

AMCS
ACTIVITIES
NEWSLETTER
Number 31 June 2008





AMCS

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The *AMCS Activities Newsletter* is published by the Association for Mexican Cave Studies, a Project of the National Speleological Society. The AMCS is an informal, nonprofit group dedicated to the exploration, study, and conservation of the caves of Mexico.

The *Activities Newsletter* seeks articles and news items on all significant exploration and research activities in the caves of Mexico. The editor may be contacted at the address below or at editor@amcs-pubs.org. Exceptional color photographs for the covers are also sought. They need not pertain to articles in the issue, but need to be high-resolutions scans or digital originals.

This issue was edited by Bill Mixon, with help from Katie Arens, Yvonne Droms, Nico Escamilla, Rodolfo "Fofó" González, Mark Minton, and Al Warild.

All previous issues of the *Activities Newsletter* are available, as are various other publications on the caves of Mexico. Contact sales@amcs-pubs.org, see www.amcs-pubs.org, or write the address below.

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Front cover

Al Warild in Sistema Brumas-Selváticas, Puebla, during the Mexpé 2007 expedition. Photo by Gustavo Vela.

Back cover

Jim Coke in dry passage before Los Tubos in Sistema Tizik K'una, Quintana Roo. Photo by Simon Richards.



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MEXICO NEWS



MEXICO NEWS

Compiled by Bill Mixon

CHIAPAS

The proceedings of the VIII Congreso Nacional Mexicano de Espeleología contains an article on two projects of the Grupo Espeleológico Jaguar, one in the vicinity of **San Fernando** and one in the area of **Las Rosas**. It was accompanied by two location maps, which are copied here, despite their having been poorly printed in the original. An article by them on the caves of the San Fernando area appears in *AMCS Activities Newsletter 28*, pages 104–108.

CHIHUAHUA

A huge pit, 30 meters across and 185 meters deep, lies in the foothills of the Sierra Diablo, near the border with Coahuila. It has been used by Rancho **El Hundido** as a water source for many years, but has only recently come to the attention of cavers. Tourism authorities in Jiménez are considering its potential as an attraction. *Source*: March 3, 2008, article in *El Heraldo de Chihuahua*, posted to Iztaxochitla e-mail list by Juan Montaña Hirose. This pit has been visited by Carlos Lazcano, who promises an article for the next *AMCS Activities Newsletter*.

Chihuahuan historians believe they have located the cave where Poncho Villa hid for two months in 1916 while being pursued by thousands of American and Mexican troops. The cave, **Del Coscomate** in Mpo. San Francisco de Borja, is a small tectonic cave near the top of a desert peak. *Sources*: March 26, 2008, *El Diario* article posted to Iztaxochitla e-mail list; Carlos Lazcano.

COAHUILA

“The Polygenetic Caves of **Cuatro Ciénegas** (Coahuila, Mexico): Morphology and Speleogenesis,” by L. Piccini, P. Forti, I. Giulivo, and M. Mecchia. Abstract: The Cuatro Ciénegas area is renowned worldwide for its thermal springs, which feed a unique ecosystem consisting of many pools, lakes and marshes. The pools represent a very important water resource in a region characterized by scarce rainfall. Field investigation has emphasized the role of karst in the hydrogeology of the area. Only few and restricted forms of surface karst are represented; caves are mainly relics of old speleogenetic phases of thermal and barthypheatic water flow. *Source*: http://ijs.speleo.it/article.php?id_art=551. The full article, which appeared in the *International Journal of Speleology*, volume 26, number 2, 2007, can be downloaded in PDF form there. Maps of most of the known caves in the Cuatro Ciénegas area are in an article in *AMCS Activities Newsletter 30*.

In April 2005, a large number of Texas cavers piled into two old four-wheel-drive school buses and visited Rancho San Judas Tadeo, just outside of Ciudad Acuña. They continued the survey of sulfurous **Cueva de Casa Blanca**, but it was not completed. They also located and surveyed some smaller caves, including **Cueva Calavera del Chivo**

and **Cueva Pasto del Chivo**. *Source*: article by Terri Whitfield in *Texas Caver*, January–March 2008.

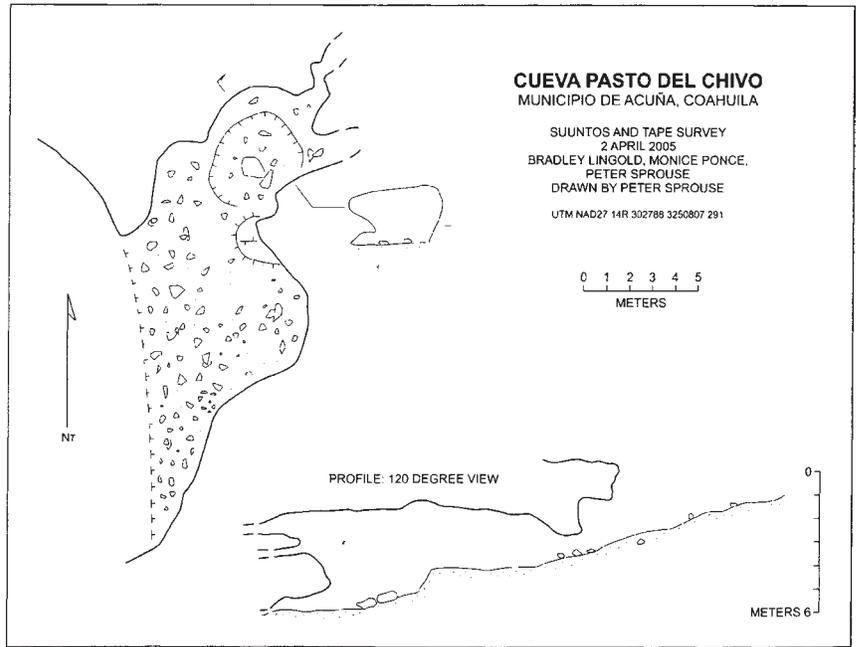
EspeleoCoahuila 2007 was held at the Jimulco ecological reserve near Torreon on July 5–7. It was hosted by the Asociación Coahuilense de Espeleología, the AMCS, Expolaradores del Desierto, and the Reserva Ecológica Municipal “Sierra y Cañón” de Jimulco. The reserve comprises eight *ejidos*, with elevations up to 3120 meters. The goal of the event was to search this area for caves. Camping was at a ranger station in the reserve. Twenty-six cavers registered, fifteen of them from Austin, Texas, and the rest from

Poncho Villa’s cave. *Carlos Lazcano*.



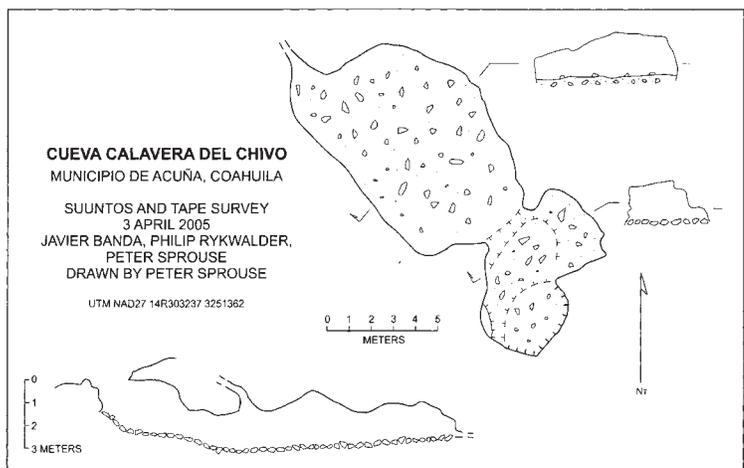
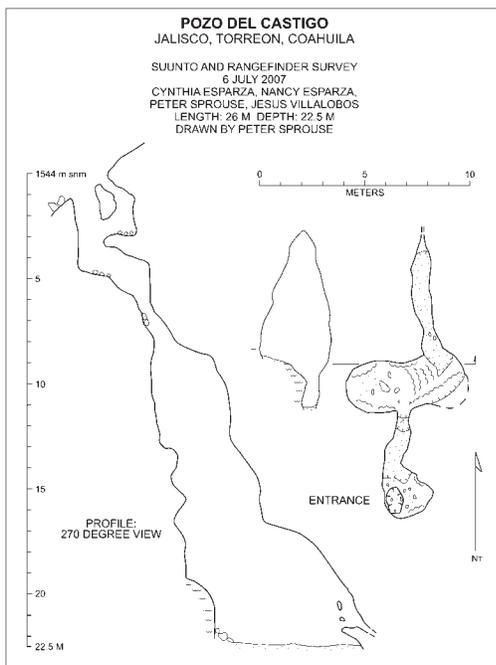
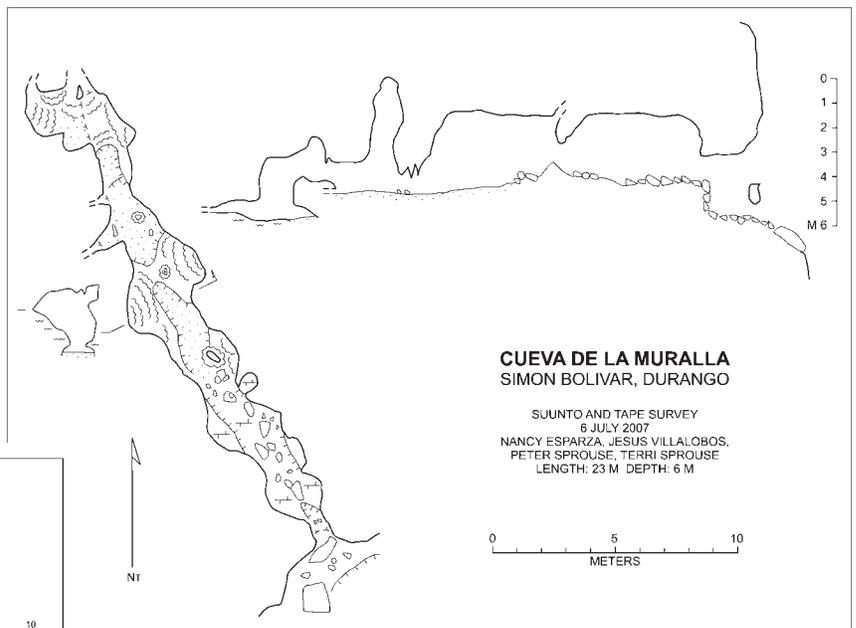
Caves mapped during
EspeleoCoahuila 2007

Coahuilla	length	depth
Cueva Podarohe	28	4
Cueva del Guano	24	11
Gruta de la Llanta	96	50
Pozo del Castigo	26	20
Cueva de las Arañas	5	?
Cueva Gatera	12	6
Cueva del Guano 2	10	7
Cueva Delgada	28	5
Cuevita del Borrego	8	2
Durango		
Cueva de la Muralla	23	6
Cueva de Cutberto	14	3



JALISCO

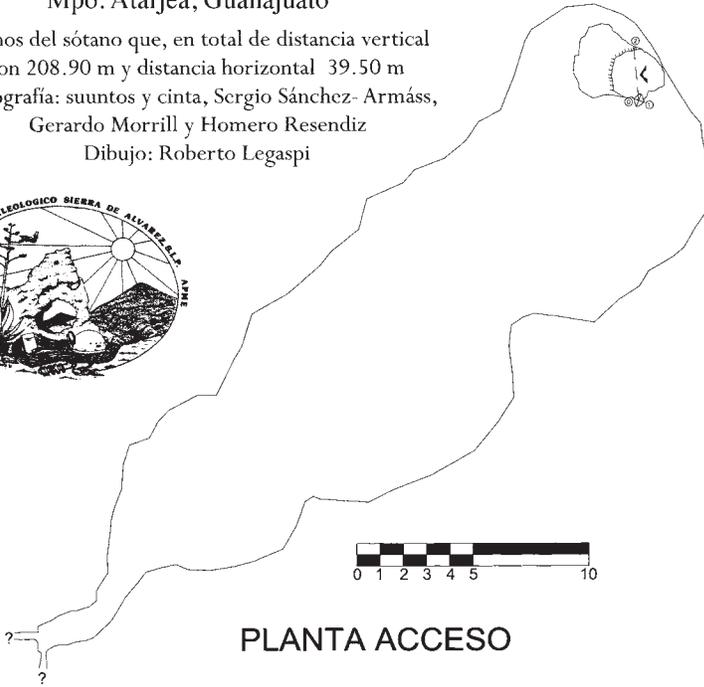
The recent International Underwater Cave Rescue and Recovery mobilization for a cave recovery at Puerto Vallarta turned out not to involve caves. At the time of the call-out, there were several varying reports concerning what had actually happened. What was apparent was that three divers had failed to return from a dive off the north face of the wall that starts off the small islands known as Los Arcos. Initial news



SÓTANO DEL CHARCO

Mpo. Atarjea, Guanajuato

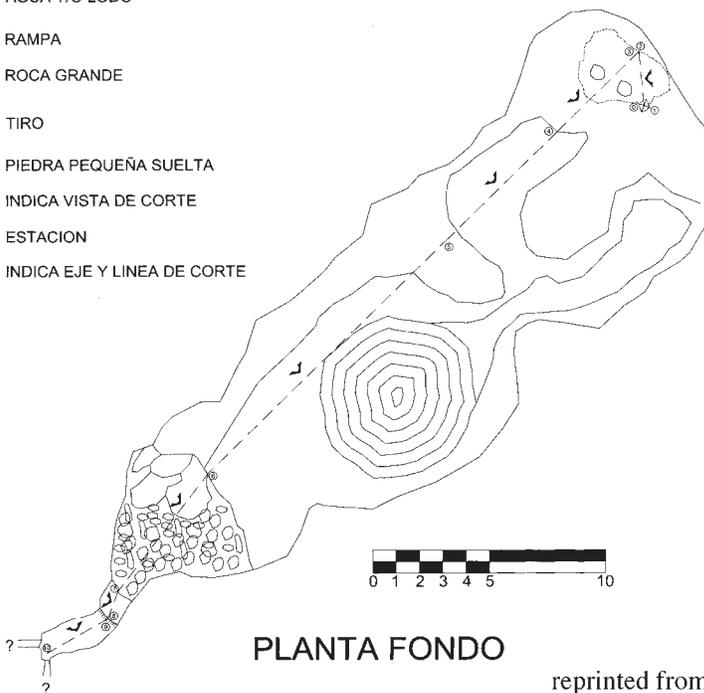
Planos del sótano que, en total de distancia vertical son 208.90 m y distancia horizontal 39.50 m
 Topografía: suuntos y cinta, Sergio Sánchez- Armáas,
 Gerardo Morrill y Homero Resendiz
 Dibujo: Roberto Legaspi



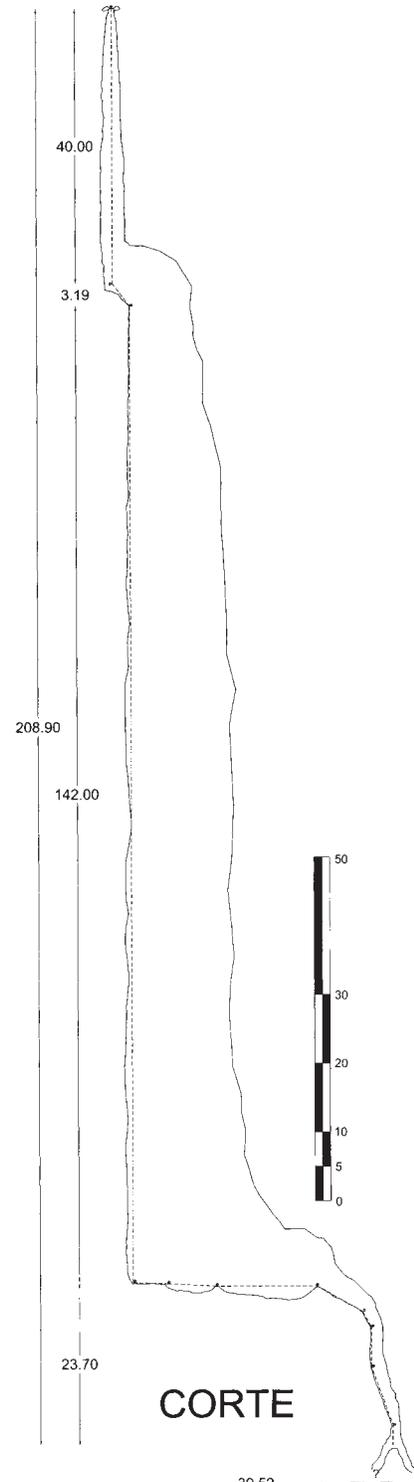
PLANTA ACCESO

SIMBOLOGIA

- AGUA Y/O LODO
- RAMPA
- ROCA GRANDE
- TIRO
- PIEDRA PEQUEÑA SUELTA
- INDICA VISTA DE CORTE
- ESTACION
- INDICA EJE Y LINEA DE CORTE



PLANTA FONDO



CORTE

reprinted from *Tsaval* 7

received in the States reported that a diver had entered an underwater cave and failed to return, that two official divers had been sent in to recover the first, and these also failed to return. Upon arrival the reports had shifted to include a collapse of the shallow coastal ledge into a submarine cavern, literally sucking the three divers all at once into the void.

At the incident briefing held Friday evening at the Hotel Hacienda it became apparent that the geology of the region did not support this theory, and that the eyewitness statements tended to indicate a sediment slump, a sort of underwater landslide, perhaps triggered by aftershocks from a 3.8 magnitude earthquake that had occurred along a major offshore fault on the previous Wednesday. As more firsthand information was gathered Saturday it tended to support this explanation above all others offered.

The facts gathered at the site are as follow: Three instructors with significant support resources and personnel were conducting a deep-diver course under the standards of an open-water certification agency. The students, including a news reporter and a *comandante* of the Protección Civil, an agency of the state of Jalisco that deals with natural disasters and civil disturbances, were in the water conducting skill assessments at the time the incident occurred. The reporter disappeared, but the *comandante* was saved, apparently by the quick actions of one of the instructors. At the time of the incident, divers observed a drastic change in water temperature, a sudden decrease in visibility, a sudden strong downward current, and an unusual number of fish in the water. Instructors' dive-computer logs showed an extremely rapid descent; one reported going from 20 to 60 meters in a matter of seconds. Observers in the boats stated that the water turned from green to reddish-brown very quickly.

IUCRR cave divers RD Milhollin from Fort Worth and Jeff Bozanic from Los Angeles executed two deep dives at the site of the incident on December 6 and 7, 2007, to determine

if remains were trapped in caves reported to exist in the area or under any sort of overhang in the vicinity. No caves, tunnels, or significant overhangs likely to prevent an uninterrupted return to the surface by disoriented divers were found. The active search was called off Thursday evening, although high-resolution remote sensing capabilities will continue to be used to search for remains in the extremely deep sediments of the bay. *Source:* RD Milhollin.

NUEVO LEÓN

Texas cavers Orion Knox and Rune Burnett have retired as coordinators of the restoration project as **Gruta del Palmito** at Bustamante. Articles on the recent activities of the Amigos de la Gruta appear in *AMCS Activities Newsletters* 26 (pages 25–34) and 29 (pages 119–122). Leftover funds will be spent on books about caves for the Bustamante library and perhaps an exhibit in “El Cono,” the building at the base of the mountain. *Source:* E-mail message from Knox and Burnett, July 2007.

OAXACA

The June 2007 *NSS News* contains articles on deep caving in Oaxaca. Jon Lillestolen, Alan Warild, and Philip Rykwaldler wrote about J2, and Nancy Pistole provided the same article about Cueva Cheve that appeared in *AMCS Activities Newsletter* 30.

For years caves have been misspelling and mispronouncing the well-known big resurgence cave at the base of the Cerro Rabón. The spelling is incorrect on both the Pat Kambesis map (*AMCS Activities Newsletter* 26, page 80) and in the Swiss publication on Proyecto Cerro Rabón. I have gotten it wrong in every article I have written about the area. The correct name is **Nacimiento del Río Uluapan**. This can be confirmed by the Mexican government's database of place names. It is also written on the side of the many yellow *camionetas* that work the area. Strange that we cavers have missed that all these years. *Source:* Mike Frazier.

PUEBLA

A small team of seven Groupe Spéléo Alpin Belge members returned to their exploration zone in Zaragoza, Puebla, for three weeks during February–March 2007. Hampered by the flu, the expedition started at a very slow pace, as only three members were able to cave for the first week. Two Mexican cavers joined the group for one week.

The first objective was to continue surveying **La Promesa** (TZ62, 2 kilometers long) in the hopes of connecting it to the underlying TZ48 (**Cueva de Tepepan Zaragoza**, 5 kilometers long, 480 meters deep). After La Promesa was rigged to the previous stopping point at –440 meters, exploration continued, and very soon the junction was made with TZ48 at –460 meters. La Promesa not being a practical entrance for pursuing exploration in TZ48, it was fully derigged, and the team returned to TZ48. Its entrance turned out difficult to relocate, but eventually the team was successful in continuing exploration in the Queue de Cheval cascade area. Upstream yielded 200 meters and downstream only 100 meters of new passage before ending.

TZ48 was derigged, and, together with La Promesa, the new Sistema de Tepepan Zaragoza now surpasses 8 kilometers in length, with a depth of 480 meters. *Source:* Summary by Yvonne Droms of an article in French in *Regards* 66 (2007) by Richard Grebeude.

From March 15–30, 2008, the Mexico City group Chicomóztoc visited caves in the Sierra Negra, around villages of **La Cumbre**, **La Guacamaya**, and **Ojo de Agua**. Among them was a cave with the Nahuatl name Cocouastli, with a depth of 150 meters (if the editor's poor interpretation of Google's poor translation is accurate). The same group signed the log book at La Trinidad, SLP, in November 2007, having done Hoya de la Luz near there. *Sources:* post to Iztaxochila e-mail list by Omar Hernández; Peter Sprouse.



The entrance and Ruta 25 passage in Cocouastli.

In an article in this issue, Gustavo Vela reports on an expedition in spring 2007 that intended to push leads at the bottom of Akemabis in the Sierra Negra, but they located the entrance too late in the trip to do much there. Instead, they re-explored Akemati. (Akemati got its name when cavers asked locals what the name of the cave was. They answered *akemati*, which means “I don’t know” on the local Indian language. *Akemabis* is another tense of *akemati*.) A large, international group returned to the area for a month in 2008. Organizers of the expedition were Franco Attolini, Gustavo Vela, and Al Warild. Other participants for at least part of the time were Kasia Biernacka, Alfonso Calvo, Marta Candel, Luis Díaz, Mike Frazier, Olga García, Marc Kotte, Roberto Legaspi, Pablo Martínez, Enrique Ogando, Guillaume Pelletier, Vladimir Ramírez, Homero Rosendiz, David Tirado, and Bev Shade.

Belgian cavers had in years past pushed **Akemabis** to –1015 meters. As they had moved their area of interest, they gave permission for this expedition to pursue the lead that they had left at the bottom of the cave. Akemabis begins as a large vertical fissure followed by several climbdowns and short rope drops to a depth of about 100 meters. At this point, the vertical nature of the cave become conspicuous, with a 150-meter drop to a shelf where a second 150-meter drop is encountered. After that, back-to-back pitches of varying depths lead to about –600 meters,

where the cave begins to get icky by Mexican cave standards. A tight, muddy passage leads to a short meandering streamway and a 40-meter or so drop. At the bottom of this a short crawl through breakdown takes one into another stream meander. There are 2- or 3-meter shots in some places, slowing surveying. After more nuisance drops, some old rope and bolts from the Belgian exploration were found at approximately –900 meters. Below a virgin 28-meter pit, there were no signs of exploration. A large passage named Calle Sierra Negra below –1000 is some 400 meters long and contains three large domes, two to the north and one at the southern end. At its northern end, there is a muddy sump at –1051 meters. The southern end appeared to end in breakdown, but during an underground camp in the passage, a way on was found into a large room with two further domes, where the water filtered away between rocks in the floor. The new depth of Akemabis is 1101 meters, and the length has grown from 1505 meters to 3219.

While this was going on, others explored a new cave, **El Santito**. It was expected to connect at about –270 meters to **El Santo Cavernario** (see Akemati article in this issue), but instead continued downward. It has been surveyed to a depth of 527 meters and explored to roughly –580, where it continues. This cave, with a current length of 1398 meters, will be the main focus of a trip in 2009.

Prospecting on the slopes of

Tzontzeuciculi located a promising cave at 2400 meters elevation. It was only surveyed to –25 meters during this trip. *Sources:* messages from Mike Frazier and Franco Attolini, Gustavo Vela, and Al Warild.

On January 22, 2008, Arthur Meauxsoone, son of well-known caver Guy Meauxsoone and a citizen of both Belgium and France, fell 5 meters at –400 meters in a cave during a twenty-hour trip in a new cave near Cuaxuxpa, about ten minutes on foot from Alcomunga. The entrance to **El Gran Plano** is at 2400 meters elevation, N18°27'50" W97°01'32". He broke one foot and injured the knee of his other leg. His group moved him up to –265 meters. Teams from Espeleo Rescate México moved him the rest of the way out of the cave. At one point there were twenty-two ERM cavers in three teams rigging the cave for hauling. A doctor was with the patient. The rescue was slowed by some difficult canyons and an 80-meter, unstable pit. Numerous members of Mexican government agencies were on the surface. Arthur left the cave at 5:30 a.m. on January 26. *Sources:* notes from Richard Grebeude (translated from French by Yvonne Droms), Antonio Aguirre Álvarez.

The Mexican government fined the members of the expedition 500 pesos each for cave exploration on a tourist visa. This is the same thing they did after the British cavers had to be rescued from a flooded cave in Cuetzalan, Puebla, in 2004. While

“sport caving” is permitted on a tourist visa, the government’s official position is that cave surveying crosses the line to research and therefore requires another sort of visa. In practice, this has been a problem only in cases where the need for rescue assistance has come to the attention of the national authorities and the press. Don’t have an accident you can’t deal with yourselves.

QUETÉTARO

Last Sunday my friend Pancho invited some of us at the **Sierra Gorda Biosphere Reserve** to visit his family home in the mountains just northeast of Jalpan, and a nearby cave. To reach the cave we had to hike up a steep slope. As we approached the mountain crest vegetation changed from low, spiny scrub to a regular forest with attractively spreading oak trees interspersed with an unusual number of Mexican walnuts (*Juglans mollis*). The Reserve protects the ridge forest, else so close to town firewood gatherers surely would have decimated it by now.

The cave we visited is known as the **Cave of the Goddess Cachún**. Pancho and his family didn’t know anything about Cachún, not even which indigenous culture she was from, maybe Pame, he suggested. (Miguel Ángel Izquierdo Sánchez, an amateur archeologist in Morelos, writes confirming that Cachún was indeed a Pame diety. He further writes that he has read that the Franciscan priest Fray Junípero

Serra, founder of many villages and churches in Sierra Gorda, removed a monolith of Cachún and gave it to the Archbishop of Mexico, who was known as a destroyer of monoliths in his ideological war against indigenous beliefs.)

The cave’s entrance, with a small wooden cross mounted above it, was about large enough to admit a Volkswagen Beetle if somehow you could get a Beetle onto that steep slope. Just inside, however, a large cavern opens up. There were no bats or snakes, but there were plenty of broken stalactites and other shattered and crunched speleothems. People had thrown stones at the ceiling to knock stalactites down. Pancho said typically only two or three people visit the cave in a year, but, still, the destruction mounts up. Don Gonzalo tells me that inside the cave there’s a stone throne where the Goddess is supposed to have sat. The Don also says that there’s another cave in the area with a woman in it hanging from a rope, wearing old-time clothing. Well, Don Gonzalo also says he has a burro who can make the sign of the Cross, so who knows?

I hadn’t realized what a cave-oriented place the Sierra Gorda area was until I came here. Many backcountry people, if they see a gringo wandering around, stop and ask if we’re looking for good caves; this happened to me last week.

Source: Jim Conrad’s Naturalist Newsletter for July 13, 2007, www.backyardnature.net/n/07/070713.htm.

Five pits have been found at an elevation greater than 3100 meters on **Cerro El Espolón** recently. Source: Gilberto Ledesma on Iztaxochitla, the Mexican cavers’ e-mail list.

QUINTANA ROO

On March 16, 2004, two cave divers died in underwater caves, apparently because the air in their tanks was contaminated with carbon monoxide. Clement Pouillot died in **Cenote Dos Ojos**, and Geoff Kalavant died in the Pet Cemetery section

of **Nohoch Na Chich**. Both divers had their tanks filled at the same place, and other divers using that source (unfortunately unidentified in the article) also reported ill effects. Source: *NSS News (American Caving Accidents)*, May 2007.

Czech and Slovak cave divers discovered a 4-meter-long skeleton of a tapir in **K’oox Baal**, a 19-kilometer long underwater cave. The skeleton is forty-five minutes by scooter from the entrance. Clearly it is very old, because a stalagmite grew up through the skeleton before the cave was flooded again at the end of the Pleistocene. Source: www.speleo.cz/clanky/unikatni-objev-na-yucatanu, called to our attention by Jim Coke. Additional information about their Xibalba 2008 expedition (in Czech) can be found at <http://www.speleo.cz/clanky/7>.

An early 2007 connection between Sac Actun and Nohoch Na Chich made **Sistema Sac Actun** the longest cave in Mexico and the longest underwater cave in the world. (See *AMCS Activities Newsletter* 30, pages 39–42.) This record didn’t last long. In early summer 2007, Ox Bel Ha was connected to Yax Chen East, which put **Sistema Ox Bel Ha**, which has 128 entrances, back in the lead for both records. The underwater cave from the other side of the Yax Chen cenote had been part of Sistema Ox Bel Ha before. (See article in *Act. Nl.* 30, pages 77–84.) The May 2008 lengths of the caves are Ox Bel Ha 169,935 meters and Sac Actun 155,686 meters, or 157,725 if the connected dry cave Yax Muul is included (*Act. Nl.* 30, pages 43–49). Other long underwater caves in Quintana Roo are **Sistema Dos Ojos** 57 kilometers, **Sistema Naranjal** 24 kilometers, **Sistema Toh Ha** 23 kilometers, and **Sistema Aktun Hu**, 22 kilometers. Sources: Jim Coke; <http://cave.org/project/qrss/>.

On August 21, 2004, a group of nine divers, including a guide, went to the **Cenote Calimba** entrance of Sistema Sac Actun. The group had been diving together for several days, including one earlier dive in another part of the **Sac Actun** system.

Arthur Meauxsoone in the hospital after the rescue in Puebla.





The skeleton found by Czech cave divers deep in K'oox Baal, Quintana Roo.

Their dive plan for the day called for a traverse between the Cenote Calimba and Cenote Bosh Chen entrances along a route notable for small but well-decorated passages and several junctions.

The divers divided themselves into two teams. The first team, comprising four divers and the guide, planned to enter at Cenote Calimba, follow fixed lines to the Cenote Bosh Chen entrance, and return via the same route. Along the way they would encounter two junctions, where they planned to leave markers to indicate the correct exit route. The second team, comprising Kent Hirsch (53), Michael Nast (37), William Downey (53), and Jeanne Downey (53), planned to enter after the first team and travel along the same route, taking pictures, and turn back at an appropriate time rather than making the complete traverse to the Bosh Chen entrance. The divers discussed the plan at length before the dive, reviewing a map and making diagrams of the junctions that would be encountered along the route.

The first team entered Cenote Calimba and proceeded downstream through about 450 meters of small, well-decorated passage to reach the first junction, known as the Snap & Gap. At that point, the main line from Cenote Calimba ends. A second line leaves the junction and enters a passage called the Paso de Lagarto, which leads to the Cenote Grande and Cenote Ho Tul entrances. The ends of the two lines are separated

by a gap of about 6 meters. The Snap & Gap is a 6-meter section of line that is left coiled at the end of the Calimba line and used to bridge the gap and connect to the Paso de Lagarto line.

The first team connected the two lines and proceeded about 20 meters down the Paso de Lagarto line to a second junction, where the Lagarto line makes a sharp turn to the right, while another passage leads left to the Bosh Chen entrance. There, the divers used a jump reel to connect to a fixed line in the Bosh Chen passage. Once again, they marked the junction to indicate the correct route for their return. They then proceeded to the Bosh Chen entrance, where they surfaced briefly before starting back through the cave to retrace their route.

The second team, of Hirsch, Nast, and the Downeys, had entered the cave behind the first and followed the same route, making the connection to the Paso de Lagarto line at the Snap & Gap, following that line for 20 meters, and switching to the Bosh Chen line according to plan. After following the Bosh Chen passage for some distance, they turned their dive and started back toward Cenote Calimba.

When they reached the junction with the Paso de Lagarto line, they needed to turn right to follow the line to the Snap & Gap and the Calimba line. Instead, they went left, following the Paso de Lagarto line toward the Cenote Grande and Cenote Ho Tul entrances. They did not realize

their mistake until they reached the end of the Paso de Lagarto line, some 400 meters downstream from the Snap & Gap junction. Two days earlier, all four divers had been on a dive from the Cenote Grande entrance upstream to the Snap & Gap via the Paso de Lagarto, and they knew that the end of the line leading to Cenote Grande and the Cenote Ho Tul line was somewhere in the room about 20 meters from the end of the Paso de Lagarto line. The Cenote Grande entrance was only about 200 meters away, and the Cenote Ho Tul entrance was somewhat closer. Hirsch attached the line from his safety reel to the end of the Lagarto line and began searching for the Cenote Grande line. Nast, however, started back upstream along the Paso de Lagarto, with Jeanne Downey following. Bill Downey started after them, and Hirsch abandoned his search, picking up his spool and following.

The four divers made their way back along the Paso de Lagarto to the Snap & Gap and the Calimba line. As they traveled along the Calimba passage, they became separated. Bill and Jeanne Downey were in the lead, with Hirsch and Nast a short distance behind. Bill Downey's air supply began to run low, and he and Jeanne were forced to share. They reached the Calimba entrance and the surface with their tanks almost exhausted.

Meanwhile, the first team had made their way back through the Bosh Chen passage, made the correct

turn to reach the Snap & Gap, and followed the Calimba line to the surface. When the Downeys surfaced and told them what had happened, divers from the first team went back into the cave to help Hirsch and Nast. Unfortunately, they were too late. Hirsch and Nast were found together, 75 meters short of the entrance, their tanks empty. The men had drowned after exhausting their air supplies. *Source: NSS News (American Caving Accidents)*, May 2007. A shorter note about this incident appeared in "Mexico News" in *AMCS Activities Newsletter* 28.

"Cenotes (Anchialine Caves) on Cozumel Island, Quintana Roo, México," by Luis M. Mejia-Ortiz, German Yáñez, Marilú López-Mejía, and Esteban Zarza-González. Abstract: Cozumel Island is a Caribbean locale having karst as the main component of its surface. Known caves are steep-sided, water-filled sinkholes (cenotes), and almost all of them are considered to be anchialine caves because they have seawater connections. In order to identify the location of as many cenotes as

possible on the island, we based our study initially on aerial photographs. This was followed by visits to each site for field verification and collection of physical data and biological specimens. We explored several cenotes to record physical data such as temperature, salinity, dissolved oxygen, depth, pH, light, and to collect the animals living there. As a result, we report on eighteen cenotes on Cozumel Island, their location and fauna. Physical data from three cenotes showed that the freshwater is very thin at the top of the water table. Most of the systems are marine water filled. Varying degrees of connection exist between these sinkholes and the ocean. In addition, other water bodies were found not to be cenotes, but *aguadas* (shallow water basins). *Source: Journal of Cave and Karst Studies*, volume 59, number 2, August 2007.

The site newsinfo.inquirer.net/breakingnews/sports/view_article.php?article_id=91972 reported an Agence France-Presse dispatch of October 2, 2007, that stated the Austrian free diver Christian Redl

announced a new world record after diving to 60 meters in **Cenote Angelita** in 1 minute and 46 seconds. The dispatch says Cenote Angelita is "off the Mexican Yucatan coast" (false) and that the dive was done on September 28. It gives Redl's personal web site as authority for this.

This is very mysterious. According to Wikipedia, all free-diving depth records are much greater than 60 meters. The only one that is close is 86 meters, for a dive without fins or a drop weight, which means the diver had to descend without any equipment to a depth of 86 meters and return to the surface. In that category, 60 meters was exceeded first in 2003. Redl's web site, www.christianredl.com/website/index.php, does not appear, as of May 2008, to have anything at all on it about such a dive.

What Redl's site does have is a lot of news coverage of an alleged distance record of 101 meters for a breath-hold dive, made either in the vicinity of Cenote Garden of Eden or between **Cenotes Corral** and **Ponde-Rosa**, depending on what you read. The duration of that dive is said to have been 1 minute and 16 seconds. Again, this is nowhere near a record, 200 meters for such a dive having been exceeded first, again, in 2003. Perhaps the claimed records are just for free-diving in *caves*.

Founded in 1990, the Quintana Roo Speleological Survey (QRSS) maintains a current catalog of cave-survey information for the underwater and dry caves of Quintana Roo, Mexico. As an official project of the National Speleological Society, we support conservation, safe exploration, and systematic documentation of these unique caves.

Our present area of interest continues to expand. We study the coastal district of Quintana Roo that includes over 8500 square kilometers (3280 square miles). This region is bordered presently on the north by the municipality of Puerto Morelos, extending south to Chumpon Pueblo, and west to the state border with Yucatán. Our records integrate raw cave-survey data with 74 kilometers of land surveys and

Cenotes on Cozumel Island, Quintana Roo

Cenote	Latitude (°N)	Longitude (°W)	Length (m)	Depth (m)
Rancho San Miguel Cenote	20° 30' 40"	86° 53' 55"	8.0	3.0
Rancho San Miguel 1	20° 30' 15"	86° 53' 55"	9.0	2.0
Cenote del Dr. Villanueva	20° 30' 20"	86° 53' 10"	12.0	4.0
Cenote Bambu	20° 29' 35"	86° 52' 30"	61.0	51.8
Universidad de Quintana Roo	20° 29' 30"	86° 56' 45"	15.0	1.5
Cenote Chu-ha (San Francisco)	20° 29' 25"	86° 57' 20"	38.1	18.3
Aerolito	20° 28' 00"	86° 58' 45"	18.3	7.0
Xkan-ha	20° 27' 55"	86° 57' 15"	80.0	35.0
Tres Potrillos	20° 27' 05"	86° 59' 15"	94.0	38.1
Km 1 (Quebrada System)	20° 26' 40"	86° 59' 45"	6.0	5.0
RokaBomba (Quebrada System)	20° 26' 40"	86° 59' 40"	2.0	5.0
Cilpa (Quebrada System)	20° 26' 45"	86° 59' 20"	2.0	4.0
Cenote Cocodrilo	20° 23' 00"	87° 01' 10"	2493.0	17.4
San Andrés El Cedral	20° 22' 50"	87° 00' 30"	15.0	4.0
Rancho Juvencio El Cedral	20° 21' 20"	86° 59' 55"	8.0	3.0
Cenote 1, Rancho El Chino El Cedral	20° 20' 20"	86° 59' 40"	12.0	5.0
Cenote 2, Rancho el Chino El Cedral	20° 19' 10"	86° 56' 05"	3.0	1.0
Cenote 3, Rancho el Chino El Cedral	20° 21' 20"	86° 55' 20"	5.0	1.5

adapted from JKCS 9(2)252

over 560 GPS waypoints for cave entrances. By establishing georeferenced control points, we are able to archive and detect regional karst trends and relationships between 166 independent underwater caves and cave systems that total over 713 kilometers (443 miles) of surveyed underwater passage.

