



# Conquering the Blue Abyss

The Cambrian Foundation 1997 Belize Blue Hole Expedition

KENNETH FURMAN • ANDREAS MATTEN

The Great Blue Hole located on Lighthouse Reef, an atoll approximately 50 miles east of Belize in Central America, is an incredible place to see . . . and dive. It is the water-bound equivalent of the Acropolis in grandeur and immensity. In 1970 Jacques Cousteau explored this natural wonder with two one-man submersibles and some relatively shallow diving on scuba. The resulting TV episode became one of the most popular broadcasts of its time.

In 1995, an international group of divers under the Cambrian Foundation banner became the first open circuit divers to touch the bottom, exploring and bringing back descriptions of the 408-foot-deep center part of the formation. The Cambrian Foundation is a not-for-profit organization dedicated to the research, education and preservation of aquatic resources.

In 1997 Bret Gilliam put Dr. Robert

Dill (head geologist for the Cousteau expedition) in touch with The Cambrian Foundation to discuss his interest in how these deep diving techniques could be of assistance to marine geologists. During the 27 years since the first Blue Hole expedition, new analytical techniques and instruments had been developed that would permit the dating and determining of the chemical nature of speleothems. These dates and isotopic values could be used to determine important historical changes in the world's oceans as they filled with water stored on land in the vast continental ice sheets following the last ice ages.

An expedition was scheduled for June 1997 to continue the work Dr. Dill had started in 1970. The 20 plus member expedition team (including Dr. Dill and his associates) would be based at the luxurious Lighthouse Reef Resort on a gracious invitation from Walt

Walters and the management staff of the resort. After performing the logistical tightrope walk of getting all the people, equipment, gas and boats together on this small, quiet island, the objectives were set forth:

- With permission from the Belizian government we were to obtain geologic samples from various depths to provide scientists with one-of-a-kind specimens

for establishing a time line for the rising sea levels following the previous ice ages.

- To obtain core samples of the sediment on the bottom of the Blue Hole.
- To explore potential cave systems leading to or from the Blue Hole.
- To acquire a complete video record of the entire project.

One of the divers on this expedition was Andreas (Matt) Matten, fondly known as The German. He is originally from Braunscheig, Germany and currently lives and teaches cave diving in Akumal, Mexico. It is from his unique outlook (not to mention his logbook) that this story is being told.

#### Day 1 - June 2, 1997

We spent the day oxygen cleaning the tanks and valves needed for our partial pressure blending method. The steel tanks which were brought from the U.S. are assembled into doubles configurations. The Lighthouse Reef Resort has more than 100 aluminum 80 cubic-foot tanks, of those, we oxygen clean about 40 to be assembled as doubles and others are rigged for stage bottles. And for safety, all of the valves are changed to DIN valves.

In the evening, the whole expedition team assembles for the first time, meeting in one of the spacious bungalows donated by Lighthouse Reef Resort. Introductions are made and I know about a third of the team members from previous projects. During the meeting our goals and objectives are explained. Since this is a true scientific expedition, the geologists will tell us where to dive, where to take samples, and what to document.

The physicians will try to validate our deco software by performing Doppler tests over a period of 5-6 hours after every mixed gas dive. They will also look for bacteria prone to grow in oxygen rich regulators.

