superb conditions for both wide-angle and macro photography. Traveling northward from the Seattle area, we crossed the Canadian border and caught one of the huge ferries between the cities of Vancouver on the mainland and Nanaimo on Vancouver Island. From there we drove to the logging and fishing town of Port Alberni at the head of the long saltwater Alberni Inlet. It was at Port Alberni that our host, Dave Christie of Rendezvous Dive Ventures, Ltd., collected us for our trip into Barkley Sound. As Dave pointed the bow of the boat up Alberni Inlet and westward toward Barkley Sound, the signs of human occupation and activity were left behind and we began to get a sense of the marvelous isolation that awaited us.

Steep walls covered in dense Fir trees climbed toward the sky from the shore and cold green waters of the inlet as we motored along, entertained by Dave's stories about the sound told in a deep Scottish brogue. Bald Eagles cruised overhead, constantly watching for fishing opportunities in waters that at the time held a large run of Sockeye Salmon surging in from the Pacific. Hours after our departure we finally turned into a spot known as Rainy Bay and caught our first glimpse of Rendezvous Lodge, which would be our "home away

Left: The grasping tentacles of a gold and crimson Fish-eating Anemone (Urticina piscavora) swirl in the current in anticipation of its next meal.

Left: A Nudibranch (Flabellina sp.) glides over the underwater terrain of one of Barkley Sound's many rocky reefs.

Below: Its prey immobilized, a Giant Pacific Octopus (Enteroctopus dofleini) dines on a Leather Star, (See the arm protruding at bottom center).

from home" for the next few days. Built lovingly by hand, picturesque in its isolation and surrounded by seemingly unending miles of wilderness, the lodge would prove to be a fitting location to return to each day after we had tasted the colorful and wild underwater wonders of Barkley Sound.

The next morning our first dive found us at a site known as Kyen Point -- two rocky pinnacles with a small "valley" in between them. Visibility proved to be around 30 feet and as my buddy, Steve Martino, and I dropped down into the chilly emerald waters (47 degrees at depth) we grinned into our mouthpieces as the puffy white clouds of giant Plumose Anemones literally burst into view. The rest of the team scattered in all directions, each seeking subjects to record forever on film. Both Steve and I had set up our systems for macro, and it wasn't long before we stumbled upon the "mother-load" -- a huge wall covered with gorgeous, tiny "Strawberry" Anemones. Delicate and as bright red as their namesake, Strawberry Anemones make beautiful subjects all by themselves, but as an added benefit they attract a host of other tiny creatures custom made by God for the macro photographer. The majority of our film was shot on this dive within a 20-foot radius, yet we both surfaced with wide grins on our faces. The others arrived at the stern of the boat with tales of Octopus, Wolf-Eels, monster Ling Cod and stunning numbers of Rockfish, Greenling and Anemones of all hues and stripes. My first dive in Barkley Sound had produced memories that will remain forever embedded in my mind.

Over the next few days the experience only got better as we experienced many other dive sites, each with its own unique personality and photographic offerings. My favorite location, however, proved to be a rocky reef that Dave had named after his charming wife, Renate. "Renate's Reef" proved, like her, to be a classic. Nowhere have I seen more color and more life of all shapes and sizes - fluorescent pink algae enshrouded the rocks and was in turn covered with layer upon layer of hydrocorals, sponges, snails, urchins, tunicates and hundreds of anemones of all shapes, colors and sizes. Naturally curious, hoards of Rockfish of various species darted in and out of the openings in the rock and between the stalks of the largest anemones, the beautiful black and yellow China Rockfish being especially colorful and a popular subject for photography. Massive predatory Sunflower Stars stalked their way across the seascape, sending smaller creatures in waves in front of them as they scurried to escape the grasp of the multi-armed hunters. On this dive I happened to be diving with another photographer, Dennus Baum, and together we

Above: The colorful living "Artist's Drop Cloth" that is Renate's Reef.

Below: One of the many color variations of the Scalyhead Sculpin (Artedius harringtoni).

came across a female Wolf-Eel coiled on the bottom. At our appearance, she turned and swam across the rocky reef with Dennus on one side and I on the other, hastily snapping pictures as her long sinewy body flowed toward a hidden sanctuary beneath an outcrop. As she disappeared beneath the rock, I turned to make my way toward the anchor line only to have two other members of our team beckon me over to a small depression between two rocks. There, I saw a mass of tentacles curled around a beautiful tan, horned mantle, completely framed by the colors of the surrounding anemones -- a Giant Pacific Octopus (Enteroctopus dofleini) was nestled in the depression feasting on a Leather Star and perfectly willing to remain in place and pose for photographs. My shutter finger working as fast as my strobe would recycle, it took only a few minutes before the last frame of my film was gone and it was time to ascend. As I slowly followed the anchor line upward toward the waiting surface I kept glancing down, wanting one more view of the marvel that is "Renate's Reef."

That afternoon, as the boat turned eastward to return us to the world of freeways, jobs and cell-phones, each of us could be caught from time to time shooting a furtive glance back toward Barkley Sound and the tranquility that we had come to both cherish and respect. Before the first foot touched the dock back at Port Alberni dreams had already begun to take shape and tentative plans were coursing through the air. I won't be a bit surprised if the same group finds itself once again winding down the long inlet next year, seeking the underwater treasure that is Captain Barkley's Sound.

For information on diving Barkley Sound, please contact:
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