QRSS has expanded their database with survey data from over twenty underwater caves in recent years. These additions are significant either as emerging independent cave systems, caves now connected to older cave systems providing new areas for exploration, or even smaller caves that serve as indicators for local hydrology and geological faulting patterns. Seven underwater caves are noteworthy because they impinge on the Holbox Fracture Zone. We hypothesize that this fracture zone, roughly 11 kilometers inland from the Caribbean Sea, regulates speleogenic evolution and hydrology of near-coastal caves in Quintana Roo. With survey information collected from these and other established caves, over 100 kilometers (62 miles) of surveyed underwater passage was added to the QRSS database. In addition, QRSS maintains survey data and reports from Sistema Ox Bel Ha, Sistema Sac Actun, and Sistema dos Ojos. These are among the longest caves in Mexico and in the world.

We have improved our survey catalogue by initiating a new database on the dry caves of Quintana Roo. Our documentation of these karst features remains in an early phase. The majority of cave exploration in Quintana Roo is focused on submerged passages. Much of this reflects the area's geology, its shallow water table, and a strong historical predisposition for underwater cave exploration in the region. At this time, we maintain survey records on twenty-two dry caves for a total of 11 kilometers of surveyed passage. We report two dry caves (Sistema Tixik K'una and Sistema Yax Muul), each at over 2 kilometers in length. These are the longest documented dry caves in Quintana Roo. Sistema Tixik K'una is expected to see further growth in

2008. [See article and map for Yax Muul in *AMCS Activities Newsletter* 30. Tixik K'una is described in an article in this issue.]

The QRSS sustains this extensive database through the generosity of our contributors. Over one hundred cartographers, explorers, and scientists engaged in diverse cave studies have provided valuable survey information and scientific observations to this archive. Their collaboration continues to reinforce one of the largest records of underwater survey data in the world. All individuals who are concerned with the conservation and documentation of these anchialine and dry caves are encouraged to contribute to the project. The rationale behind this database is twofold: it preserves an account of karst exploration that could otherwise be lost should investigators leave the area and acts



as a central location of information for scientists who are involved in legitimate research. We do not reveal cave locations, where 'going leads' might be found, or share survey data without explicit permission from the original exploration team.

Our companion pursuits include coordinating extensive support for scientific papers on regional hydrology and biospeleology (two papers published, one in press) and expeditions fielded by the Instituto Nacional de Antropología e Historia.

We continue to promote cartographic representations of the underwater caves of Quintana Roo. The majority of underwater survey data in the area is collected as knotted-line survey, where knotted segments of the guideline are tallied between survey stations. This technique normally produces elementary line maps of caves. Only sixteen underwater caves in Quintana Roo are surveyed by methods generating detailed cave maps. These maps

include measurements with fiber-glass tape, compass backsights, and documentation of passage details to create useful maps. Cave divers and dry cavers who are interested in participating in current mapping projects are welcome to join QRSS mapping efforts. *Source:* 2007 annual report of the QRSS to the National Speleological Society Research Advisory Committee, by James G. Coke IV.

There is an article on cave-diving in Quintana Roo on *Discover* magazine's web site at discovermagazine.com/2008/apr/11-the-race-to-find-the-world-s-biggest-underwater-caves. *Source:* Jerry Atkinson.

SAN LUIS POTOSÍ

It was mentioned in "Mexico News" in the last issue that a new road was nearing the village of La Trinidad. Pit fanciers will be glad to know that now, at least with a four-by-four with lots of road clearance, you can drive all the way into La Trinidad. Now **Hoya de la Luz** is only about 1.5 hours of hiking from the trailhead in the highlands above Xilitla. There is a small charge for admission to the area, and a guide will need to be hired. *Sources:* Jim Conrad's *Naturalist Newsletter* for September 28, 2007, at <http://www.backyardnature.net/n/07/070928.htm>; Bill Stone.

Alejandro Vera Morales (43) was participating in the last day of a technical caving course of the Asociación de Montañismo y Exploración of UNAM, to **Hoya de las Guaguas**. There were twenty-eight in attendance, and Alejandro was an instructor. Guaguas has a 150-meter (490-foot) entrance pit. On Saturday, the ropes were rigged and members rappelled in. Alejandro was the last person to go in. During his rappel, he became detached from the rope and fell from somewhere near the top. He died instantly. Examination of his gear showed that his carabiner was unlocked.

Espeleo Rescate México and the Cave Rescue Division of the Red Cross of San Luis Potosí responded. At 1:30 p.m. Sunday, their ropes

were rigged, and the body reached the surface at 4:20 p.m., followed by the remaining people. *Source: NSS News (American Caving Accidents), March 2008.*

In January 2003, cavers toured the large pits in the Aquismón area. They mapped a small cave located in the cliff surrounding Sótano de la Puente, Cuevacita Blanquita de la Puente, which has 22 meters of passage. *Source: article by Gordon Birkhimer in Speleo Digest 2003, pp. 380-381.*

During the Texas Speleological Association's spring convention in April 2008, the Texas Cave Management Association held an auction to raise money to pay for the cave preserve that contains Punkin and Deep Caves in Edwards County, Texas. Vertical gear that was used by TR Evans in the first descent of Sótano de las Golondrinas in 1967 sold for \$320.

A note on current access to **Hoya de las Guaguas**: We headed from the highway to the village of San Isidro. The road is paved all the way, and it took only fifteen minutes. The road continues on to Tampaxal and

Tamapatz. In San Isidro, we parked in front of a building beside the road and visited a house to pay our visitor's fees. The charge was 35 pesos each to rappel and only 10 pesos just to look. A guide took us back to the pit to show us where to rig our ropes. It was a very nice trail, with stone steps and plenty of trash cans. There is a concrete viewing platform set back about 10 meters from the lip on the lower side of the pit. The day we did the pit, we saw perhaps fifty or sixty other visitors to view the pit. *Sources: trip report posted to TagNet e-mail list by Cody Planteen; Andy Zellner.*

Notes on a recent visit to **Sótano de las Golondrinas**: The road to Golondrinas is partly paved, but quickly turns into a dirt road that you wouldn't want to take your car up. We did see a new Honda Fit in the parking area, but its oil pan was leaking from the ordeal. There were a ton of people there, over 300. There must have been fifty or sixty cars. There was a solid line of people all the way from the bend in the road to the pit, grandmas, moms with misbehaving kids, even a guy with a broken leg hobbling up the trail on crutches. It was definitely more

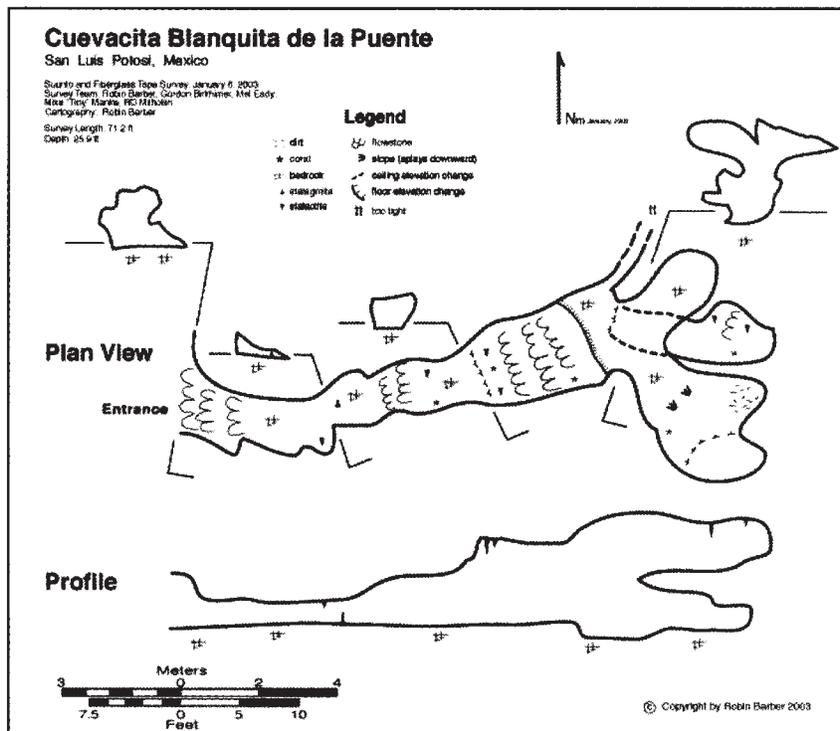
than the locals had ever had to deal with before, and they seemed almost as surprised as we did. We attribute the crowd to the fact that it was *Semana Santa*, Easter Week. There were extra policemen in Aquismón just to deal with the traffic. There were even vendors selling Golondrinas trinkets. We paid our 10 pesos to enter the pit area.

The local people are trying very hard to accommodate all the visitors, but it's just too much. There is nowhere to park so many cars on that single-lane, bumpy jeep-trail. Golondrinas now has its own ranger/security staff of about a dozen people, and to their credit they are truly attempting to keep the pit and surrounding land as it always was. You won't see a single piece of trash, on the surface or at the bottom of the pit. They are installing pit toilets and walkways. It's just a matter of time before there is a large viewing platform at the top of the pit for bird-watching.

There are also at least eight local cavers who live in the area, and they have all done Golondrinas many times. One guy says he's done it fourteen times now. They have their own equipment and are very familiar with vertical-caving techniques.

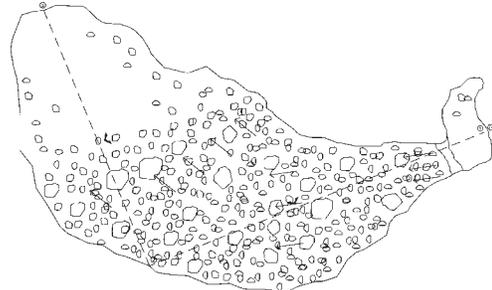
A local man named Orlando told us he lived in a town above the pit, La Unión de Guadalupe, and that they had a spot where we could camp. We gave him a ride up to town, and we camped across from a store in an empty lot (or farmyard, as there were a lot of pigs and chickens in it). We hired three people to help carry and haul the ropes the next day. The town wants to see more visitors. So many people go up to see the pit, but they don't go the little extra distance to La Unión. The town doesn't get any of the fee money from Golondrinas. They are working on a hotel next to our camp field. Everyone in town was very friendly.

We got up early the next morning and prepared our two 1200-foot ropes in two bags each. Our three helpers and I carried the ropes to the pit. I consider myself a decently fast hiker, but I was running to keep up with them. We paid our fee of 35



SÓTANO PUENTE DE LOS TEPOZANES

Mpo. Villa de Zaragoza, San Luis Potosí



Levantamiento suunto y cinta:

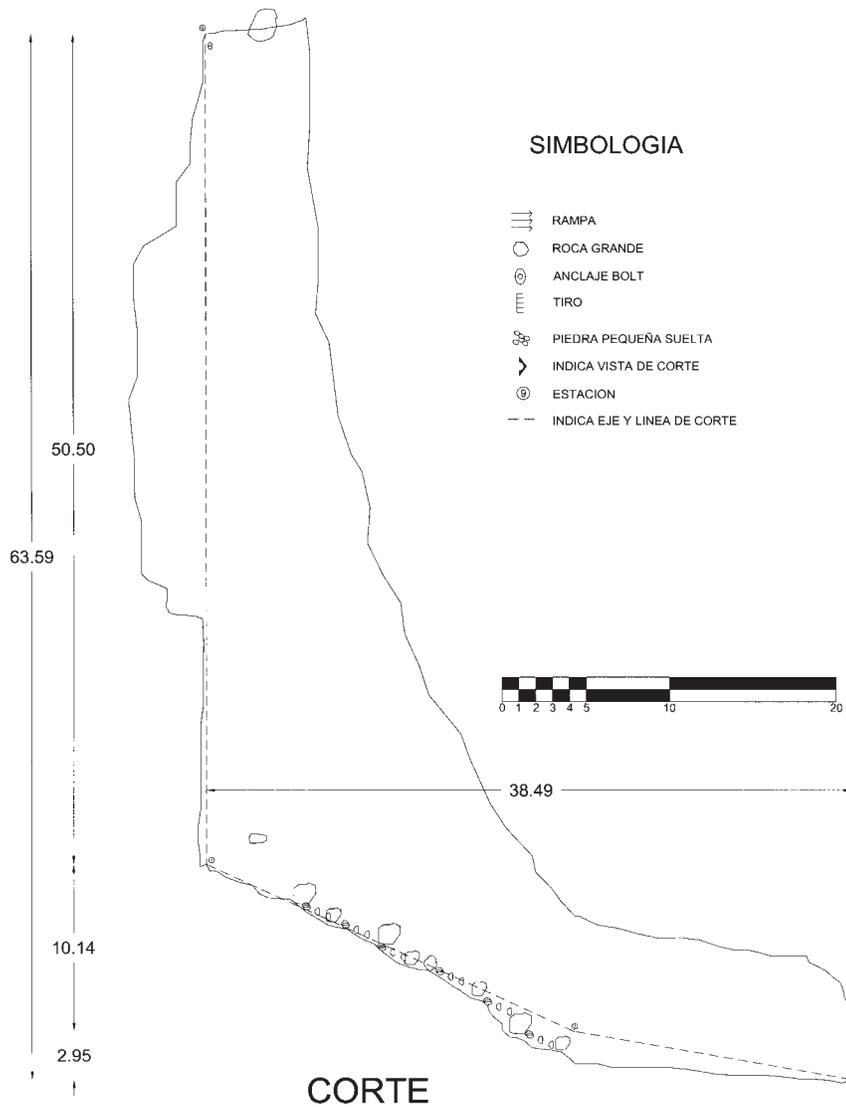
Cyntia Chinchilla
Homero Resendiz
11 de Junio 2006

DIBUJO:
Roberto Legaspi

reprinted from
Tsaval 7

SIMBOLOGIA

- RAMPA
- ROCA GRANDE
- ANCLAJE BOLT
- TIRO
- PIEDRA PEQUEÑA SUELTA
- INDICA VISTA DE CORTE
- ESTACION
- INDICA EJE Y LINEA DE CORTE



pesos each to rappel. We convinced them to let us rappel from the low point, because we weren't sure the ropes would reach from the overlook they took us to first. We rigged the ropes and waited for the green light to descend. We had the pit derigged by 3 p.m.

Most of the other visitors are there to see the birds in the morning or evening. Relatively few were there in the middle of the day. *Sources:* TagNet posts by Cody Planteen and Andy Zellner. There are a large number of photos from the TAG cavers' trip to the Aquismón area at www.yank.to/Photos/2008/20080315%20Mexico/index.html.

New rates and regulations for **Sótano de las Golondrinas:**

Entrance fee 10 pesos per person

Camping 40 pesos per tent

Descending 40 pesos per person

The hours for descending are from 10 a.m. to 3 p.m. If you are planning to camp on the bottom, someone must stay on the surface to pull the rope before 6 p.m., because the rope may not be left there while the birds are returning to their nests. If you are not planning to camp on the bottom, plan your ascents so that everyone is out by 6 p.m.

These rules are needed to protect the population of parrots living in the pit, which a study by a local university showed was declining. It is recovering, but the ecology remains fragile. *Source:* Notice from Sr. Tomás Pérez López, Presidente del Comité de Ecología del Sótano de las Golondrinas, cell 481 101 42 25. Nico Escamillo helped the editor understand the Spanish.

Epeleo Rescate México recovered a body from a well in the village of **El Saucillo**, Mpo. Villa de Reyes, SLP, in April 2008. *Source:* <http://www.espeleorescatemexico.org/tunel/tunel.html>.

TAMAULIPAS

In mid-June 2006, fourteen cavers from the US, Canada, and Mexico camped inside the Infiernillo entrance to **Sistema Purificación** and continued the exploration and survey of the complex Confusion Tubes. They surveyed 993 meters of new

passages, nudging the length of the system over 93 kilometers. *Source:* Article by Dan Green in *Canadian Caver* 66, 2007.

Cornelio Garcia, age thirty, was on his way home from a party and fell into a 50-meter roadside pit. He was killed by the fall. When he did not return home when expected, friends and family members began searching for him along the old road between Gómez Farías and Alta Cima in the **El Cielo** biosphere reserve. The area around the edge of the pit, about 80 meters from the junction for Rancho Cielo, had been disturbed, but the bottom was not visible. After several days of searching with no sign of the missing man, Jean Muzquiz, a caver in Mante, was asked to check the pit, from which the body was recovered. *Source:* Jean Louis Lacaille Muzquiz, in *NSS News (American Caving Accidents)*, May 2007.

In recent years a staircase, complete with bright orange handrails, has been installed at **Cueva de El Abra**. The nearly three hundred concrete stairs and path have made the cave, which is conspicuously visible from a major highway, much more accessible to the general public. Unfortunately, this had led to an abundance of graffiti in the cave. It is heartbreaking to those who remember the cave in its former glory. Also, sections of the handrail are in disrepair. My hope in publishing this information is that a group of conservation-minded cavers will take it upon themselves to clean up the cave next time they are in the area, and possibly even install a sign at the entrance about restraint with the paint. *Source:* Mike Frazier.

Among the sites near Ciudad Mante being promoted by a Mexican tourism web site are the following (somewhat edited):

"El Nacimiento [del Río Mante]. Following the same trail [as to Aguja] 4 kilometer farther, you will get to El Nacimiento. This is an ideal place to practice swimming and enjoy nature. This site has parking facilities as well as a small restaurant served by the locals. It also has rental swimming

gear, row boats, and other equipment that will allow you to get inside the cave that is formed at the base of the mountain range, where the waters surges from deep in the Sierra de Cucharas [known to cavers mainly as the Sierra de El Abra].

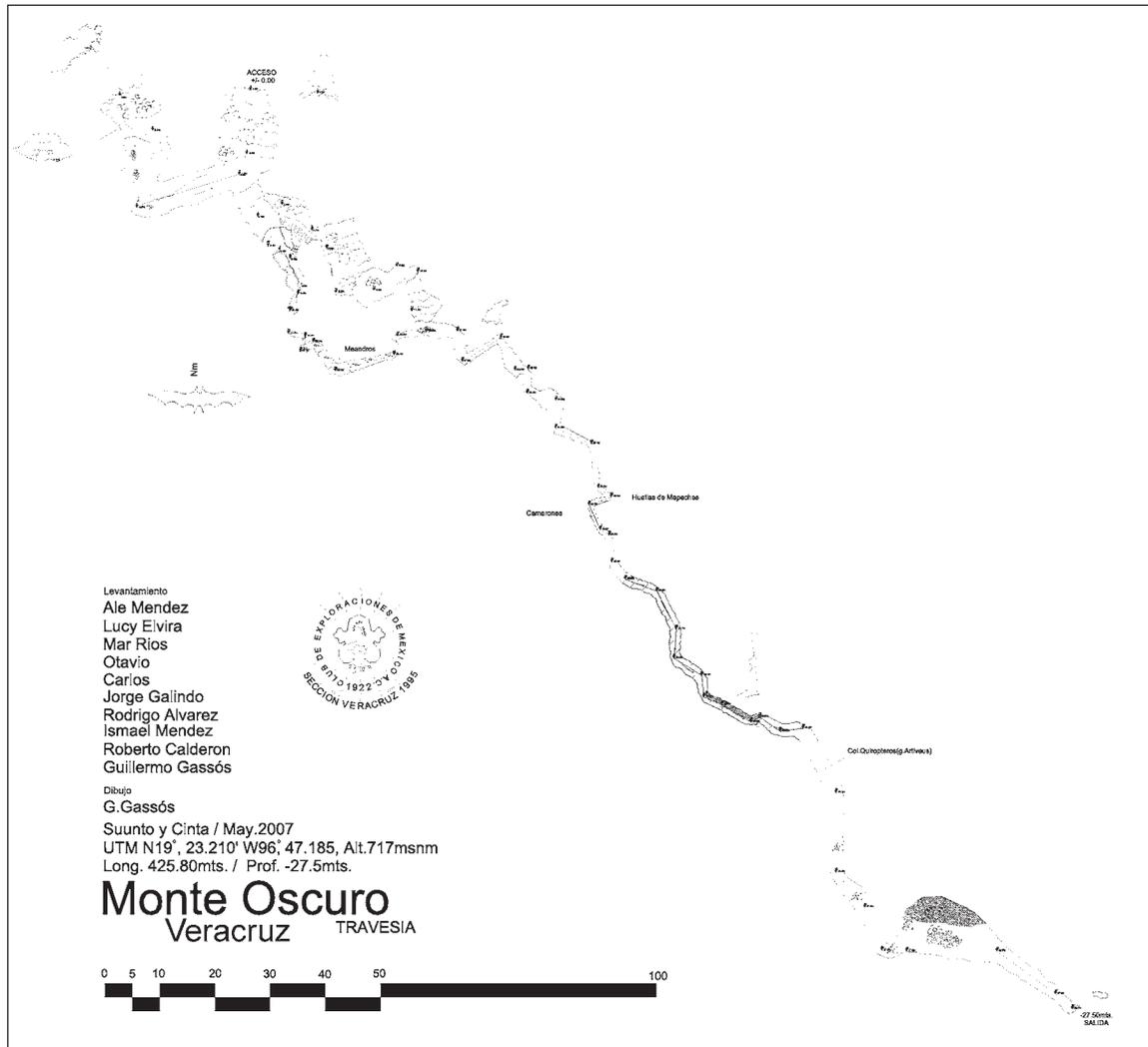
"La Gruta del Quintero. This is a cave in the Sierra de Cucharas situated only 5.5 kilometers from the exit to Cd. Mante on Highway 85 to Cd. Valles. There you will find a small sign on the right-hand side that will guide you to this place. After reaching the town of Quintero by 2 kilometers of paved road, you will find another sign directing you to the cave over an unpaved road (in somewhat regular conditions) for one and a depth of several meters. [Sic ?? Something is obviously missing.]

"La Cueva de El Abra. This is another cave on the Sierra de Cucharas that is accessible to visitors. It is located 4 kilometers ahead from the turn to Gruta de Quintero using the same Highway 85 to Cd. Valles. Here, you can admire the underground that is located at the bottom of the cave, which has main tunnel of 116 meters and was partially descended by a speleologist from Texas in 1956." [Not many tourists see the main decorated passage, because it is down a 27-meter drop. The 1956 visit referred to is that by Frank Nicholson, Bob Hudson, and Jimmy Walker. See *50 Years of Texas Caving*, page 308.] *Source:* <http://www.tourbymexico.com/tamps/mante/mante.htm>, called to our attention by Louise Power.

VERACRUZ

In May 2007, members of the Coordinación de Espeleología of the Veracruz section of the Club de Exploraciones de México, AC (CEMAC) explored and surveyed **Cueva Monte Oscuro**. The village of Monte Oscuro is near Chavarrillo, southeast of Xalapa. *Source:* www.oztotl.com/ps/reports/Monte_Oscuro.pdf.

On March 28, 2008, a field worker fell down a 30-meter pit near **San Andres Temascalapa** (or San Isidro Temascalapa). Members of the Veracruz section of Espeleo Rescate



México recovered the body the next day. *Sources:* <http://espeleorescate-mexico.org/temas/temas.html>; Antonio Aguirre Álvarez.

YUCATÁN

The Indo-Asian News Service reported in November 2007 that Mexican anthropologists have discovered 5000-year-old paintings predating the Maya period in a “Kab cavern” located near Chichén Itzá. Carlos Augusto of the Faculty of Anthropological Sciences at the Autonomous University of Yucatan is quoted as saying many manlike figures, as well as animal drawings, were found in the cave, which is a maze of 3 to 5 kilometers of tunnels 8 meters underground. *Source:* www.

Cavers at the entrance to Cueva Monte Oscuro. From left: L. Elvira, R. Álvarez, G. Gassós, Otavio.



Scenes from the recovery operation at Temascalapa, Veracruz.

.earthtimes.org/articles/printstory.php?news=142281. This description sounds a lot like **Actun Kaua** [see *AMCS Activities Newsletter* 26, pages 65–69], and archaeologists suspect the “discovery” may be of the much more recent paintings there.

Since 2002, Curt Bowen, editor of *Advanced Diver Magazine*, has been organizing diving expeditions to cenotes of Yucatán. Much of their work is documented on the magazine’s web site. In reaction to an inquiry from the AMCS, Bowen password-protected the link to this material from the magazine’s home page, but, as of May 2008, the information can still be reached using the full URLs that follow. Links to data forms, some with maps, on a number of cenotes are on page www.advanceddivermagazine.com/ExpMaya/CENOTES/dataforms.html. A table of GPS coordinates of all cenotes located or explored is GPSDATUM.html. (Locations named *rancho* in the list are not cenotes.) A location map for the region around the towns of Homun and Holca is CENOTEMAP.html. Assembling a usable TIFF file of that map will require dealing with over one hundred smaller image files.

MISCELLANEOUS

Official Mexican **state road maps** are no longer at portal.sct.gob.mx as announced in “Mexico News” in *AMCS Activities Newsletter* 29. They can now be downloaded from <http://dgp.sct.gob.mx/index.php?id=440>. These updated versions are password protected against printing, unlike the downloads I made two years ago. However, a Google search for “remove PDF passwords” will take you to a lot of solutions to that problem. *Source:* David McKenzie.

Beginning on January 31, 2007, **United States citizens returning by car** from Mexico have been required to show proof of their American citizenship at the border. (Formerly, they were allowed to just orally declare their status.) Suitable documents include birth certificates and of course passports or the new passport cards. Since these are the same sorts of things that have been required to obtain a Mexican tourist visa when entering Mexico, this should present little problem.

Travelers returning by air have been required to show a passport or other secure travel document since January 23, 2007.

Beginning on June 1, 2009, according to current schedule, citizens

returning by car from Mexico will be required to present a secure travel document. This could be a passport, a passport card (the new, less expensive and cumbersome card with an RFID chip in it), or a secure drivers license from a state that issues RFID cards that meet the standards set by the Department of Homeland Security. Currently only the state of Washington is issuing such drivers licenses, but all others are expected to begin to soon. Be prepared. *Source:* www.dhs.gov/xnews/releases/pr_1200677666905.shtm.

It is now possible to obtain **Mexican vehicle permits** in advance at certain Mexican consulates in the US or by Internet, although these options are more costly than doing it at the border. See www.aduanas.sat.gob.mx/aduana_mexico/2008/index.html. (Unlike most web sites, this one requires, for some reason, that the index.html part be included.) Click “English” at the top, then “Passengers arriving by land.” Beside how to obtain the vehicle permit, there are other helpful bits of information there. *Source:* Mark Minton.

Recommendation for avoiding or surviving an **Africanized honeybee** attack:

Cenotes Explored during July 2002
ADM Expedition to Tunkas, Yucatán

Azul	20°56.302'	88°44.207'
Balantum	20°55.477'	88°54.595'
Cajun	20°49.723	88°32.658'
Cenotillo	20°57.953'	88°36.196'
Chaua	20°56.089'	88°46.030'
Chenboox	20°58.492'	88°41.274'
Lukuncham	20°56.244'	88°44.491'
Muche-1	20°58.581'	88°40.476'
Mumun Dzonot	20°57.293'	88°44.243'
Noh Sahc	20°48.613'	88°32.806'
Pibtuch	20°56.862'	88°40.473'
Pujila	20°56.542'	88°47.661'
San Andreas	20°59.382'	88°40.493'
San Carlos	20°56.422'	88°45.926'
Tabi	20°35.929'	88°53.957'
Tepakan	20°53.175'	88°40.956'
Vaj	20°58.468'	88°41.330'
Xkolac	20°54.568'	88°51.990'
Xmabel	20°52.073'	88°50.732'
Xtsuts	20°56.789'	88°43.929'
Yax	20°32.963'	88°49.576'

Listen! If you hear the loud hum of bees ahead, backtrack. Slowly go back the way you came. If it's noisy because of cicadas, waterfalls, or whatever, you have lost your early warning system and should be extremely cautious.

Don't use lemony or flowery scents. Any of the following, if scented, may provoke an attack: perfume, deodorant, hair spray, hair gel, cologne, aftershave, soap, shampoo, even chewing gum.

Don't wear bright colors, especially yellow.

Be quiet. If you're in the danger zone, they only need to hear you to attack you.

Remove or cover shiny objects such as carabiners, harness parts, or earrings.

Wear long pants and have a wind-breaker handy (tie it around your waist in hot weather). Wear a hat with a chin strap. Put a beekeeper's veil or your own homemade version of one, as well as a pair of gloves, into your backpack. (The gloves are handy in any case in the thorny Mexican bush.)

Carry Avapena, enough for all members of the group. If stung badly, take one pill and head for a hospital. (Avapena is an antihistamine available in all Mexican pharmacies and

recommended for scorpion and insect bites. The active ingredient is chloropyramine hydrochloride.)

Run! Bees can't fly as fast as a person can run.

Smoke! Smoke always scares them away, even if it's coming from a single cigarette.

Don't jump into the lake. This only works in the movies. The bees will patiently wait for you to surface.

Scrape to remove stings. Use a credit card or knife blade. Don't pull stings out with your fingers, as this will squeeze more venom into the victim.

Source: Attack survivors John Pint and Cesar Guardarrama of SpeleoClub Zotz, www.saudicaves.com/mx/bees/.

There are **geology maps** of Mexico at various scales at www.coremisgm.gob.mx/inicio.html. Near the top of the main page there's a grid of six large icons. Click the upper-right one, "Carta Impresas." This opens a page named "Productos," with icons near the top representing maps of a certain scale. They lead to pages where you can select maps of several kinds in either of two ways, by name or by clicking on an index map. They include a colorful one of the Yucatan Peninsula showing clusters of cenotes, many with names, alongside a dashed arc labeled "Lineamiento de Cenotes Chicxulub." These maps are not the standard geological maps produced by overlying geologic data on the 1:50000 or 1:250000 topo maps, however.

A somewhat useful **database of Mexican place names** can be downloaded from the National Geospatial-Intelligence Agency site at earth-info.nga.mil/gns/html/namefiles.htm. For Mexico, this gets you a 16.6 MB text file with 115,309 records. (This seems like a large number, but the Mexican government's shapefile of rural localities has more than 285K entries.) Each immensely long line has twenty-five tab-separated fields, including location in various coordinate systems and three different

versions of the name (all caps no spaces, mixed case with and without accents). It is difficult to navigate, but you can search for a name using the "find" function in a word-processing program. [I use it mainly to verify spellings.—ed.]

If you are interested in **shapefiles** of Mexico for GIS use, you can go to www.inegi.gob.mx. At the top of the main page, select "Geografía," which takes you to www.inegi.gob.mx/default.aspx?s=geo. At the lower left of that page, there is a section headed "Datos." Click on link beneath it names "Descargos gratuitos" to arrive at www.inegi.gob.mx/default.aspx?s=geo&c=911. Finally, click "Marco Geoestadístico" there to arrive at mapserver.inegi.gob.mx/data/mgm/?s=geo&c=1298. That page has links to four shapefile sets (as ZIP archives). Note that if you click one of the download links you will be asked for name and password. Registration is free and without consequence.

If you go back to the next-to-last page above (c=911) and click on the link named "Información escala 1:1000000," you'll see a page with links to several dozen potentially interesting shapefiles, such as topographic contours, highways, rivers, faults, and archaeological sites. There's even one named "Entrada a gruta" containing fourteen cave locations. Source: David McKenzie.

The Twelfth International Symposium on **Vulcanospeleology** was held in Tepoztlan, Morelos, on July 2-7, 2006. It was organized by Ramón Espinasa and John Pint. There were thirty-eight papers presented. The abstracts and available papers from that symposium, together with those of the preceding two symposia, for 2002 and 2004, have been published as AMCS Bulletin 19, *Proceedings of the X, XI, and XII International Symposia on Vulcanospeleology*, a 305-page book published in April 2008. (Ordering information is at www.amcs-pubs.org.) Below are the titles of the fourteen paper on Mexico. Those whose entries are followed by an asterisk have full papers, not just abstracts, in the proceedings.

Importance of Lava-Tube Flow Emplacement in the Sierra Chichinautzin Volcanic Field, Mexico. Ramón Espinasa-Pereña

Lava Tubes of the Suchiooc Volcano, Sierra Chichinautzin, México. Ramón Espinasa-Pereña

Sistema Tlacotenco, Sierra Chichinautzin, México: Maps and Profiles. Ramón Espinasa-Pereña

Palaeoenvironmental Reconstruction of the Miocene Tepoztlán Formation Using Palynology. N. Lenhardt, E. Martínez-Hernández, A.E. Götz, M. Hinderer, J. Hornung and S. Kempe *

Comparison between the Texcal Lava Flow and the Chichinautzin Volcano Lava Flows, Sierra Chichinautzin, México. Ramón Espinasa-Pereña and Luis Espinasa *

Surveyed Lava Tubes of Jalisco, Mexico. John J. Pint, Sergi Gómez, Jesús Moreno, and Susana Pint *

Cueva Chinacamoztoc, Puebla. Ramón Espinasa-Pereña

Lava Tubes of the Naolinco Lava Flow, El Volcancillo, Veracruz, México. Guillermo Gassós and Ramón Espinasa-Pereña *

The Lithic Tuff Hosted Cueva Chapuzon, Jalisco, México. Chris Lloyd, John Pint, and Susana Pint

Cueva Tecolotlán, Morelos, México: An Unusual Erosional Cave in Volcanic Agglomerates. Ramón Espinasa-Pereña and Luis Espinasa *

Limestone Dissolution Driven by Volcanic Activity, Sistema Zacatón, México. Marcus O. Gary, Juan Alonso Ramírez Fernández, and John M. Sharp, Jr.

Possible Structural Connection between Chichonal Volcano and the Sulfur-Rich Springs of Villa Luz Cave (a.k.a. Cueva de las Sardinas), Southern México. Laura Rosales Lagarde and Penelope J. Boston *

Cueva del Diablo: A Batcave in Tepoztlán. Gabriela López Segurajáuregui, Rodrigo A. Medellín and Karla Toledo Gutiérrez *

Troglobites from the Lava Tubes in the Sierra de Chichinautzin, México, Challenge the Competitive Exclusion Principle. Luis Espinasa and Adriana Fisher *

The VII Congreso Nacional Mexicano de Espeleología of the Unión Mexicana de Agrupaciones Espeleológicas was held from February 2–5, 2007, in Cuetzalan, Puebla. It was organized by URION, the Unión de Rescate e Investigación en Oquedades Naturales AC. The presentations as listed in the *memorias* of the event are given below. An English translation of Carlos Lazcano's paper appears elsewhere in this issue.