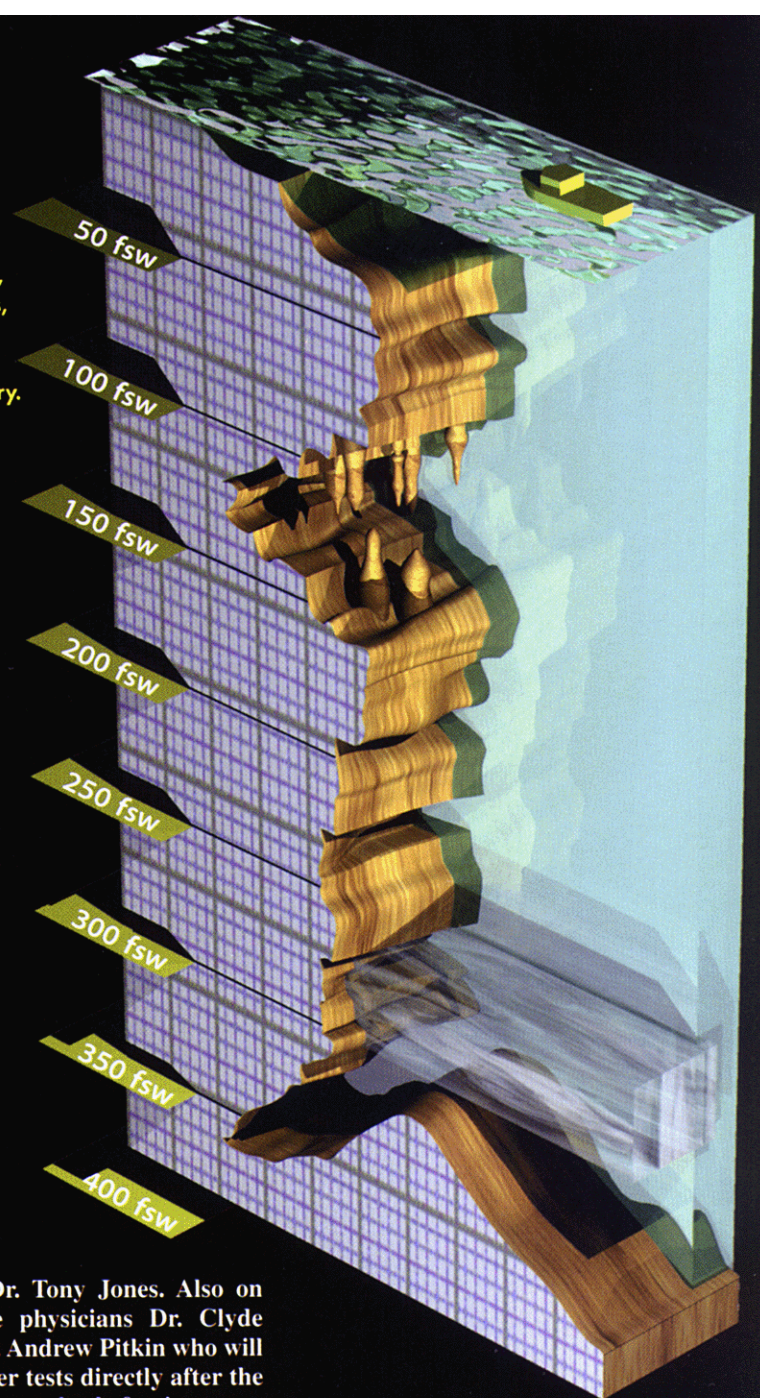
The two big Bauer compressors of the resort run late into the night to fill and blend all the tanks necessary for the dive tomorrow. Until after midnight the compressors can be heard on the otherwise perfectly quiet tropical island.

#### Day 2 - June 3, 1997

The day begins very early. It takes a couple of hours to transfer all the equipment from the filling area down to the dock and onto the boat. Terrence Tysall and I will be the first divers out of this year's expedition to return to the bottom of the Blue Hole. On the boat are the film crew and the geologist,

FIGURE 1

Divers explored caves and grottos and took samples of rock formations, called speleothems, from the Blue Hole to help geologists determine its history.



