## ZACATON

*Zacaton is the deepest of five ceynotes located on a large ranch, El Rancho Asufrosa, in northeastern Mexico. It was "discovered" on a reconnaissance trip made at the end of two weeks of exploration and surveying in the Nacimiento Santa Clara, a cave system at the base of the El Abra near the Nacimiento Mante. The exploratory team lead by Jim Bowden and Ann Kristovich had laid more than 1400 ft. of line in the Santa Clara, but had ceased their efforts due to the depths encountered in the distant reaches of the cave. More than 1100 ft. back, depths exceeded 250 ft.* At that time, 1989, the team was not routinely employing mixed gas techniques in their exploratory efforts in Mexico. The door to the Santa Clara was temporarily "closed". Jim had studied geological survey and topographical maps which revealed the possibility of inland "ceynotes" in the karst terrain found at the southern extreme of the Sierra de Tamaulipas.

On a ranch near the small town of Aldama, five ceynotes of variable size and character were located. Exclusive entry and permission to dive was granted by the owner and in late April, 1990, exploration began. The ceynotes proved to be extremely unusual. They are aligned generally east to west within a radius of approximately two miles. They are highly sulfurous in odor, in one named Poza Asufrosa, the sulfur precipitates and floats on the surface in raft-like formations. The waters discolor, and tarnish all metals, and seem to leech the surface of galvanized tanks. The systems are surprisingly warm, 93 degrees in Poza La Pilita, 87 degrees in Zacaton, 86 degrees in Poza Caracol, 87 in Poza Asufrosa, and a cooler 83 degrees in the huge oasis-like Poza Verde. Unlike the others, the waters in Poza Verde are layered in thermoclines and behave more as a lake in times of flood and drought and seem less responsive to the changes imposed by the water table.

The team began the systematic exploration of the ceynotes. Initial efforts were concentrated in Poza La Pilita. This 68 ft. by 120 ft. ceynote is the warmest of the five at 93 degrees F. The surrounding walls reveal tufa formations often associated with warm thermal springs. The side walls are coated with a dense algae which hangs like curious stalactites. Measurements made using the SCUBAPRO personal sonar device revealed a system that enlarges significantly with increasing depths. At 150 ft., La Pilita is 396 ft. from north to south and 239 ft. from east to west. The team initiated the search for a connection to the ceynotes located

Photo by Ann Kristovich

*The pristine beauty of Zacaton, Mexico, the world's deepest cave system.*

Photo by Ann Kristovich

*Jim Bowden preparing his equipment prior to record attempt in April 1994.*

immediately to the east or west, however, no ongoing passage was found in the early exploration. The depth of La Pilita was plumbed to 360 ft. and dives were made to 250 ft. On May 2, 1990, divers Jim Bowden and Gary Walten entered the Nacimiento at the western boundary of the ranch. The river is formed by the spring run emanating from Zacaton. A typical "boil" was noted on the water's surface near a limestone outcropping.

Pursuing this current, the divers located a small cave and followed a northeast azimuth until they had exhausted the line on their reel. With passage obviously continuing, they turned the dive, obtained an additional exploratory reel, returned to their tie-off and resumed laying line. Now in the lead, Gary soon noticed a bottle green glow ahead. He covered his light and confirmed a natural light source that could mean but one thing, they had made a connection to the surface. The exuberant

divers emerged into Zacaton at a depth of 26' and surfaced in the beautiful ceynote which takes its name from the islands of tall grass, *zacate*, which float across it's surface.

The succeeding days were spent surveying the nearly 600' of passage (named El Pasaje de Tortuga Muerte for the frequently encountered turtle skeletons) connecting the Nacimiento and Zacaton and recording baseline information on this impressive system. The surface of Zacaton is approximately 70 ft. below the surrounding land. It is 380 ft. in diameter and roughly circular. It's lateral walls undulate and the system dimensions increase with increasing depth. A rough survey has been completed to 175 ft. of depth from the center of the ceynote using the SCUBAPRO personal sonar device. It is hoped that side scanning sonar techniques can be applied in the future to study the full extent of this ceynote which is now known to exceed 1080 ft. of depth. The depth recorded for Zacaton in 1990 was erroneously measured at 250 ft. when divers Walten and Ann Kristovich dropped the weighted plumb line onto a prominent ledge which projects markedly into the ceynote at 230-250 ft. Exploration continued on the ranch in August, 1990 with dives by Karen Hohle and Ann Kristovich in Poza Verde.