Breve historia de las exploraciones de la SMES y espeleólogos británicos en Cuetzalan, Puebla, México. Dr. Ramón Espinasa Pereña

Geología y Espeleogénesis del Sistema Cuetzalan. Dr. Ramón Espinasa Pereña

La intervención escultórica del espacio subterráneo. Alberto Maldonado Bravo

El Sistema de Cuevas Volcánicas más grande de América. Biol. Hugo Enrique Ramírez Silva



Una perspectiva para la conservación de cuevas en México. M. en C. Ada Alicia Ruiz Castillo

Bioespeleología en la zona de Ixtaxochitla: diversidad de artrópodos cavernícolas en la Cueva de las Ratas. Saúl Castañeda Contreras, Aldo Bemal Rojas y Alejandra Domínguez Álvarez

Métodos de colecta Bioespeleológica, el caso de las arañas en la Cueva de las Sardinas. Lucía Georgina Pastrana Ruiz

Biodiversidad de microartrópodos de la "Cueva de la Boca", Santiago, Nuevo León, México. Daniel Alfonso Estrada Bárcenas

Primeros registros de campodeidos (Diplura: Campodeidae) de Coyomeapan, Puebla, México. Arturo García-Gómez

Nuevos registros de los colémbolos (Insectos) de México. José G. Palacios-Vargas

Las cuevas mexicanas, hacedoras de Mitos y Leyendas. Gerardo Jaso Nacif

El mito del Hombre Salvaje de las Cavernas. Carlos Augusto Evia Cervantes

Estudio mitológico y analítico de un ser Arauco en cerámica. Adrián Álvarez Chávez

Épocas e intereses de la exploración del mundo subterráneo en México. Alejandrina Pérez Casar

La Cruz Roja en la espeleología mexicana. Alejandro Lorenzo García Gallardo

Historia de la espeleología en Chiapas. Ibán Corzo Hernández

Plan de Manejo de la Caverna Santa Catalina, Matanzas, Cuba. Esteban R. Grau, Ivonne Vázquez

Treinta años explorando México: una reflexión. Carlos Lazcano

Grutas Xoxafi: un desarrollo sustentable. Erick Patricio Angeles, Efraín Bautista y Norberto Bolaños

Espeleodifusión Yucatán. Arqloga. Fátima del Rosario Tec Pool

Labor comunitaria del grupo Manuel Santos Pargas en el mayor humedal del Caribe insular. Marlon López Hernández

Cuevas de Bellamar: El Tour de las Esponjas. Fernando Arencibia, Esteban R. Grau, Ivonne Vázquez, Humberto Fernández

El Proyecto Naica (Chihuahua, México). Giovanni Badino, Tullio Bernabei, Alicia Dávila, Paolo Forti

Construcciones prehispánicas en el interior de cuevas del estado de Yucatán. Arqloga. María José Gómez Coba

Arqueología de paisaje ritual en la Caverna de Cuncabac, Tactalopa, Tabasco. Eladio Terreros Espinosa

Evidencia cultural de ocupación prehispánica en cuevas de la cordillera Puuc, en la región de Tekax, Yucatán. Susana Echeverría Castillo

Nuevos hallazgos arqueológicos en las cuevas de Ixtaxochitla, Puebla: Evidencias y posibles significados. Ramona García Aburto y Rodrigo Remolina Anzures

Arqueología histórica en un refugio

- de cimarrones: Cueva “El Grillete”. Boris Ernesto Rodríguez Tápanes y Odianyer Hernández de Lara
- Estudio de una cavidad cárstica en el Castillo de San Severino de la ciudad de Matanzas. Lic. Leonel Pérez Orozco, Dr. Candido Santana Baranis, Lic. Ricardo Viera Muñoz y Lic. Jorge I. Rodríguez Bueno
- Espeleología y arqueología en Humedal del Sur: Aportes a la población cenaguera. Nibaldo Calvo Buides
- Semanario Girón. Análisis bibliográfico temático (espeleología y arqueología). Arnaldo Calvo Buides
- El Método Geográfico aplicable a las Investigaciones Espeleológicas. Alejandro Torres Cid del Prado
- El fenómeno cárstico de la Sierra Mixteca-Zapoteca (Oaxaca, México). Marco Mecchia, Leonardo Piccini, Alicia Dávila
- Exploración de la extensión de la espeleogénesis por ácido sulfúrico en la región norte de Chiapas, sur de Tabasco, México. Laura Rosales Lagarde, Penelope J. Boston, Mike Pullin, Kevin W. Stafford
- Geología y sus aplicaciones en la espeleogénesis de la zona de Cacahuamilpa, Guerrero. Javier Bustamante, Rogelio Hernández, Lenin Valdez, Esli Salgado, Rosa Dorantes y Alberto Avilés
- El fenómeno cárstico del Valle de Cuatro Ciénegas, Coahuila, México. Leonardo Piccini, Tullio Bernabei, Italo Giulivo
- Ice in caves — genesis, dynamics and paleoclimatic significance. Aurel Perşoiu
- Aplicación de estándares NFPA para el espeleosocorro. Antonio Aguirre Álvarez.
- Krubera-Voronia: Memorias de un viaje. Gustavo Vela Turcott
- Topografía y diseño: Cerro Colorado (Córdoba, Argentina). Walter Alberto Calzato
- Importancia del clima en la actividad espeleológica de México. Dr. Mario Gómez Ramírez
- Estudio descriptivo de la meseta de Copoya, Chiapas, México. Jorge Antonio Paz Tenorio
- Exploración de “El Volcán de los Murciélagos”, Calakmul, Campeche, México: Entorno clave para la conservación. Roberto Rojo, Tom Gheysens y Enrique Escobedo
- Proyecto Espeleológico Selva Lacandona Metzabok. Octubre de 2004 y Septiembre de 2005. Javier Vargas Guerrero
- Proyecto de exploración geográfica y espeleológica San Fernando, Chiapas, México. Mauricio Náfate López
- Las cuevas pintadas de la Mixteca Alta de Oaxaca, México como lugares de origen de la escritura y narrativas pictóricas. Carlos Rincón Mautner
- Una cueva conocida es una gruta destruida, Vandalismo y Turismo. Mike Boon
- Subterranean Biology*, volume 4 (2006), contains the following papers on Mexico: “First Faunistic Records of Arthropods from **Cueva de Oxtotilan**, Guerrero, Mexico,” by G. Palacios-Vargas et al., and “Reduction of a Visually Mediated Association Preference in the **Cave Molly** (*Poecilia mexicana*, Poeciliidae, Teleostei),” by M. Tobler et al. The site <http://www.fi.cnr.it/sibios/subtbiol.htm> lists three more papers on the cave molly in volumes 1 and 2. It contains no abstracts, and not even the tables of contents for volumes later than 2.
- The Society of American Archaeology held its seventy-second annual meeting in Austin, Texas, April 25–29, 2007. Two of the sessions concerned **Maya cave archaeology**. Session 108 was a symposium “Cave Perspectives on Mesoamerican Religion and Politics,” organized by Keith Prufer. Scheduled 15-minute talks were:
- Quen Santo Revisited. Sergio Garza, James Brady, Christian Christiansen, Allan Cobb, and Jennifer Mercede. (Five alleged authors for a 15-minute talk—now *that’s* academic game-playing—ed.)
- The Canoe in the Cave: A Case for a Burial Shrine in Southern Belize. Holley Moyes, Keith Prufer, and Bethany Myers
- In the Maya’s Own Words: The Use and Context of the Ch’en Glyph. Bethany Myers
- Gender and Jakaltek Cave Use. Jennifer Mercede
- Recent Advances in the Study of Ancient Maya Cave Use in the Macal Valley, Belize. Cameron Griffith
- The Chicomoztoc and Modern Jalkateko Origin Mythology. Arnulfo Delgado and James Brady
- Mortuary Practices in Cenotes of Northern Yucatán: A Regional Approach. Guillermo de Anda Alanis
- Regional Pilgrimage, Caves, and the Politics of Class. Shankari Patel
- Gender Processes in the Formation and Negotiation of Power in the Main Chsm, Aguateca, Guatemala. Reiko Ishihara
- On the Trail of the Shaman: Cueva de los Músicos and the Puente Colosal, Mixteca of Oaxaca and Puebla. Delfino Pérez-Blas and Carlos Rincón Mautner
- New Lines of Inquiry for Ritual Assemblages: The View from the Southern Peten. Jon Spenard and Brent Woodfill
- Session 141 was a symposium “Ten Years since Nashville: Assessing the First Decade of Mesoamerican Cave Archaeology,” organized by James Brady and Ann Scott. Scheduled 15-minute talks were:
- The Role of the Nashville Cave Session in the Development of a Self-Conscious Subdiscipline. Ann Scott
- The Contribution of Cavers to the Development of Maya Cave Archaeology. Allan Cobb and James Brady
- BVAR and the WBRCP in the Development of Maya Cave Archaeology. Jaime Awe
- Heart of Earth: An Assessment of a Decade of Publications on Mesoamerican Cave Archaeology. Dominique Rissolo
- The Cave/Settlement Survey as an Emerging Investigative Approach. Polly Peterson.
- Contributions of Cave Archaeology to a Generalized and Comparative Understanding of Mesoamerican Societies. Keith Prufer
- Emerging from the Dark: Defining Cave Archaeology as a Field. James Brady

Mark Minton
 May 2008
 Depth in meters

DEEP PITS OF MEXICO

1	El Sótano (de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de la Culebra	Entrance drop	Querétaro	336
4	El Zacatón (mostly underwater)	Entrance drop	Tamaulipas	335
5	Sótano de Tomasa Kiahua	Entrance drop	Veracruz	330
6	Sótano de Alhuastle	P'tit Québec	Puebla	329
7	Nita Xonga	Psycho Killer	Oaxaca	310
7	Akemabis		Puebla	310
9	Sotanito de Ahuacatlán	Second drop	Querétaro	288
10	Sótano del Arroyo Grande	Entrance drop	Chiapas	283
11	Sima Don Juan	Entrance drop	Chiapas	278
12	Hálito de Oztotl	Entrance drop	Oaxaca	250
12	Sima Dos Puentes	La Ventana	Chiapas	250
14	El Santo Cavernario	El Santo Tiro (Pozo Fabian)	Puebla	245
15	Sótano del Aire	Entrance drop	San Luis Potosí	233
15	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
17	Sistema Ocotempa	Pozo Verde	Puebla	221
18	Sótano de los Planos	Puits Tannant	Puebla	220
18	Sistema Soconusco	Sima de la Pedrada	Chiapas	220
18	Sótano de Eladio Martínez	Entrance drop	Veracruz	220
18	Live in Busch	Entrance drop	Oaxaca	220
22	Sótano de Coatimundi	Entrance drop	San Luis Potosí	219
23	Pozo del Cerro Grande	Entrance Drop	Jalisco	218
24	Resumidero el Borbollón	Tiro Grande	San Luis Potosí	217
24	Sótano de Sendero	Entrance drop	San Luis Potosí	217
26	Sima del Chikinibal	Entrance drop	Chiapas	214
27	Kijahe Xontjoa	Son On Jan	Oaxaca	210
28	Nacimiento del Río Mante (underwater)	Macho Pit	Tamaulipas	206
29	Hoya de las Guaguas	Entrance drop	San Luis Potosí	202
30	Hoyanca Calpulalpan	Entrance Drop	Tlaxcala	201
31	Kijahe Xontjoa	Lajao Se	Oaxaca	200
31	Fundillo de El Ocoté	Entrance Drop	Chiapas	200
31	Sistema de la Lucha	Entrance drop	Chiapas	200
31	Sistema H3-H4		Puebla	200
31	Nita Gatziguin	Entrance drop	Oaxaca	200
36	Sima La Funda	Entrance drop	Chiapas	198
37	Sótano de Soyate	Entrance drop	San Luis Potosí	195
38	Cueva de los Murmullos (Cueva del Tízar)	Tiro de los Murmullos	San Luis Potosí	190
38	Sótano de Alpupuluca	Entrance drop	Veracruz	190
38	Cuabtempa	Pozo con Carne	Puebla	190
38	Sótano de Tepetlaxtli No. 1	Entrance drop	Puebla	190
42	Sótano de Puerto de los Lobos	Entrance drop	San Luis Potosí	189
43	Hoya de la Luz	Entrance drop	San Luis Potosí	188
43	Sótano Hondo	Entrance drop	San Luis Potosí	188
45	Sótano de Hermanos Peligrosos	Second drop	Veracruz	186
46	Atlaquía (Sótano) de Ahuihuitzcapa	Entrance drop	Veracruz	180
46	Sima de Veinte Casas	Entrance drop	Chiapas	180
46	Croz 2	Entrance drop	Puebla	180
49	Sima del Cedro	Entrance drop	Chiapas	175
50	Sótano de la Cuesta	Entrance drop	San Luis Potosí	174

DEEP CAVES OF MEXICO

Mark Minton
May 2008
Depth in meters

1	Sistema Cheve	Oaxaca	1484
2	Sistema Huautla	Oaxaca	1475
3	Cueva Charco	Oaxaca	1278
4	Akemati	Puebla	1226
5	Kijahe Xontjoa	Oaxaca	1223
6	J2 (Ozto Faustino, Ozto Barbie)	Oaxaca	1209
7	Akemabis	Puebla	1101
8	Sistema Ocotempa	Puebla	1070
9	Soncongá	Oaxaca	1014
10	Sistema Purificación	Tamaulipas	957
11	Guixani N'dia Kijao	Oaxaca	955
12	Sistema Perrito (Nia Quien Nita + Nia Nga'co Nita)	Oaxaca	906
13	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli)	Puebla	899
14	Nita Chó	Oaxaca	894
15	Sótano de Agua de Carrizo	Oaxaca	843
16	Sótano de El Berro	Veracruz	838
17	Sótano de Trinidad	San Luis Potosí	834
18	Resumidero El Borbollón	San Luis Potosí	821
19	X'oy Tixa Nita	Oaxaca	813
20	Nita Ka	Oaxaca	760
21	Sistema H31-H32-H35	Puebla	753
22	Sonyance	Oaxaca	740
23	Nita Xongá	Oaxaca	739
24	Yuá Nita	Oaxaca	705
25	Aztotempa	Puebla	700
26	Sótano de los Planos	Puebla	694
27	Sótano de Alfredo	Querétaro	673
28	Sistema de los Tres Amigos	Oaxaca	659
29	Sistema Cuetzalan	Puebla	658
30	Sótano de Tilaco	Querétaro	649
31	Nita Nashi	Oaxaca	641
32	Cuaubtempa Superior	Puebla	640
33	Sistema Soconusco - Aire Fresco	Chiapas	633
34	Sistema Atlalaquía	Veracruz	623
35	Cueva de Diamante	Tamaulipas	621
36	Sistema Coyolatl	Puebla	620
37	R'ja Man Kijao (Nita)	Oaxaca	611
38	Nita He	Oaxaca	594
39	El Santo Cavernario	Puebla	593
40	Meandro Que Cruce (H54)	Puebla	588
41	Yometa	Puebla	582
42	Sótano de las Coyotas	Guanajuato	581
43	Sótano Arriba Suyo	San Luis Potosí	563
44	Sistema Tepetlaxtli	Puebla	535
45	Sótano de Nogal	Querétaro	529
46	El Santito	Puebla	527
47	Resumidero de la Piedra Agujerada	San Luis Potosí	526
48	Grutas de Rancho Nuevo	Chiapas	520
49	Atlalaquía (Sótano) de Ahuihuitzcapa	Veracruz	515
49	Sótano de las Golondrinas	San Luis Potosí	515

Updates and corrections:

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Mark Minton
 May 2008
 Length in meters

LONG CAVES OF MEXICO

1	Sistema Ox Bel Há	Quintana Roo	169935
2	Sistema Sac Actun	Quintana Roo	157725
3	Sistema Purificación	Tamaulipas	94536
4	Sistema Huautla	Oaxaca	62099
5	Sistema Dos Ojos (Sistema Jacinto Pat)	Quintana Roo	57762
6	Cueva del Tecolote	Tamaulipas	40475
7	Sistema Cuetzalan	Puebla	37676
8	Kihaje Xontjoa	Oaxaca	31373
9	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli)	Puebla	28283
10	Sistema Soconusco - Aire Fresco	Chiapas	27793
11	Sistema Cheve	Oaxaca	26194
12	Sistema Naranjal (Najarón-Maya Blue)	Quintana Roo	24257
13	Sistema Toh Há	Quintana Roo	23005
14	Sistema Coyolatl	Puebla	23000
15	Sistema Actun Hu	Quintana Roo	22286
16	Sistema K'oox Baal	Quintana Roo	19178
17	Sistema Aerolito	Quintana Roo	18000
18	Cueva de Alpazat	Puebla	15200
19	Sistema PonDeRosa (Pondazul, Eden)	Quintana Roo	15019
20	Atlixicaya	Puebla	13000
20	Cueva del Río La Venta	Chiapas	13000
22	Chjine Xjo	Oaxaca	12400
23	Cueva Pitch	Quintana Roo	12000
24	Sistema San Andrés	Puebla	10988
25	Cueva de la Mano	Oaxaca	10841
26	Sistema Taj Mahal - Minotauro	Quintana Roo	10600
27	Actun Káua	Yucatán	10360
28	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
29	Cueva del Arroyo Grande	Chiapas	10207
30	El Chorro Grande	Chiapas	9650
31	Sistema Camilo	Quintana Roo	9649
32	Sistema Muul Three	Quintana Roo	9630
33	Sistema Tepetlaxtli	Puebla	9600
34	J2 (Ozto Faustino, Ozto Barbie)	Oaxaca	9536
35	Sistema Tux Kupaxa	Quintana Roo	9254
36	Sistema Chac Mol - Mojarra	Quintana Roo	9193
37	Cueva Quebrada	Quintana Roo	8921
38	Sistema Brumas Selváticas	Puebla	8870
39	Sótano de Las Calenturas	Tamaulipas	8308
40	Nohoch Aktun	Quintana Roo	8200
40	Gruta del Tigre	Quintana Roo	8200
42	Sistema de Tepepan Zaragoza (TZ48-TZ62 (Promesa))	Puebla	8000
43	Sumidero Santa Elena	Puebla	7884
44	La Ciudad	Puebla	7828
45	Cueva Yohualapa	Puebla	7820
46	Cueva de la Peña Colorada	Oaxaca	7793
47	Cueva de Comalapa	Veracruz	7750
48	Sistema Zapote (Toucha-Há - Vaca Há)	Quintana Roo	7697
49	Sistema Xunaan-Há (María Isabella, 3B)	Quintana Roo	7600
50	Sistema de los Tres Amigos	Oaxaca	7474

ARTICLES



AKEMATI AREA EXPEDITION 2007

Gustavo Vela Turcott

We'd all heard the story from our friends in the Groupe Spéléo Alpin Belge, the story of how they'd stopped exploration in Sótano de Akemabis at -1015 meters at the edge of a 30-meter drop because they were out of time. That was in 1990, during one of a series of expeditions to the Sierra Negra in Puebla. Over the years since then, the GSAB has moved their search for new caves farther to the northwest and has left this area behind.

In March 2007, motivated by the story that Akemabis continued, I, along with my friends Franco Attolini and Alan Warild, organized an expedition of thirty days and thirteen cavers from ten clubs and six nationalities. Our objectives were to have a good time, explore a bit in Akemabis, and, if we had time, descend Sistema Ocotempa, another thousand-meter-deep cave in the area, by the Pozo Verde entrance. Of our three objectives, the only one we achieved was to have a good time.

Freeeeee," was how I let Al Warild know that he could use the rope. I had just passed the second rebelay, and another stretch of the rope was free. I was 60 meters above him hanging from the rope in a 134-meter pit; I still had the second half to ascend. We were completely soaked, because we'd just been hit by a flood. It had been raining all day on the surface, and the soil just couldn't

absorb another drop. Small streams had begun to form and flow directly into the caves. What had been just a few drops on our way down had been transformed into a good-size waterfall. An "ooo-kaay" confirmed that my friend below was continuing his ascent.

At the beginning of the expedition, there were seven of us in the tiny community of Ocotempa in the Sierra Negra. While some set up base camp, the others went in search of the entrance to Akemabis. Two of us who had been on a expedition to the area a few years before believed we knew where the entrance was, so we went looking, and after a short battle we found one well hidden in the scrub. Only a short way in, though, we realized that the cave bore no resemblance to the map we had. So we were confused. Were we in Akemabis or a new cave? We'd

relied on our memories instead of asking for more details from the original explorers. Just to be sure, five of us went to take a closer look for entrances near Akemati, another thousand-meter-deep system that had been explored by the GSAB in 1988 and 1990 to 1226 meters below the higher Akemasup entrance. We knew that Akemabis was only 100 meters away in a straight line to the northwest and 20 meters lower than Akemati—no problem, then . . .

After a few hours of searching, instead of lessening our frustration, we had only increased it. In the dense cloud forest we found more cave entrances, and any of several of them could have been Akemabis. If that wasn't enough, our Belgian friends had given us coordinates, but we didn't have a GPS. (But we'd have been dubious, anyway, about a 1990 GPS point taken in the thick forest.) A



From left: Lorenzo Ortiz, Yolotzin Medina, Ignacio Rafael, Jon Lillestolen, Ángel Barrio, Alan Warild, Franco Attolini, Joaquín Dobarrio, and Gustavo Vela. Other expedition participants not shown: Ruud Brassé, Tjerk Dalhuisen, Sergio Ortega, and Tony Seddon. *Gustavo Vela.*

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Translated from Spanish by Al Warild.

Franco Attolini near the entrance to Santa Cavernario. *Gustavo Vela.*



topo map with the entrance marked in the wrong spot didn't help, either. So we navigated through the forest with map and compass and our explorers' instincts. Tired, we rested beside the track and discussed the problem. Laurencio, a young landowner from Huizmaloc, appeared around the corner. He assured us that he could take us to Akemabis. He kindly led us several minutes *up hill* to the entrance that we apparently had been looking for, although it didn't nearly fit the description, "only 100 meters away in a straight line to the northwest and 20 meters *lower* than Akemati."

Oh, well. The next day, Lorenzo Ortiz and Tony Seddon began rigging the cave. Eight hours later they returned, telling how they had found some bolts near the top of the entrance pit and had descended a

roughly 130-meter pit, stopping at the top of a 30-meter drop. Everything *inside* the cave, at least, appeared to indicate that we were in Akemabis at last.

During the night, a misty rain dampened base camp. Al and I set

off early to rig more rope. We began the descent, first a 5-meter drop, then a 4-meter one, a short ramp, a narrow passage, and then we hit the big pit over 100 meters deep. As we descended it, we realized that our friends had rigged the rope directly where water would flow, had there been more than the few drops that moistened our clothes and helmets. We commented on how "interesting" it would be after rain, but there wasn't much we could do about it with the rigging gear below, so we continued down to where our friends had stopped. We rigged and descended the 30-meter pit, but instead of finding more pitches, we hit a horizontal gallery. "What? Where are we?" we asked ourselves. The cave no longer looked anything like the line plot we had of Akemabis. We looked for footprints or other marks of previous explorers and found none. We had to admit that we weren't in Akemabis but in some other partially explored cave, where below -200 meters there were no marks. A new cave is better than an old one any day, so we decided to continue.

After walking and occasionally crawling we eventually hit another



Alan Warild, Franco Attolini, and Tjerk Dalhuisen in the room at the top of the first big drop in Santo Cavernario. *Gustavo Vela.*

Tjerk Dalhuisen just before the first big drop in Santo Cavernario. *Gustavo Vela.*



Photos by Gustavo Vela, clockwise from upper left:

Sergio Ortega at -280 meters in Santo Cavernario.

Ignacio Rafael in Akemati.

Lorenzo Ortiz rigging the 101-meter Midnight Express pit at -980 meters in Akemati.

Passage in Akemati.

Ignacio Rafael in a skylight near the entrance to Akemati.

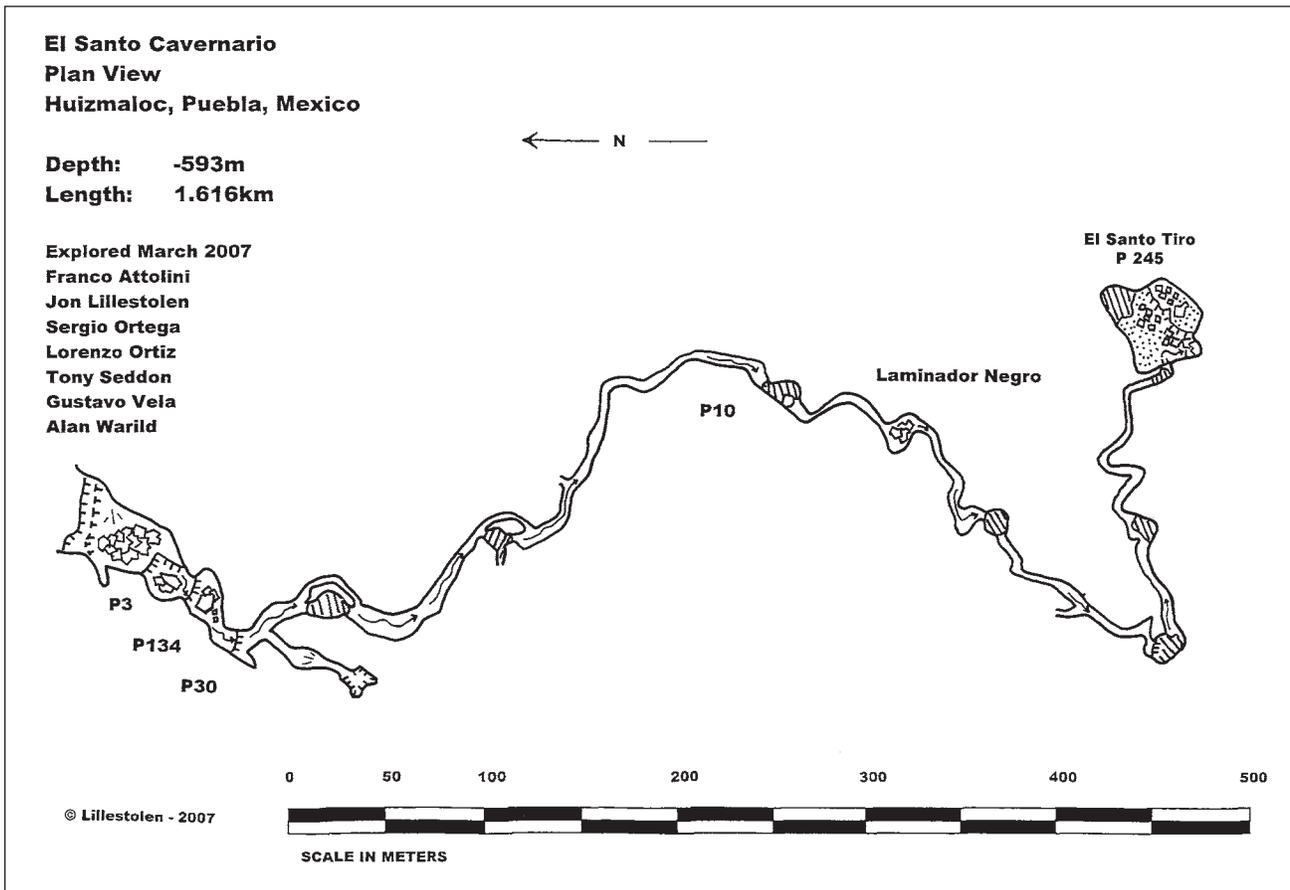




Franco Attolini at -550 meters in Akemati. *Gustavo Vela.*



Ignacio Rafael descending the first drop in Akemati. *Gustavo Vela.*



drop. Even though it was small, we descended, hoping to find more pitches, but to our surprise we found a second horizontal passage even narrower, to our dismay, than the previous one. So narrow, in fact, that some spots were only passable by squeezing through the low bedding-plane slot between roof and floor, sharing it with the water—no chance of getting through here dry. We got about 100 meters farther before we stopped at a tiny 4-meter drop. Eight hours in and having strategically left the rigging gear at the foot of the small drop, we decided to head for home. On our way up we passed Franco Attolini and Jon Lillestolen, who were on their way down to relieve us. They told us not to hurry, as it was still cold and rainy on the surface.

Only when I arrived at the foot of the 130-meter pit did I notice that there was a little more water. Hungry, tired, and cold, I didn't fully realize what was happening. I clipped to the rope and began to ascend, but, to my horror, the few, intermittent drops that had dampened our descent had been transformed into a waterfall. In a few moments I was completely soaked, but I continued up despite

the fact that the stream might rise even higher. Some time later, I'm not sure when, I realized that we were in the middle of a flood. The first 30 or 40 meters of the climb, where the water fell with the most force, were the worst, and the sudden heat loss was making me clumsy. After I had passed the second reelay, I called down to Al that the rope was free. Wet and shivering, I continued up with some difficulty. I looked to the right and then the left and saw that only 2 or 3 meters away in any directions there was no water and that our problem was due to where the rope had been rigged.

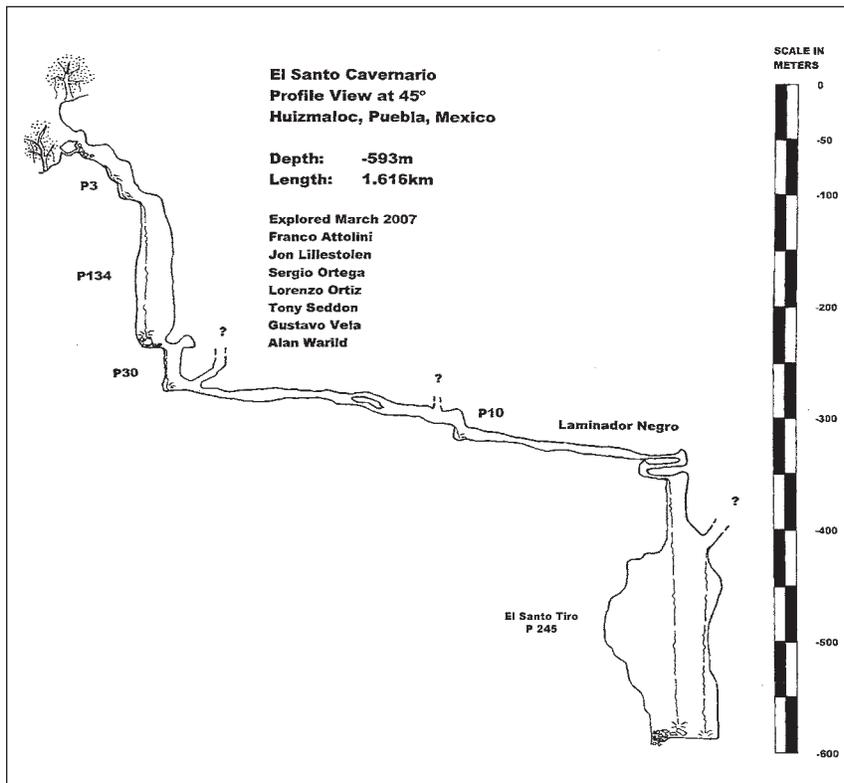
Resigned, I continued up as my energy level decreased and my mind wandered. I could not decide whether it was better to continue and end the torture as quickly as possible or drop back down and wait a few hours for the flood to subside before trying again. In the end, I don't know whether it was my fear of being trapped soaking

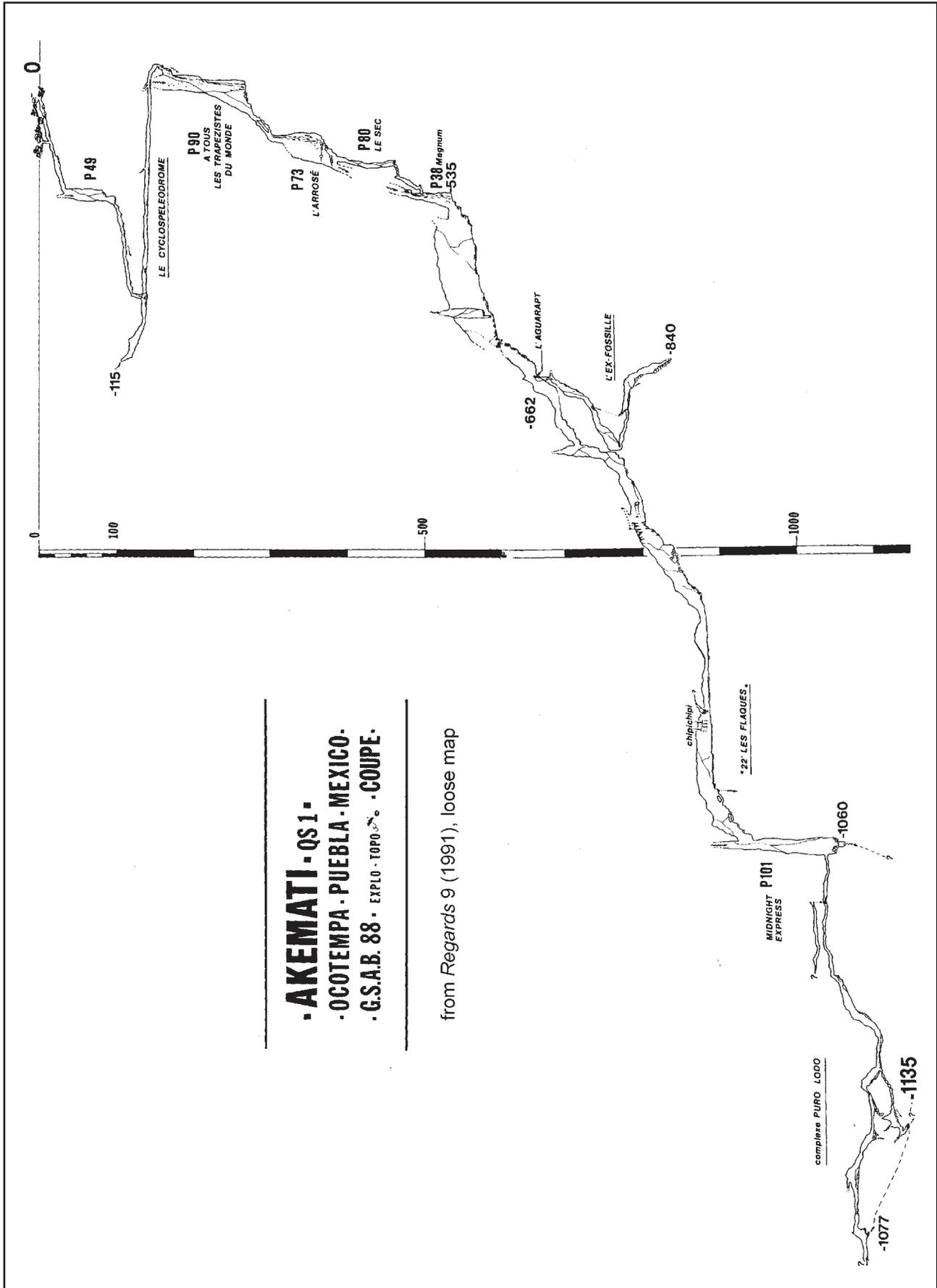


Lorenzo Ortiz below -900 meters in Akemati.
Gustavo Vela.

wet in the cave with no food or my stubbornness that pushed me up that rope. I was only twenty-five minutes in the shower, but it felt like hours. After another twenty minutes, my companion arrived, similarly soaked. As we emerged into the evening we found that it was getting colder and still raining.

A hot meal and dry clothes made us feel much better as we recounted our adventure to our companions, just how bad it had been and how the only thing that had kept us warm was keeping moving. Now all we had to do was wait for Franco and Jon, who were still inside. Two hours later Franco arrived after a similar experience and with the news that Jon had a problem. While Jon was climbing, Franco had called up, "Look down." Jon heard it as, "Come down," and did. Once on his way back down the rope, Jon decided to keep going and wait in a dry place at the bottom for the water to drop, rather than stay on the rope and get hypothermia. Clearly, with Jon now trapped and wet, it was important to get him some dry clothes and food for his stay. Fortunately, Lorenzo was rested and in good condition







Ignacio Rafael and Joaquín Dobarrio at -200 meters in Akemati. *Gustavo Vela.*

Passage in Akemati. *Gustavo Vela.*



Lorenzo Ortiz below -900 meters in Akemati. *Gustavo Vela.*

Ángel Barrio looking at a potential high lead in a canyon in Akemati. *Gustavo Vela.*



to volunteer. With a PVC suit and a pack full of food and sleeping gear, off he went, to return in a couple of hours with the news that Jon was fine and would be out in the morning.

Early the next morning, Jon surfaced, and Tony returned to the cave to adjust the rigging by hanging the rope completely clear of the water. If the rain continued, we wouldn't have a repeat of our performance of the day before. As it turned out, we didn't have another flood anyway.

In all the excitement, Franco had forgotten to tell us that they had reached the end of the horizontal passage and found a pit estimated at 80 meters. Even though it looked interesting, they hadn't tried to descend into it on the short rope that they had with them. We'd just have to take a look and see what was there. Two groups entered the cave: Al Warild, Franco Attolini, and Sergio Ortega to rig the new pit and Lorenzo Ortiz and I to begin mapping. Eight hours later our groups met in the cave. The first group was on its way up after having rigged their 100-meter rope, plus the rope left the previous day, and having been left hanging in space with the bottom of the pit a long way below. The beams of their lights hit nothing but blackness. The rigging had been difficult due to the thin bedding and chert that meant the rope had to be positioned with great care. With an altimeter, they'd calculated that the pit was some 130 meters deep to where they had gotten and that it

began at about -340 meters. Tired but happy, we all left the cave.

Early the next day, Tony Seddon, Jon Lillestolen, and a 200-meter rope headed in to continue the rigging. They spent several hours hanging on the rope in an effort to find the best route down the drop. In the end, the top 115 meters had several rebelay, but below that the wall was too far away and the rope hung free the final 130 meters. The pit that Franco and Jon had estimated to be 80 to 100 meters deep turned out to be 245 meters, overhung all the way.

Tony and Jon searched the bottom of the pit and the chaotic pile of boulders that covered one end of it, but found no continuation. A day later, Lorenzo and Al also went to the bottom to check again. They spent hours poking between boulders and climbing the walls, but found nothing. On the way up, they surveyed the pit and the lower part of the bedding-plane passage that remained to be mapped. The day after that, five of us managed to derig the cave and take a few photos. Back in camp, we summed up the meters and got 1616 meters long and 593 meters deep. If we had only been able to find another two pitches like that last one, we'd have made it to -1000, but it didn't work out that way.

Our cave needed a name. "Ake-maquién-sabe," because of how we had first thought we were in Akemabis. "Pozo Negro," as a companion to the nearly Pozo Verde. Then one

day we heard the radio playing a popular *cumbia* that went something like, "el Santo Cavernario [Holy Cave-man], *Blue Demon y el Bulldog* . . ." all actors on the very popular Mexican wrestling scene. It seemed to fit with "holy tortuous bedding plane" and "holy 245-meter pitch"—El Santo Cavernario.

Days had slipped by, cavers joined or left the expedition, and still Akemabis stayed hidden. We'd finished El Santo Cavernario, and with no cave we had nothing to do. At least we knew for sure the entrance to Akemati, so we decided to bottom it instead. We began with short trips by teams of two or three, rigging the thickest ropes near the entrance to avoid having to carry them too far down. In the first push, Lorenzo Ortiz, Sergio Ortega, and Tony Seddon reached -250 meters through the most comfortable part of the cave, the beautiful 350-meter-long Cyclospaleodrome. A day later we were at -450 meters in the most vertical part of the cave. Another day got us to -600 meters and the section of wet cascades. As the days went by, the trips got longer as we descended from and returned to the surface each day.

Day four saw us descend to -600 meters, rig 120 meters of rope, and return the 720 meters back to the surface, all in seventeen hours. The section we rigged that day can be very dry if you detour from the water down a dry, fossil passage instead of

Franco Attolini, Ángel Barrio, and Ignacio Rafael sorting gear in preparation for a deep trip. *Gustavo Vela.*



Joaquín Dobarrío in a tight spot that the GSAB had to dig open in 1988 to continue in Akemati. *Gustavo Vela.*





Below the "Chipichipi" at -900 meters, Akemati is wetter. *Gustavo Vela.*

the main route at the Aguarapt. On the fifth day a team reached -880, just beyond the influx of water from the Chipichipi stream, which perhaps comes from an as yet unknown cave if it is not just the Aguarapt water returning. From here the cave resumes its normal wet nature.

On the sixth day, anticipation was building, because this time we should pass one thousand meters, to the -1060 level. Lorenzo and I readied our gear and off we went. Four hours saw us at -880 and beginning to rig. It took us five hours to rig and photograph our way to -960. As Lorenzo and I went through the cave it was inevitable that we remembered stories. Every part of the cave awoke a corner of our memories of things we had experienced eight years before with our team from GEU-UNAM: the Cyclospéleodrome, the 90-meter pitch, the 73, the 80, Magnum-38, Aguarapt, the bedding plane where we had slept at -850, Chipichipi, the room where we had all met up at -920, and all the other places and events of 1999.

We then spent hours trying everything at the head of the 101-meter pitch, but couldn't find a way to rig it. Frustrated, we turned around, and ten hours later we reached the surface. When we got to camp after twenty-four hours in the cave, our

companions hit us with a barrage of questions. "What happened?" "Did you reach -1000?" "How did you rig the 101-meter pitch?" "Did the rope reach?" "Did it agree with our memories of it?" All we could answer was, "No, we didn't make it down Midnight Express to the -1060-meter point." Even after five hours of searching, we saw no routes that looked sufficiently safe from falling rocks, rope rubs, or rotten rock, and, besides, the head had fallen off the only hammer we had and we weren't willing to work our way down such a pitch without one. Not to mention that we'd already been working for fourteen hours and had who knows how many more to reach the surface.

We immediately formed the next rigging team, the one that would finish the rigging and finally reach the bottom of the cave. Al Warild and Jon Lillestolen and another hammer set off with a little more rope and plenty of incentive. They returned with the dawn eighteen hours later, tired, wet, and from the bottom. Now all that remained was for anyone else who wanted to see the bottom to remove the nearly 1500 meters of rope we'd just rigged.

The next day, Lorenzo Ortiz, Franco Attolini, Joaquín Dobarrio, Ángel Barrio, and I started down. We descended ropes, walked a little, descended more, a tight bit, a wide bit, down, down. At last, five and a half hours later, we arrived at about 1090 meters below the Akemati entrance, in the complex Puro Lodo, the best name for that area below the 101. We took a few photos and began the ascent. The 101-meter-pitch had been split up by several rebelayes, so we figured all of us would follow straight up the rope at the same time, that is, until the first person

knocked off a mega-rock. Fortunately nobody was below it, but we did decide to each wait until the previous climber had completely left the rope. Of course, hardly another rock fell, so we ended up waiting a long time for nothing. The five of us derigged to Aguarapt at -600, then went out after eighteen hours.

A day later, Ignacio Rafael and Yolotzin Medina entered to continue the derigging to -350, and the next team, right behind them, got to -200. One more trip saw us get the last of the rope out. The cave was as we'd found it, no rubbish, no rope, no light.

With only seven days left, we didn't really have time for a sport trip down Pozo Verde, so we adjusted our plans again. A few days earlier we had, finally, been shown the real Akemabis entrance. We spent the last week rigging as far

The entrance canyon of Akemabis. *Gustavo Vela.*





Gustavo Vela.

Expedición al Área de Akemati 2007

Los espeleólogos de esta expedición esperaban explorar pasajes en el fondo de Akemabis, en la Sierra Negra de Puebla. Sin embargo, la entrada a la cueva no fue ubicada sino hacia el final de la expedición. En vez de esto exploraron y topografiaron una cueva casi totalmente nueva, Santo Cavernario, y visitaron de nuevo el fondo de Akemati a alrededor de -1080 metros.

down Akemabis as we had the time and people for. We reached -730, not the bottom, but there's always next year.

Months later we found out that the GSAB had entered the cave now known as El Santo Cavernario. Once they saw our photos, they remembered it very well. In 1990 the bedding plane below the 134-meter pit had been plugged up with boulders, water, and mud and was impassable. They climbed a few walls, but found nothing. In 1990 it was a 180-meter-deep cave. The cave must have been opened up since by one of the many floods that have swept through it.

Expedition leaders:

Franco Attolini, Mexico
Gustavo Vela, Mexico
Alan Warild, Australia

Other participants:

Ángel Barrio, Spain
Ruud Brassé, Netherlands
Tjerk Dalhuisen, Netherlands
Joaquín Dobarrio, Spain
Jon Lillestolen, USA
Yolotzin Medina, Mexico
Sergio Ortega, Mexico
Lorenzo Ortiz, Mexico
Ignacio Rafael, Spain
Tony Seddon, United Kingdom

PRELIMINARY EXPLORATIONS IN SISTEMA TIXIK K'UNA QUINTANA ROO

James G. Coke IV

Explorations in Sistema Tixik K'una at Rancho Esperanza began at an overgrown depression sheltering a small yet remarkably well preserved Maya ruin. Positioned on the inland flank of a Pleistocene ridge, four dry cave entrances on the edge of the depression surround the old structure. A small crack or pit entrance 6 meters east of the ruin's central portal exposes a jumbled flight of cut-stone steps descending abruptly to a partially flooded cave. The first explorers selected a wider entrance behind the ruin to investigate. With small backup diving lights, they stumbled upon a promising sump just outside the cave's natural-light zone. A diving mask, small waterproof light, and one deep breath of air confirmed the sump would lead to further underwater cave.