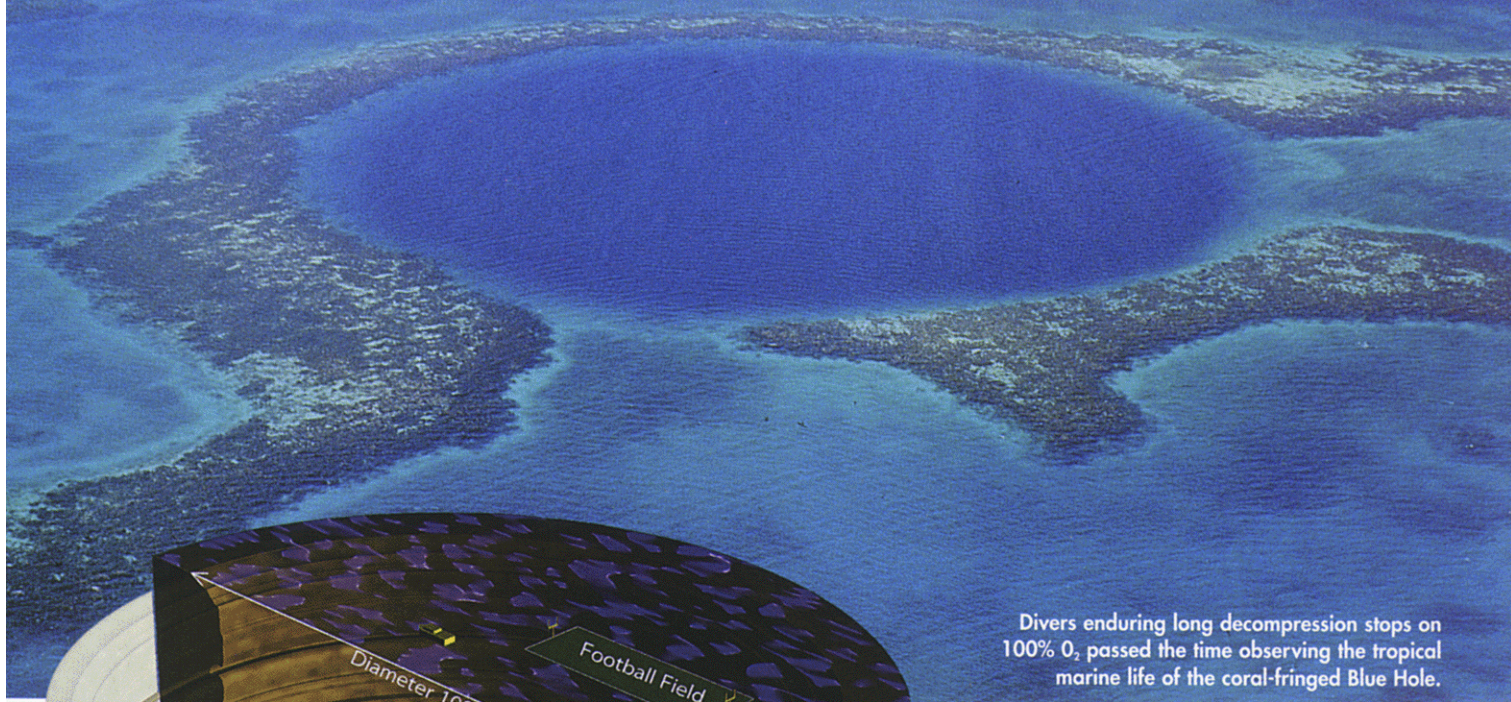
Dr. Dill and Dr. Tony Jones. Also on board are the physicians Dr. Clyde Martin and Dr. Andrew Pitkin who will conduct Doppler tests directly after the mixed-gas dive to check for inert gas bubbles in our bloodstreams. This information will be used to determine how safe our deco profiles are with the Pro Planner decompression software.

Bottom mix is an 11/60 trimix (11% O<sub>2</sub>, 60% He), since we know from the last expedition that the depths are around 410 feet. On board there are three safety divers who can assist us in case some unforeseen thing happens with our deco gas supply. The dive plan is to switch back from bottom mix to air at a depth of 220 feet, then switch to EAN 40 at a depth of 100 feet and finally, spend the shallow 20 and 15 foot stops on 100 percent oxygen.