This tropical oasis is greater than 600 ft. across, somewhat cooler than the other ceynotes and surprisingly shallow, a mere 140 ft. by measurements in four quadrants. Bowden and Walten sought passage in Poza Asufrosa with side mount configurations, but the tight passage choked off after 30 ft. of penetration. Caracol, like her immediate neighbor, Zacaton, sits beneath a cliff face. To date only one dive has been made in this cave by Bowden, but he observed large going passage on an azimuth that would lead to Zacaton. The maximum depth in this system is not known as the passage travels beneath the cliff and could not be adequately measured by plumbed line. The maximum depth on Bowden's dive was 72 ft.

After this early exciting start, members of the Proyecto de Buceo Espeleologico Mexico y America Central spent the next two and a half years exploring cave systems associated with the inland Blue Hole of Belize. Solo efforts by Bowden from 1987 to 1988 had resulted in the connection of St. Hermann's Cave with Petroglyph Cave and the inland Blue Hole. The 1990-1991 efforts of the team added more than 1500 ft. of water filled passage to the survey, and discovered a previously unknown and spectacular pit in the jungle. Dives made in the downstream

Boiling Hole follow an azimuth which will likely result in a connection to the Actun Tah system. Work was halted in Belize in 1992.

The "Proyecto" resumed the exploration of the five ranch ceynotes in April, 1993, fully equipped with mixed gas capabilities to allow the safer exploration of the deeper systems. Sheck Exley joined the team for a week and with Bowden dived the previously unexplored depths. La Pilita revealed at greater than 358 ft. of depth, going passage to the southwest. Zacaton however revealed the greatest surprise. On air dives to 258 ft. by Bowden and 407 ft. by Exley, no bottom was in sight. The previously plumbed depth of 250 ft. was proven to be an error! The divers dived beyond the ledge which had captured the measured line in pursuit of the elusive bottom. The following day, Bowden, Exley, and Kristovich returned to Zacaton to attempt a more accurate plumb. The line spun off the reel, past 500' past 800', past 1000'! The weight finally stopped after some 1080' had been measured.

The line was secured to the north wall of the ceynote and the divers completed plans to make a deep mixed gas dive the following day. In April 1993, Bowden dived to 504 ffw. and Exley to 721 ffw. Tables for both dives were prepared using Dr. X. software. Neither diver experienced performance difficulties or physiological complications during or after the dives. These two would be the first of seven sub-500 ft. dives made in Zacaton in a twelve month period. As the week of diving came to an end, Exley and Bowden agreed to return together to Zacaton, and like Hillary and Norkay, pursue the exploration of the depths of this upside down Everest. The apparent perfect site for an open circuit dive to 1000' and beyond had at last been found. It was warm, there was no perceptible current, the natives were friendly, and access to the system was uncomplicated.

The goal was thus declared, that within the calendar year, a dive to obtain the bottom of Zacaton would be made by Bowden and Exley. Members of the Proyecto made six trips to Mexico during the ensuing twelve months. With each return, Bowden dived progressively deeper in order to prepare himself for the 1000' attempt. Exley meanwhile pursued the exploration of a huge underwater cave at Bushmansgat, South Africa, diving to 863' in this system. During this dive, Sheck experienced visual, somatic, and neurological symptoms of high pressure nervous syndrome (HPNS). The symptoms resolved during his ascent to his first deco stop at 400 ffw. and there were no persistent effects.