Rancho Esperanza is one of the last properties in the X-cacel area that continues to remain in family hands. At roughly a square kilometer, the ranch provided a meager living with sufficient land for livestock and seasonal *milpas*, small slash and burn farming plots. With tourism expanding along the coast, the family established a small restaurant in the 1970s, while all but abandoning their pastoral life. As visitors stopped for food and drink, they came to learn of the small inland ruin and its "cenote" adjacent to a rough jungle road that had been used during the early ranching years. Steve Gerrard and Steven Keene were the first explorers to investigate the site for potential underwater cave

chac@consolidated.net

development. In a blend of luck and perseverance, they surveyed 596 meters of underwater passage in the Templo cave in 1994.

Sifón Templo, named after the small ruin, held a few interesting surprises for the team. The sump descends directly to a spacious horizontal tunnel at -10 meters. Dripstone formations coat the surrounding walls and ceiling. The trunk passage continues northwest as it makes a gradual descent to the halocline, an area where the freshwater aquifer meets a deeper saltwater intrusion. Contact between flowing freshwater and the base intrusion produces a mixing zone; below it is a contrasting underwater cave environment unlike that found in the upper, freshwater aquifer. Divers encounter distorted visibility and abrupt buoyancy changes at the halocline. Mixing-zone dissolution also builds a layer of easily disturbed silts throughout the conduits and produces fragile and unstable cave walls and ceilings.

Mindful of the changing environment, the explorers continued past a short branching tunnel before turning the dive on air rules 400 meters from the entrance to the sump. A second dive in the side passage reached nearly 19 meters in depth, where the tunnel ended. These explorations in Templo established the longest reported sump entered from a dry cave in Quintana Roo until 2006, when it was surpassed by the Yax Muul sump in Sistema Nohoch Nah Chich (now a part of Sistema Sac Actun; see *AMCS Activities Newsletter* 30, pages 43-49, for an exploration account of Sistema Yax

Muul). Gerrard and Keene made just a few trips to Templo before quitting the cave. Additional exploration in Templo occurred in 2003, when Bill Phillips, Robbie Schmittner, and Andrés Labarthe resurveyed the sump and added another 175 meters of new tunnel. Today, the underwater cave remains at 771 meters in length.

The most significant discovery made during the first explorations in Templo was an incomplete human skeleton. As Gerrard and Keene descended the entrance to the sump, they found the remains lying in the middle of the cave floor. It was the third set of human remains to be documented in an underwater cave in Quintana Roo. Unfortunately, the depth and position of the skeleton exposed it to the freshwater aquifer. Dissolved oxygen in this upper layer of water encourages bacterial growth and destruction of the protein tissues that can be used for radioisotope dating. Research scientists from INAH (Instituto Nacional de Antropología e Historia) have since removed the skeleton and attempted to date the tissues by radioisotope methods. At this time their dating studies have produced inconclusive results.

As word of the human skeleton spread, occasional groups of tourist divers would visit the cave to view the remains. In time, investigations within the large and partially flooded cavern near the sump produced going dry cave passage that contained a noticeable breeze. Another large, dry entrance nearby on the coastal flank of the Pleistocene ridge was also investigated. Gentle drafts of air breathe in and out of this entrance, located in a small but sharply



Simon Richards preparing to dive a sump beyond Ka'chihol, in the southwestern part of the cave. *Jim Coke.*

contoured depression next to the access road. A significant portion of a large resident bat population exploits this entrance during their nocturnal forays. Most cave divers in the area were indifferent about documenting the dry section of the cave, although one group installed a curious blend of nylon line and steel wire between the two main entrances, the new Tixik K'una entrance and the original Ruins entrance, in 2001. The guidelines were used for a few sporting through-trips rather than surveying; most of those lines have since been removed. A proper survey of the dry cave did not begin until 2006. By this time unauthorized use of the property by cave divers and the removal of the skeleton from the sump had created some distressing landowner issues. After a prolonged and occasionally uncomfortable discussion, permission for mapping and photography in the cave was granted to the author and team members. Maps, photographs, and exploration updates are always shared with the landowner. These gifts and a few introductory cave trips for family members have improved our relationship immeasurably.

Tixik K'una (Dry Temple) is a perplexing cave to explore and survey. A central maze is concentrated under the Pleistocene ridge, between the coastal Tixik K'una

entrance and inland Ruins entrance. Mapping efforts during 2006 were focused on this area, as it defined the core of the cave. Large passage descends rapidly from the Tixik K'una entrance to an ever-present water table. The maze is characterized by deep pools and channels of water, interlaced by a sprinkling of isolated islands, columns, pillars, calcite-sand banks, and high, dry ledges next to the cave walls. Water depths in the lakes rarely exceed 2 meters, although sporadic floor fractures can lead to greater depths. Simon Richards, with sherpa support from Nadia Berni and Dave Sieff, explored three of these fractures in 2006 as possible underwater extensions. Every fracture was choked by dunes of sunken calcite rafts or narrowed to impassable dimensions. As drier surveys progressed, short looping passages were found that parallel the main trunk passage. The southern loop produced three leads whose ceilings descend towards the water table. Two larger leads were found close to La Bodega (The Store-room). With surveying between the two main entrances still incomplete, surveying in these southern deep-water tunnels was postponed until the next year.

While the survey traverse from the Tixik K'una entrance to the large cavern south of the Templo underwater cave was being done,

a small branching passage was found to bypass the Ruins Entrance through Entrada Eb Tun Ha (Stone Staircase Water Entrance). A steep Maya staircase rises through a natural cleft to pierce the surface east of the ruin. Just as it begins its ascent, a rubble-filled passage circumvents the cleft entrance to merge with larger cave beyond the Templo sump. The passage north of the main Ruins entrance was pursued beyond the Templo sump to complete the Eb Tun Ha loop. This airy section of cave is enticing for many reasons. Besides its size and going leads, the area is likely to contain Maya petroglyphs. A large entrance with standing water and an adjacent ruin increase the chances that rock art might be discovered on an obscure wall. So far any solid evidence for Maya exploration has yet to be found. A few locations near the entrances contain bits of carbon ash and partially burned rolls of vegetation. A wonderful image comes to mind of a determined Maya explorer probing this watery cave with a torch constructed from tightly wound palm leaves. It remains as intriguing speculation for now.

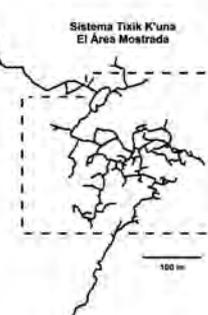
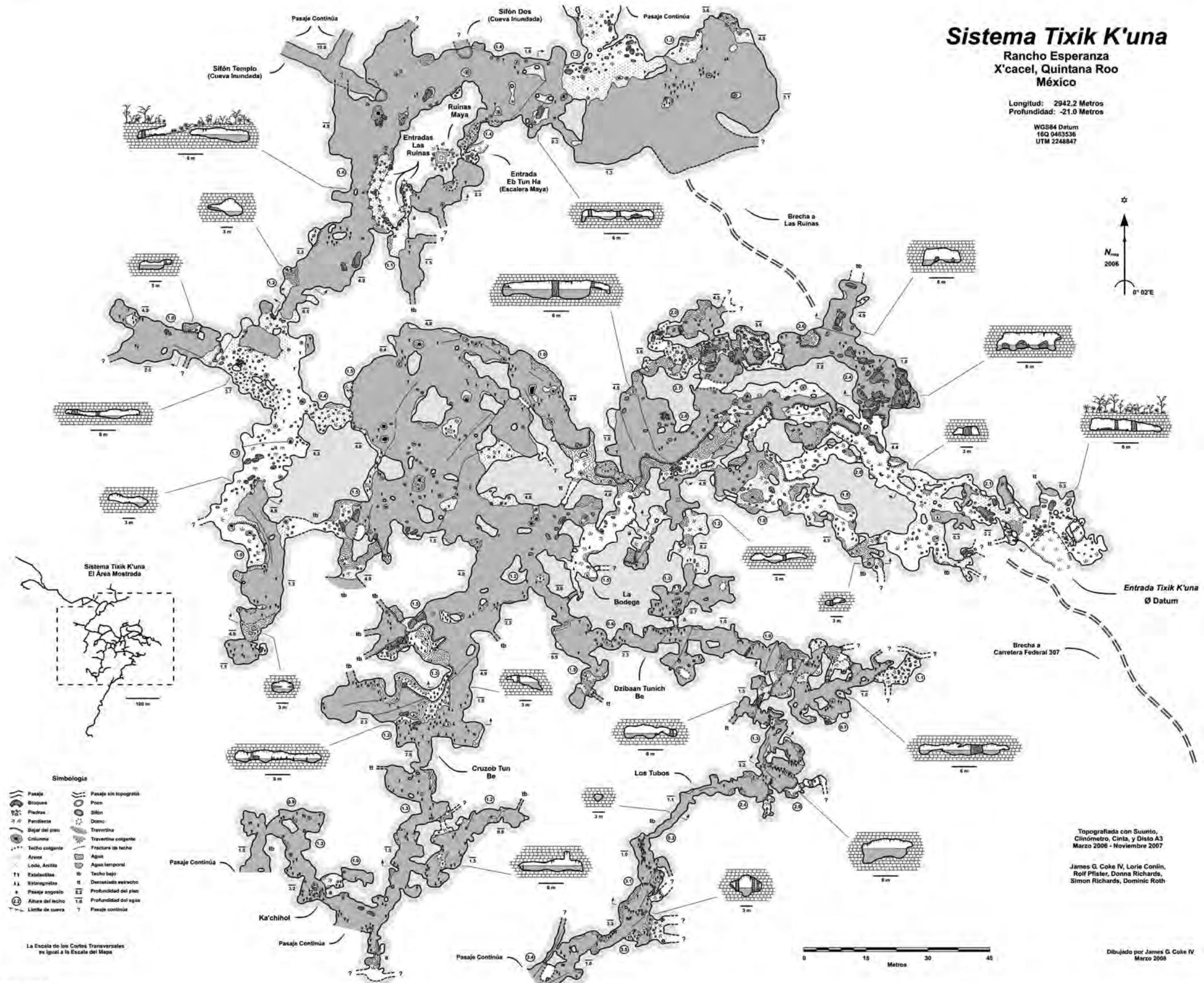
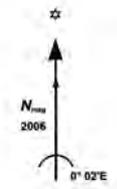
A second sump was discovered 30 meters beyond the entrance to the Templo sump. Knowledge of this came as a large surprise to local cave divers. A guideline anchored to a small loop of inner tube on the ceiling makes a gradual descent to the water, continuing through a large sump entrance on the west wall. A piece of duct tape on the line is inscribed with a distance in meters. North American cave divers rarely if ever use rubber tie-offs (termed snoopy-loops) on rock projections or duct-tape distance markers in meter intervals. This guideline technique suggests an effort by European divers. Whoever they are, the explorers have not reported survey data from the second sump; a resurvey by fiberglass tape of the underwater tunnel is planned for 2008. Three extensive lake rooms are encountered beyond the entrance to Sifón Dos. Joined by sections of dry passage, the rooms are located within strata

Sistema Tixik K'una

Rancho Esperanza
X'cacel, Quintana Roo
México

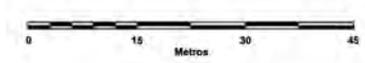
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Profundidad: -21.0 Metros

WGS84 Datum
16Q 0463536
UTM 2248847



Simbología

La Escala de los Cortes Transversales es igual a la Escala del Mapa



Topografiada con Suunto, Clinómetro, Cinta, y Disto A3
Marzo 2006 - Noviembre 2007

James G. Coke IV, Lorie Conlin,
Rolf Pfister, Donna Richards,
Simon Richards, Dominic Roth

Dibujado por James G. Coke IV
Marzo 2008

on the inland side of the Pleistocene Ridge. Soft, clay-like floor deposits are common to its dry sections, while speleothem development appears sparse when compared to other areas of the cave. Evidently the host rock is a separate deposit from that found in other parts of the cave, or it has been exposed to a different history of dissolution. Future studies in this area will be exciting because of its different character and many unexplored leads. Mapping in this area proceeds at a sluggish pace, though. The two fracture-controlled trunk tunnels to the south of the core maze near La Bodega have proved to be an irresistible distraction.

Bicycle tubes and a Darren barrel were part of the fundamental kit during the first probes of these trunks, Cruzob Tun Be (People of the Stone Cross Passage) and Dzi-baan Tunich Be (Written Stone Passage). Dry caves in Quintana Roo are very warm. Even when one is wearing light clothing, brief trips through shallow wet areas provide a welcome relief from the heat and humidity. Thermal protection by a wetsuit is unsuitable for all but the longest immersions. A small-diameter inner tube counteracts the negative buoyancy of heavy boots and clothing during deep-water crossings wearing normal clothing. With the valve stem removed, a

breath or two will inflate the tube. Tight valve caps prevent any major air leaks; tubes may be deflated after the swim or worn through shallow areas punctuated by deeper holes and fractures. They are nearly indestructible, and deflate to a light and minimal load for transport through the cave. A small loop of webbing secures the tube at midpoint after one puts one leg through the tube and lifts it over his head. A second tube passed under the opposite leg may be deployed to negotiate longer stretches of swimming cave. Darren barrels lined with neoprene cushions are reliable containers for water- and impact-sensitive equipment. They also supply additional flotation during longer swims.

The beginning of Cruzob Tun Be contains short sections of passage that can be swum, contingent on ocean tide levels and local meteorological events. Survey progressed at a steady pace through a highly decorated tunnel. Mapping of secondary chambers to the west of the trunk passage exposed a fascinating complexity in the cave's speleogenesis. Variable water levels yield a few dicey leads in these subsidiary rooms; these remain unexplored currently. A concealed tunnel beyond a deep-water fissure at the Stone Cross continues south to a small room before the Ka'chihol (Broken Hole)

constriction. Exploration of branching tunnels produced three dry leads and two sump possibilities. By this point, near-constant immersion in 24.5°C (76°F) water was growing uncomfortable. Collecting survey data and drawings at survey stations was a numbing experience; the cold trip back to drier ground through many deep pools was also becoming a worry. With sumps to explore and deep-water leads ahead, we established cache of wet suits and backup gear at La Bodega, an ideal staging area for southern-tunnel explorations. Simon Richards dove both sump candidates near Ka'chihol in the fall of 2007, but both were choked with calcite silts. Two leads were also surveyed in this area; each is very exciting and continues. One lead was pushed through a very low airspace with the aid of a diving mask during the few minutes afforded by low tide. A small room containing three diverging tunnels was found at the end of the survey. Yet this was clearly not the moment to press further exploration. With the tide reversing, a measured retreat through rising water was in order. This territory is reserved for the dry season, or the support of a tank of compressed air if necessary.

Meanwhile another southern lead near La Bodega was producing an amazing array of complex cave. The



Rolf Pfister in the tunnel leading to the final room explored to the south in 2007 (not on the detailed map). *Rolf Pfister and Dominic Roth.*

Bats. *Simon Richards.*



Jim Coke measuring the level of calcite-raft deposits on the wall in Dzibaan Tunich Be. The water is white with floating calcite. *Rolf Pfister and Dominic Roth.*

Dzibaan Tunich Be passage was starting to resemble the Cruzob Tun Be section. Once a dozen stations had been surveyed across deep water, a wetsuit became regular apparel. Although the warmth of neoprene was welcome, it was clear that future investigations would hinge on reliable tidal and meteorological predictions. Used prudently, the information could be used to forecast the most opportune times to enter and leave flood-prone areas during longer excursions. Tixik K'una is just over a kilometer from the Caribbean Sea, and the cave is quite responsive to sea-level variations. Observations of calcite rafts on the water's surface in Cruzob Tun Be disclose rising or ebbing tides. Rafts drifting south with the water current indicated a falling tide, while their migration towards the north signals the need for a retreat towards larger passage or higher ground. By using a steel rule mounted in the first chamber at Cruzob Tun Be, water levels were recorded at the start and end of all trips. These readings were plotted for comparison to sea-level predictions for the tide-monitoring station at the CALICA limestone strip mine 35 kilometers northeast of Tixik K'una. The Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) maintains a comprehensive network of oceanographic monitoring stations in Mexico. Graphs of tidal-range predictions versus time (in UTC) for any of these stations may be accessed on their web site.

Water fluctuations recorded at the ruler were generally consistent with the CALICA charts. Meteorological forecasts were consulted to estimate daily wind direction and velocities. Strong onshore winds could produce elevated water levels in the cave by retarding normal low tides. During ideal conditions, a seven- or eight-hour tidal window for exploration could be expected on a normal day. We timed our arrival at the Rancho Esperanza trailhead an hour or



more, depending on the size of our group, before the tidal crest. This allowed sufficient time to reach the cave entrance and navigate the first set of dry passages to La Bodega. All that remained was a change to wetsuits, preparing equipment for wet caving, and a final assessment of water level and gear. By advancing the schedule, our departure from La Bodega would coincide with falling water levels soon after high tide.

As the survey moved through Dzibaan Tunich Be, small stones or flagging markers were fixed at the water surface. Inside the cave, few clues can warn of changes in surface winds or heavy precipitation events. The markers serve as telltales for an unanticipated surge in the water table, and they are maintained in all of the southern tunnels to alert explorers to rising water.

Two rooms in the Dzibaan Tunich Be area interrupt a circuitous set of tunnels before Los Tubos (The Tubes). The largest room has an amorphous character, with four passages radiating from a central mound of clay and calcite sand capped by a skim of flowstone and speleothems. Two or three delightful bands of old calcite-raft deposits ring the walls of this chamber. The highest deposit hovers at 75 centimeters above average water levels. These residues may record high-water events during past hurricanes or tropical storms. They are a sober reminder of how vulnerable Tixik K'una remains to tidal influences. A small, mazy area to the north of the first junction room coalesces into two small tunnels. One ascending passage is littered with

rat feces, small bones, and insect exoskeletons. An occasional breeze in this area indicates that the rodents that exploit this part of the cave must be using an undiscovered opening to the surface.

A fracture-oriented third tunnel continues south towards Los Tubos from the junction room. It meanders through old bedding-plane tunnel in waist-deep water towards a set of decorated constrictions. These present a bottleneck for large parties of cavers due to the speleothems that shape the passage. Each team member must turn around in limited space and move feet-first through the formations. The restriction ends at an abrupt drop to a small deep-water pool. An asymmetrical slot between two stalactites follows on the opposite side of the pool. A few gymnastics over 5-meter-deep water takes one to the end of the series of tight spots, in a decorated chamber. A swim through a second chamber and a small tunnel announce the beginning of Los Tubos. A sequence of low-ceiling places in the tunnel can limit access to larger passage beyond. In ideal conditions, trips beyond Los Tubos commit explorers to a time limit should they plan to leave the cave within the tide window. Ear, eye, and nose dippers are not uncommon should a late exit be made. Spaced out exits among the cavers are also normal procedure during high water. Any disturbance of water levels creates small waves, converting eye and nose dippers into unexpected face dippers.

Large passage beyond Los Tubos makes the cautious exit planning worthwhile. A final constriction opens into a crowded anteroom. Rows of tightly packed stals and columns steer the caver around the room's perimeter to a slender void between curtains of solid stalactites. Floating through the portal sideways, cavers emerge into 180 meters of some of the largest and most decorated "dry" passage in Quintana Roo. The floor begins a gradual descent in deep, crystal-clear water, while the roof arches to an incredible assortment of meters-long stalactites. Lengthy ceiling fractures complemented by occasional floor fractures guide the trunk passage as it progresses southwest under the coastal edge of the Pleistocene ridge. Incomplete surveys of side tunnels suggest that some are minor parallel conduits to the main passage. Many ascend to dry ground, triggering an instant sauna for a surveyor in a wetsuit. Two leads remain at the water table after an initial constriction or two. They trend towards the Cruzob Tun Be section. A second exit route, one bypassing Los Tubos, would be a welcome alternative.

Another cave entrance in this southern section would prove to be of great value logistically; this seems feasible in light of the final 2007 survey stations. In any cave, drafts of air that pass through unexplored tunnels are reason to suspect a distant entrance exists. Survey in the southwestern section of Tixik K'una ends over 550 meters from the nearest known entrance. An intermittent breeze originates from unexplored tunnels at the end of a

large room. A second hint of a new southern entrance is given by bats and their behavior. Tixik K'una is an important home for two species of Chiroptera. Hundreds of bats, if not more, use the cave as a permanent home. Solitary bats or small congregations are found in all sections of the cave. Large groups will occupy or abandon specific areas depending on their water levels and the season. Throughout the year a large roost occupies tall domes in a partially flooded room adjacent to the Cruzob Tun Be passage that is 280 meters from the entrance. A slog through meter-thick underwater guano deposits releases vile gas bubble and substantiates the longevity of the roost. Bats that are disturbed at this roost invariably head towards the Tixik K'una entrance. Being more familiar with the cave than humans, they use precise flyways to move through the cave. Perhaps these paths are friendly to echolocation, or successive generations of bats have trained their offspring to use these traditional avenues. Their devotion to fixed routes has produced narrow black trails of guano, a track that cavers can follow over dry ground when searching for additional leads.

Most bats will also flee towards the Tixik K'una entrance when disturbed on the exit side of Los Tubos in the southwest section. Low ceilings and variable water levels in Los Tubos appear to discourage their travel through the tunnel. However, a healthy population of bats is found beyond the restrictions. Their reaction to our first intrusions was to fly deeper into bigger cave. Bats agitated at a distant roost that

were expected to fly back toward Los Tubos instead simply vanished. We would not see them again until the deep-water trunk passage ended at a small, dry room. A winding guano trail through crawlways and a forest of stals dispelled any doubts about their preferred route, or that passage would follow. Changes in tunnel complexity and size were an indication of a slight shift in the configuration of faults and fractures on the coastal flank of the ridge, modifying the general character of the cave. This in itself was not an obstacle; being forced into higher dry passage was the primary concern.

Low, dry crawls and stal restrictions created a seemingly endless string of short survey shots. It was a slow and testing exercise in a hot and muggy wetsuit. Survey efforts with fewer than three team members were often truncated when the last reliable water-level telltale and the Los Tubos constrictions grew more distant. It was impossible to detect changing water conditions in the cave without returning to the trunk passage or leaving a volunteer behind to raise the alarm. A crew decided to leapfrog past the final survey station and scoop a preview of the upcoming tunnels. They reported more dry passage, guano trails, and constrictions ahead, ending at a mud and clay funnel descending to spacious fracture passage and deep water. The clay ramp and water passage were finally tied to the map after three more excursions. A telltale was installed at the bottom of the clay ramp during a refreshing plunge into cool water. In just a few more stations, a chamber with branching leads interrupted this promising passage. Rising water delayed exploration until the following day.

Discontinuous fractures in this area create abrupt junctions. A short climb through a tight spot leads to a second room, where a steep descent through breakdown rubble and clay floors leads to shallow water. Small guano stains paint many leads that



Los Tubos during rising water. Note the rock for monitoring water level that is suspended by flagging tape in the middle of the photo. *Simon Richards.*

Jim Coke (barely visible behind formations at left), Rolf Pfister, and Dominic Roth in passage beyond Los Tubos.
Rolf Pfister and Dominic Roth.



branch from both rooms; sorting these out will help us understand patterns of speleogenesis in this portion of the cave. A huge breakdown room beyond the second room crowns the 2007 mapping effort. Flat, rectangular blocks of breakdown form sizable islands between arrays of interconnected deep-water canals. Long stalactites and prospective sumps that dive underneath suspended ledges ring the circumference of the room. The final day of the expedition produced two breezy and highly decorated passages tracing a southwest course. Both guano deposits and slight drafts of air from these tunnels are very encouraging.

A bivouac near the final chamber is planned if another entrance fails to materialize soon. A temporary camp would allow for a cozy twenty-hour exploration period. Spring tide cycles will be verified during the first week of the 2008 expedition as less distant side passages are mapped. Water-level crests should be more forgiving this time of year; but there is no doubt that daily oscillations of the water table will continue. There are numerous areas in the cave that are dry during high-water episodes. Stocking a temporary camp for one or two cavers would require little effort; a sturdy dry bag containing food, dry clothes, and other gear can be floated through most passages. Suspending the cache high above water with a temporary wire trapeze would defend the bag and its contents from very agile and

curious rodents.

Two alternatives to a bivouac remain. Alpine-style caving may allow a little more time for exploration; a solo caver or two-person team is much faster than a larger group on the round trip between La Bodega and the final chamber. But it would still push the exit clock should a small crew decide to push the farthest leads. Alpine-style missions would best be suited for the unexplored leads in Los Tubos trunk passage that could connect to the other southern passage, Cruzob Tun Be. The second option is to cache 5-liter (40-cubic-foot) scuba tanks for an exit through flooded tunnels. This has its merits, although a tank and regulator are needed for each caver. Transporting a pressurized cylinder through the cave safely is difficult, even with flotation and good valve protection. Should a tank of this small capacity be used, it would have to be hauled out, refilled, and moved back into position. Larger tanks could be used for more than one exit, but moving full-sized tanks

through the cave requires sherpas, patience, and a good reason to attempt this effort. A bivouac would minimize hauling heavy gear back and forth and also minimize damage to this section of cave.

Exploration in Tixik K'una is not running out of options or going cave. Many leads that are not entirely water-filled remain in most sections of the cave, not to mention the potential unexplored or undocumented underwater passages. Should a southern entrance be found, an overland trail to it would boost further explorations. There is much more to explore and map in this cave.

The author would like to thank Don Carlos Abuadili, Nadia Berni, Lorie Conlin, Rolf Pfister, Bil Phillips, Donna and Simon Richards, Dominic Roth, Aneke and Robbie Schmittner, Dave Sieff, María Isabel, and Don Pedro for their invaluable support in documenting Sistema Tixik K'una.

Exploraciones Preliminares en el Sistema Tixik K'una, Quintana Roo

Esta es una cueva con mucha agua pero no totalmente sumergida cerca de la costa de Quintana Roo. Tiene dos entradas principales, Tixik K'una y el Cenote Templo. Dos pasajes subacuáticos salen de la parte seca de la cueva cerca de la entrada de Templo. Han sido exploradas hasta un total de 771 metros. La parte seca de la cueva ha sido topografiada por más de 2 kilómetros, y es un laberinto con lagos y pasajes con muy poco espacio entre el agua y el techo. Las partes sureñas de la cuevas únicamente pueden ser exploradas durante la marea baja y en temporada de secas.

J2

Marta Candel Ureña and Alan Warild

Background: The 2004 Cheve Expedition was organized by US caver Bill Stone to run from early February until early April, and it was surrounded by a lot of hype (see <http://magma.nationalgeographic.com/ngm/caverace/week9/index.html>), especially considering that it was only a recon expedition.

What color is the sky? In the heart of the Sierra Juárez in the north of the Mexican state of Oaxaca, it's green. We've been here for two weeks, connected to civilization by a single walkie-talkie that often as not doesn't reply to our questions. For three days now, our companions who are supposed to be on the other end have shown no signs of life. We are organized into two groups. One has stayed in the *Presidencia* in the village of San Francisco Chapulapa. The other established a forest base camp at 2400 meters elevation in the middle of nowhere, and the middle of everything: the Mexican cloud forest. As we left the village, accompanied by seven mules that carried most of our food, water, and equipment for three weeks in our high camp, the mule drivers wasted no time asking, "What are you looking for in the caves?" They were convinced that there must be gold, silver, or archaeological artifacts to motivate us to travel 9000 kilometers to go under the ground. When we explained that we'd come only to explore the caves and make maps of what we found, they nodded in comprehension, then a short time later asked, "Is there gold in there?" and told us

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stories of fantastic hidden treasures. In some Mexican caves, especially those near villages or towns, you can find a great variety of religious objects thrown into the pits in days gone by—offerings thrown into the entrance to the world of the dead. At least that's how it was explained to us by Faustino Navarrete, the owner of the mules that were carrying our gear. In pre-Hispanic times, caves were often used as cemeteries. The colonial priests often destroyed all they found in order to eliminate the "false religion." During the war of independence, the reform, the intervention, and the revolutionary period of 1911 to 1920, caves served as refuges for fighters as much as for whole villages hiding from sporadic assaults on their homes. Our exploration area however, was quite a way from the nearest village, and there was no indication that anyone had ever lived there.

The day begins in the high camp. A few more attempts to contact the guys in Chapulapa and we give up. Tomorrow we'll try again. Armed with a topo map, compass, and GPS, each day we head off in a different direction looking for wet-season stream beds and where their waters sink, crawling into every entrance we find, into every hole that it's physically possible to squeeze into—an especially tough job given to the smaller cavers on the expedition. The rest stay outside, listening for any sound that transmits information from within such as moving rocks or carabiners clinking against walls, and speculating and hoping for the call "It goes!" This is the magical phrase. It always makes it possible

for the larger people to fit into the smallest passage. We search the caves with the greatest care, all our senses alert. Water and air: these are the keys to finding the way on. The water because it created the caves, and moving air because it indicates other entrances or a cave beyond. The cave breathes; all you have to do is listen and interpret its breathing, and it will tell you what lies ahead. And so we continue. Some continue exploring the jungle, marking new caves on the map and finding new routes to them through the exuberant vegetation, others continue down the caves.

We finally contacted the Chapulapa team. They'd been working in Sumidero Aguacate for a week without leaving the cave. They were convinced that Aguacate was going to connect with Cheve, and they were digging, removing rocks and mud from a crack near the terminal sump, never admitting defeat despite the abundant signs that it wasn't going anywhere. They'd climbed into holes in the roof and looked in every corner, but the airflow only led to an impenetrable crack. Not much luck this year. The two caves they hoped might be keys to a back door into the depths of Cheve both finished quickly. The previous month they had spent forcing their way into Sumidero Barranca Estrella without success, and Aguacate was going the same way.

For more than twenty years cavers have been exploring caves in this massif. Cavers from all over the world have joined forces to disentangle the underground mysteries of Mexico. Cueva Cheve was first



Greg Tunnock at the start of the vertical series at about -320 meters, reached in 2004. *Al Warild.*

entered in 1986 and at -1484 meters it occupies ninth place [through 2007] in the list of the world's deepest-caves and first place among the deep caves of the Americas. The cave ends in two sumps. In 2003, divers passed the first one and reached air-filled passage, but immediately beyond a second sump the cave was blocked by an impenetrable mass of boulders that only the water could pass. Cheve has been dye-traced and has a potential depth of 2547 meters, because the dye emerged 17 kilometers away in Cueva de la Mano as the *nacimiento* of the Río Frío de Santa Ana at an elevation of 300 meters. For three years in a row, teams had dived in Mano, but they never found a route through the sump. Meanwhile, exploration higher up the mountain continued. In 1989 Cueva Charco was discovered, and after many long years it reached -1276 meters, but it never

Al Warild.

made the hoped-for connection with Cheve.

The 2004 expedition was organized by the US Deep Caving Team and made up of cavers from Australia, Poland, Holland, Spain, and USA. [See *AMCS Activities Newsletter 28*, pages 119-140.] The principal objective was to find another entrance to the route of the water between Cheve and the resurgence. A connection between the two would easily beat the current world record of -1713 meters in Kubera-Voronia in Abkhazia and surpass the mythical 2000-meter mark, something never yet achieved in a natural cave. [Krubera has since been pushed over 2000 meters. See article in this issue.] The mythical limit was once 1000 meters. But advances in techniques and equipment have taken us way beyond this depth. There is now a genuine race to be the first to pass 2000 meters. But this year it was not to be. Our expedition finished with kilometers of jungle explored and a multitude of new caves entered. The

two most promising were edging towards 400 meters deep, with strong airflow, but they'll just have to wait until next year. Perhaps they are the long-sought entrances to the first

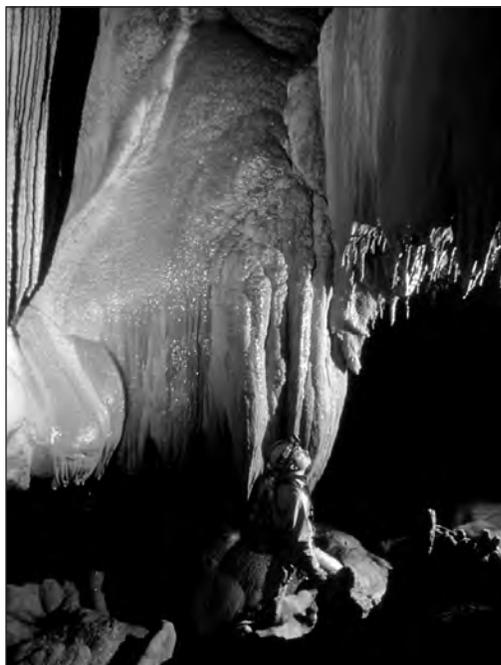
2000-meter-deep cave. Whether or not they are, we'll continue caving, because what's really important is that exploration of the very few remaining corners of the Earth never stops. Between us all, we're writing the history of exploration of this planet of mountains and caves and green skies.—*Marta Candel Ureña*

The expedition will focus on J2, the deepest discovery of the 2004 expedition. It is our intention to immediately establish a camp at -450 m and to have a surface-based support team provide logistical assistance to a team of 8 to 10 based at Camp 1. I intend to be equipped to reach -2000m, if it goes that deep."—First Notice to Team Members: Cheve 2005 (J2 Expedition), March 21–May 15, 2005.

A personal account, which means that I don't have to bother telling what other people did. . . .

It's strange what finding a going cave can do to your common sense. In March-April 2004 we'd had a lot of fun hunting for caves in the jungle above El Ocotil in southern Mexico, and right at the end we even got into a going cave. Barbie we called it, for the physique that would have made the entrance easy. Tight as a Barbie's . . . whoops, this is family reading. A going cave with an entrance at 2300 meters means that you *have to* go back, despite the latest Mexican government ruling of "no foreign cavers allowed." Bill Stone and José Antonio Soriano got us special one-off visas





Wicho Diaz appreciates one of the beautiful formations at about -800 meters in J2.
Gustavo Vela.

to go caving in Mexico, and we bit our tongues when negotiating about doing things “the USDCT Way.” The price is never too high. Early April 2005, and we’re on our way again. [Another article on this expedition appears in *AMCS Activities Newsletter* 29, pages 25–30.]

This time three Australians, Greg Tunnock, Mark Wilson, and Alan Warild, joined about fifteen Americans from the US Deep Caving Team and fifteen others from Mexico, Spain, Poland, Ireland, Holland, and Britain. Five of us have filled the back quarter of a bus with the “foreigner’s”—that is, non-American’s—food for five weeks. At the last side road before San Francisco Chapulapa, the bus doesn’t just stop as it usually does, but instead it lurches up the side road and bumps its way toward El Ocotal. The locals on board wonder what’s going on, but most of them don’t mind, because it saves them a few kilometers of walking. We know what’s happening; Paweł Skoworodko has paid the driver to deviate from his official route and drop us and our gear at the front door—*así es México*. . . .

Four days after the main group arrived, rerigging of the top 450 meters in the cave now called J2 was

finished, and there was new cave to be had. Four of us, Soriano, Mark, Paweł, and I took over the lead at -550 meters and decided to go true alpine style, with light bivy gear, and survey as we went. Several hours later and in a wet, breezy streamway without even a dry spot to sit down, alpine style didn’t look like such a good idea. But that was alright; I was out front rigging, so I didn’t notice the cold. A small pool blocked my way, beyond it, black and the sound of a lot of falling water. It was a 25-meter cascade down the side of the biggest chamber so far. What’s more, there was a place to camp for the night, windswept, misty, wet, and noisy, but better than sleeping on a ledge above the streamway. After a little bit of work, we had

enough flat area to sleep, and later groups stayed there and called it Camp II. We didn’t even bother rigging the few short drops to the bottom of the chamber; they’d still be there for the next group. They were. But the cave diminished into a small, deep-looking pool at the foot of a small cascade. ¡Mierda!

Week one of a six-week expedition, and the only show in town had just closed for the season. No amount of poking and trying not to fall in the sump showed any prospects. There was only a way too thin rift in the wall above, but nobody could fit into a place that so obviously didn’t go. This, however, didn’t stop a second group from trying. Afterwards, they confidently assured us that there was no hope. They’d spent two days burning papers in that rift, and there was no draft. Anne Mariah Tapp could only wiggle in about 2 meters from a ledge way above water level. Maybe somebody thought of looking into the water, but nobody did.

With a lot of people in camp and only one real lead in the cave, we had to find other things to do while waiting our turn at the sharp end; there’s just so much resting you can cope with. The high

country here is rough karst, ravaged by hurricanes and fires and choked with nasty regrowth containing mysterious cow paths that start and finish nowhere. We did, however, find one promising hole, Pozo de la Vaca Voladora (Flying Cow Pit), but it only went to -110 meters. There were no hoof-prints in the mud at the bottom.

When Team AustralEspaña’s turn came around again, we took a diving mask and a change of clothes. Ignacio “Nacho” de Rafael Ramos suggested that after all that paper burning, all we’d find were ashes, but in the water there were no ashes to be seen. They’d all been carried away by the spray from the cascade and the strong draft blowing on my right ear. Still, the rift was too narrow, and, as it extended underwater, even a desperate roof-sniff was out of the question (good!). There was an opening below the surface, but with no more than a mask and tiny torch I didn’t get far. (Next time perhaps I’ll try some candles in a bathing cap so that the ghost of Casteret can show me the way.) It did leave us with a dilemma, though. The air could get through just fine, but we humans had a sump in the way. The cave was a goer, if only we could get through, but we had no dive gear with us. On our way up, Mark Wilson and Enrique “Zape” Ogando climbed about and checked a few high leads, but we knew there was only one way on. After discussing the possibility of visiting a local dive shop, we decided that the owners wouldn’t appreciate what we intended to do with their equipment, and none of us wanted to use local rental gear, anyway. There was a second possibility. Bill has some very good connections in Texas. After a few calls on Greg Tunnock’s sat-phone, Robbie Warke, Paula Grgich-Warke, Soriano, and John Kerr were on their way north to pick up ‘the stuff’ at the border and bring it back. The rest of us would wait. Half a dozen of the team wandered off to the lowlands to try their luck there and were shown to a cave they called Ken—what else could we call the companion cave to Barbie? It eventually went to about 240 meters deep, but, more importantly, was near beer, good food, good weather,



J2 photographs by Gustavo Vela

Upper left: Greg Tunnock hauling gear on one of the many traverses in the cave, here at -450 meters.

Upper right: Tjerk Dalhuisen and Mark Wilson traverse at the top of a pit at -650 meters.

Lower left: Wicho Diaz ascending in a wet section of the cave after a trip to -1000 meters.

Lower right: Tony Dwyer cooking in Camp 2A at -900 meters. Inside the tent it is 18°C; outside it is 12°C.



beer, a broadband connection (in a village in the hills that barely has a road to it), and beer.

The dive gear finally arrived, and the travelers sent it up the mountain as soon as they could get four burros ready. Despite my best efforts to keep the load down, Stone still needed eleven loads of dive gear. After a week of hanging around, there was no shortage of people ready to carry gear down there, just to do something, anything. We almost had to draw straws to decide who'd get the privilege of carrying a tank down and who would wait outside to carry the next loads in, or out, once we had a result about the sump.

The next day, after hours of rebuilding regulators and kitting-up, Bill was ready to enter the sump. Three minutes later, he was back. The sump went all of 5 meters to a squeeze that he couldn't fit through, and he couldn't take his tanks off to give it a real try. Fortunately, the backup diver had trained in grotty, dirty, small sumps. With one bottle hanging off my chest harness and the other on a short tape like a party balloon, I popped straight through to be greeted by the best ever post-sump sound: the roar of falling water and a draft blasting out of the rift above the sump. I dropped the dive kit (pretty easy when it's hardly attached) and took off down the passage to make sure that it really went. It did, and so did the draft. We were on our way again.