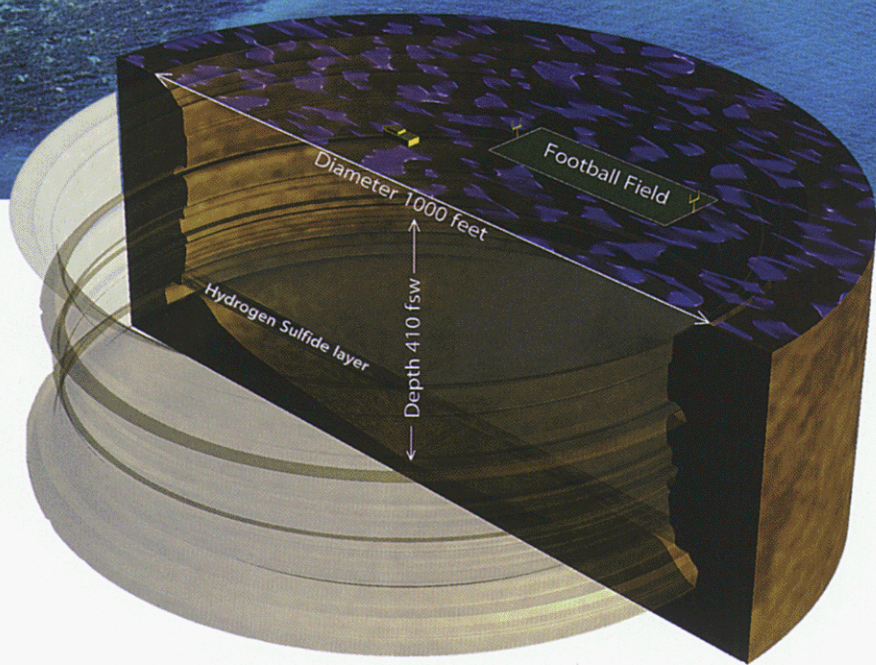
I have a tri-pack with bottom mix on my back (double 108s with a 45-cubic-foot bailout between them) and a

80-cubic-foot stage bottle on the left and one on the right with air and EAN40 respectively (our safety divers were staging the oxygen tanks at 30 feet). We wait for our safety divers, Kyle Creamer and Chris Johnson, to get in the water and put the oxygen tanks in place. Just before the descent, with closed eyes, I go slowly through the dive, visualizing every phase of the dive with all hand signals and gas changes. After a while Terrence looks over to me and with a short nod he signals that he is ready. So am I. The descent begins.

Down to about 150 feet the water is relatively warm. There, a thermocline refreshes us. The visibility clears up to an incredible 150+ feet below the 150



Divers enduring long decompression stops on 100% O<sub>2</sub> passed the time observing the tropical marine life of the coral-fringed Blue Hole.



**FIGURE 2**

The Blue Hole was formed when this giant cave's ceiling collapsed and left a massive crater in the sea floor. The top of the resulting debris cone is at 360 feet.

foot level. Along the south wall of the Blue Hole, at a depth of about 155 feet, stretches a big grotto with giant stalactites. At 220 feet, we level off to conduct our gas switch. The helium mixture is easier to breath due to its lesser density. A quick hand signal and we continue our descent toward the darker water layers below us. The dark blue changes first to a dark gray-blue then to black. At a depth of about 300 feet we hit a hydrogen sulfide layer and the visibility drops down to a couple of feet. The sulfur smell is very distinct. With the downline from the reel we dropped before the dive in one hand, my 50-watt headlight in the other, we drop slowly through the hydrogen sulfide layer. Below the layer, at about 350 feet, the viz clears up to about 100-120 feet. Now, the bottom comes into view — light brown silty sediments. It is flat toward the center of the Blue Hole, but toward the wall, the falling sediments formed a kind of dune directly below the

rim. A quick partner check and with the help of a compass we swim over the dune toward the wall and under a giant overhang which prevents a direct ascent to the surface. At our maximum depth of 360 feet the rock looks like swiss cheese. It reminds me of the rock in the Mexican caves I dive regularly. I feel so small in this giant hole in the ground, like an ant in a bowl, it is huge.

After a 20-minute run time the up signal is given and we start our slow ascent back to the surface. Unfortunately we couldn't localize any stalactite or stalagmite formations on the bottom, near where the wall joins the floor.

The downline is now permanently installed. Along it we ascend to a depth of 220 feet to commence our switch from trimix to air. One of our safety divers is already waiting there for us, asking about our gas supply status and well being.