In September, Bowden dived to 744 feet. Team member Kristovich dived to 554 feet, setting a new women's depth record with this effort. On December 2,1993, Bowden made a dive in excess of 800'. The exact depth of the dive could not be documented as all three of the digital depth gauges he was wearing ceased to function at various depths ranging from 684' to 756'. Bowden, however, had visually noted the 825' marker on the descent line before reversing the direction of his dive. Bowden experienced multiple joint DCS upon the completion of his decompression obligation. Symptoms resolved following aggressive hydration, oxygen therapy and in water recompression. There were no persistent symptoms.

The 1000' attempt had been slated for December 25, however, it was the consensus of the team in early December that the conditions imposed by the unusually wet rainy season were unfavorable for such an effort. The current in El Pasaje de Tortuga Muerte was fierce, and imposed a very undesirable heavy exertion dive prior to any deep attempt. It was necessary to traverse this nearly 600 ft. of linear cave passage prior to any dive in Zacaton, making all of the deep dives, in fact, repetitive dives. For the safety of the divers, the dive was rescheduled for April, 1994.

In April, 1994, the Proyecto, including Exley and Mary Ellen Eckhoff assembled on the Rancho Asufrosa. Two days were spent staging the required decompression bottles at their specified depths in Zacaton and El Nacimiento. The dive would be accomplished on independent descent lines, a condition both divers favored to avoid contact and potential interference during the very rapid descent. Each effort would be solo by necessity. Exley would use Heliair 6 as his bottom mix, Bowden, Heliair 6.4. Their tables were similar and were formulated utilizing Dr. X. software. Both divers carried an assortment of tables since the exact time of descent ( bottom time ) and maximum depth of the dive was unknown.

Both Bowden and Exley made multiple deep air acclimation dives to prepare themselves for the 1000' attempt. Early in the morning on Wednesday, April 6, 1994, all was felt to be in readiness and the divers and their support team assembled on the banks of El Nacimiento. Bowden and Exley geared up and swam together through "El Pasaje" and into Zacaton. The pre dive mood was positive and optimistic. The men began their descent at approximately 9:50 am central standard time. Bowden dived to 925' and would spend nine+ hours decompressing. Exley, for reasons we will probably never know, failed to return from his dive. He had reached a maximum depth of 906'.

Jim Bowden provides this account of that final day with Exley as they prepared for the 1000 foot dive.

> *"The time between December and April had passed rapidly with preparations and planning consuming every day and night. In addition to three sub-500 ft. dives, I made over 30 dives in excess of 300 ffw. Some were done on air to acclimate and build up my narcosis tolerance. Many of these dives included skills testing at depth, primarily problem solving questions or tasks posed by a colleague on mix while I was on air. It was essential that I be comfortable with an equivalent narcosis depth (END) of 330 feet. My bottom mix of heliair (69.5 He, 24.1 $N_2$, 6.4 $O_2$) called for an END of about 300 feet at 1000 feet. The bottom would demand that and more. I made one dive to 411 ffw on air, a record on air in a cave, but it was soon eclipsed by Sheck with his dive to 420 ffw on April 4th two days before our attempt for the bottom.*
>
> *"Now was the time to fish or cut bait. The final preparations were made and the first support team left camp to put down decompression oxygen and my DiveComm full face mask that I planned to switch to at 20 feet. Shortly thereafter, we all left for the spring."*

Present on the day of the dive was the team consisting of Exley, Bowden, Mary Ellen Eckhoff (Exley's ex-wife), Karen Hohle (Bowden's wife), Ann Kristovich, and Marcos Gary. Press representatives included a writer and photographer from *Sports Illustrated*, a photographer from *Destination Discovery*, and a television film crew from Channel 7 of Tampico. Also in attendance was the land owner and his family along with many of the local residents of the area.

Bowden continues, "Sheck and I geared up and swam through the 600 foot passage, El Pasaje de Tortuga Muerte. to access our dive site. Surfacing in Zacaton, we swam slowly over to our descent lines. We commented on the beautiful day and wished each other luck. We separated at that time and went to our respective down lines. Time passed in silence as we calmed our breathing and focused our minds on what was ahead.