By now we'd reached week four out of six, and there would only be a handful of people for the last few weeks. Everyone had to get in to have their bit of cave. Sherpa Team II took not quite all they needed, but all they could, and moved in. The only problem was that a 12-meter sump with a squeeze in the bottom is not for the uninitiated. We got John Kerr and later Marcin Gala through to work on lowering the water level, while most of the team sat in Camp II, windswept, misty, wet and noisy, and ate their precious food and sat around with nothing to do except clock up more sleeps in the cave.

Just when most of the team had to go home, the sump was drained and

the cave was wide open. Greg and I got one last trip down the streamway for one more pitch, and then we too had to head for home. Back at base camp a day later, the computer told us—810 meters. And it was still going, but instead of changing our airline flights, we went home and left the glory for the *derig* team.

While perhaps they didn't quite push Iraq off the headlines, they did indeed get their moment of glory: about 3 kilometers more cave to about -1100 meters. That's where my story ends. The rest is from e-mails sent by Bill and Paweł, who stayed until the end. Loosely translated from Paweł's wonderfully flavored Polish-Spanglish:

Children of chingones! Thanks so much to everyone who worked so hard to open up that whore of a sump for us. Each morning passing that thing woke me up better than the morning coffee. Getting through the first time I was so scared that I really did wet myself (with water! What were you thinking?). Arturo, Kasia, and I stayed at Camp II for a week and did three trips of about 20 hours each. On the other side there's a chingón of water. It's the first time I've ever been canyoning, but later on the galleries are big and dry and so chingón that Arturo dropped his bag and took off like a loco with a rocket up his ass. I wonder what we should call the first dry gallery? "Galeria de los piratas" for our caving "familia" perhaps... Surely it's the best exploration of my life. There are also rockfalls. One is called "Where is Paweł?" The first time I passed through it, I had no idea how to get back. Another is called "The pirates are lost again." . . . 1100 m+ and still going.

Once again the USDCT guys are dreaming of a connection to the nearby Sistema Cheve and its becoming the deepest cave in the world, but each year the Soviets keep upping the ante by pushing Voronia even deeper. No matter. It'll

be at least 1800 meters deep before it connects, if it makes it that far and doesn't die in a rockpile or impossible sump. We'll be back in 2006 to find out.—Alan Warild

Time to find out.

In 2006 things will be different. This time we'll do things properly. Just a few not so subtle changes like common expedition food, a fair chance for all at the lead, some planning, and bolts that you can place by hand *or* power drill. (The USDCT is *sooo* high tech that it is unable to place bolts without a power drill.)

After six months of haggling, things were shaping up well. The USDCT had even conceded on the group food issue, provided they could have nothing to do with it beyond telling me what they wanted. During the year there had been talk of a hydro-electric generator to charge batteries in the cave. I thought that sense had prevailed and the idea abandoned. No such luck. Two months before the trip, word trickled out that we would have a mini hydro-electric generator. "Small" and "lightweight" may have been appropriate had we been comparing it with the Hoover Dam. It weighed only 7 kilograms and would recharge drill batteries forever, but it filled a plastic drum that had a larger diameter than many parts of the top 300 meters of the cave and three very big packs of pipes and hoses and batteries, and 10 meters of water head was required to run it. Pity the cave had become horizontal, with neither a hydro-head within kilometers of the lead nor a need to drill many holes once we got there. "But you don't understand. The mini-hydro thing was supposed to be a test run for drying clothes in Camp 9." (Name withheld to protect the source.)

In Oaxaca city was the first time I've rolled up at a cash register and paid two-thousand-dollar grocery bill, and that was only the first half. On our last shopping day, José Antonio Soriano was snoozing in his truck waiting for us to return from the market when he felt a bump. He looked out to see a guy trying to remove the front wheel just outside

his window. "Sorry," says the guy as he hastily leaves. "I didn't think there was anybody in the truck."

It took us a three-ton truck and some forty burro loads to get most of what we needed up the hill, then a couple more days to get base camp in place, before we could get on our way. This year we had organization and plenty of good will to get things done. We had 11 kilometers of phone wire to set communications between base camp and the underground camps. We used Michie Phones, robust, single-wire telephones that run for weeks on a single 9-volt transistor battery. We had standard food packs. We had two underground-camp tents for six cavers each. We had hand-drivable spits to place bolts without half a pack of electric drill. We had a plan of attack that didn't require a hydroelectric plant.

Each trip in laid phone line or carried in supplies. In ten days we had three camps set up. Camp 1, at -500 meters, was only a staging station for gear carries and a stop for a cup of tea. We moved Camp 2 from beside a noisy waterfall to a nice sandy beach beyond the former sump. This Camp 2a was at -900 meters. Camp 3 was in a fossil stream canyon just beyond the 2005 limit of exploration at -1100 meters. Not surprisingly, placing it took a bit more work, but we found a tolerable spot if you didn't mind a boulder in the bedroom.

Enrique Ogando watching James Brown return from the sump explored in 2006. *Enrique Ogando and Marta Candel.*



The rockpile between C2a and C3 that had caused so much concern last year when they had to move boulders to get Paweł Skoworodko out gave in easily when the second team in found a low-level, stable, but tight route through. The choice was simple: uncomfortable but dangerous or really, truly uncomfortable, but safe. Once a Barbie, always a Barbie.

Each trip out dragged out a bit more of the junk left behind in 2005. Even so, it took us until the second to last trip to get it all out. Extra points to Paweł and Fernando Pinto for pulling out the pink dive tanks (2005: "They're old and not worth anything." 2006: "They were strategically located.") and Jon Lillestolen for the rock pick.

As usual, Barbie really called the shots. She wasn't going to give up her secrets easily or lie down and die without thrashing us first. Despite a fresh team heading down every three days, we kept hitting stoppers, the first of them another rockpile that swallowed the efforts of two push trips. This led to more big passage, then an "interesting" echinolith-fossil streamway that you had to climb along with great care, because everything sounded and felt breakable and some of it was. You could always hear the stream below, but never reach it.

Then it all went quiet.

Then the walls became coated with mud.

Then a sump.

Not a small pool with a cascade entering it and wind everywhere like in 2005, but a big, still, deep, blue lake. The cave had in fact been almost horizontal beyond the pitch that had stopped last year's exploration. The only substantial "down" was after we climbed up to pass the rockpile.



Wicho Diaz. *Gustavo Vela.*

We lost count of the number of caver-hours we collectively spent banging our heads against dead-ends to try to bypass Sifón de los Piratas. Mark Wilson spent two hours lost in a boulder maze only 100 meters long. Greg Tunnock and I all but got lost just following the survey tags back out. We felt or imagined breezes in the most amazing places. In the end, everything either stopped or wound its way back to just above the sump.

Eventually we had to make the call no one wanted to make: "Looks like a dive." The ramifications were far from trivial, heavy and bulky dive gear down 1200 meters and through 6 kilometers of passage, much of it unpleasant, with almost no just plain walking. It is either tight or boulder jumble to walk over or wiggle through. Last year's load of eleven packs to put a diver in Sump 1 was still fresh in our minds. James "Jaime" Brown was our specialist diver. He's no vertical caver, but we would help him and his gear down the cave if he could fit it into five reasonable packs. He did. He dived 150 meters to a breakdown room, dekitted, and found his way through a short rockpile to a room with another sump. His orders were

"If it's over 100 meters long we won't be pushing it this year."

Meanwhile, on the surface and before the news came back, Bill Stone was making plans for a follow-up dive. Most other people were making plans to leave for home. Clearly, we had enough people to get the gear down there. Just as clearly, to most of us anyway, we wouldn't have nearly enough people to get it out in a week's time, even with a hero who claimed to be able to carry out four tanks himself. Down below, Team Pirata was on the ball and

let the remaining air out of Jaime's tanks even before he was dry. Sure, it would have been better to save the air for a second push, and that's probably what would have happened on another expedition, but considering many people's fears as to what that second dive would entail, they made a self-preservation decision that left the lead still hanging. There's nothing worse than a half-dead Barbie.

With the tanks out, all that remained was the derig, but wait. Why derig, when you can strategically

place (some cynics would say abandon) as much as possible in the cave in case it's needed in the future? Stone led one final team in to bolt up the walls and try to find a way on, as well as do the all-important job of eating up the excess food we'd carried in. The rest of us had to leave some gear and the ropes, as there was that last party below us, but we did remove just about everything else that wasn't nailed down.—*Alan Warild*

J2

J2 es una cueva en Oaxaca con aproximadamente 1100 metros de profundidad que está entre la Cueva Cheve y la resurgencia de la Cueva de la Mano. Está siendo explorada para ver si conecta con pasajes más allá de la zona conocida en Cheve. La expedición de 2005 buceó y luego abrió un breve sifón, y la exploración se detuvo en un tiro vertical. En 2006 J2 fue explorada hasta otro sifón, de 150 metros de longitud. Después de él hay una bóveda con bloques de colapso y otro sifón.

HOW TO MAKE A MAJOR CONNECTION IN TWO WEEKS

OR

THE SHIFTING SANDS OF TIME

Matt Covington and Mark Minton

The sleepy Mexican village of San Agustín Zaragoza lies in a saddle that divides two giant sinkholes, each approximately 2.5 kilometers long, 1 kilometer wide, and 300 meters deep. It is a caver's dreamscape, and the site of many caving triumphs and defeats. Forty years ago, during the heyday of Mexican cave exploration, a hardy group of Canadian and British cavers journeyed down to San Agustín from McMaster University in hopes of joining the push to extend the depth of Sótano de San Agustín, which occupied the bottom of one of the sinkholes and was then the deepest cave in the area. Upon arrival in Mexico, the Canadians joined a group of American cavers from the Association for Mexican Cave Studies, who had previously explored San Agustín and had recently discovered and dropped Golondrinas. It was decided that there was too much of a crowd for one cave, so the Americans suggested that the Canadians explore another nearby cave, Sótano del Río Iglesia, which occupied the other giant sinkhole and had only been entered for about a hundred meters. After three weeks of exploration, the Canadians had pushed Río Iglesia to a depth of 530 meters, surpassed the depth of San Agustín, and set

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The first title is a take-off on the title of the first reference at the end of the article.

a new Western Hemisphere depth record. Río Iglesia ended in a mud choke. (See references.) Little did they know what lay waiting just a short distance beyond that choke. Only a few months later, San Agustín was pushed even deeper than Río Iglesia and later became the central segment of Sistema Huautla.

Huautla grew to be a massive system and is perhaps the most complex of the world's deep vertical caves. Huautla has more independent deep routes than any other cave in the world, with three routes over 1,000 meters deep, one over 900 meters, two over 800 meters, one over 700 meters, and two over 600 meters. Before this year's expedition the cave had seventeen entrances and 55,953 meters of passage. In 1987, twenty years after the initial bottoming of Río Iglesia, during an expedition into San Agustín, Mark Minton, Doug Powell, and Bill Steele discovered a series of shafts in San Agustín called the Fool's Day Extension. This route paralleled the main route and eventually went over a deep series of drops that reconnected into Tommy's Borehole above the Upper Gorge. Later on that same expedition, while checking leads in Fool's Day, Jim Smith, Andy Grubbs, and Ed Holladay surveyed a side passage that led to more drops and also connected into Tommy's Borehole. However, this side passage also had an upstream extension. Beyond a series of sand crawls, the upstream end terminated in what the survey

notes describe as a "major infeeder, sand sump." Little did they know what lay waiting just a short distance beyond.

In 1994, Bill Stone led a Huautla expedition that brought a major breakthrough when the team cracked the sump at the bottom of San Agustín and discovered kilometers of passage beyond, including a major infeeder which was thought to be the water from Río Iglesia. This discovery increased the depth of the system to 1475 meters. The expedition received a fair bit of publicity as the result of a *National Geographic* article and a book, *Beyond the Deep*.

Though Huautla saw many years of expedition caving, little progress was made in Río Iglesia. In fact, since the initial exploration all attempts to reach the bottom half of the cave had been thwarted by either a sand plug or a sump at the downstream end of a large chamber called the Penthouse. Because only one trip had been made to the bottom half of the cave and that trip had been in the early days of the exploration of deep caves in Mexico, many cavers have wondered what leads might remain in lower Río Iglesia. To add to the mystery of Río Iglesia, the large stream that flows into the cave disappears at the bottom of the waterfall entrance drop, never to be seen again in the lower portions of the cave. It is thought that this stream might bypass the first sumps at the bottom of San Agustín, reemerging at the waterfall found in 1994. In 2001,

Mark Minton pushing one of the new passages in the upper cave.
Yvonne Droms.

a small group of cavers returned to Río Iglesia to check leads in the Penthouse. Page Ashwell, Gustavo Vela, and Andy Zellner dug on the sand plug and after a couple of hours broke through to the far side. They reported that the dig was dry. However, several days later, after a heavy rain on the surface, they returned to the passage to find it sumped shut. [See *AMCS Activities Newsletter* 25, pages 53–55.]

During the last ten years, much of the focus of deep Mexican caving has been across the river from Huautla in Sistema Cheve, which has a far greater depth potential, with the deepest dye-trace ever done between an entrance and resurgence. Both Huautla and Cheve resurge within a kilometer of each other in the Río Santo Domingo. Recent discoveries in the Cheve area include two new deep caves, Cueva Charco and J2. In 2007, after three years of caving in J2 and reaching a terminal sump there in 2006, we decided to take a rest from Cheve and once again try our hand at Río Iglesia. [For Charco, see *AMCS Activities Newsletter* 30, pages 25–32. For 2006 J2, see Alan Warild's article in this issue.]

Bill Stone assembled a relatively small team of cavers, including a number of Huautla veterans, for the trip: Matt Covington, Wicho Díaz, Yvonne "Vonny" Droms, Mark Minton, David Ochel, Yuri Schwartz, Vickie Siegel, Jim Smith, José Antonio Soriano, Bill Steele, Bill Stone, and Diana Tomchick.

The beginning (Matt Covington): On Sunday, April 8, 2007, the team converged on San Agustín. David, Yuri, and I arrived early in the morning after busing in overnight from Mexico City. Soriano was already there and had made arrangements to rent a house from Jaime, who has been hosting cavers for more than thirty years. A few hours later the rest of the group arrived in two trucks, having driven down from Texas. We spent the rest of the day unloading the trucks, organizing gear in the house, and poring over



maps and old trip reports.

The next day was our first day in Río Iglesia. Our primary objectives were to become familiar with the cave, rig down to the bottom of the Penthouse, and check out the constriction at the downstream end of the Penthouse. We divided into two teams. One group headed in the upper Sótano entrance, which would become the main trade route. The other group rigged in from the Cueva entrance, which provided a backup route in case anyone vandalized the more exposed rope in the Sótano. The passages meet just before the top of the Christmas Shaft. Each team was carrying rope for rigging the Christmas Shaft. The plan was to rig both a 9-millimeter European-style route and an 11-millimeter straight hang down the shaft. This would provide two parallel routes and speed up travel on the longest, 70-meter, pitch of the 140-meter shaft.

Bill Steele, Diana, and I were the first to bottom the Christmas Shaft. We proceeded down the 50-meter-diameter passage of the Penthouse toward the infamous constriction that had blocked progress to the lower cave for so many years. At the pinch, the ceiling of the Penthouse drops rapidly down, and the passage enters a sandy crawl. After about 30 meters of hands-and-knees, the passage enters a belly crawl. Bill Steele and Diana waited there while I went ahead to assess. As I went into the crawl Bill called out to me, "Make it go!" After entering the belly crawl, I noticed that there was a significant

draft coming out of the passage. This spurred hope, until I saw a pool of water that looked like a sump. With my face near the water, I could see a few inches of clearance to what appeared to be a rock blockage beyond. Bill's words echoed in my head. "Oh well, I guess I have to get wet," I thought. I crawled into the ear-dip and discovered that the rock blockage was simply a thin wall of cobbles, and I was able to plow through until I emerged into the low airspace on the far side.

The passage went back to hands-and-knees, went around a corner, and slinked into another low airspace, this one blowing like the one before. On the other side lay a steep sand bank that rose about 3 meters out of the water. At the top of the slope, I was surprised to find yet another pool, which appeared to be completely sumped. The strange thing about this pool was that it was perched high above the previous one, and water was slowly flowing back into the lower pool. In this part of the cave downstream was uphill. This explains why the sediment backs up there. However, I knew it couldn't be a complete sump since there had been so much air.

Then I noticed a roaring sound, like a distant waterfall—only it wasn't water. It was air ripping through a small hole and creating ripples across the pool. I inched out into the pool and searched for the source of the sound. There was a small archway about 20 centimeters wide and 8 centimeters high in the

middle, blasting air. Luckily the passage significantly belled out below the surface of the water. I removed my helmet and slipped through the arch to discover a head-sized air pocket on the far side. All of the air was blowing out of a small triangular hole of rock and sand above. The flow was strong enough that it made it difficult to see. Excitement and adrenaline welled within, and I began burrowing through the sand and pushing it behind me with my feet. In thirty seconds I was through, and this was the constriction's last cruel trick. Beyond, it opened to walking size and soon began heading downhill through nice, clean-washed marble. We had broken out. The source of the water was a small infeasible just beyond the constriction that was back-filling the pools. Excitedly, I rushed back through the passage, knowing that I had been gone too long. Bill and Diana were excited to hear the news, and we retreated to the surface, encountering David and Yuri just finishing up the proper rigging of the Christmas Shaft with the 9-millimeter rope.

We spent the next afternoon packing and preparing for our main assault on the cave. Our chief concern was that the low airspace at the constriction would sump if it stormed on the surface. For safety, we decided to dig out some of the sand to enlarge the three constrictions and to rig a rope through the passage so that a diver could use it as a dive line. Furthermore, we prepared a minimal

set of camp gear and food to leave on the far side in case a trapped party had to wait out a flood. David, Yuri, and I went in for a three-day camp trip. Our plan was to spend one day working at the constriction and then to continue rigging down the cave. Meanwhile, others would work on the numerous leads in the upper cave, trying to find the continuation of the main stream.

Upper Cave Booty (Mark Minton): On the first rigging trip into Río Iglesia, Yvonne Droms, Vickie Siegel, Bill Stone, and I went down the passage that connects the upper Sótano entrance with the waterfall and Cueva entrances just before the Christmas Shaft. Near the bottom of the descent Vickie noted on the wall a small hole with good airflow. It was too small to enter, but looked intriguing. After descending the last short pitch to stream level, we headed downstream to look at the Triple Pots, an alternate route into the Penthouse. Before we got there I noticed a small hole with very good airflow in the floor of an alcove. I immediately started pulling out rocks and soon had a passable opening. There was canyon passage below. We followed it to a deep drop. We also made light-contact with the hole in the wall that Vickie had seen. This was not on the map. We had only one rope, which we rigged to naturals, and we descended past a couple of ledges to a steep boulder slope in tall passage. The rope was about a meter

off the bottom, but it was possible to rappel off the end and climb down. A short way ahead was a multi-way intersection leading to pits at every turn. There was good airflow, and we were heading downstream to the south, exactly where we expected the long-lost active flow of the Río Iglesia to be. The entrance to our new passage was within sight of daylight and had gone overlooked for forty years.

Two days later we were back at our lead loaded for bear. Yvonne and I rigged while Bill and Vickie surveyed. We chose the right-hand branch at the junction and descended a drop into tall canyon heading two ways. Downstream, a U-turn to the north took us past several short drops to the brink of a deep, echoing shaft with the sound of a waterfall in the distance. This was either really good, or we had rediscovered the Penthouse. Yvonne rigged the pit with a Y-hang, and Vickie got the honors of the first descent. Thirty-five meters later she landed at one end of the Penthouse, coming out of a dome that had been noted on the Canadian map. Since this was a spring expedition we named it the Easter Shaft, in keeping with the historical name of the Christmas Shaft that had been found in December forty years before. Soriano, who had soloed in behind us, Bill, and Vickie went to visit the cave campers, while Yvonne and I completed the first crossover trip out the Christmas Shaft.

While we were pushing our lead, Jim, Bill Steele, and Diana pushed a lead of their own in the Cueva entrance to Río Iglesia. It went down a couple of drops and dead ended. Bill then led a climb that came out as an overlook of the waterfall entrance, adding to the complexity of the Cueva area.

On the next trip Bill Steele, Diana, Jim, Yvonne, and I made the crossover in reverse, descending via Christmas Shaft and derigging up Easter Shaft and the rest of our route back to the bottom of the third drop, where a good-looking climb continued south, but upstream. This led to a large chamber, which we called



Matt Covington in the first low air space in the Dumpster. *David Ochel.*

the Friday the Thirteenth Room. It ended in well-decorated shafts going up, one of which I bolted up for a way before calling it quits where it appeared to flowstone shut.

Yvonne and I headed in two days later and began rigging down the other pit off of the junction where we had stopped our first day. Tall canyon passage headed downstream to the south for a while, then got low and also turned north. After some complicated route finding, we stopped at a low stream crawl that appeared to open up again. We surveyed out. On the next trip Bill Steele, Diana, and Jim joined us and continued the survey, while Yvonne and I rigged. The passage alternated between spacious and crawly, eventually ending in a tall, narrow room that seemed to pinch at all levels. I finally hammered open a very tight vertical squeeze near the ceiling. We named the S Filter because it would exclude larger people like Smith, Steele, and Stone. It dropped back to the small stream and then popped out into a huge dome-pit. Shouts into the void were answered from camp, confirming our worst fear: we had connected to the Penthouse again, this time near the Christmas Shaft.

One final lead remained in our new section, and it actually had the most air flow. Part way down the first drop was a ledge with wind one could feel when passing by on rope. Bill Steele, Diana, Yvonne and I finally checked it out on April 19. Our goal was to not connect to the Penthouse again. The ledge led down a deep, narrow drop and clean-washed canyon to a three-way intersection. One way dropped into the Easter Shaft route, another led to yet another deep drop into the Penthouse, and the third came out as a window in the Christmas Shaft. Damn! The latter two were not descended for lack of sufficient rope, but we dropped flagging down the first pit, and it was found near the Christmas Shaft by the camp crew, with whom I actually spoke as they were ascending when I happened to be at the window. All leads were thus exhausted.

The new discoveries in the upper cave added over a kilometer to the survey and four new routes into the

Penthouse at roughly -200 meters. Unfortunately, the long-sought active river course was not found. A few climbing leads remain, however.

Beyond the Dumpster (Matt Covington): After choosing a camp location in the Penthouse, David, Yuri, and I went down to the constriction to begin the work of enlarging it and rigging a dive line. We spent several hours digging, until we felt that the passage would be passable by a rescue party of cave divers. Yuri rigged the dive-line with a series of bolts on the ceiling to direct the rope along the center of the passage. We then placed the stash of emergency gear on the far side. The final thing we wanted to do was drain the upper pool. Since it was 3 meters above the lower pool and dammed up only by a sand bank, we thought we could drain most of it and get rid of the worst of the low air spaces. Yuri and I dug a trench through the pool and toward the edge of the sand dam. David kept an eye on the first low airspace, because we were worried we might quickly raise the water level of the lower pool and sump ourselves in. Once the trench was deep enough, I removed a large rock that was holding back the flow. This released a flood of water that quickly eroded a canyon into the sand and rapidly increased in volume. Yuri and I looked at each other and then dove down the sand bank, following a slurry of water and sand into the lower pool. Luckily there was enough volume in the lower pool that it had not yet risen significantly, but we didn't hang around any longer to find out if it would sump. After a day of working in the constriction we had decided on an appropriate name for the place—the Dumpster. Of course that name had the added benefit that if anyone were to come after a party trapped on the far side they would be “dumpster diving.”

We slept late the next morning. We had made an arrangement with the surface

crew that each morning someone would come in to warn us if a major storm had moved in. Each team leaving to go through the Dumpster would wait until at least 11:00 a.m., allowing time for a team from the surface to sound the alarm. This gave us a way of knowing that the weather was good even during a long stay underground. At quarter to noon we were confident that there would be no alarm. We went back through the Dumpster, which was not sumped shut, observing our handiwork from the day before. The final low air space was now much more pleasant, with the water level nearly a foot lower. We continued down the clean-washed, marbly canyon and began rigging into the lower part of the cave. We took turns rigging as we came to each drop, and we found that we rigged about twice as many drops as the Canadians had. Of course with a hammer drill for placing bolts, we had the freedom to rig any drop that was questionable.

The first drop was a short, overhanging nuisance drop of 4 meters and was noted in the Canadians' description. I rigged this with two bolts at the lip. After a few down-

David Ochel stemming over potholes in the canyon passage beyond the Dumpster.
Matt Covington.





Yuri Schwartz ascending the marbly drop just above the old Canadian camp. *Matt Covington.*

climbs, we reached a spot that we dubbed the Zapatería (Shoe Store), another gravel-choked constriction, where we found three old shoes. At the Zapatería one bypasses a drop by going through a short stream crawl. The cave then opens up again into large, polished passage.

There was another short down-climb, and then we encountered a slick handline drop that had not been rigged by the Canadians. David rigged this 5-meter pitch with one bolt. It dropped into a waist-deep pool. After wading through the pool, we reached a 10-meter drop that the Canadians had rigged with a handline and noted was "strictly free-climbable." This is not something that any of us would have wanted to free-climb, although a fall probably would not have proved fatal, as it would have landed you in a deep plunge-pool below. Yuri rigged this drop and placed a pendulum bolt at the bottom to keep us out of the water.

Next we reached a short 4-meter pitch not noted on the Canadian map. As I was drilling the bolt holes, Yuri noticed that I had the drill in reverse. The drill was a Hilti, which had a control reversed from my own Bosch drill that I was so accustomed to. While placing a final bolt for that pitch the drill ran out of power. I had gotten just enough depth to safely place the bolt, but because of the

backwards drilling the battery had lasted for only about half as many bolts as it should have. We continued on to the next pitch, which was a handline drop of 7 meters. We were able to rig on a natural anchor that was about 5 meters back from the lip. This was followed by a down-climb and then another drop into a deep pool that needed to be rigged as a bolted traverse, so we left the extra rope and rigging gear and returned to camp much earlier than we had planned. So much for the big plans of rigging down the cave that day. I felt stupid. At least this allowed for a leisurely evening around camp, taking photos and inventorying the food and rigging gear.

As planned, we left the cave the next day, and Bill Stone and Vickie Siegel headed down to the camp. We spent the afternoon drying out and packing gear for the next camp trip, gathering enough food for at least a five-day stint. In the middle of the afternoon Yuri, David, and I wandered around San Agustín in search of cold drinks. "*¿Hay refrescos fríos?*" After many unsuccessful queries, we reached the last store that we were going to try, and, much to our surprise, the answer was, "*Solamente cervezas.*" We returned triumphantly to the field house with what Bill Steele thought were the first cold beers ever drunk by cavers in San Agustín.

The next day David, Yuri, and I headed back in to camp at the Penthouse. Bill Steele, Jim, and Diana planned to enter for a three-day camp trip on the following day. We arrived in camp around mid-afternoon. Bill Stone and Vickie had been working on further enlargement of the Dumpster. After a large hot lunch, the five of us returned to the Dumpster for a few more hours of work.

At noon the following day Yuri and I headed down the cave to continue rigging. The other three would catch up with us later. After about an hour travel from camp, Yuri and I reached the previous end of rigging. Yuri continued with the traverse that had stopped us before. Shortly after the traverse was a 14-meter drop through brilliantly banded rock, which I rigged with an offset rebelay at a ledge to avoid hanging in the water. This drop was followed by a very deep and pretty blue plunge pool, which we avoided with a protected traverse on the left. Immediately after the pool we found the 21-meter drop into the Base Camp Chamber of the Canadians. Yuri rigged this with a short traverse at the top to a rebelay that provided a nice free rappel for the full length of the drop. During the rigging of these drops the other three caught up to us.

The Base Camp Chamber contained a lead that was one of our primary objectives, a large breakdown blockage in an alcove on the wall high above the stream. On the map the breakdown wall was about 50 meters across and appeared to be a tantalizing lead. Once in the chamber, we split up to search for the way up into the breakdown alcove. During my search I found myself following a lone set of footprints through the dirt and gravel. I could clearly see the pattern of the boot soles. I quietly set my feet over these marks, which had lain undisturbed for forty years, thinking of all that had changed in the caving world since the previous explorers trod there. I had not even been born when

these marks were left. Never before had I felt such a strange connection with history. Soon my introspection was interrupted by finding my objective.

Vickie and I had converged along separate paths and simultaneously found the breakdown blockage. While the blockage was large, it didn't seem too promising. For about thirty minutes we scoured the wall, poking in every nook in the angular rock. The rock was frighteningly sharp and brittle, and maneuvering through it required patient and methodical motion. We never felt any air or saw anything even remotely passable, though one could certainly dig there. While Vickie, Bill, and I searched, David and Yuri had continued to scout ahead. They returned, and we all convened near the old Canadian camp. They had passed through another constriction and turned around at another drop. We briefly wandered around the Canadian camp, which was absolutely filled with footprints and also some other remains of their presence, including an old carbide can, a plastic bottle that appeared to have once contained fuel, and the remains of what looked like burnt pieces of wetsuit. It was surprising that in forty years the water had never risen high enough to erase the footprints, as the camp was only about a meter above the stream bed, which clearly sees a lot of water. Bill had brought the emergency cache down to leave at this old camp, as it was a more pleasant place to spend

Remains of the old Canadian camp.
Matt Covington.



a few days if necessary.

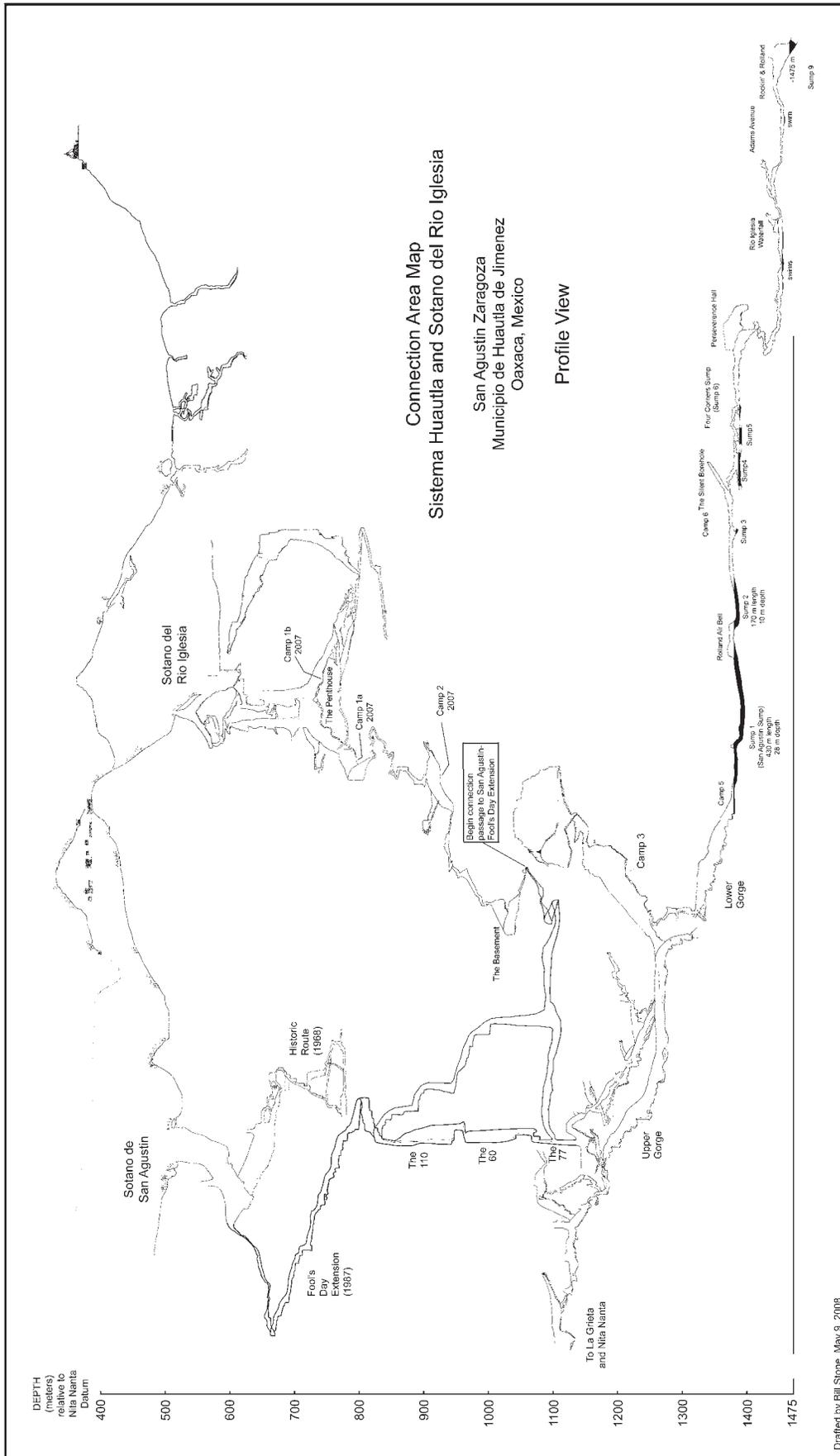
We continued on and through the constriction, which was a 60-meter belly crawl. On the far side we emerged again into big canyon passage. Near the top of the next drop was an interesting climbing lead. Above a short vertical wall of loose boulders cemented together by mud, a passage continued as a hands-and-knees crawl that appeared to get bigger. Given the loose nature of the face, free-climbing it was questionable. However, I thought that with a boost I could hoist myself over the edge. Bill agreed to do the dirty work, and in a few seconds I was up. The passage grew larger, but then turned and appeared to drop back into the main passage. While I rigged a line to a column for the climb into my lead, Yuri finished up rigging the drop in the main passage below. He went down, and we verified a connection back to the main passage. However, there was another intriguing climbing lead above me. It was about 5 meters of slightly overhanging bedrock wall with a modestly sized canyon passage emerging from above. I convinced the others to come up and have a look. We agreed that we would rather be scooping virgin booty than following the cave to the bottom, so Bill spotted me while I gave the climb a shot.

After a few low-fifth-class moves, I was past the crux and scrambling up into the canyon. It averaged about 5 meters tall and 3 meters wide, but unfortunately it was going upstream. I scooped ahead to see what it would do. After about 100 meters the passage intersected a large dome, maybe 25 meters tall, and to my surprise I realized that I had just discovered one of those oft-theorized but rarely seen cave passages—a drainage divide. Water fell down the dome and split, with a trickle heading back the way I had come, and another going ahead into a 7-by-15-meter descending canyon passage. I rushed back to tell the others, and Yuri retrieved the rope from below so that I could rig the climb.

After a couple of short down-climbs we reached a sloping 10-meter drop. It was all quite free-climbable, but there was one exposed spot

near the top that was a little scary. I climbed down and began poking in the leads below, while the others decided to rig a rope. There were three leads at the bottom. The first was a tight, narrow canyon where the water went, but this didn't look passable. The second was a large void above us that one could bolt up into. And finally, I found another descending route, which required squeezing through a boulder choke and going down a short climb. Just past the climb was another sizable drop, which definitely required a rope.

We rigged the rope with webbing wrapped around a natural. At the lip we placed a bolt for a reelay. The drop was about 20 meters and sloping, with lots of sharp, jagged rock. About halfway down I found a bedrock column that I wrapped with webbing for another reelay. The rope just barely reached the bottom. The passage continued as a 5-meter-wide, 15-meter-tall canyon and went down a series of short down-climbs interspersed with very muddy pools. After about 30 meters, we reached the top of another drop into what appeared to be quite a sizable chamber. Judging by how far we had come, we suspected that this might be the Basement, the large room discovered by the Canadians that preceded the terminal mud plug. However, since we were out of rope, our suspicions would have to wait for another day. It was getting late, so we decided that we would return the following day with more rigging gear to push and survey the passage. Bill and Vickie opted to crash in the old Canadian camp, where we had left the emergency bivy gear. Yuri, David, and I went back up to the Penthouse camp. We expected to find others in camp who had been planning to join us there, but it was deserted when we arrived. We got to bed around 4 a.m., and woke up again the next afternoon, with still no signs of newcomers in camp. At this point we assumed that something had kept them from deciding to camp; perhaps they had broken out somewhere in the upper cave. We left camp bright and early at 5 p.m. and met Bill and Vickie at the Canadian camp a couple of hours later.





Matt Covington and Yuri Schwartz and the load they hauled out of the bottom section of the cave after the connection. *Matt Covington.*

Yuri and I continued to the end of exploration and began rigging the next drop while the others surveyed the previous day's find. The drop proved to be another 20-meter drop covered in sharp resoled flowstone. This made for poor bolting, and it took Yuri over an hour and three rebelay to get to the bottom. For some of these rebelay he had to place two bolts because of concerns about the rock and the pendulum over sharp projections that would occur if a bolt pulled. When we finally reached the floor, we began our search to determine if this was the Basement. It was a sizable chamber, but the ceiling height seemed to be quite a bit lower than that depicted on the profile of the Basement. Furthermore, we didn't see an obvious place where another route could be entering the room. We explored down the large passage, uncertain of whether we were in virgin territory.

The chamber averaged 25 meters wide and 12 meters tall. Near the far end we came to a large mud canyon cut in the floor, not a good sign. Sure enough, after about 50 more meters the chamber ended in a very terminal-looking clay plug. We spent a couple of hours scouring the chamber for side leads.

There were some domes that could have passage at the top, but nothing particularly tantalizing. In one place on the side of the chamber we found a short passage where an in-feeder came in and then dropped through an extremely tight canyon in the floor. We spent a while hammering and squeezing to no avail. By this point we were pretty certain that this was not the Basement. It simply didn't match up with the map. We had been throwing around ideas for a name, and Yuri came up with Anti-Basement, which stuck. As we would later find out, the name was quite appropriate. Survey showed that our passage passed over the main passage and dropped down to a level almost equal to that of the Basement. The two chambers sit side-by-side, paralleling each other. Shortly after the dig attempt, the others arrived. Yuri helped with the survey, while I took photos of the chamber.

The connection (Matt Covington): Once the survey was finished, we showed the others the potential leads and had a meeting to discuss our plans. The end of the expedition was drawing near, and many members would have to leave in the next few days. However, we had still not bottomed the cave to look at the terminal plug or try to figure out where all of the air was going. Yuri and I decided to make one more push to bottom the cave and see what we could find. If we found continuing passage, we would leave the cave rigged, and the small remaining team would continue the push. If it didn't go, then we would derig all of the way back to the Penthouse. Bill and Vickie planned to recover for a day and then head to the surface. David was on the fence, but in the end decided to head for the surface as well, wryly exclaiming, "I'll let you guys have all of the glory."

We reached camp sometime around 7 a.m. and crashed for a long stint of recovering. One of the most pleasurable things about an extended

cave camp is the extended-cave-camp recovery, where one alternates bingeing on food and sleeping for long periods of time. This is easy to accomplish in the ever-present, still, cool darkness of the underground. After twenty-four hours of this Bill, Vickie, and David left for the surface. Yuri and I packed our gear for one final trip down the cave, and left camp around 9 a.m. We took extra food to leave at the emergency bivy in case we decided to crash there on the way out.

It took us roughly an hour and a half to reach the Canadian camp. We dropped our extra supplies and headed on down the cave. Below the side passage that we had previously surveyed, we rigged three rope drops and two handlines. First was the short, awkwardly offset drop that Yuri had rigged before. The next serious drop, of about 12 meters, was also one that the Canadians had rigged. We were able to rig it clear of rub points with bolts only at the top of the pitch. This was followed by a handline drop over a big, deep pool and then two more pools before we reached the top of the final 21-meter drop into the Basement. This drop went almost free from a bolt at the top of the pitch. We protected a short rub point about 10 meters off the ground with a pad. The Basement ends in a clay-floored belly crawl that leads to another small chamber. This is where the Canadians had stopped. It was obvious from the debris that this chamber floods to at least 7 meters above the floor, almost to the ceiling.