The visibility is very good. At different

depths, divers can be seen, busy with filming or geological studies. The stalactites in the grotto are of immense size. Only when a diver gets close to one is the real size seen. A diver can completely disappear behind one of those giants. The rim and the boat can be seen from 200 feet. The first decompression stops are short and at 100 feet we do our gas switch to EAN40, the deco stops become longer and longer the shallower we ascend.

At 20 feet we do our gas switch to 100 percent oxygen to maximize our off-gassing process. Laying in the sand on the Blue Hole rim makes this dive one of the easiest to decompress on. Small colorful fish entertain us in the rather boring process of decompression after a long, deep mixed gas dive. Laying there on the sand I have plenty of time to think about how grateful I should be to do this kind of diving. In times where people have been walking on the moon, climbing the tallest mountains of our planet, walking to the poles and kayaking through the Amazon, one should think that there have been people everywhere, that everything on this planet is explored. But, there are still areas where nobody has been before and that you can be the first. That is an awesome feeling.

After three and a half hours of decompression it is time to ascend back to the surface. The rest of the expedition team is waiting with food and lots of water to rehydrate, something I really need right now. Just out of my wetsuit, Dr. Pitkin begins with his Doppler testing. Only a low grade bubble score is registered after performing the required squats. The readings are recorded on a DAT recorder for

photo: Fred Garth; illustration: C. Bowen

later analysis by specialists in England.

On the boat ride back to the Lighthouse Reef Resort I am still thinking about the dive — the magic of the Blue Hole has gotten to me. The next two weeks of diving look promising.

The evening is full of activities, readying equipment, and blending breathing gasses for the next day of diving. Getting the gear down to the pier, maintenance, calculation of gas volumes and dive profiles and their transfer to slates are also time consuming.

Meetings with the geologists, who lay out the plan and goals for the next day, depend on our findings on a day to day basis. There are also the continuing Doppler tests for hours to come and the safety divers calculate and rig the needed spare gas and tanks.

An expedition of this size would not be possible in a smaller group without a significant loss in our safety margin. And despite our numbers, we are still working late into the night.

Between the second and seventh day, teams of divers continue to film, survey and collect samples from the bottom of the Blue Hole. Objectives and strategies change with each viewing of the previous dive's video footage. On June 7th, Ken Furman, Dr. Pitkin and Chris Johnson set out to the southwest wall of the Blue Hole to explore for speleothems (stalactites, stalagmites, etc.) and a cave formation. A possible penetration point is found in the shear underwater cliff at 245 feet, but time did not permit exploration. That duty would fall on the next day's team — Terrence Tysall and me, the German.

#### DAY 7 - (June 8, 1997)

The entrance to the underwater cave is at 245 feet. It's a little crack, almost invisible in the dark light of this depth and located under an overhang. Just big enough to let a diver in back-mounted doubles and one stage bottle pass, the chimney goes straight up to a depth of 135 feet where it ends in a big chamber. The first look tells my partner Terrence and I that we hit the mother load. This is not a coral cave, this is a solution cave. The chamber has a diameter of about 50 feet. Directly in front of me, in the absolute darkness and illuminated only by our powerful cave lights, I see a giant turtle skull. Excited, I give Terrence a light signal to show him my find, when he shows me a complete six-foot-long turtle skeleton laying belly up on the edge of the chamber. By the time we are done exploring this cave system we will have found five complete turtle skeletons.

The water in the cave is so clear that it is hard to see it. Fine light brown silt is

covering the floor, which looks like it is covered in flowstone. Visibility here can change dramatically if a diver does not move with the utmost care to prevent the silt from being stirred up.

Slowly, we progress through the cave. My partner is laying the guideline in front of me. In places, floor to ceiling height is only enough to get through without back-mounted tanks. Visibility deteriorates fast. Our light beams illuminate the little passages which have probably never seen light. Some parts of the cave are highly decorated with speleothems, the geologists are going to be happy. We've hit the jackpot. The floor is littered with hundreds of crab shells, covered in light brown silt. They're entombed in the cave, like the turtles who couldn't find their way out of this maze of absolute darkness. Throughout the cave we see dozens of small red shrimp and even some lobsters in the entrance area. On what they feed, I don't know — maybe on fellow marine life that lost their way into this cave system.