> *"After a time, I felt all was right and glanced over at Sheck. He seemed to sense my glance and nodded affirmation. I submerged and hesitated at 10 feet for a minute or so and then went into a free fall. I had planned a descent rate of one hundred feet per minute to 300 feet on air, then the same rate to 600 feet on heliair (50 He, 39.5 $N_2$, 10.5 $O_2$) and then switching to my bottom mix. I planned to slow my descent around 750 to 800 feet where I had first noticed the HPNS symptoms on my previous dive. All went according to plan. As I passed the 800 foot mark, I was conscious of very little tremor. I could just see*

*Sheck Exley and Jim Bowden in Zacaton, April 6, 1994. Only Bowden would return.*

*Sheck's light in the distance. It was the last I saw of him."*

However, at 900 feet Bowden was shocked to find that he had breathed far more gas volume than he had planned. His bottom mix cylinders contained barely more than 1000 psi. At that depth, his regulators could not deliver if the pressure dropped less than 500 psi. This was a big problem and Bowden had to deal with it quickly.

> *"I inflated my BCD wings and managed to stop my descent at 925 feet. I switched to the 80 cubic foot tank of bottom mix under my right arm and breathed that and then my travel mix back up to my first stop at 450 feet. By the time I got there they were both empty. To my horror, the regulator on my deep deco bottle free-flowed violently when I turned it on. It seemed to take a lifetime to shut it off again. I switched back to my back-mounted doubles to deal with the problem but I couldn't fix the regulator. The only solution was to open and close the valve with each breath. I had eight minutes of stops between 350 and 300 feet where my next bottle was hung."*

Bowden could breathe easier when he made it to the fresh decom bottle with a properly functioning regulator. Now would come the really long decompression and the worry about oxygen toxicity and bends. Another switch to air at 260 feet would see him to 130 feet and a 30% oxygen nitrox mix. That's when he knew something was wrong with Exley.

*"At 130 feet, I relaxed. Here I could clearly observe the line that Sheck used on descent. All of his stage bottles were still neatly packaged and unused. The sinking feeling in my heart was overcome by the confidence that he had gone deeper than I had and was probably still below me."*

But on the surface, the support team already knew that Exley was in trouble. Ann Kristovich had watched the bubble paths of both men on the initial descent. Bowden's bubbles disappeared at two minutes and Exley's vanished a few seconds later as they both reached the deep ledge at 250 feet. Only one set of bubbles reappeared after about 15 minutes and she couldn't be sure if they were Bowden's or Exley's. Kristovich exchanged uneasy glances with Bowden's wife, Karen Hohle. As planned, she then dived to meet Bowden at the 47 minute mark of the dive profile. She was relieved to find him but chilled to see Sheck's stage equipment still hanging with no sign of him. The grim awareness of the situation gripped the pair.

Meanwhile, Mary Ellen Eckhoff (one of the world's premier cave divers and Exley's ex-wife) was watching from the cliffs with no knowledge of the problem. She joined Hohle at the surface and was appraised of the scenario. Concerned but not panicked by the situation, she grabbed an extra decom bottle to take to Exley and swam down to encounter Bowden and Kristovich. Now her worst fears were becoming reality. She hastily scrawled on a slate, "I'm going to 250 to look for bubbles". Dropping over the deep ledge, she could find no sign of Sheck or any bubbles coming from the depths.

*Hohle had scrambled into her gear and caught up with Eckhoff. "I met Mary Ellen at about 100 feet on her way back up. She was crying and her mask was messed up. She wanted to go back to the surface but I grabbed her gauge and saw that it read 278 feet. I just held her. We stayed down for more than thirty minutes to get through the decompression. It was a very lonely time."*

Bowden was finally told that Sheck was lost as he reached his 60 foot stop. He felt himself grow numb from the loss and describes the remainder of his decompression as a mechanical exercise with little conscious thought. After a total of nearly ten hours, he surfaced but suffered a left shoulder DCS hit that then was treated with in-water therapy on the site. Bowden was now the first diver to successfully break the 900 foot barrier on self-contained scuba. His record depth of 925 ffw eclipsed Exley's old 881 mark.