We crawled into the passage, which had been plugged in 1967, and found a strong draft blowing out into our faces. This was the source of the air. The passage continued as a steep, uphill, sandy belly crawl for as far as we could see. Yuri charged in and I followed. It was slow going up the steep slope in the sand, but the air was encouraging. After about 30 meters, we hit a constriction that required digging. I handed up the shovel to Yuri, and he furiously struck at the sand and exclaimed, "It blows! It blows!" After three minutes of digging he was through, and we plunged ahead excitedly. Thirty meters later the passage opened up

into a chamber. The walking-sized passage was short-lived, however, and soon led into another sand crawl. After a series of crawls and chambers, we emerged into a passage that really looked good. All of the sand we had just crawled through had piled up there because the passage was going uphill, just as in the other constrictions in the cave. But now the cave was going down, big and clean-washed. We were getting the sense that we had broken out. Should we return for survey gear or scoop ahead? We decided to push on for a few more minutes to get an idea of what to expect. After a down-climb and S-bend, the passage dropped off into a large, deep fissure. Hmm . . . We would have to go back for the rope and rigging gear in the Basement.

As we assessed the rigging options something caught my eye on the far wall—FB83 . . . FB83? In carbide on the wall. My heart sank. Obviously someone had been here. Before I really had time to process what was going on I said, “Look, a survey station.” Yuri saw it and let out a huge whoop with both arms raised in the air. “We did it!” That’s when it hit me—the meaning of the station. We had connected to San Agustín! Then a quiet came over Yuri, and he looked at me and said, “Listen.” In the distance, we could hear a deeply thundering river. It was in the Upper Gorge, the main drain of Sistema Huautla. After a few more minutes of excited whooping and amazement we set in on the task at hand. We knew that the expedition was about to end, and that we had just made a major connection. No one else would be coming back to the bottom of the cave this year. That meant that we needed to survey our entire scoop. We headed back through the crawls, which were much easier going down hill. The sand was steep enough in places that you could dive in face-first, wiggle back and forth, and surf down by the power of gravity. We dubbed this passage the Sanddives.

We reached our survey gear, soaked in sweat, and began surveying back down the passage. It was cold work in the breezy passage, but we made quick progress. After 430

meters and six and a half hours of survey, we tied in to the old station. Then at 10 p.m. we began the long process of heading out. After derigging the lower cave, we reached the Canadian camp at 1:30 a.m. Wasted from the day’s activity, we opted to crash there for the night.

After eight hours of sleep we got up, leaving camp at 1 p.m. The trip to the Penthouse was laborious. It took five hours instead of the normal two. We carried out all of the emergency camp gear, and at each drop we gained more rope. As we reached each drop, one of us would derig while the other began moving the gear farther up the cave. By the time we reached the final drop before the Penthouse, we had two regular camp packs, one extra-large camp pack, and 50 meters of rope that wouldn’t fit in a pack. We were happy to do our last trip through the Dumpster and to arrive at the Penthouse camp. We dropped all of the extra gear, and after a hot lunch we headed out of the cave with relatively light packs.

We had worked up a whole routine of how we would report the connection. We would calmly ask Bill Stone if FB83 meant anything to him, and then see how long it took him to figure it out. Upon reaching the Christmas Shaft we saw lights from above. Mark and Vonny had just finished pushing another lead that ended up in the Penthouse. This one popped out somewhere in the middle of the Christmas Shaft. They began asking us what we had found. Yuri and I looked at each other, trying to figure out what to say, as we couldn’t play our game over this distance, and we wanted to report our discovery firsthand on the surface. We pretended that we couldn’t hear them well enough, but did communicate that we had derigged the cave. They presumed we had found nothing. As he went up the shaft, Yuri got within close speaking distance of Mark, but held his tongue, as he wanted me to be there when we told them.

We reached the surface at 10 p.m. and at the entrance we ran into Bill Steele. He asked us what we found. We began our game. “Does FB83 mean anything to you?”

“No.”

“Well, we connected to it.”

“Oh.”

He was tired from a day of pushing, and it hadn’t sunk in.

“Bill, we connected to San Agustín.”

Finally he got it and replied, “Wow! Congratulations, guys!” Then a somber look came over his face and he said, “It’s sad really. We’ve lost another cave.” We charged on up the hill, passing Diana on the way and announcing the news. Upon reaching the field house, we ran into the others, though Mark and Vonny had still not emerged from the cave. When they asked us what we had found we once again began our game. “Well, we went through the dig at the end, and it continued. And then we found this strange writing on the wall. FB83, does that mean anything to you?”

“What? Nawh, you didn’t. You guys are pulling my leg.”

“Yeah. And we tied into it.”

“You’re just messing with me.”

As we started digging in our packs for the survey notes, Bill Stone started to believe us. Soon Mark and Vonny arrived at the field house. “Man, I can’t believe you guys didn’t tell us,” Mark cried out. We felt bad for leaving them in the dark, but Yuri’s consideration for me had kept his lips sealed. After a hearty meal we had a major celebration and typed the survey into the laptop. Sure enough, our survey plot lined up perfectly with the passage surveyed by Jim Smith, Andy Grubbs, and Ed Holladay in 1987. It turned out that they had dropped down a large dome in the middle of our passage. They had pushed downstream until hearing the gorge, and then pushed upstream to the beginning of our crawl, which had been sumped with sand. We figure that of the 430 meters that we surveyed, only about 70 meters of it was new passage that hadn’t been seen before from either side. This 70-meter gap, which is intermittently filled with sand, had twice stopped a major discovery from occurring. As Bill Stone put it, if the Canadians had broken through in 1967 they would have found the main drain in Huautla and it would have “blown

their minds." Río Iglesia would have become the central piece of Sistema Huautla, and the passage that lay below would have seriously stretched the cave exploration technology of the time. If Jim Smith and his crew had wandered into the Basement, they would have thought that they had discovered a new large room. It might have taken some serious time with the data on the surface to figure out where they really were. In fact, they might not have ever figured it out, as this was not the expected connection point for Río Iglesia. Forty years after the initial exploration, and twenty years after the second chance, the sands had shifted, and Fortune chose us to uncover the missing link.

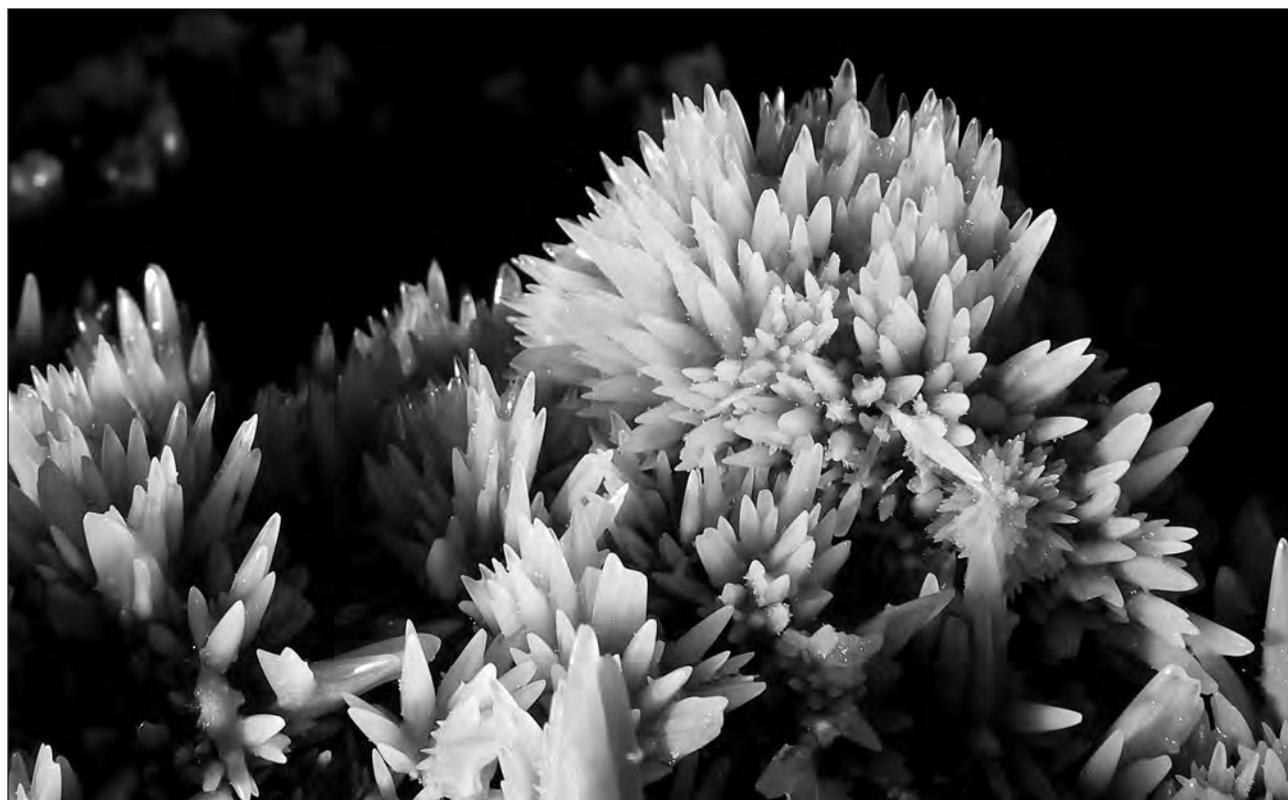
The Final Push (Matt Covington): The morning after we emerged from the cave, many of the group had to leave for home. We said goodbye to David, Diana, Jim, Bill Steele, and Yuri. Mark, Bill Stone, Vickie, Vonny, Wicho, and I remained for a final push. We would go back in to spend five days camping in the Penthouse to see if we could find

the deeper continuation of the main Río Iglesia stream, which disappears just inside the entrance. That day we went into Huautla for breakfast and resupply. It was nice to spend a day on the hot, sunny surface. We spent the following day, too, in more lazy recovery and preparation for our final trip into the cave. Unfortunately, about this time a stomach bug started making its way around camp. At first it struck Vickie. She and Bill would join us in camp after she had time to recover. Then the following morning as we were getting our gear together to go into the cave I was struck with a bout of intestinal distress. It appeared that I might be getting it too. Conflicted for a while, I ultimately decided to go ahead and go in to camp. Maybe it wouldn't get worse, and it was a short trip to camp. As it turned out, it did get worse, and by the time we got to camp I was pretty worthless with chills and aching. I lay in camp while others began the work of poking around in the Penthouse looking for leads. Luckily, the next morning I felt better, but later that day Vonny would come down with

it as well.

In plan view, the Penthouse is shaped like a giant U. Most of the water enters the room near the bottom of the U. There are multiple drainage divides and water leaves the room in several locations near the tips of the U. At one of these tips is the Dumpster. The other tip ends in two different sumps. We had not yet looked at these passages on this trip, so we started our first full day in camp by heading downstream that way to look for leads. The first sump was abysmally grim and would require digging to make it even big enough to get into. We spent a while exploring around in a maze above this sump, which had a series of tricky climbs. Some of these passages had been sketched onto the original map, but we found no promising leads. We went down to a large dome called the Echo Chamber and found no further leads. The other sump was beyond a short rope drop, and we had left all of the rope at camp. After a lunch break we headed back to camp. Mark and Vonny would go check the second sump, while Wicho and I would push

Nice crystal formations near the Ascension Shaft. *Matt Covington.*



an aid-climb in a blowing infeeder that had been partially explored in 2001. Mark and Vonny found no promising leads down near the sump, and during that time Vonny started to feel pretty bad.

After a bit of stream crawl and ascending two ropes, Wicho and I reached the climb where Bill Stone and Bev Shade had stopped in 2001. It was a wet and windy climb, but I was able to avoid the brunt of the water by climbing up a chimney and then traversing over the top of the pit to the passage above. After 5 meters of free-climbing and a 3-meter bolted traverse I was on top. I rigged a static line, and Wicho followed while cleaning the pitch. The next chamber was a fair-sized dome and very drippy. We dashed across it to the far side to find a series of flowstone ramps going up. I free-climbed these ramps and then rigged a rope for Wicho to follow. Most of the water was actually coming out of an alcove in the main dome; but we left this lead for later in favor of the walking-sized passage heading off above the ramps. After scooping about 100 meters of nicely decorated passage, we reached a 10-meter dome. I suited up for another climb. At the top was some really amazing pure-white crystalline flowstone, with individual crystals reaching 10 centimeters in length. However, the passage ended in a flowstone choke. We called it a day and headed back out to camp.

The next morning we were joined in camp by Bill and Vickie. They headed off with Wicho to continue aid-climbing in the infeeder that Wicho and I had bypassed the day before. Mark, Vonny, and I followed soon after and began surveying the previous day's scoop. In the process Mark found a grim little infeeder that we had missed, but it quickly became too tight. After finishing our survey we returned to the drippy dome, where Wicho had almost finished the 8-meter pitch into the alcove where the water was coming out. Mark and Vonny went back to camp, and I opted to join the climbing team. The alcove was indeed a passage, and it quickly led to another pitch of about 7 meters. Vickie took over the lead for this climb while the rest of us poked

into holes and took pictures. At the top of this climb was another dome room and yet another waterfall pitch. This one was about 15 meters. I took the lead and was able to free-climb the bottom portion before placing five bolts and reaching the top. Beyond a short crawl the cave went up a couple of short cascades and entered a boulder choke. I poked around for about twenty minutes and decided that there was no way on. We descended our climbs and headed back to camp. There were still remaining climbing leads in the drippy dome chamber, but we were out of time. Since two of the other shafts into the Penthouse are the Christmas Shaft and the Easter Shaft, we stuck with the theme and dubbed our new find the Ascension Shaft.

The next morning it was time to leave the camp. We packed up, and most of us ended up with two packs. We group-hauled the ropes up the Christmas Shaft and then set out toward the entrance, arriving on the surface that afternoon. Sistema Huautla now has twenty entrances and is 62.1 kilometers (38.6 miles) long. Our connection added over 6 kilometers to the system, of which 1.75 kilometers was virgin.

The next day was spent washing and organizing gear so that we could leave San Agustín. Finally, we piled all the gear and ourselves into Big Red, Stone's enormous F-350, and made our way toward the Texas border. It had been a good expedition. One more piece of the Sistema Huautla puzzle is in place. However, another mystery remains. We still haven't found where all of the water in Río Iglesia goes. Breakthroughs around there seem to happen every twenty years. Anyone interested in Expedition Río Iglesia 2027? We'll find the river.

Personal note (Matt Covington): This expedition, while exciting in its own right, also had a particular personal significance for me. As a sophomore in high school, when I



Vickie Siegel leading a climb in the Ascension Shaft. *Matt Covington.*

was already a caver, my grandparents showed me the *National Geographic* article on the 1994 expedition to Huautla. I was enthralled. I carried it around for days and burned the images into my mind. That was the kind of caving I wanted to do. I wanted to cave in Sistema Huautla. The article speculated about the connection between Iglesia and Huautla, showing the photo of a giant infeeder waterfall that I will never forget. So while I have been caving in Mexico now for a number of years, this expedition was for me the pursuit of a dream, one that I now can say I have fulfilled. To all cavers out there, young and old: Cave the dream!

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Cómo Conectar una Cueva en Dos Semanas

o

Las Cambiantes Arenas del Tiempo

En abril de 2007, espeleólogos de los Estados Unidos y de México regresaron al Sótano del Río Iglesia, cerca de Huautla, Oaxaca. Topografiaron nuevos pasajes en la parte superior de la cueva, todos los cuales llevaron a la zona ya conocida del Penthouse. El pasaje que sale del fondo del Penthouse, que había sido bloqueado por restos dejados por inundaciones desde la exploración original de la cueva en 1967, fue hallado libre de obstáculos, sin embargo fue necesario escarbar un poco para poder pasar por él. Se exploraron nuevos pasajes en las partes bajas de la cueva, acampando en el Penthouse. Durante el último día en el campamento, dos espeleólogos visitaron el final de la cueva, que cuando espeleólogos canadienses lo vieron en 1967 era un tapón de lodo. Lo hallaron libre, y después de unos 60 metros de gateras arenosas llegaron a un pasaje más grande, donde encontraron una estación de topografía de la sección Upper Gorge del Sistema Huautla. Con esta conexión el Sistema Huautla llegó a 62.1 kilómetros de longitud, con veinte entradas, incluyendo las dos entradas al Río Iglesia.

THE 2007 LOS TOROS EXPEDITION

Mark Minton

Soplo de Los Toros is a major cave in a new area of exploration near Los Toros, Nuevo León, in the central Purificación karst [see *AMCS Activities Newsletter* 30, pages 71–76]. Ten people gathered for the 2007 trip: Matt Cavanaugh, Adam Zuber, and Emily Zuber from Washington, James Hunter, Colin Lee, Eva Osmer, and Tanja Pietraß from New Mexico, Charles Formen from Texas and Mexico, and Yvonne Droms and Mark Minton from Virginia. We spanned six decades of ages, from young Emily at 19 to Purificación veteran Charles at 63. Zaragoza was our rendezvous, and we ended up spending an extra night there when we found out that Adam's group had accidentally gone to the wrong Zaragoza—one somewhere west of Saltillo, near Torreón. During that stay we learned that even Zaragoza has an Internet cafe. On the morning of December 17 we finally headed up into the mountains. The road leading west out of Zaragoza

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is now paved as far as the turn-off, and there is even an official highway sign for Dulces Nombres pointing the way and giving the mountain road number NL 1, no doubt a nod to the Caracol mine there.

The steep road up to the base of El Viejo was in very good shape, being graded even as we traveled it. La Escondida, the village at the crest, seemed largely abandoned. We did see several acorn woodpeckers in the vicinity. We had seen their telltale stash trees often, but this was the first time we had seen the birds themselves. The remainder of the drive was uneventful, requiring seven hours to travel thirty-one miles. We saw no other vehicles on the roads the rest of the way to Los Toros. After speaking with our friends in the village, we settled in at our previous campsite above town. The mountains were very dry, and the water in the Los Toros spring we use was running only about half as high as the year before.

In camp we set up a solar panel and deep-discharge battery with an

inverter for charging lights, cameras, drill batteries, and a laptop computer. This worked extremely well, and avoided the periodic flattening of truck batteries that we had experienced the year before. We also set up a rebelay course in a tall tree so people could practice right in camp. Yvonne also used this to test whether she would be able to go underground after her recent appendectomy. When not caving, we hiked around looking for entrances. No significant new caves were found this year. One of our local friends indicated that he had located a large pit on a neighboring ridge, but we never arranged to go see it. Maybe next year. On one hike I did find an interesting slot canyon that actually had a bit of running water in it in spite of the generally dry conditions. We also checked on the road work we had done the previous year. The old road is probably still usable with a little work in the arroyo, but it had obviously suffered during the rainy season. Fortunately the new way in from the west avoids this obstacle.



Our first caving business was to rerig the upper drops in Soplo and place some rebelays. Tanja carried 180 meters of new PMI which Adam's father had donated to the cause. Thanks, Ron! While some of us were in Soplo, others went to nearby Poza de Zorillo for vertical practice and to look at a blowing lead Yvonne had from 2005. On the way back to camp I scouted the ridge for a better route and found a

Mark Minton on the last drop in Soplo, at –450 meters. *James Hunter.*



A long helictite with a water drop in Soplo. *James Hunter.*



Mushroom-shaped redissolved flowstone mass in Zorilla. *Yvonne Droms.*

much easier way to get to the caves. On the next trip to Soplo, James and Colin took photos as far as Zuber's Bathtub, while Adam, Matt, and I carried rope, redeployed rigging, and added rebelay as far as the Hanging Boulder Drop at -300 meters. Several others came down the first two drops practicing rebelay, one of which caused problems because it was rigged too tightly. Yvonne placed flagging and cairns along the new trail to make it easier to follow at night. Later we added tiny reflectors, which were very effective for night travel, but almost invisible during the day.

The first push at the bottom of Soplo came on December 21. Colin, James, and Tanja checked the various pits in the floor of the room at -366

meters, where we had stopped last year. One ended and two went down 15 meters to a smaller, lower room with an even smaller slot in its floor and a few other leads. The following day Adam, Matt, and I determined that these other leads either ended or reconnected, leaving only one way on. It was not pretty. The character of Soplo had changed dramatically. Instead of large drops and spacious passages, we were now in a tight, sinuous canyon barely wide enough to fit through and carrying a trickle of stream. We hammered our way past ledges and slowly worked our way down to a 9-meter drop in a passage we named the Small Intestine. When I went to set a bolt for

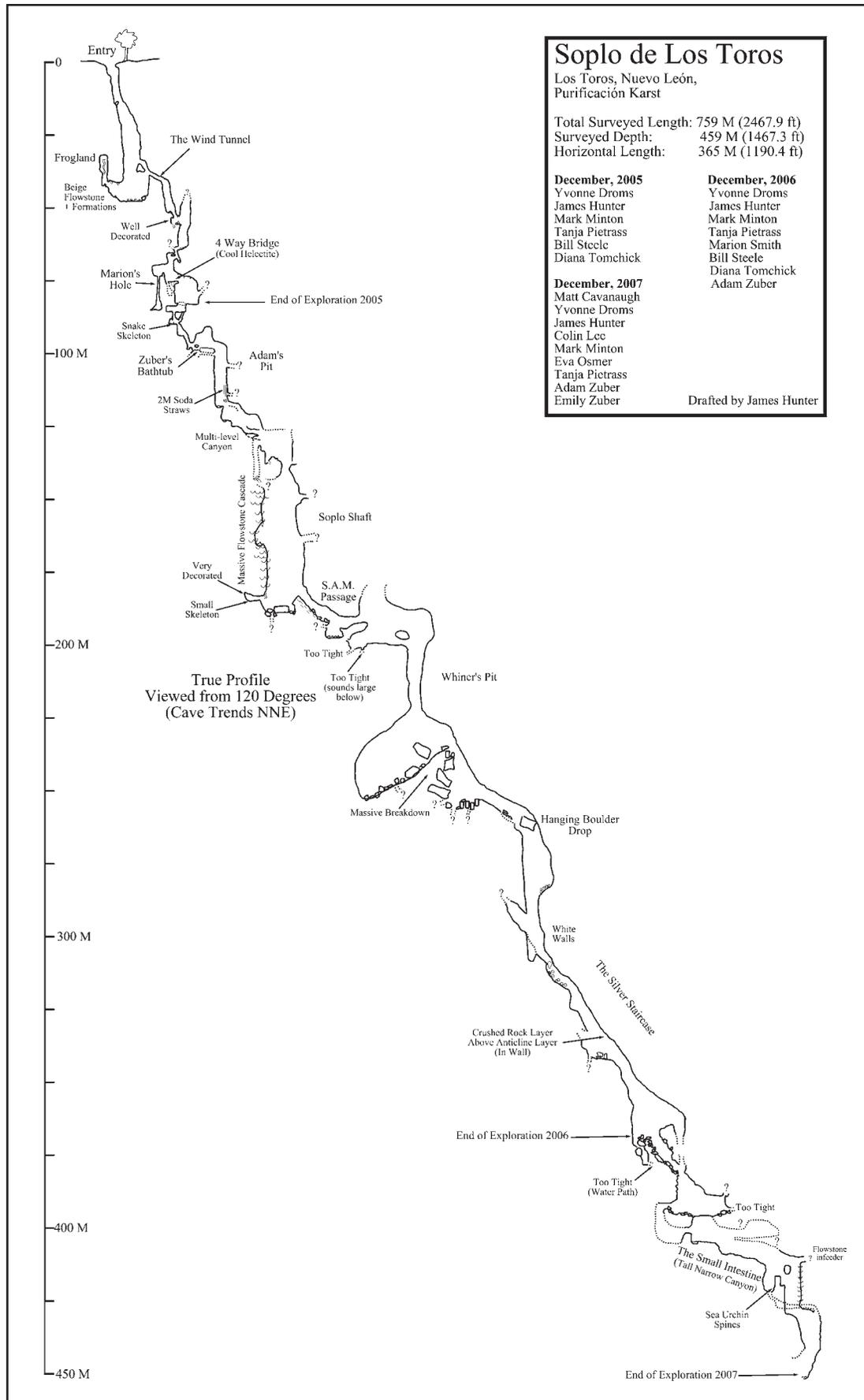
the drop, the drill died. We finished the survey and headed out, arriving back in camp just before dawn. We had gained only 44 meters of depth in two trips.

While the work in Soplo was going on, Yvonne led a project digging in neighboring Poza de Zorillo. She had recovered from her appendectomy enough to be on rope a little, but not enough to go on the arduous trip to the bottom of Soplo. Eva, Charles, and Yvonne labored for two days enlarging a blowing hole through breakdown and mud at the bottom of the 30-meter entrance drop. It was an awkward dig, facing downhill in small passage. On the third trip there I joined Charles and Yvonne,

Charles Fromen emerging from Zorillo. *Yvonne Droms.*

Soplo is muddy. *Charles Fromen.*





Formations in the passage beyond the Ocopus Room in Zorillo. *Yvonne Droms.*

and we removed the last couple of large rocks, opening up a 5-meter pit with another dig at the bottom. The following day we returned and removed a couple of large rocks from the lower dig, opening a small hole going down with good airflow. It led to a small room and another short drop, for which we had no rope. We named it the Christmas Passage.

On Christmas morning we noticed a row of ten small Christmas stockings hanging from our clothesline. No one in camp claimed to be responsible. After dinner everyone selected a stocking. Each contained a lighter and a small toy or other item. Although it is unproven, we suspected that Charles was Santa. The following morning Adam's group left. They planned to drive out to the east, completing a cross-mountain trip from west to east. We learned later that they had been successful, spending about the same amount of time as we did going west. This confirms that Los Toros is almost exactly in the middle of the Purificación karst, at least as far as driving time is concerned.

The final exploration trips for the year in Soplo and Zorillo took place on Wednesday, December 26. Colin, James, and I went to the bottom of Soplo. With everything rigged we made very fast time; I was at the lead at -410 meters in only two hours. Even with fresh batteries the drill would not work, so I cleaned all of the contacts and finally discovered that there must have been corrosion in the switch that selects between simple drilling and hammer drilling. Rotating the switch several times fixed the problem. Whew! By then Colin and James, who had been taking photos, caught up. We rigged the pit and I descended. There was a large balcony on the opposite side of the pit near the top and a well-decorated,

James Hunter on rope in the Silver Staircase at -340 meters in Soplo. Note the layer of fractured rock in upper right between faults. *Colin Lee.*



but tight, spiky drain passage at the bottom. The latter carried the small stream and led to an even tighter drop that would require hammering to enter. Colin joined me at the bottom of the pit, and then James came part way down and traversed around to the ledge. He reported two pits there and another traverse in larger, dry passage. This reinforced our observation that whenever we are with the active flow in Soplo the passage is tight, whereas when we are in abandoned phreatic passage

the cave is larger and more comfortable. In some places the active route is totally impassable, so we are fortunate to have been able to get through when forced to travel the lower route.

James rigged a rope down from the balcony and joined us at the bottom. Some long, pencil-like formations sticking out of the wall caught our eye. James said they were sea-urchin spines. I had seen fossils of bodies of smaller sea urchins in caves before, but this was the first time I had seen





Yvonne Droms climbing out of Zorillo.



Yvonne Droms and Mark Minton hiking in Arroyo Ramírez.

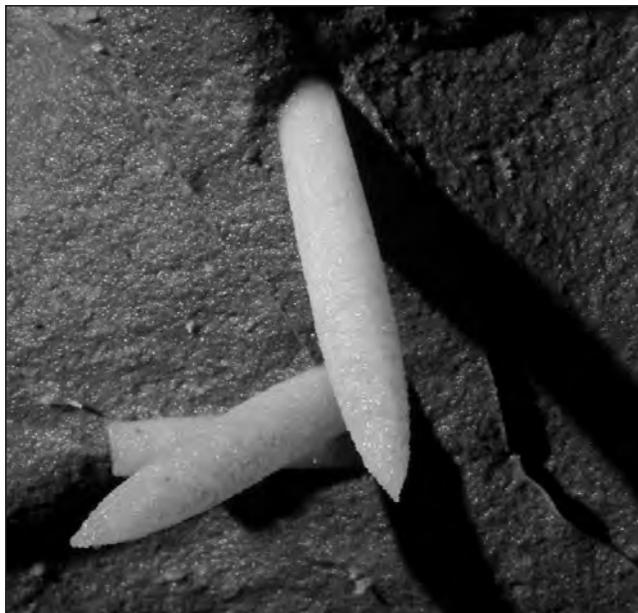
Photos by Charles Fromen

View down Arroyo Luna and Cañón Los Hervores from an overlook near camp.



Yvonne Droms donating rope and saying goodbye to the *jefe's* family.





Fossil sea urchin spines at -420 meters in Soplo.
James Hunter.



Tanya Pietraß surveying at -375 meters in Soplo.
Colin Lee.

spines, and these were big.

We decided to explore the larger, upper route first, so we all went up to the balcony. The two pits there connected at their bottoms, 15 meters down, and another pit beckoned. This was more like it. At the bottom of that 10-meter drop we were faced with another extremely tight canyon, but James managed to bash a short way through to a climb-down into larger passage. A trickle of water fell from above, no doubt the same stream we had seen at the bottom of our first drop. After one more 10-meter drop we were out of rope and time. A tight, but passable, tall canyon continued at stream level, and it might also be possible to chimney up into a wider level back out in the pit. The trip out required over six hours due to the muddy ropes and generally slow going. We added 50 meters of depth to Soplo that day on a 16-hour trip.

Meanwhile Charles and Yvonne surveyed the newly opened Christmas Passage in Zorillo. The next drop was also about 5 meters deep. It was blind at the bottom, but a passage took off 3 meters up on the wall. With some difficulty Yvonne managed to climb into it by lassoing a rock. A ramp sloped down for 15 meters to a deeper drop over flowstone into a room. Exciting! Charles

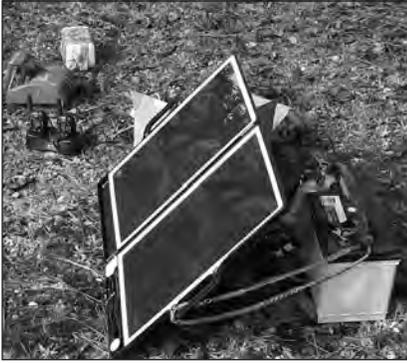
came down and they tried to set a bolt above the lip, but the rock was too soft. Halfway back up the passage, Yvonne finally got one in, but the breakover would be difficult. Charles was not comfortable with the 25-centimeter-wide opening, so Yvonne went down alone. The drop was 17 meters. Long stalactites and draperies hung from the opening, giving rise to the name Octopus Room. Several leads took off. A well-decorated canyon passage went 30 meters to another drop, estimated at 6 meters deep. Since Yvonne was alone, this bottom section of the cave was not surveyed. After Yvonne rejoined Charles, they surveyed the rest of the passage and derigged the cave. The new section added 40 meters to the depth of Zorillo (83 meters total depth), and gives us another lead for next year.

Alas, it was time to go. Our last day was spent cleaning gear and packing. As we had in the past, we gave gifts of old rope and water jugs to the people of Los Toros. We made a special gift of a new car battery to the family of the

girls who had shown us the caves. Even in Los Toros they have solar panels, but their only battery had died. At Margaras we talked with an old man who told us that a fire had burned off much of Cerro Pizaña the

Mark Minton headed for Soplo with Adam Zuber's new 180-meter PMI.
Yvonne Droms.





Solar panels charging batteries in camp. *Charles Fromen.*

year before. It is now covered only by yucca and small scrub. We met no trucks on our descent back down the mountain to Zaragoza. We bade farewell to Charles in Zaragoza and spent the night in Galeana, before driving back to the States.

Progress in Soplo was much slower in 2007 than it had been in 2006. We added only 94 meters to the depth of the cave, less than we had added on just the final push trip last

year. The passage has gotten smaller and more difficult, but it is still going down steadily. The cave is now 759 meters long and 459 meters deep, not quite beating out Sistema Cretácico for second deepest in Purificación. With any luck, however, we should easily move into the number 2 spot in 2008, hopefully surpassing 500 meters and becoming deepest in Nuevo León as well.

Expedición Los Toros 2007

Espeleólogos regresaron a Soplo de Los Toros, cerca de Los Toros, Nuevo León, en la parte central del carst de Purificación. Ya que la cueva continuó pequeña y difícil, sólo se le añadieron 94 metros de profundidad, llegando a 759 metros de longitud y 459 metros de profundidad. La cueva continúa. También se exploró el Pozo de Zorrillo a una profundidad de 83 metros, con una buena posible continuación para el siguiente año.

KRUBERA-VORONYA

THE DEEPEST CAVE IN THE WORLD

Gustavo Vela Turcott

He said, “Be careful, don’t get stuck on anything inside the sump, don’t get nervous, take your time. See you on the other side.” And after filling his lungs with air, my good friend Al Warild disappeared into the dark, water-filled passage. We were at –1440 meters in the deepest cave in the world, Krubera-Voronya. The ceiling of the passage we were in had gotten so low that it reached down into the placid water in a pond. The water temperature was about 5°C, it was waist-deep, and I couldn’t stop shaking, but I don’t know if that was because of the cold or because of the fear in my veins. I had both lights on my helmet on, but I couldn’t see more than 3 meters ahead because of the steam left behind by two cavers who were already on the other side. And in that area, the rock is darker than in the rest of the cave. In spite of all this, my friend had told me not to worry. That’s something easy to say, but such is life. I put the mask on, let excess air out of my drysuit, filled my lungs with air, and eased my head underwater. . . .

Since caving as a sport began, it had been a dream to find caves more than 1000 meters deep. They have been compared to mountains over 7000 meters high, because of the logistics, technical work, and dedication required to reach the summit of such a mountain or the bottom of such a cave.

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Translated from Spanish by Rodolfo “Fofó” González.

In 1953, Joseph Berger and three friends found the Gouffre Berger, and three years later an expedition reached the first sump, at –1122 meters. Today, fifty-five years later, that cave is 1271 meters deep and the twenty-fourth deepest in the world. For seventeen years, Réseau Jean Bernard in France held the world depth record of 1602 meters, but in 1998, –1610 was reached by diving a sump in the Gouffre Miroloda, also in France. This record, however, as short-lived, because in August of the same year, Polish cavers reached a depth of 1630 in the Lamprechtsofen-Vogelschacht-P2 System in Austria. Now there are over eighty caves that reach the –1000 mark, and nine of them are in Mexico.

The new dream is to find a cave over 2000 meters deep. For many mountain climbers, the biggest dream is to reach the summit of the highest mountain, Everest, at 8848 meters elevation, or to climb the greatest mountain wall in the world, on Nanga Parbat, an impressive 4600 meters. For cavers, the wildest dream is to go to the deepest cave in the world, Krubera-Voronya, 2191 meters deep.

It was in the 1960s that cavers from Georgia, now a former Soviet republic, resumed exploration in the high parts of the Caucasus Mountains in Abkhazia that had been started fifty years before by the fathers of Russian caving, Kruber and Martel. The Georgians saw the great potential of the caves in the area. Of the many caves discovered, a 57-meter-deep pit, especially beautiful, was the one they liked best,

and they honored their predecessor Alexander Kruber by naming the cave Krubera.

In the 1980s, Ukrainian cavers started to work in the area, which had again been abandoned back in the 70s. Discoveries were plentiful, and they pushed Krubera to –340 meters in 1987. At this time they added Voronya (*crow* in Russian) to its name in honor of the birds that nest at the entrance and to prevent confusion with a cave in the Crimean peninsula that was also named Krubera. For many years, it was thought that Krubera had reached its maximum depth, and caving schools from Kiev, Moscow, St. Petersburg, and other places visited it only as a training ground. But in 1999 a Russian and Ukrainian expedition checked some windows and side passages and found another series of pits. In only four expeditions, the cave went from 340 to 1710 meters, a record depth reached on January 7, 2001.

More expeditions went to the Caucasus, and on August 16, 2003, they reached a depth of 1640 meters by following an alternate route. A year after that, on August 25, 2004, a depth of 1840 meters was reached. After such discoveries and with the promise of an undescended pit, cavers returned two months later, and on October 19, 2004, the dream of so many cavers was achieved. The cave was pushed past two thousand meters deep, to –2080 meters.

In October 2005, after diving four sumps in a different deep passage, cavers reached –2140. A year later, in September 2006, another sump dive pushed the cave down 18 more



Photos by Gustavo Vela of the Krubera-Voronya base camp.



meters, and continued diving in the same sump reached -2191 in September 2007.

I was immensely surprised when I read the news that a cave in Abkhazia had surpassed the two-thousand-meter mark. "Abkhazia?" I asked myself. "How would life be there?" It sounded really, exotic, different, a place in my imagination far away, and my mind started racing, thinking about this new discovery, this new dream. Like a little kid who wants a candy and can't stop thinking about it, I wanted to go, but I didn't know how, when, or with whom. All I knew was that I was somehow going to go.

In April 2005, during an international expedition in El Ocotil in the Sierra Juárez range in Oaxaca [see *AMCS Activities Newsletter* 29, pages 25-30 and 123-126], I met an Australian caver who had been to Krubera-Voronya, Alan Warild, a juggernaut of an explorer who has been all over the world on numerous caving expeditions and projects. During our conversations, I let him know that I was interested in going to Krubera-Voronya, and he said that he would talk to his Russian contacts and let me know. After three months, I received an e-mail saying that I should look for a plane ticket to Russia, that he might have secured a spot for me in an expedition that was about to leave in a few weeks, so, full of excitement, I did. A few days later, however, he wrote that there were problems with permits for foreigners and that I should wait for the following year's expedition, for which my name was on the waiting list. Heartbroken, I went back to work.

In April 2006 we saw each other again during an expedition in the same mountains of Mexico, exploring the latest

Mexican cave to surpass -1000, J2, currently 1209 meters deep. [See article in this issue.] I reminded him of my interest in going to that cave in the Caucasus, and he told me that yes, he would see about it later. On June 8 I received an e-mail from Al asking if I was still interested in going to Krubera. I said that of course I was, but I didn't have any money. I asked him to save me a spot, though, because I would find some way to get there. So, being a Mexican, and according to the long-honored traditions in the country, I got all my savings from under the mattress, asked by family and all my friends for money, and worked full-steam. Seven weeks later, on July 26, I finally sat down inside the flying machine that was going to take me over the ocean, the beginning of an epic odyssey.

As I waited to meet Warild at the Moscow airport, I had time to think about what I was doing. It had all happened so fast. I remembered that when I had returned home at the beginning of May, I had already had a good caving season during March and April, traveling almost five thousand meters on rope exploring Mexican caves. I had thought I'd spend May working on the photographs I had taken during those expeditions, but I had been wrong in thinking my caving was over for the season. All those caves had been only a prelude to what was waiting for me, training for the Caucasus, and I had not even known it.

In the morning, we boarded a plane as old and strong as its airport and heard instructions in Russian, which of course we couldn't understand. This was just another leg in the trip to our goal, and, as sometimes happens in Russia, the plane was somewhat outdated, but the powerful engines took us immediately to the heights, and we could feel the change in pressure in our ears. I noticed I was the only dark-skinned person on the plane. I didn't think much about it, but perhaps officials would. We flew over the Black Sea and landed in the city of Alder, a paradise that we would only see in passing, because we immediately left for another one, more remote and rugged.



The main base camp shelter.
Gustavo Vela.

and that we could enter the Republic of Abkhazia. Finally!

We had met in Gantiadi with part of the Cavex Team, a group from Moscow that has been exploring in the Caucasus for several years. We were talking about our mishaps of the day, dining next to the blue-green Black Sea, and looking at an amazing sunset at almost 10 p.m. The Russians told us that because of all the problems in the region since 1992, when Abkhazia declared its independence from Georgia, relations among countries in the region had been strained. Neither Georgia nor the UN recognize Abkhazia, but Russia does. We were in a country that doesn't exist for many, and there were no consulates, embassies, UN offices, or anything else like that, so they were emphatic that we should keep a close eye on our passports. They also said that the border crossing had been so difficult because I looked Chechen, not so much because of my skin color, but because of my beard, identical in style to Chechens'. They suggested shaving before going back to Russia. The situation in a country at war is always delicate, and we should be careful—but that won't stop an expedition or an explorer.