The only sound is that of our bubbles collecting on the cave ceiling, slowly working their way up to the surface through the porous rock layers. They are seen by fellow team members who are exploring the upper rim of the Blue Hole, above the cave.

The cave passage is about 250 feet long, floor to ceiling height is between two feet and six feet. We reach our turn-around pressure and I have to leave this beautiful place after 45 minutes of bottom time. We are able to survey the now permanent guideline and cave features in order to produce a basic grade three map the same evening.

After the extensive decompression, we surface with big smiles and agree to come back tomorrow to film this beautiful cave for the planned documentation.

As Dr. Dill and Dr. Jones hear what we found and that we've seen lots of speleothems, they get really excited and outline the plan for tomorrow's day of diving. This will include shooting



Preparing for the plunge — divers used an 11/60 trimix to reach the 400+ foot depths of the Blue Hole.

Just as I pick up the reel, I see a speleothem at a depth of 300 feet, but have no time to collect it — it is the deepest speleothem we have located so far. At about 320 feet it is getting really cold, we drop through a thermocline and are now in about 60 to 65 degree water.

Its a smooth, slow and controlled descent. When my depth gauges show that we passed the 400 foot level and there is still no bottom to see, it dawns on me that this is going to be the deepest cave dive I have done so far. My first depth gauge freezes at 422 feet, leaving me two that work just fine. From there the bottom comes into view. At 450 feet we hit the debris cone, made out of sand falling in through the chimney and building up a dune. On top of the dune is a metal fishing trap, useless at this depth where I don't see any marine life at all. After I tied into the trap (no other stable objects are close) I look around to check on my dive partners. All there, everybody looking happy, lots of gas and lots of line on the reel, so I decide to swim slowly down the slope. We produce enough light so that in the distance we can see the walls of this giant sinkhole. The video camera is still recording the quiet, cold and dark place.

The silt is becoming much finer, still the color of sand with ripples in it, just like on the beach. At 14 minutes run time, and at a depth of 485 feet, I come to my turn-around pressure. A little rock lies just in front of me. It must have fallen from the ceiling some time ago. It provides an ideal point to tie off the line. The bottom is still sloping down a little, but we can see the end of the Abyss, must be at about 500 feet maximum depth.

After the dive had been called, our slow, long ascent begins. It's hard to comprehend that I am 485 feet deep in a cave. Our first safety stop is at 400 feet for one minute, the next one is at 300 feet for another minute. By then it looks like we are in a snowstorm, lots of white sediments falling on us, dropping the visibility to almost zero at 300 feet. Once more, the guideline is the only lead out. At 220 feet, we switch back to our travel gas (air) and start our first deco stop at 200 feet. Once out of the chimney and the layer, it becomes warm again. Clear water, full of light and our support divers are a very welcoming sight. We smile at each other and continue the major part of the dive — a more than three and a half hour decompression, requiring a lot of concentration.

After almost four hours, we ascend with big smiles. Only one diver in our team had been deeper. Just out of our wet-suits, Dr. Pitkin is conducting Doppler tests and is very satisfied with the

results — only low grade inert gas bubbles are detected after performing knee bends.


A great dive to end this successful expedition.

All in all, the team accomplished their objectives, and in most cases, exceeded them. During the two weeks, the teams:

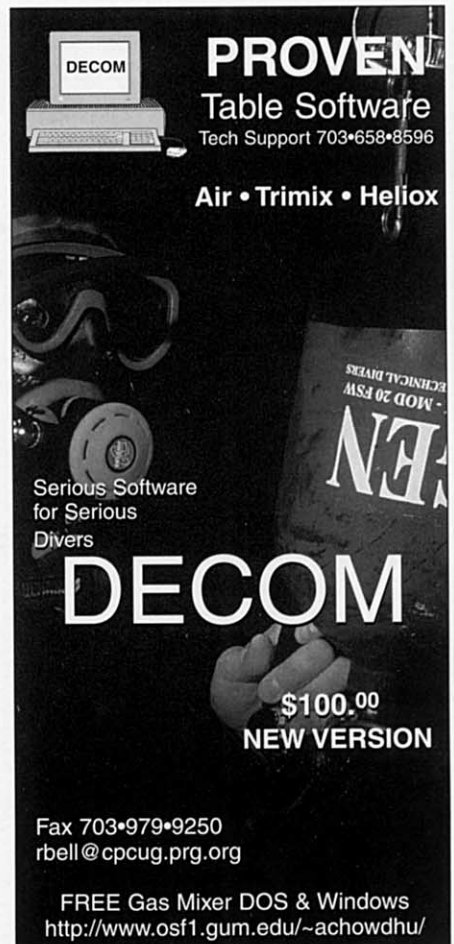
- 1) Collected rock and core samples in the Blue Hole at depths of 320, 375 and 408 fsw.
- 2) Retrieved speleothems samples from 130 and 235 fsw.
- 3) Surveyed and mapped the only cave found on the southwest wall.
- 4) Surveyed and mapped 33 stalactites and columns covering approximately 400 feet of the south wall.
- 5) Established the maximum depth of the Abyss at 500 fsw.
- 6) Conducted Doppler tests after all mixed gas dives and recorded them on DAT for later analysis.
- 7) Completed tests for bacterial growth prone in oxygen rich regulators.
- 8) Conducted operations consisting of more than 20 dives on mixed gas between 320 and 485 fsw along with the corresponding deep air dives for support and reconnaissance.

The next two days were spent packing up and leaving the hospitality of the island resort and our many new friends.

The team members returned to their respective locations. The core samples collected from the center of the bottom of the Blue Hole (408 feet) went to Dr. Eugene Shinn in St. Petersburg, Florida where they will be analyzed for Saharan Desert iron sediments. The other samples have made their way to the Radioactive Isotope Laboratory in New Mexico where Dr. Yemane Asmerom will begin his analysis of them.

Examples of the excellent video footage were presented to the Fisheries Department of Belize and to representatives of the local University, the Departments of Forestry, Geology and Mineral Resources. The footage will be edited and made into a segment to be included in the SeaTek television program. Plus, a scientific documentary for professional geologists and an educational presentation of the expedition is being made. 

*The Cambrian Foundation is a not for profit corporation created in 1994 to conduct scientific research and aid in the preservation and exploration of aquatic and oceanic resources.*



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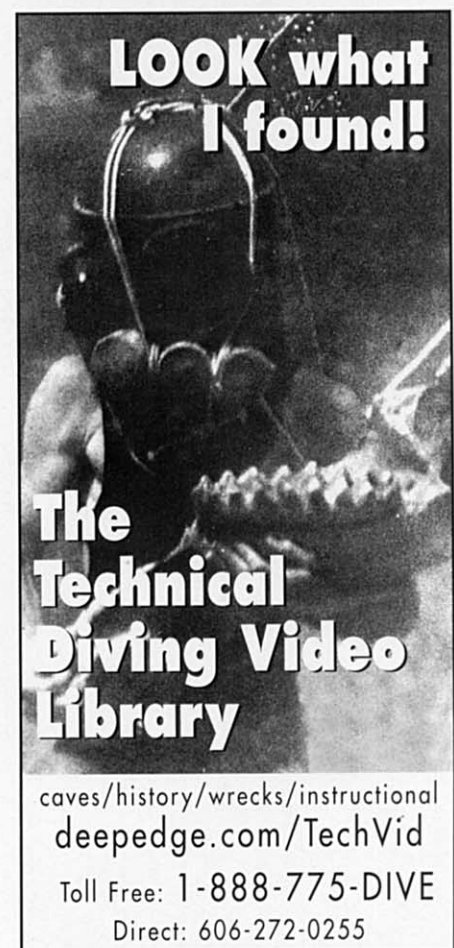
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