There was no consideration given to mounting a body recovery for Sheck since it was accepted that the only man capable of effecting such a recovery was the man who was already down there. Three days later while hoisting up the remainder of the equipment, Exley's body was found. He had apparently drifted up from the deep cave passage and become entangled in the line. One of his tanks still had gas and his computer read 904 feet, suggesting that whatever trouble he had did not occur until about nine minutes into the dive.

The best educated guess would point to an HPNS incident. Exley had experienced a bad one in Africa that resulted in uncontrollable muscular spasms and multiple vision. This may have manifested again with more violent tremors that could have triggered an oxygen convulsion or simply made it impossible to negotiate gas switches as necessary. His death will remain a mystery and a tragic loss to the cave community.

*As Sheck's last dive partner, Bowden shares his thoughts, "I've been angered by unkindness and idle speculation by arm chair quarterbacks. And I have been touched by those who seem to understand and genuinely express sympathy without the need to pull something out of my soul. Much has been written in praise of Sheck and more will come. Ultimately, he will represent even more to us as history and recognized as the pioneer he truly was.*

*"I first met Sheck in Mexico in 1988 when he was making his then world record dive to 780 feet in Mante. I drive up to the spring while he was still underwater in the cave. He was alone in that great system. His support staff of only three, Ned DeLoach, Sergio Zambrino, and Angel Soto were awaiting his return. In this egomaniacal discipline of cave diving it was refreshing to see a man accomplishing the impossible without fanfare and entourage that we see so often with far lesser endeavors. Sheck sought my friendship as I did his for the same reason: we were loners. He was the only one of the north Florida group that respected my work. He did that with other explorers in all parts of the world. He was interested, humble and supportive of projects than many of "new age" cave divers didn't even know existed. We had a common bond, an obsession, a passion... our love of exploration.*

*"Exploration was a demanding mistress that got in the way of our relationships with others and I know could cause a lot of pain to those who loved us. We could spend most of day on a project without even talking to each other. Our personalities were direct opposites. He was the most disciplined man I have ever met with a brilliant calm intellect. On the other hand, I'm 52 years old, still get in fights, drink too*

*much at times and competitive to a fault. Yet, we got along great. Karen and Ann have both said that we looked like little boys who found the greatest treasure on earth when we found that Zacaton was the ultimate world class deep system. I do believe that we both were never more alive than in those moments of trial in virgin space.*

*"Mexico loved him. He truly respected their culture and ways. The rural poor of Mexico have a remarkable ability to judge courage, honesty, and sincerity. The only time I allowed myself to succumb to emotion during those days of our loss and the recovery was when I walked to the edge of Zacaton and saw the simple cross and flowers*

Photo by Ann Kristowich

Jim Bowden, the deepest scuba diver in history, attained 925 feet on mixed gas in Zacaton cave system, Mexico.

*put there by the people of el Nacimiento and Higeron.*

*"Sheck met life head on, with few misconceptions. Only death deceived him, taking him by surprise. Project Zacaton will continue. There was never any question about it. I was quoted as saying it would be an insult to Sheck to shut it down. I found this system some five years ago and put it on hold to obtain the technical training and the support to make it possible. Sheck gave me that. I will miss him very much, but then we always dived alone anyway. Perhaps now he will be with me more than ever."*

The Proyecto will continue it's efforts in Mexico after a brief pause for the rainy season. Bowden feels certain after reaching 925 ffw that a dive to 1000 ffw is possible and he will pursue his plans to see the bottom

of Zacaton. With the use of Heliair, the survey of the distant passage of the Nacimiento Santa Clara will be resumed. The exploratory team also plans to aggressively explore the magnificent deep caves of the Sierra Madre Oriental, including the Rio Choy, Rio Frio, Rio Sabinos, Nacimiento Mante, Nacimiento Huichihuayan, and many others.