Every night has its end, and there's no day that doesn't arrive. Early in the morning we gathered part of what was needed at the base camp: food, caving gear, and of course more cavers. A four-wheel-drive truck took off from the home of Vatek, an Armenian who helps the many expeditions on their way to the mountains. We took off with everything and everyone toward the Orto-Balagan glacier on the Arabika massif in the Abkhazian Caucasus. A long and winding unpaved road awaited us, but it would be spectacular, since we were at sea level and we would be climbing to 2240 meters. The changes in vegetation were incredible, from pine forests to just some ground cover among rocks. That part of the trip would not be free of adventures, thanks to a truck over twenty years old that was begging

We met Denis Provalov, a Russian caver, at the airport. He arranged for a taxi to take us to the border of the Republic of Abkhazia. In past years, due to the war between Abkhazians and Georgians, the Russian side of the border had been closed to foreigners. Only Russians could cross it, and if cavers from other countries wanted to follow them, they needed a special permit, and even then the crossing was not guaranteed, at least by the legal route—there was always the option of an illegal crossing. But this would be the first time in years that foreign cavers would cross into Abkhazia without that special permit.

Apparently seeing an Australian, a Japanese, a Russian, and a Mexican traveling together was not something common, as we were stopped at the first police post, where they said that we looked suspicious. They examined our documents, and we were questioned for twenty minutes (in Russian, of course) about our intentions in the Caucasus. Denis was very helpful in these negotiations, but the officer was not convinced by our arguments, so we were taken to another office so that they could take our fingerprints and photographs. Thirty minutes later an officer returned, saying that he had checked with Interpol and that everything was clear. We had just looked very suspicious, especially the Mexican with his long and unkempt beard.

They let us go, and we walked a short distance to Russian customs.

Pretty much the same thing started again, but this time with x-rays checking out our luggage. More questions, including some new and funny ones like, "Where are the guns?" Their insistence in asking me directly in a language that I didn't understand was starting to become awkward. Denis kept trying to clarify everything, and thirty-five minutes later they let us go—to the next step, emigration.

We got there already knowing that it would not go quickly, and of course there were more questions, but now, for a change, they were focusing mostly on the Australian in the group, saying they had never seen an Australian passport. They took our documents to show to their supervisor, and thirty minutes later they came back saying that everything was clear, and we were allowed to leave the Russian Federation.

We walked over the bridge through the no-man's-land that divides the countries. We could feel the soldiers looking at us from a distance, wondering who we were and what we were doing there. Of course, they stopped us as soon as they could, and we gave our passports to an officer who went off down some stairs with Denis. While we waited, we could see the soldiers at the post, and it was obvious that they were talking about us. We didn't know if they thought we looked dangerous, strange, or just funny. After thirty minutes, more officers and Denis came back, and they said that everything was ready



Gustavo Vela in the entrance to Krubera-Voronya. *Al Warild.*

to be left to rust peacefully in a junk yard, but instead was carrying cavers and gear up a steep road. The truck often forcefully requested a break, either by overheating or just simply dying for no apparent reason. At least these stops allowed us a chance to stretch our cramped legs.

It took us six hours to cover the 50 kilometers from Gantiadi. The thick forests were below us, and our landscape was now punctuated by limestone rocks. We reached the home of Ivan and his wife, two friendly Abkhazians who every summer go up there with their goats. This is as far as the truck could go. We unloaded the tons of gear, and little by little we took it all on foot toward the base camp. Within an hour we could see the Orto-Balagan valley, dotted with tents and cavers that had arrived on earlier days. After five days of traveling, two continents, and four border crossings I was where I had dreamed of being, where I wanted to be. I almost couldn't believe it. I don't know if destiny wanted it this way or if I had managed to bend it to my will, but I was finally at Krubera-Voronya.

The expedition we were joining had started ten days before. It was mostly Russian cavers, but there were people from eight other countries, a total of thirty explorers. The objectives of this expedition were to explore a climbing lead ascending from -2080 meters and to carry in diving tanks for the continued

exploration in a sump. When we arrived, Cavex cavers had already installed most of the 3500 meters of rope needed to rig the cave. To make rigging and derigging easier, the rope is left in the cave. When not in use, it is stashed at the top of a pit, away from the water. During the next trip, the rope is rerigged in the pit. Because of the objectives and the logistics involved in achieving them, there were sixty-eight packs ready in base camp to be taken down. Some were going to various camps in the cave, at -700 meters, -1400 meters, -1600 meters, and -2000 meters. They contained food, cooking utensils, sleeping bags, rope, carabiners, bolt hangers, gas, carbide, diving tanks, other diving gear, and many other things. The expedition leaders had a briefing session for the cavers who were at Krubera for the first time. They told us we needed to make a few acclimatization trips, because the cave is very vertical, with lots of pits, one of them 152 meters deep, several tight spots, some confusing places, and, above all, as an alpine cave the temperature is very low, around 3°C (about 38°F), because the water entering the cave comes from melting snow. That is roughly as cold as your refrigerator.

So while some cavers went to -1400, -1600, or -2000 meters, some of us were getting acclimatized by going to -700 meters. These were five- to eight-hour trips with a pack hung from our waist. After two such

trips into the cave I had a couple of rest days, but they were active rest, doing typical expedition work like cooking or doing dishes in the kitchen or collecting ice, the only water around, for melting. We also did several hikes back to Ivan's house to pick up more food and gear. During those days I found out that I needed to do more and deeper hauling of gear into the cave, because they don't tolerate speleo tourism. If I wanted to get to -2000, I had to work harder.

With that in mind, the next morning I readied myself to go to -1200 meters with Sergio García-Dils, a Spanish caver who has been working in the area for several years and had been on the August 2004 expedition. We started our smooth descent down the ropes and through the passages and in three hours made it to -700 meters, where we met one Czech and two Polish cavers who were taking gear to the deep end of the cave. We had *chai* (Russian for *tea*) and left quickly so that we wouldn't lose our pace. Two hours later we made it to -1200, where we left the packs and started the painful climb out. In three hours we had gotten up to -700 meters, where Natasha, Sasha, and two other Russians offered us some *chai*, which we accepted gladly because we were pretty wet and at 38° any hot drink suits a shivering body perfectly. Sergio, who was even colder than I was, kept moving out. After eating and drinking, the Russians and I packed up the cooking utensils and started out. I was the first to get on rope, but the Russians were at my heels all the time. Although I made a great effort, I just couldn't leave them behind, so I decided to let them through and continue at my own pace. I can definitely attest that Russian cavers are strong and fast. They made it out from -700 in only four hours; it took me five.

The following day was another break in my caving, and that morning I received the bad news that I didn't have a spot on the schedule for going to -2000. Even though I had done everything possible to gain a

spot, there was none. Camps were full. The news was like a punch in the face, followed by some pats on the back and, "Good job, see you next year." Coming from such a far-away place and not going all the way, not achieving my dream, well, it was disappointing. But in the end I understood that when there are too many people who want to descend, it's always the strongest and fastest that get to do it: the Russians. I was resigned that there remained only a very small possibility I would get on a deep trip.

Two days later, I heard that Peter Hartley, a British caver who had gone into the cave, had been lost for four hours and had left the cave really tired, with an aching knee and a stomach upset that had left him with little energy, and that he was not going down again. That meant there was an available spot on a deep trip before the expedition was over. There was a Japanese caver, Jun Koike, who had been working hard too and also wanted to go all the way down, but they would not let him go because they did not think he was experienced enough. So I had a chance for the empty spot.

I heard that on previous expeditions some cavers, when faced with the sump at -1440 meters, had said, "No, I'm not going through that," and they just left their loads, turned back, and headed out. This made the

ones who did pass the sump carry extra loads. I was asked if I was sure I would dive the sump and not turn back. I confidently said, no, I would not turn back, yes, I would go the bottom, but inside I was deathly afraid. I had no idea if I would be able to get through the sump. Of course, I didn't say that.

That night I couldn't sleep. I could not stop thinking that something could happen to me. What if I get stuck? If I drown? If I never again see my loved ones or that one I haven't found yet. I didn't want to place that burden on my family, on my friends, or on the expedition. I wanted to live. I thought that maybe I would wake up with diarrhea, maybe I would twist my ankle while walking around camp, perhaps someone will steal my helmet or some leader will look at me and say, "No, he is not going down." But the morning came and nothing out of the ordinary happened. So I put fresh batteries in my headlamp, prepared all my gear, had breakfast, looked at the sun, and was ready. My mouth was dry. I drank some water, but it was still dry. I looked again at the sun, which warmed everything and which I wouldn't see for five days. I was shivering, but not because of the cold.

On that morning of August 9, Alan Warild descended first, I followed, and that's how we progressed. Pits,

meanders, a waterfall, another pit, a tight spot, a complicated spot, an easy one, and slowly I relaxed, felt at home, and started to enjoy the cave as never before. After six hours we reached Denis and Sergio at the -1400 camp, where we ate, drank, and joked. We then chose the drysuits that would keep the cold water away from our bodies in the tight sump 40 meters below us. This drysuit is made out of rubber, covers all your body except for your face and hands, and really insulates you from the cold, but its 3 kilograms on top of thermal underwear, caving suit, and harness makes you expend much more energy, and by the time you get to the sump you are drenched in sweat and, of course, also very afraid.

We started to organize in what order we would pass the sump and how we would pass the packs. Denis was first, and the ones behind helped pass the packs. We fixed diving weights to each pack so that it wouldn't float too much, making it easier to pass it through the sump. After all the packs were sent through, it was Al's turn. He took a very deep breath and disappeared. A few moments later I received the signal that all was well and it was my turn.

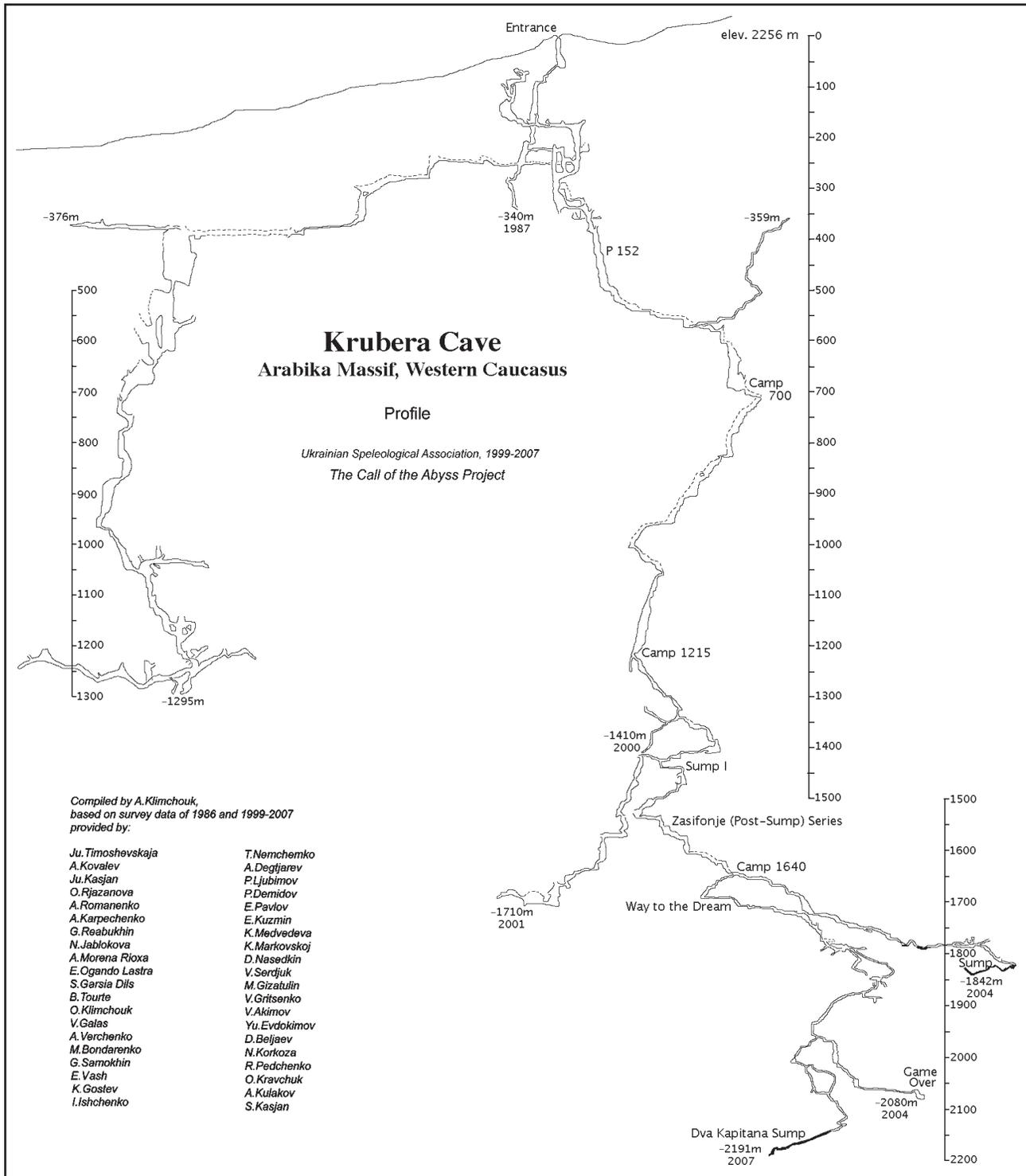
I had been shivering so much that I was tired, so I relaxed, quieted my mind as much as possible, went

Gustavo Vela in the Zasifonje Series just below Sump 1 at -1440 meters. *Al Warild.*



Gustavo Vela on a drop in the Zasifonje Series. *Al Warild.*

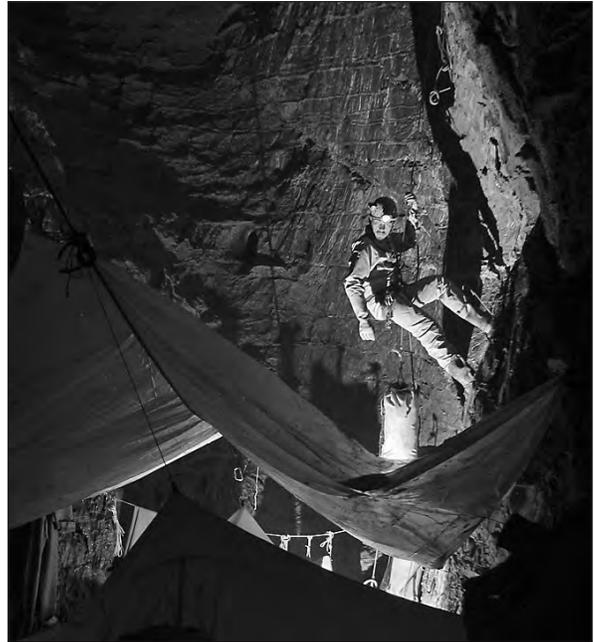




Profile map traced and simplified by Bill Mixon from the map at http://www.speleogenesis.info/img/werbung/krubera_profile_large.gif. There is also a plan view, at /krubera_plan_large.gif.



Gustavo Vela and Al Warild having tea in Camp 2000, which is really at -1980 meters, after their trip to the Game Over room at -2080. Sergio Garcia-Dils.



Gustavo Vela leaving Camp -1640 on the way out of the cave after the deep trip. Al Warild.

through the required movements in my mind. I put the diving mask on, took a deep breath that under normal circumstances would probably have been good for two minutes but here would last half that, and slid under the water. I was dry, but I felt dry water pressing on my body. I opened my eyes, and the visibility was about 50 centimeters because there was a lot of sediment floating around. I started to pull myself down the lifeline that had been installed in the sump, noticing that it was a small passage about 1.2 meters tall by 1 wide. As I moved on it got smaller, ending up about 50 by 70 centimeters. Through the 2-meter length of the sump I eventually saw a light, and when I got out of the water I saw my two friends Denis and Al, who were waiting there and congratulated me when I got out of the water. We immediately let Sergio know it was his turn.

Beyond the sump there is a 40-meter pit. I was warned that after the temperature shock of the sump I should be really careful, because my mind would be slower than usual. Before we descended it, we took off the drysuits, because there would be no more need for them. Our goal for the day was the camp at -1637, so

we moved on and reached one of the most beautiful parts of the cave, with some easy pits that had been beautifully polished by the water. Twelve hours after entering the cave we reached the camp. A tent, some plastic tarps to keep the drips off and insulate it from the cold, and eight sleeping bags (for four people) were waiting for us. We took the wet stuff off and left only the merely damp on. With the four of us in the tent, the temperature increased to 15°C. Considering that it was 5°C outside the tent, it felt as if we were on a beach in Mexico. In a few hours our undersuits were almost dry. A good pot of *grechka* (buckwheat) calmed our stomachs, and after a bit more *chai* we were ready to hit the sack.

That night I went to sleep thinking that there were famous Mexicans in every discipline, like the mountaineer Ricardo Torres Nava, the first Mexican and Latin American to reach the summit of Everest, in 1989. Or Carlos Carsolio, who opened some of the first mixed climbing routes on Nanga Parbat, in 1985. I also remembered the first Mexican cavers to reach -1000 meters, Carlos Lazcano and Guillermo Mora, at the Gouffre Berger in the French Alps

in 1982.

In the morning, we had a nice breakfast of flavorless cooked rice, we prepared the packs that we were going to leave at -2000, and we left. We took the only known route to the bottom, the Way of the Dream, tight, muddy, and wet. After several pits, we reached the camp at -2000, where we found two Russian cavers. They were waiting for two of their friends who were doing a bolt climb. Al and I went to see if they needed any help and, of course, to take a few souvenir pictures. We reached Game Over, discovered on October 19, 2004, and which will forever be known as the first room found below 2000 meters. As a good ending to this muddy, cold part of the cave, the temperature was slightly higher, at 6°C. We met the cavers who were checking for ascending passages, took some pictures, and started on the long way to the surface. It took three days to leave the cave, and it was August 14 when we finally saw the stars again.

I took my first bath in three weeks. Of course, two liters of water were not enough to remove all the dirt; that would not happen until the Black Sea. Because of my experiences at the border, I decided to shave my

beard off, but it left me feeling naked. I did do another trip into the cave, to -700 meters to haul some gear out. This strengthened my friendship with the other cavers and marked the end of the expedition.

The year was 2006, the month was August, the day was the tenth, and the time was 22:59 when this caver became the first Mexican and the first person from the American continents to reach the depth of 2080 meters in Krubera-Voronya. As of this writing, about thirty-four cavers have been below -2000. There have been more people on the top of Everest and in space than in the depths of our planet.

Thanks:

To life, for allowing me to go there . . . and back!

To my good friend Alan Warild for finding a spot for me on the expedition.

To all the Russian cavers for making me feel like the slowest turtle in the cave.

To the Cavex group for opening the door for me at -2000 meters.

To my dad Arturo for believing in me and lending me money for

the flight.

To my friend Lorena for lending me money for eating in Russia.

To all my good friends for putting up with me.

To the Limite X store for their sponsorship of the caving wardrobe.

To Petzl Mexico for their sponsorship in this sport.

To my loneliness for increasing the voice of my dementia.

To my dementia for dreaming up this great life.

Krubera-Voronya: La Cueva Más Profunda del Mundo

El espeleólogo mexicano Gustavo Vela Turcott vistió esta cueva en el Cáucaso abjasio en agosto de 2006 durante una expedición rusa que incluyó a varios espeleólogos de otros países. Realizó varios viajes a las profundidades de la cueva cargando mochilas como apoyo para el proyecto. En uno de estos viajes alcanzó una bóveda a -2080 metros, convirtiéndose en la primera persona del continente americano en sobrepasar los 2000 metros de profundidad en una cueva.

XILITLA, NOVEMBER 2007

Philip Rykwalder and Peter Sprouse

The karst of Xilitla in the state of San Luis Potosí has attracted cavers since the earliest days of Mexican caving. It has the classic ingredients for world-class caving: massively thick limestone and huge low-elevation springs. The luxurious tropical environment, indigenous culture, surrealist art center of Las Pozas, and ease of access combine to make it an easy choice for a week of caving. Despite the fact that hundreds of caves have already been explored in the area over the previous fifty years, it remains quite

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Heather and Philip 120 meters down in Sótano de Apetzco.
Jean Krejca.



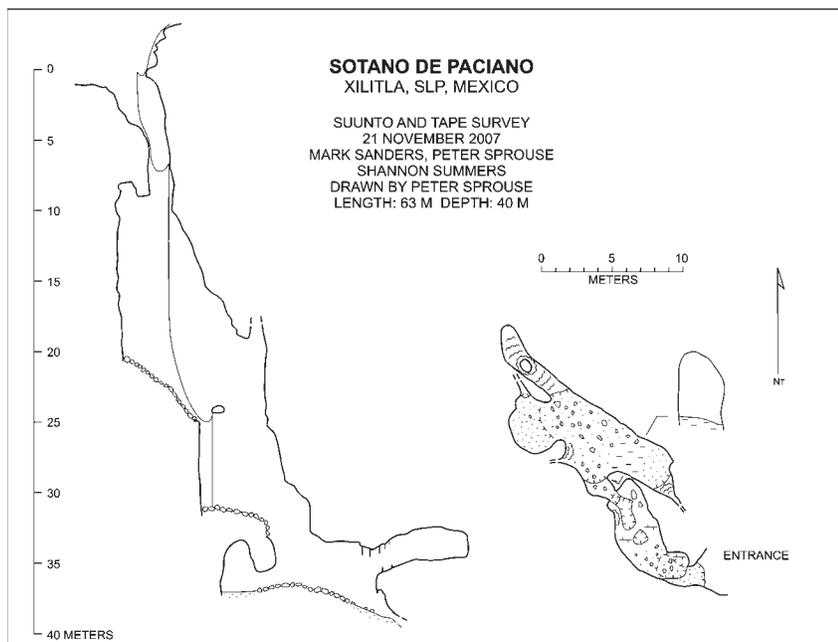
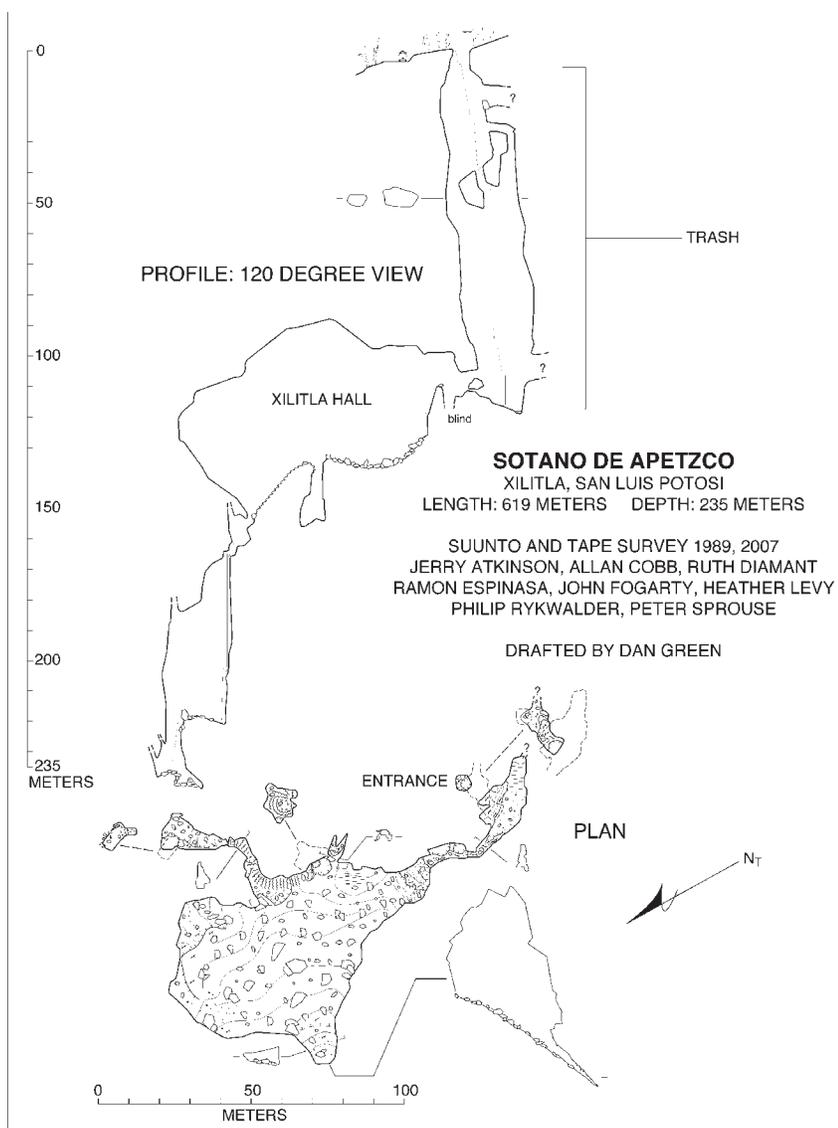
easy to find plenty more, as more roads are constructed into previously remote communities. This trip brought together cavers from the United States (Peter Sprouse, Philip Rykwalder, Heather Levy, Jean Krejca, Mark Sanders, Shannon Summers), Canada (Dan Green and Vince Massey), and Mexico (Raquel Aguilar, José "Pepe" Rivera and Gustavo Vela) in November 2007.

Most of the crew convened in downtown Xilitla on November 17. Unlike most caving trips, they were to have an urban base this time. Gustavo and Raquel arrived from Mexico City the next morning, and Pepe joined us partway through

the week. The cavers divided into two teams for the first day's adventures. One team comprised Dan, Philip, Heather, Vince, and Shannon, and their objective was Sótano de Apetzco. This pit is by the side of a road above Xilitla and had been partially explored in the 1980s. They rigged down a pitch series, including a beautiful 80-meter wall, to Xilitla Hall at -120 meters. The entrance series was full of dirty diapers and contained hundreds of meter-tall truck tires. After a long day on rope, they stashed ropes for a push the next day and climbed out to a nighttime drizzle. Meanwhile, Jean, Gustavo, Raquel, Mark, and Peter

Dan Green entering Sótano de Apetzco. *Jean Krejca.*





drove up above Xilitla to Miramar to explore a pit that Peter had been shown in March 2004. The locals call this roadside pit Sótano del Cilantro. Jean rigged down a funnel-shaped sinkhole that led to a 15-meter drop, and the others followed her down, while Peter stayed on the surface talking with the locals. They progressed down a narrow canyon passage with many constrictions and a few more short pitches and left it going, with air flow.

The following day Dan, Heather, Raquel, and Philip returned to Sótano de Apetzco and pushed a lead off Xilitla Hall down a 25-meter blind pit. They rechecked the original route to the bottom, looking for the source of the airflow, but, unable to find it in a large, rainy room at the cave's bottom, they derigged to the bottom of the big pitch. Jean, Mark, and Shannon returned to Sótano del Cilantro, where they carried on through some more awkwardly narrow crawls, hammered their way past some difficult obstacles, and continued down several more small and constricted pitches. They reached -96 meters at the top of another pit, stashed their rigging gear in the cave, and called it a day. Gustavo, Vince, and Peter drove east to the village of Uxtuapan, where they got permission from the Juez to visit the local water-supply cave, Sótano de Uxtuapan, actually a cave, not a pit. Steps led down to a concrete water tank where the locals gather water. From inside the cave's entrance, a stream passage continued steeply down a 35-degree angle for about 100 meters and pinched at a stream dig. Back at the entrance, they pushed an up-dip crawl for a short way to another dig. After that they drove down to Cruztitla, where the last two trips to the area had found a fine through-trip cave, Sistema Huateacán [see *AMCS Activities Newsletters* 28, page 174, and 29, page 33]. The topo map indicated a sinkhole lying over the middle of the cave. They hiked through a bit of jungle and found a sinkhole with an enticing entrance, but never had a chance to revisit it during this trip.

On 20 November, Jean, Heather, and Mark went back up to Sótano del Cilantro, where they



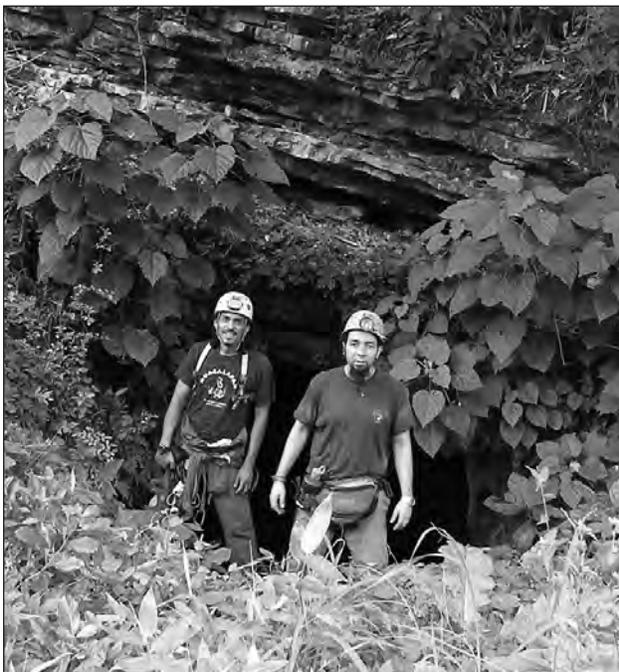
Heather Levy leaving Cueva Seca. *Peter Sprouse.*

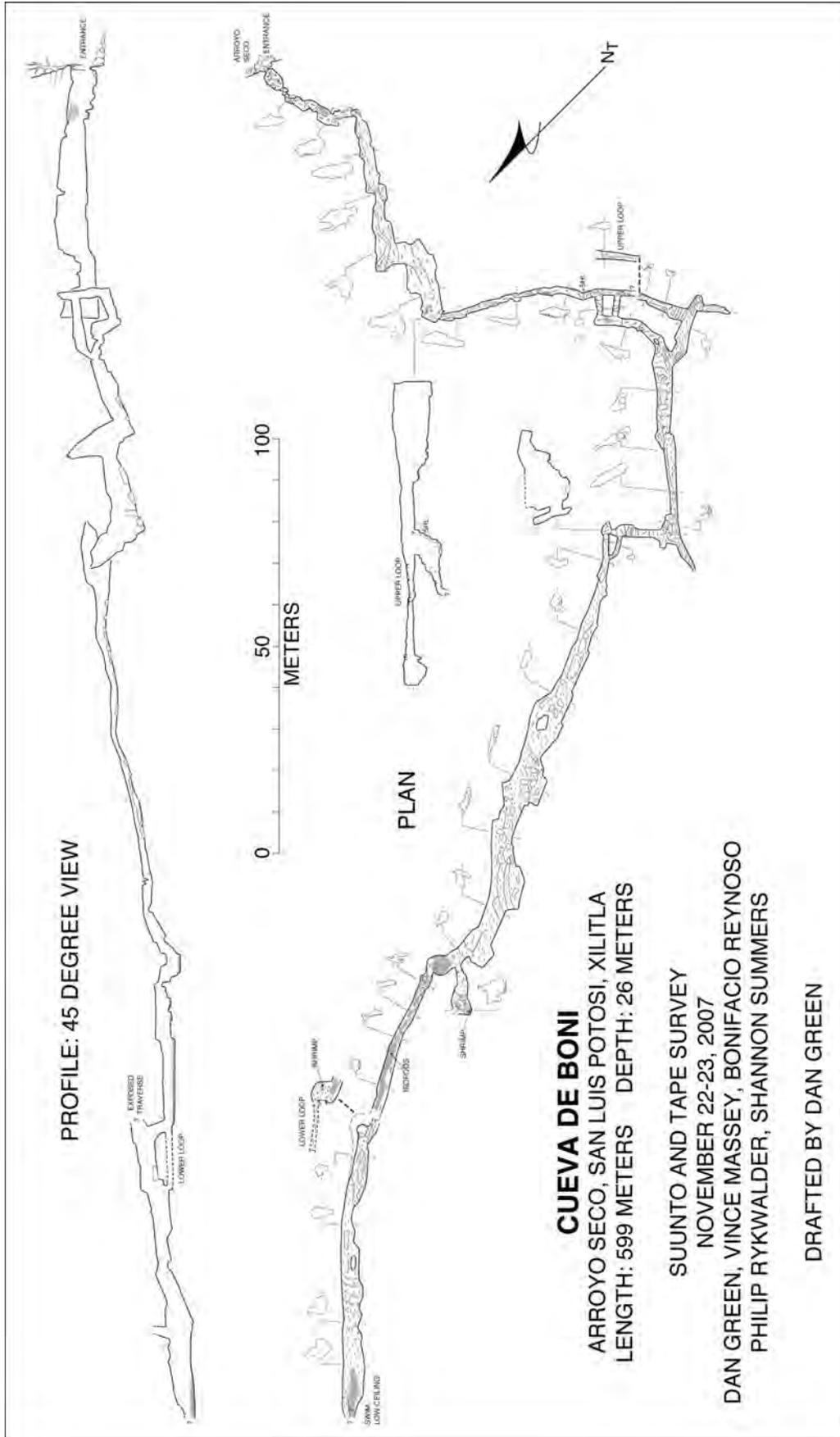


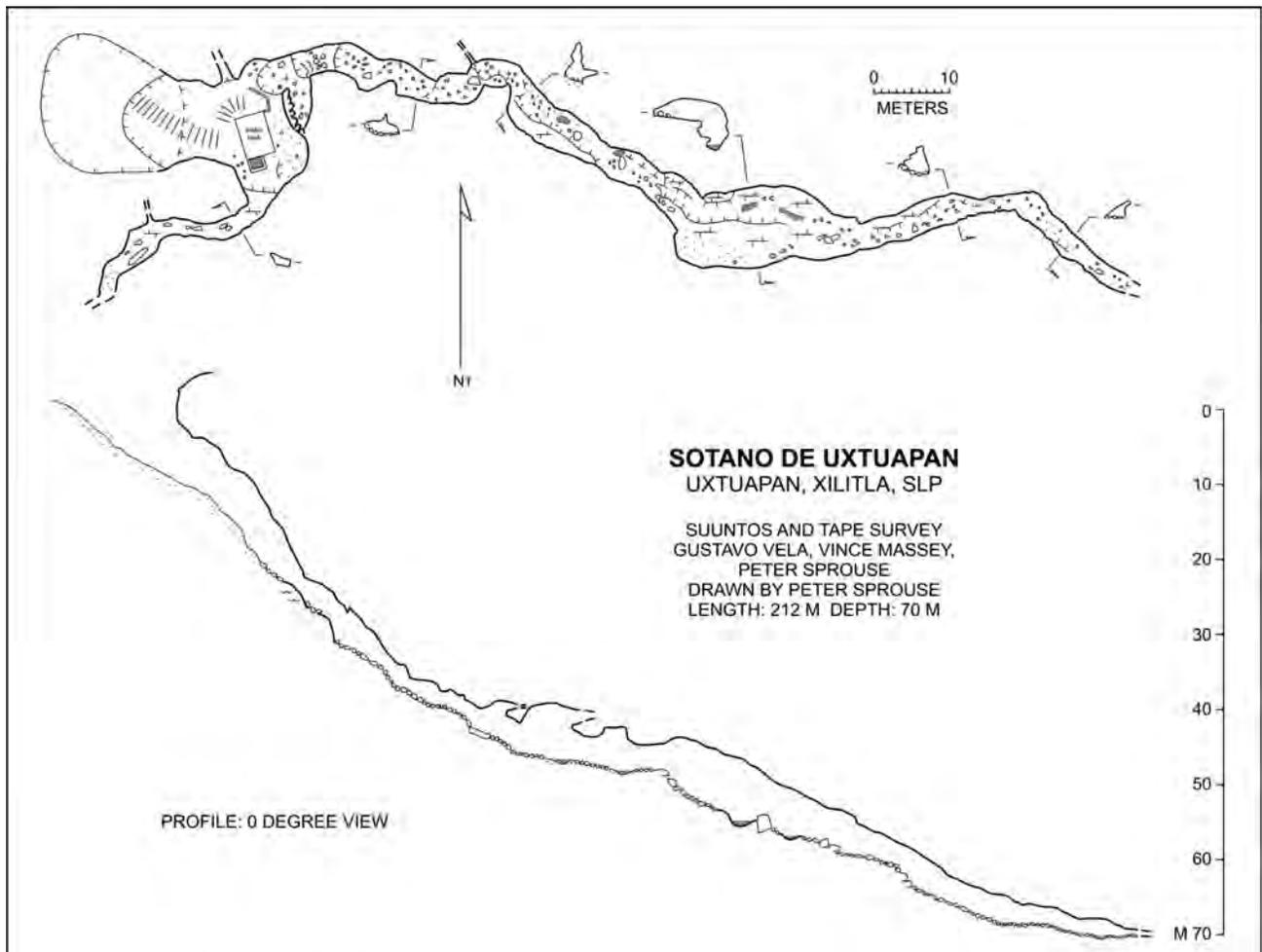
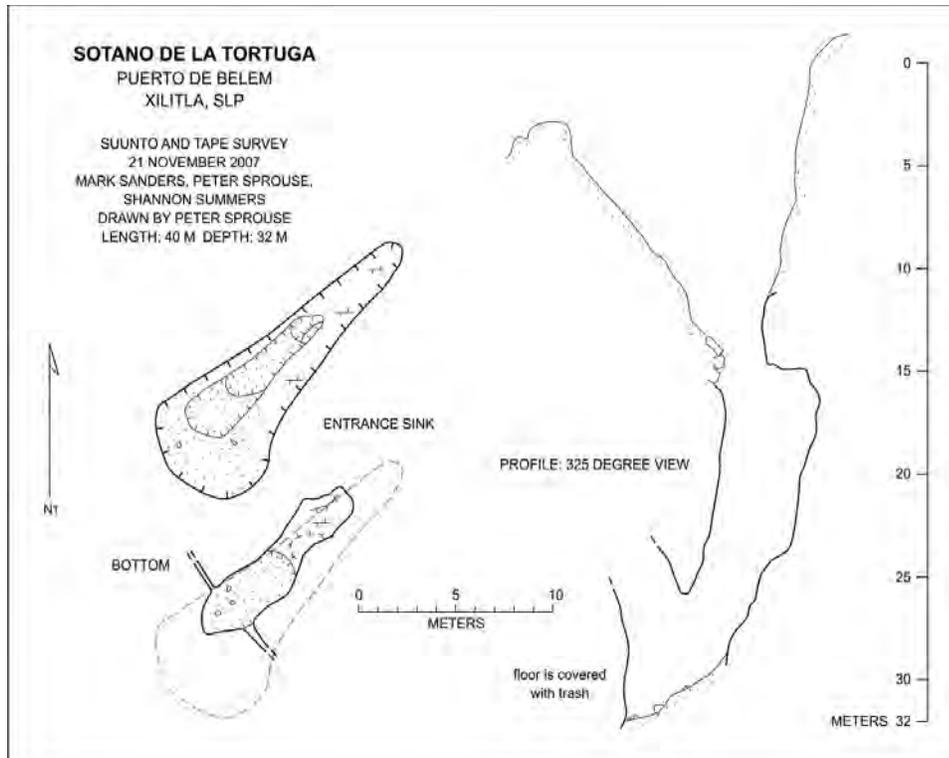
Raquel Aguilar at Sótano del Cilantro.
Peter Sprouse.

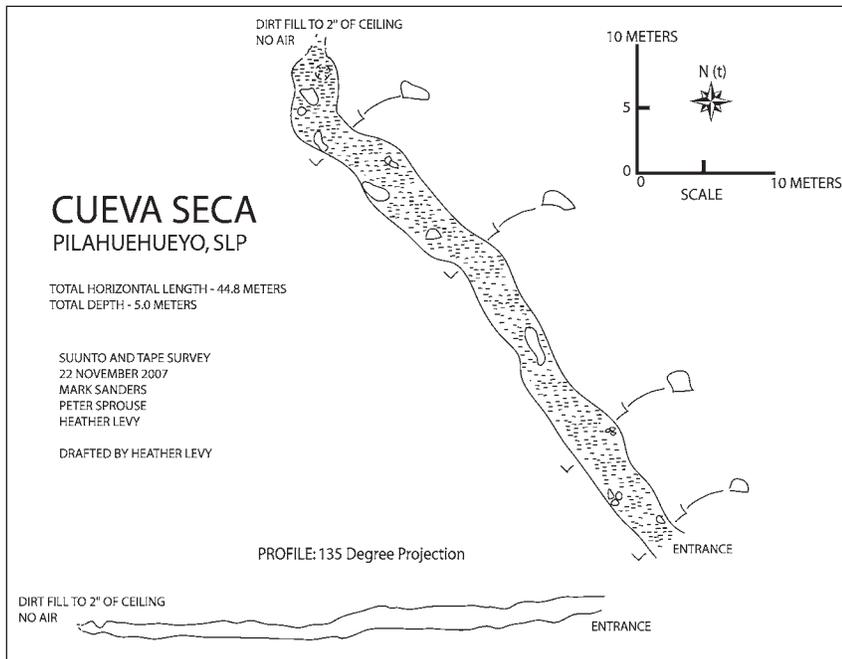
Mark Sanders at the bottom of the entrance
drop to Sótano de Paciano. *Peter Sprouse.*

Gustavo Vela and Pepe Rivera at Cueva de Poncho.
Jean Krejca.









continued down a few more drops and climbdowns, stopping at yet another drop, having pushed the cave to 249 meters long and 113 meters deep. Shannon, Dan, and Philip hiked around in the same area (Miramar Nuevo), but didn't find anything. Vince and Peter drove back to the area around Plan de Juárez below Xilitla, driving through Tierra Blanca and stopping to look at Sumidero de Tlaletla [see *AMCS Activities Newsletter* 19, pages 18–19]. They also looked at a stream sink against a large headwall, but it was mostly choked. On the drive back to Uxtuapan they picked up a roof-load of local kids who showed them two pits, one of which turned out to be Sótano de la Pared de Piedra, explored by Marion Smith in 1990. The other one was in a big sink that looked quite good, leading to a promising pit entrance. They continued driving farther down the mountain through Cruztitla and on to the road to La Tinaja, along which there are great views of Xilitla and Arroyo Seco, though the locals there knew of no caves. The road joined the road to Ixtacapa, and they turned left and continued down to the valley floor. Where the road crosses Arroyo Seco they parked and hiked up the

Heather Levy and Jean Krejca in Cueva de Cándido. *Peter Sprouse.*

canyon to search for resurgence caves. After 1.35 kilometers, an inviting entrance 4 meters off the canyon floor was found. It seemed to be a wet-weather resurgence and contained bats, but lacking lamps they did not enter it.

The next day Jean, Heather, and Gustavo explored the big sink near Uxtuapan that Peter and Vince had been shown the day before, naming it Cueva de la Asesina. It has two separate pits that may connect via a high lead. Dan, Philip, and Vince returned to Cilantro, where they descended a blind pit to the bottom of the cave. In an effort to find a continuation, Philip led both

a climb out of the final pit's far side and an awkward traverse over the top of it, but neither led to anything. They surveyed a final three shots and derigged the cave on the way out. Peter, Shannon, and Mark went to Puerto de Belén to look at pits found in 2004. First they went east to Sótano de Meloxco, which Shannon rigged but quickly abandoned when he was attacked by wasps and stung numerous times. A local resident named Paciano showed them two more pits nearby, the first of which they named Sótano de Paciano. It had drops of 20, 7, and 3 meters. A bit farther north was another pit that seemed to be a 10-meter drop leading to a sloping floor, but Shannon was attacked by wasps again, bringing his sting total to seventeen for the day, so it too was abandoned. On the way back toward Xilitla they stopped at the house of Leonardo Hernández to leave a copy of the map of Sistema Huateacán, which he had helped survey four years earlier. Then they went to a pit that he had shown to Peter in 2004, located nearby on a ridge that affords a great view of Xilitla. It has a steep dirt ramp leading down into a rift, then drops free to a trash-covered floor. They rescued a turtle from the bottom, inspiring the name Sótano de la Tortuga.

On November 22, Jean, Philip, Gustavo, and Gustavo's friend Pepe, a jeweler from Mexico City, went to visit a cave north of Aquismón that had been partially



Pepe Rivera in Cueva de Poncho.
Jean Krejca.

mapped by Peter in 1990. It is near Las Armas, on the isolated limestone outcrop known as the Tantobal Dome. They located the stream-sink entrance of Cueva de Poncho with no trouble and started mapping in the cave's northern reaches. The cave was quite hot and contained much guano and multiple bat species, including vampire bats. Philip bolted down a 6-meter pitch and found a mazy, very hot, and fairly extensive lower level that was not explored. They left lots of leads in this cave, having increased the mapped length to 187 meters. Vince, Shannon, Dan, and Xilitla caver Bonifacio (Boni) Reynoso went to check the new resurgence cave in Arroyo Seco found by Peter and Vince two days before, which they named Cueva de Boni. Inside the entrance was nice walking passage with some mazy parts and many vampire bats. After traversing over large pools of liquid guano in a tall canyon passage near the entrance, they left it going, with plans to return the next day. Heather, Mark, and Peter drove south from the Y Griega on Highway 85 to the Río Tancuilín, then west up to the village of Pilahuehueyo, an area where no cavers had ever been. The locals were friendly and agreed to show them caves. Soon they had four entrances to check, and with a rain starting they opted for a horizontal one first. Cueva Seca was just that, a little, dry horizontal cave 45 meters long that contained some potsherds and a few bats. The next cave they were shown was right in the village and was a crawlway full of trash, so they skipped it. The two remaining leads were pits, and the better one was chosen to explore first. A crowd of locals watched Mark descend the 30-meter entrance pitch of Oztoc Pilahuehueyo to a trash-strewn floor. The others descended and found that an overly tight window led to a continuation. As Heather hammered on it, the others searched for fauna. Soon she was able to squeeze through the window and down a 2-meter climb that led to a 5-meter pitch, so Mark headed in to help her. Meanwhile, Peter climbed out to report to the



locals what was going on below. They knew of more caves up the mountain to the northwest, so he set off with five guys who all spoke the local Nahuatl Indian language. They led him through tangerine and coffee groves to the crest of a ridge with a fine view of the Sapuyo valley to the west, then they turned south along a trail to a large pit. It was about 15 meters across and seemed at least 60 meters deep. Farther along the trail they reached a cave about 25 meters long that had a man-made platform of flat rocks at the back. Returning to Oztoc Pilahuehueyo, Peter and the locals waited for the other cavers to climb out, and when they did they reported that it pinched below the 5-meter drop. Their drive down the mountain to Xilitla in the

rain involved moving a stalled truck in the road and ferrying its drivers back up the mountain.

Dan, Vince, Shannon, and Philip returned to continue mapping Cueva de Boni the next day, continuing upstream in a canyon passage with the ceiling gradually getting lower and lower until they stopped at a deep pool. The cave continues beyond the pool, as evidenced by the bats fleeing before them across the water. At the day's end the cave was 599 meters long and 26 meters deep. Back at the truck they lit off some local hand-made fireworks with interesting results. Peter, Mark, Jean, and Heather drove back up to Miramar, where they found a knowledgeable guide to show them more caves in the 1500-meter-long

Miramar sink. They were shown four pits and one short horizontal cave and surveyed only the latter, Cueva Sin Instrumentos. Then they drove the road up toward La Trinidad, stopping to look at two side-by-side 18-meter pits and continuing on to the ecotourism village with rental cabanas surrounded by forested peaks. They found a guide and were taken to a previously undocumented cave, which involved a 2-kilometer hike through a lush forest crisscrossed by babbling brooks. They approached the head of a box canyon dominated by a massive entrance, Cueva de Cándido, essentially a shelter cave 100 meters wide with a waterfall coming out of the ceiling. They hurriedly set about mapping it before dark set in, but Peter sprained his ankle stepping off of a boulder, which resulted in a slow hobble back to the truck.

On our day of departure Jean, Heather, and Philip returned to Sótano de Apetzco to finish derigging and take pictures of the huge garbage dump inside, while others visited Las Pozas, where they unexpectedly ran into fellow cavers Mike and Stanley Bittinger. On the drive north some of the crew visited Cueva de El Abra, and, joined by some of the Proyecto Espeleológico Sierra Oxmolón cavers who had been to the Aquismón area, proceeded to invade Bev and Jonathan Wilson's beach house on South Padre Island for the night.



Xilitla, Noviembre de 2007

Espeleólogos exploraron y topografiaron varias cuevas en los alrededores de Xilitla, San Luis Potosí. Hay nuevos caminos que hacen más accesibles las zonas de las alturas de Xilitla.

TWENTY YEARS AGO

THE DEEPEST DIVE A STUDY IN CONTROLLED PARANOIA

Ned DeLoach

This article, the best I've ever read about cave diving, originally appeared in the summer 1988 issue of Ocean Realm. Thanks to the author for permitting us to reprint it twenty years later. —ed.

At the sound of the last bell on Friday afternoon, April 1, 1988, Sheck Exley locked the door to his classroom at Suwannee High in Live Oak, Florida, where he teaches algebra. It was the beginning of spring break. He signed out, joked briefly with a few students gathered at the school's entrance, and walked across the parking lot to his red Ford van. The chassis was sitting unusually low. Sheck knelt down to inspect the rear tires. He made a mental note to inflate them even more. Causing pressure on the tires was the weight of thirty-four scuba tanks packed carefully inside. Each cylinder was filled to capacity with gas mixtures—helium, oxygen, and compressed air. The sizable collection of tanks, enough to supply the average needs of a sport diver for a lifetime, would be required for Sheck to make a single exploratory dive into Nacimiento del Río Mante.

Mante is a water-filled spring cave located in northern Mexico, west from Tampico across a fertile plain that runs inland from the Gulf of Mexico for 60 miles. The flat land ends abruptly just past the farming community of Ciudad Mante, where an ancient geological fault split the earth and pushed the continent straight up over 2000 feet. Flowing mysteriously from the mountain's base is a clear river. The cool water

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streams from a dark cave entrance, briefly forming a spring pool that quickly narrows to wind its way east across the arid farmland.

The river is a welcome anomaly where rain is scarce and the tropical sun unrelenting. From the early Indians until today, the local inhabitants have gathered in the basin's pleasant surroundings. They wash in the cool, sweet water that is shaded by the cliff above. Tall, flowering trees line the water's edge. Fragrant blossoms—purple, gold, and white—shower down on the bathers below. Where the river comes from, no one knows. "From the other side of the mountain," you will be told, with a shrug, if you ask.

Unlike the bathers who relax daily in the spring's outflow, Sheck knew well the hidden river's path. Starting in 1979, he had made four previous dives into the mountain cave, and he was leaving that afternoon to make another. [See *AMCS Activities Newsletter* 10, pages 23–30.]

On his first trip, Sheck and veteran cave diver Paul DeLoach penetrated 150 feet into Mante's cave opening, where they located the cavern's true course—a narrow fissure that dropped directly down the great fault.

"We had dived several other Mexican spring caves before we arrived at Mante," Sheck recalled. "Most began with a steep drop, but would form into a horizontal tunnel at a depth between 140 to 190 feet. Mante was different; it just kept dropping beneath us. Although the crevice was over 100 feet long, it was quite narrow, just over 3 feet in places. The current was difficult.

Enough water was shooting up the passage to feed a river that runs for miles. Moving against it was like swimming up a waterfall. We used our hands to pull on the sharp rock walls. Both of us were pretty cut up after the dive." The divers stopped 330 feet below the surface, hovering on the very edge of their physical limits. Below, Mante continued its plunge into darkness.

"At our turnaround point I remember thinking about Sótano de las Golondrinas, the world's deepest free-fall pit that was just 60 miles south of us. Its depth is 1248 feet. Could Mante be this deep? It was exciting to think that we might be suspended inside the deepest underwater cave in the world."

Both divers knew to venture no farther. In the deep passage, their minds were already swirling with vertigo that would intensify with depth until reality blurs into unconsciousness. Sheck tied the safety line to a rock projection and began to ascend. The return to the surface would be slow, over an hour. Long, tedious decompression was the price they paid for going deep.

Two of the world's most experienced deep-water cave divers had once again been turned away by the "depth barrier"—a set of physiological hazards that had taunted them for over a decade. The hazards combined to make deep diving a risky business below 130 feet, and past 300 feet almost suicidal. It was clear: if Mante's secrets were to be discovered, technology would have to advance to a point where narcosis could be suppressed and decompression time shortened.

Less than a decade later, Sheck would explore far beyond the barrier on a dive that would establish Mante as the deepest water cave in the Western Hemisphere and, in doing so, he would set a depth record so extraordinary that it was unimaginable in 1979.

After his reconnaissance trip to northern Mexico's caves, Sheck returned to Florida, where he continued to lead the way in the exploration, surveying, and mapping of the state's extensive aquifer system—an obsession that has directed his life since he became certified in scuba in 1965, at the age of 16. He had made his first open-water dive in a shallow spring cave in Florida's Crystal River. Although the limestone opening offered limited penetration, it was enough to ignite an insatiable curiosity that would in only a few years propel Sheck to the forefront of underwater exploration. In less than seven years, at the age of 23, he became the first person to log one thousand cave dives. This was an average of two and a half cave dives per week. During the same period he graduated from high school and the University of Georgia in Athens, a 600-mile round trip from the spring caves in northern Florida. In May 1987, his three-thousandth cave dive was entered in his log.

Sheck not only leads in the caves, but also in cave-diving education. An untiring effort has produced over one hundred articles and six books on the subject. He has been repeatedly honored for his accomplishments. These distinctions include being named a Fellow of the National Speleological Society and the Explorers Club and, in 1981, receiving the NSS's Lew Bicking Award as America's top cave explorer.

Although Sheck is proud of these honors, they are not the compelling force behind what he does. He is basically an explorer whose true passion is to go where no one has gone. Our planet's last unmeasured frontier, the earth's depths, is the realm he has chosen to enter. This compulsion has for twenty-three years repeatedly driven him farther and deeper into water caverns than anyone has gone before. At thirty-

nine he remains a forerunner, with visions yet to conquer.

"Thirty-nine is old for pushing physiological limits in underwater caves. Marathon runners tell you that your respiratory efficiency, critical on a deep dive, drops enormously as you reach the mid-30s, and the risk of bends rapidly increases with age after 30. I still feel well-prepared, mentally and physically, but I am constantly aware of my age. I must always factor it into my dive plans. Nine years ago, when I first dived Mante, I was at a physical peak, but it didn't matter, because we hadn't yet gained the know-how to go deeper. I remember looking at the cave dropping below us into unattainable depths—it might as well have been a painting. Underwater cave exploration is a technology-dependent endeavor, and we were then locked out by numerous constraints. I had no idea then if I would ever be able to explore Mante further, and even less idea from what direction new technology would come to make it possible."

As it turned out, it was a combination of three elements—oxygen, helium, and computerized decompression tables incorporating these gases—that would key new possibilities.

In the early 1970s, cave divers followed the lead of the US Navy and began to experiment with oxygen. Its use helped to shorten the long decompression stops required after lengthy cave penetrations. Breathing from tanks filled with pure oxygen at the 10- and 20-foot decompression stops could cut decompression time by as much as half. Like everything associated with deep diving, however, the innovation was not without risk. It was quickly learned that if too much oxygen was breathed below 33 feet, a deadly condition called oxygen toxicity developed. Symptoms are extreme: sudden convulsions, then death. To complicate things even further, the navy's oxygen

tables were based on experiments conducted with resting subjects in dry chambers. When cave divers applied the navy's times to their stressful environment, problems developed.

Sheck cared even less for the long decompression periods than most cave divers. "Five or six hours spent hanging out in the cool water of a spring basin was a numbing conclusion to long and difficult exploratory dives," he explained. "The sheer boredom was grueling. We used to read, play magnetic checkers, or pull tricks on each other, but generally we would put ourselves into a trance. Oxygen was a great help. It was the closest thing to a decompression pill we found."

Early experimentation by the navy found that the substitution of helium for nitrogen in underwater-breathing mixtures greatly reduced narcosis. The ability to dive deep and remain clear-headed would be a dramatic breakthrough for cave explorers, but problems complicated early trials. The navy spent a great deal of time trying to devise safe helium tables, but they were thwarted by the gas's unpredictable nature. Decompression times proving safe for one diver would cause severe cases of the bends in others. Breathing helium

A collection of color-coded tanks, each with a specific gas mix. Ned DeLoach.



also caused a rapid loss of body heat, bringing about hypothermia. On top of these problems, when breathed at great depths, it played havoc with the diver's nervous system.

Sheck doubted that the gas would ever have any serious application in cave exploration. The few divers that did use helium met with mixed results, often tragedy. The helium horror stories started in 1970, when Hal Watts, a pioneer deep diver from Orlando, Florida, used a helium mixture during a body recovery at Mystery Sink. The navy declined to take part in the search, but recommended a heliox (helium/oxygen) mixture for the difficult dive. Hal remembers being cold and nervous as he dropped into the lower reaches of the sinkhole. Failing to find the lost diver, he headed toward the surface. During his ascent, problems occurred, forcing Hal to miss his 60-foot decompression stop. He sustained a severe bends hit.

"The pain felt like my lower spine had been injected with hot lead. I agonized and vomited constantly for the two and a half hours it took to get me to a chamber at the Cape," Hal vividly recalls. It was a year before he completely recovered from the painful injury.

Sheck's closest friend, Lewis Holtzindorff, died in 1975 while attempting the world's first cave dive using helium. The divers were decompressing on oxygen at 40 feet after a dive to 265 feet. Both were suddenly unable to breathe. Lewis convulsed and drowned; his partner, Court Smith, miraculously made it to the surface and survived.

During 1978, two divers reached 325 feet in a Missouri cave. They were experimenting with trimix of helium, oxygen, and nitrogen. Although only 50 percent of their mixture was helium, both became hypothermic and had great difficulty finishing their required decompression. Sheck followed these stories carefully, remaining unimpressed with helium's potential. He had gone deeper in caves using compressed air. Why should he be concerned with helium?

In 1980, American cave diver Dale Sweet finally made a successful breakthrough with mixed gases.

Using heliox, he bottomed out the west Florida sink Die Polder #2 at 360 feet. Dale's dive had broken Sheck's cave-dive depth record by 20 feet. His achievement immediately got Sheck's attention. Six months later, Sheck made the same dive using air. Matter settled!

The big bombshell came from across the Atlantic in 1981. Europe's best underwater cave explorer, Germany's Jochen Hasenmayer, descended into the French Fontaine de Vaucluse to 476 feet. Everyone was stunned. Not only had he shattered Sheck's cave record by over 100 feet, but he had also set a new world's record for a surface-to-surface dive on scuba. Jochen was breathing heliox.

Sheck was busy setting records of his own when word of Jochen's extraordinary feat reached Florida. The team of Sheck, Clark Pitcairn, and Mary Ellen Eckhoff were making final preparations for a big push into the Big Dismal cave system. In June, the trio penetrated the underwater cavern 5,847 feet. A month later, Sheck, Clark, and Bill Main made an incredible seven-stage-bottle foray into Manatee Springs. The effort produced a world-record swimming cave penetration of 7,665 feet.

When Sheck finally stopped long enough to contemplate Jochen's record, he still remained skeptical about the use of helium in cave exploration. "Both Jochen and Dale made impressive dives, but I felt that they were riding on luck. I wouldn't give either of them odds to safely repeat the dives."

Two years later, in 1983, Jochen made another deep dive. The result was an astounding 656-foot plunge. Again, he was using heliox. With this one dive, the "barrier" that had been firmly in place for over a dozen years was swept away. Rules had been changed. A new era had begun. Matter settled!

The use of the navy's decompression tables to prevent decompression-sickness bends has been standard procedure for scuba divers since the sport began. These tables, however, are not applicable when breathing mixtures are changed from air (21 percent oxygen and 79

percent nitrogen). With the advent of saturation diving from deep-water habitats in the 1960s, the perplexing search for reliable mixed-gas tables for surface-to-surface diving came to a halt. But cave divers had begun to challenge deep caves. Their venture had many obstacles. The most pressing was safe decompression.

The 1987 Wakulla Spring Project, headed by Dr. Bill Stone, combined the latest in diving technologies to explore one of Florida's largest and deepest cave systems. The twelve project divers, including Sheck, penetrated over 4,000 feet into the passages at depths to 300 feet using mixed gas, a historic milestone in cave exploration. During the intensive diving, not one explorer had problems with the bends. The tables used at Wakulla came from a new source, Decompression Computation and Analysis Program (DECAP), an innovative computer program operated by Bill Hamilton and Dave Kenyon from Tarrytown, New York. Sheck was impressed; this was the break he had been waiting for to get deeper into Mante.

After leaving Suwannee High School, Sheck drove to his home, located a few miles outside Live Oak. He had purchased this particular piece of land a few years back because a sinkhole less than 200 feet behind his back door opened into the world's largest aquifer system. I was sitting on the front porch of his double-wide, surrounded by cameras and scuba equipment, when the van pulled through the gate. A loud greeting preceded Sheck out of the van. "Tepeizcuinte, qué pasa?" He had tagged me with this outlandish nickname during a reconnaissance trip we made to the Yucatan coastal caves in the 70s. Short on cash and civilization, we found ourselves eating from a limited wildlife menu at a cheap Maya restaurant located just off the X-caret road. The bill of fare consisted of lobster, grouper, venison, and *tepeizcuinte*.

"¿Qué es tepeizcuinte?" Sheck asked the young boy waiting the table. From what could be deciphered from his mumbled answer, we gathered that it was a small animal hunted in the jungle. In a moment of daring,

we both ordered *tepeizcuinte* and Pepsi. Although the exotic entree had been disguised by preparation and cooking, our servings suspiciously resembled skinned wharf rat done to perfection and served in a green *mole* sauce, except that on the ends of their small, muscular legs were sets of tiny hoofs.

Smiling, Sheck came up to the porch and we shook hands. I followed him into his darkened living room, where I almost tripped over a 5-foot Aquazepp underwater scooter that dominated the center of a room filled with charts, files, books, and an assortment of other unmarried-man clutter. In the kitchen, he shoved papers aside, sat down, and began to intently study a neatly spaced, three column list he had taken from his pocket. Each item represented a vital link needed for the completion of the most daring and logistically complicated scuba dive ever attempted. After nine months' planning, nothing was going to be forgotten in a last-minute rush to leave town. I left him at the table and began to load my gear between the stacks of tanks roped tightly together inside the van. Ten minutes later, Sheck emerged carrying a paper sack of groceries.

"About ready?"

"Sure," I replied. Less than five minutes later we were heading west on I-10. Our long drive to Mante would take us nearly 1,500 miles across the southeastern states, through Houston, and down to the Rio Grande Valley, where we would cross the border at Brownsville, and then 300 miles on into Mexico.

I had not seen much of Sheck for the past few years. A cave-diving photography project in Yucatan had occupied my last two summers, while Sheck had been busily involved with his deep cave diving and white-water kayaking. During the Wakulla Project I spoke to him briefly; the next month we shot some cave-diving pictures for his autobiography, to be published next year. I had heard about his big dives at Mante, but knew few details.

Sheck had called to ask if I would go with him to Mexico only three weeks before we were scheduled to leave. I said yes, thinking that the

expedition south would involve a substantial support group. It wasn't until the week we left that I realized there were just the two of us driving down. We were to meet Mexican cave divers Sergio Zambrano and Ángel Soto at Mante. They were driving north from Mexico City to make the rendezvous. Both were exceptional cave divers, but I realized that neither had the experience to help Sheck if an emergency occurred. It was only at this point that I started to comprehend the intricate web of problems that would face Sheck. There was no support for such a dive, absolutely none. Not the navy, not commercial diving companies, not even the cave-diving elite could be of the least assistance where he was going. Sheck would be a one-man show heading straight for a no-man's land where submersibles and diving bells couldn't go. If something were to happen, the show would be over. No rescue, not even a body recovery would be possible.

As we drove past Tallahassee and headed toward Pensacola, Sheck began to tell me about the dive. "After Jochen Hasenmayer's dive to 656 feet, I knew that helium was obviously the way to go. In late 1986 I made two practice dives on helium in Florida. The first was to 130 feet, the second was a 260-footer. Last April, Mary Ellen [Eckhoff] and I left for Mexico. After eight years I was more than ready to extend the line deeper into the Mante system.

"Two days before the dive we staged five tanks in the cave. I wasn't sure how deep I would go. I had decompression tables for 400 feet and extrapolations for even greater depths. My depth gauge was good to 500 feet. As it turned out, everything went well, and I tied off when the gauge read 500 feet. Since they are calibrated for denser sea water, that meant 515 feet at Mante, and my feet were five feet deeper, so 520 feet. Over seven hours and twenty-six decompression stops later I surfaced. Nothing to it," he laughed.

"What made you decide to go back after the 520 dive? Was it Hasenmayer's record?"

"Yea, it was the record, but besides that, Mante was still dropping, and I wanted to be the one to bottom

it out.

"Mary Ellen and I went back in June, just two months later. I had made a few alterations in my decompression to help alleviate the oxygen toxicity symptoms—muscular twitching in my face and legs and slight tunnel vision—I experienced during my previous dive. This time I used less oxygen, and two more shallow-water decompression stops were added.

"It took me 24 minutes to drop 660 feet. Everything worked well, but it cost me eleven and one half hours of decompression time. Over twelve hours is too long to remain underwater. I became extremely uncomfortable—cold, weak, and hypoglycemic from the pre-dive liquid diet. My exposed hands and face became wrinkled and raw and began to flake. At the time I felt that I could have dived deeper, but I knew that I had reached my decompression limits."

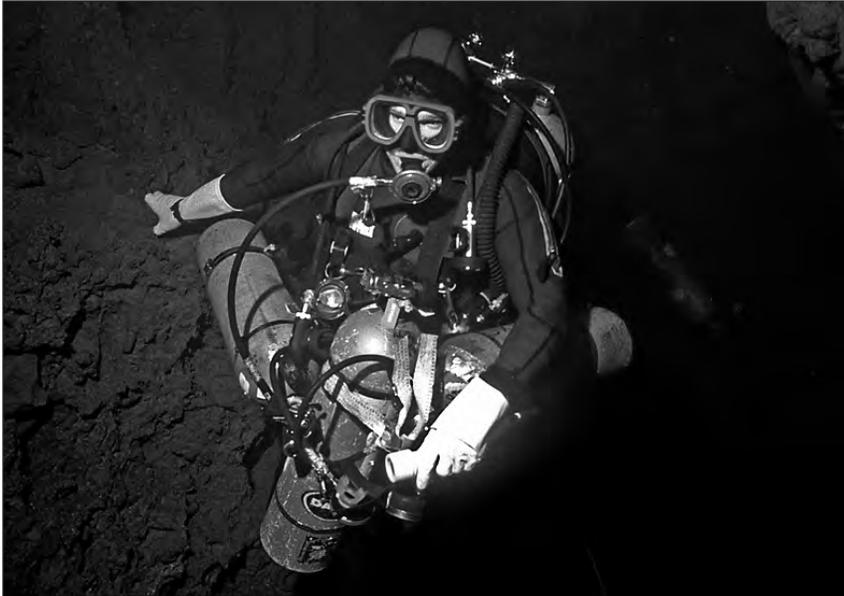
"You said you reached 660 feet. It sounds like you went just deep enough to beat Hasenmayer's record."

"No, not at all," Sheck replied. "The best way to end up dead on a deep dive is to go after a set number. First, you have to understand that I didn't know how deep I was after I left my depth gauges at 515 feet. To figure my depth, I connected a pre-measured line to my previous line. At the deepest point I tied off and cut the strand. After surfacing it was a simple matter to calculate my depth from the remaining length. When I decided to turn around I had no idea if I was above or below Hasenmayer's depth. As it turned out, I was so close to his mark that I didn't claim the record."

"So now you're headed back," I asked.

"Yea, so now I'm headed back," he repeated.

With that, we silently settled into the ride. Sheck slid a cassette into the deck, and soon we were absorbed in the sounds of his beloved Beethoven. We were 350 miles into the trip, just west of Mobile, when we switched places. I climbed behind the wheel, and Sheck stretched out in the reclining passenger seat. A light rain began to fall. I glanced over at Sheck. He



was resting with his hands behind his head. Since our earlier conversation we hadn't talked about the dive, but I couldn't get it out of my mind. Sheck would soon be asleep, this would be the last chance until morning to ask questions.

"How deep do you think you will be able to go on this trip?" I asked suddenly. Sheck didn't answer for a while. Then just as abruptly as I had asked the question, he answered.

"At least 700 feet, maybe more." Again silence. I waited, but he didn't continue.

I tried again. "What about decompression?"

"I'm using new tables," he replied. It was obvious that he would rather be with his own thoughts than in conversation, but I chose to persist.

"Whose tables are they?" With this Sheck relented and sat up adjusting the seat to support his back.

"Bill Hamilton's, the fellow from New York who did all the tables for the Wakulla Project."

"Have they ever been tested as deep as you are planning to go?"

"Of course not. Who would test them?" he answered tersely.

"Hasenmayer," I retorted. Sheck broke into laughter. He was ready to talk.

"I was maxed-out on decompression during the 660 dive. When I finally got out of the water, I was wasted. I knew then that I would

have to come up with a shorter schedule before I went deeper; and besides, I was losing confidence in the tables I used for my four previous dives. They were based on purloined commercial tables that I extrapolated to the point that I was concerned about their validity.

"Hamilton's DECAP program was not only more liberal than the tables I had been using, but it allowed me to custom-tailor my gas blend. The few cave divers who are now using mixed gases are abandoning nitrogen altogether. My body seems to have a high nitrogen tolerance, so I choose to use trimix during the deepest part of my dive, hoping that this will help me avoid helium's high-pressure-nervous-system syndrome and hypothermia.

"Using the computerized tables for this dive will require that I stage sixteen bottles and carry four tanks. Eleven different blends will be used. I will make fifty-two decompression stops, starting at 520 feet and ending with a half hour at the surface breathing oxygen. How long the stops take will depend on the descent time, my maximum depth, and how quickly I can get up from the deep water. The last variables can't be plugged in until I actually make the dive."

I glanced over at Sheck. He was again lost in thought, staring blankly into the night. It had been fascinating listening to him discuss the facts and figures of the dive, but what I

Two days before the big dive, Sheck emerges from the Mante shaft after a lengthy dive to place the deepest stage bottles for his dive. He is carrying empty bottles that carried extra gas needed even for this setup dive.

Ned DeLoach.

really wanted to hear about were the things that go on inside his head when his is buried under several hundred feet of water, inside a rock crevice, on the very edge of life, and still going down.

"How are you going to decide when you have gone deep enough?" I asked.

"Fear." Sheck answered immediately as if he had been patiently waiting for such a question.

"It's a mind game. The cave and the odds are out to get me, and it is obvious that they will catch up with me sometime. That I am alive today is a miracle. To extend my winning streak I must spend hundreds of hours thinking of every possible thing that can go wrong. During my dive preparations I do what I can to prevent problems. I mix my own gases, I check every piece of equipment over and over, and I memorize each aspect of the dive plan. The dive itself is like hunting a tiger in a thicket. Fear keeps me alert. I am constantly attuned to every feeling in my body, every function of my equipment, and every happening in the surroundings. Off guard for a minute and the tiger is on my back.

"I've learned to handle the fear by what I call controlled paranoia—a combination of meditation and experience. The meditation clears and settles my mind, allowing me to stay at a high state of alertness, continually aware of my body's reaction to the stress. My experience has taught me how vulnerable I am.

"During my 23 years of cave diving, I've survived every life-threatening situation: bends, panicked buddy, being lost, silt-outs, light failures, out of air, line entanglement, trapped in restrictions, on and on. When something goes wrong, I must immediately rein in the fear and let experience take over. Problems can occur, but an error in judgment is deadly.

"From the dive's start, the idea

is to get down as fast as possible without plummeting out of control. I use gravity and pull on the wall to keep from using my legs, which would increase my exertion. While dropping in the deepest part of the shaft I'm in a high-risk zone. At such depths each breath causes the pressure-gauge needle to drop unbelievably. Like a pilot constantly picking out alternate landing sites for emergencies, I'm always looking for a projection to tie off. If anything goes wrong, my experience takes over. The problem must be solved on the first attempt or I immediately abort the dive. If the dive goes as planned, the turnaround point will be dictated by my down time, the amount of gas expended, and an indefinable coalition of sensory perceptions that tells me to get the hell out."

After finishing the statement, Sheck wished me good night and crawled across equipment to the back of the van, where he had constructed a platform bed over the tank storage. To save time, we had planned to drive straight through to Mexico. I was to drive the night shift so that Sheck wouldn't have to alter his regular sleeping habits before the dive. A mellow, sensuous sax from a New Orleans all-night station kept me company through Louisiana and into Texas. We had streaked through Houston at 4:00 a.m. and were ready to head south toward the border when he crawled back to the front.

"How about breakfast, amigo, or do you want to drive a bit farther?" he joked. We pulled into the first diner I saw. My body was still on autopilot and buzzing from fatigue after the eight-hour ordeal. Sheck was making an issue of how well he had slept as we walked into the restaurant lobby, where a set of brightly lit arcade games glittered against the wall.

"Hey, amigo, just the thing for you." He stepped over to a machine and dropped a quarter in the slot. An animated race car leaped into action, careening from side to side at a dizzying pace down an endless highway. As I stumbled into the dining room, heading for the first vacant booth, I could still hear

echoes of Sheck's laughter coming from the lobby.

At noon, we crossed the border. It was always exciting being in Mexico, a country I learned to associate with great pleasure. During my dozens of trips there I had acquired a penchant for the land and people, but not for Customs. There we were, packed to the pavement with tons of elaborate underwater equipment, trying our best to act nonchalant, like ordinary tourists out for a weekend's fun. The first official who looked in the van called another, who called another, who called another. In the meantime, Sheck was inside efficiently going from desk to desk getting our papers approved. By the time an inspector came inside to report the strange load, Sheck had all the documents signed and stamped. A mini-summit was held in the foyer. We suddenly spoke no Spanish; just kept repeating "scuba holiday" whenever one of the inspectors glanced our way. Twenty dollars later we were heading out of Matamoros.

The highway's first 150 miles passed through sparse, flat agricultural land similar to southern Texas. Then, in the distance, we saw the mountains begin to rise. This was the emergence of the wild terrain that inspired B. Traven's classic *Treasure of the Sierra Madre*, a bold frontier for hardy spirits where fortune and tragedy coexist only a heartbeat apart.

We spent the night in Victoria, choosing to wait for the freshness of morning before tackling the 100 miles of twisting mountain roads that wind their way to Ciudad Mante.

When we woke, the morning sun was still red on the mountains and the air still cool. We set out early so that we would be unhurried during the difficult drive. It was Easter Sunday. Mexico was dressed in its finest. All along the roadway, well-groomed families followed the sounds of church bells to early services.

The night's rest readied us for the mountain road, but, as expected, progress was slow. It took three hours to reach Ciudad Mante. Sheck drove straight through the town without stopping. At the southern *glorieta*, we veered off onto a narrow road that led toward a distant mountain range. It was the end of the dry season, and Sheck was eager to learn if the lack of rain had tempered the spring's flow. The volume of water that surged up the crevice was a critical factor in how deep he would be able to dive.

As we approached, the dark mountain bluff began to show detail. Large bands of gray limestone, separated by dense foliage, shot straight up from the plain. The closer we drove the higher it grew, until the crest could no longer be seen through the windshield. We paralleled the cliff for a quarter mile before arriving at the spring.

While walking down to the water, we saw two dry-suited divers with fins in hand coming up the embankment. Sheck immediately recognized the men. They were Sergio and Ángel returning from their first dive into Mante. Warm greetings were passed. While the two cave divers removed their cumbersome gear, Sheck led

Sheck staggered down the path to the water's edge under the immense weight of his gear at the start of his 1989 dive. Ned DeLoach.



me to where I could get a view of the spring cave.

There it was, exactly 1,464 miles from Sheck's front door, a cave entrance right out of a Spielberg movie. Looking down from the cliff, we watched the water pour from the mountain. It rushed from the bottom half of the cave entrance into a blue spring pool 50 yards wide. Although it was only midmorning, several bathers already sat cooling themselves on the basin's rocks.

We left the spring for town, following Sergio and Ángel's jeep. After checking into a hotel, we ate lunch together. That morning they had dived the cave to 180 feet. The visibility was 50 feet and the flow moderate. Conditions were good for Sheck's dive.

Sergio and Ángel are expedition men in the purest sense, a pair that goes to exotic places to do extraordinary things: Himalayas, Peru, sky diving, rock climbing, and for the past five years, cave diving. They do such things for no other reason than the spirit moves them. During the difficult process of setting up and breaking down his dive, Sheck could have no better help. Both men worked diligently to stage the sixteen tanks in the cave and were always available to do what needed to be done. One of their strengths is knowledge. They questioned Sheck immediately about how he was going to put together his dive.

After lunch, Sheck made the decision to move the dive up a day. We had arrived at Mante ahead of schedule, the weather was splendid, and he was eager to get started. The change of plans meant that he had to make a difficult 330-foot dive that evening to stage the deepest tank.

When we returned to the spring at 4:00 p.m., the basin area was swarming with holiday bathers. During the two hours it took to prepare for the dive, Sheck was surrounded by on-lookers who asked a ceaseless stream of simple questions. Hot, annoyed, and losing concentration, he finally asked the crowd to leave him to his job. Courteously, they all backed up a few paces, and once again commenced with their inquisition. After he was finally outfitted and heading to the water, his faithful entourage

followed closely at his heels. A few even splashed happily after him as he pulled his heavily equipped body through the current and disappeared inside the cave.

It was dark and the crowd was long since gone when I saw his light beam cut through the pool. In the time he had been down, I made a dive into the cave, explored the cliff above the basin, read several chapters of *War and Peace*, listened to *somba* tapes, and took a nap. What a trial of boredom Sheck must have experienced during the same period while hanging from the rocks waiting for the nitrogen to seep from his tissues. That evening's decompression was only a quarter of what he would have to endure in two days. If a problem developed during the deep dive, forcing him up early, he was certain to sustain a serious bends hit. The shortest route for treatment to relieve his agony would be a 90-mile drive to Tampico, a low-altitude flight to the Harlingen, Texas, airport, and then an air ambulance to Methodist Hospital in San Antonio, which had the closest chamber.

The next day was long and busy. Fifteen additional tanks were tied off on the line. Sergio and Ángel secured stage bottles 20 feet apart from 160 feet to 80 feet, and at 10-foot intervals from 70 feet to 30 feet. Sheck made another deep dive, leaving two cylinders at 270 feet, one at 240 feet, and another at 210 feet. This time I followed behind, taking pictures. At 100 feet, I stopped in the center of the narrow passage and watched Sheck, silhouetted by his powerful light, go down beneath me until his beam evaporated in the darkness.

That night at eleven, when I turned out my reading light, Sheck was still knotting line and double-checking charts. In the morning, when I awoke, his bed was empty. I found him in the van cleaning the second stages on his regulators. He was so intent on his effort that I said nothing and went back into our room to dress. A moment later he came in. It was easy to tell by his actions that the paranoia was beginning to set in. To and fro, from box to bag he went with long quick steps.

"Good morning," I said.

He stopped and glanced around to where I was sitting on the bed.

"Can I help you with anything?" I asked.

"Good morning, yeah, sure, here." He handed me a paring knife and a whetstone he had just taken from a gear bag. It was the knife from his wrist scabbard that would be used to cut the line at the dive's deepest point.

"Moving the dive up a day has set me behind," he stated. "Really shouldn't be diving today. It's already getting late, almost 7:00 now."

"Just wait until tomorrow," I suggested.

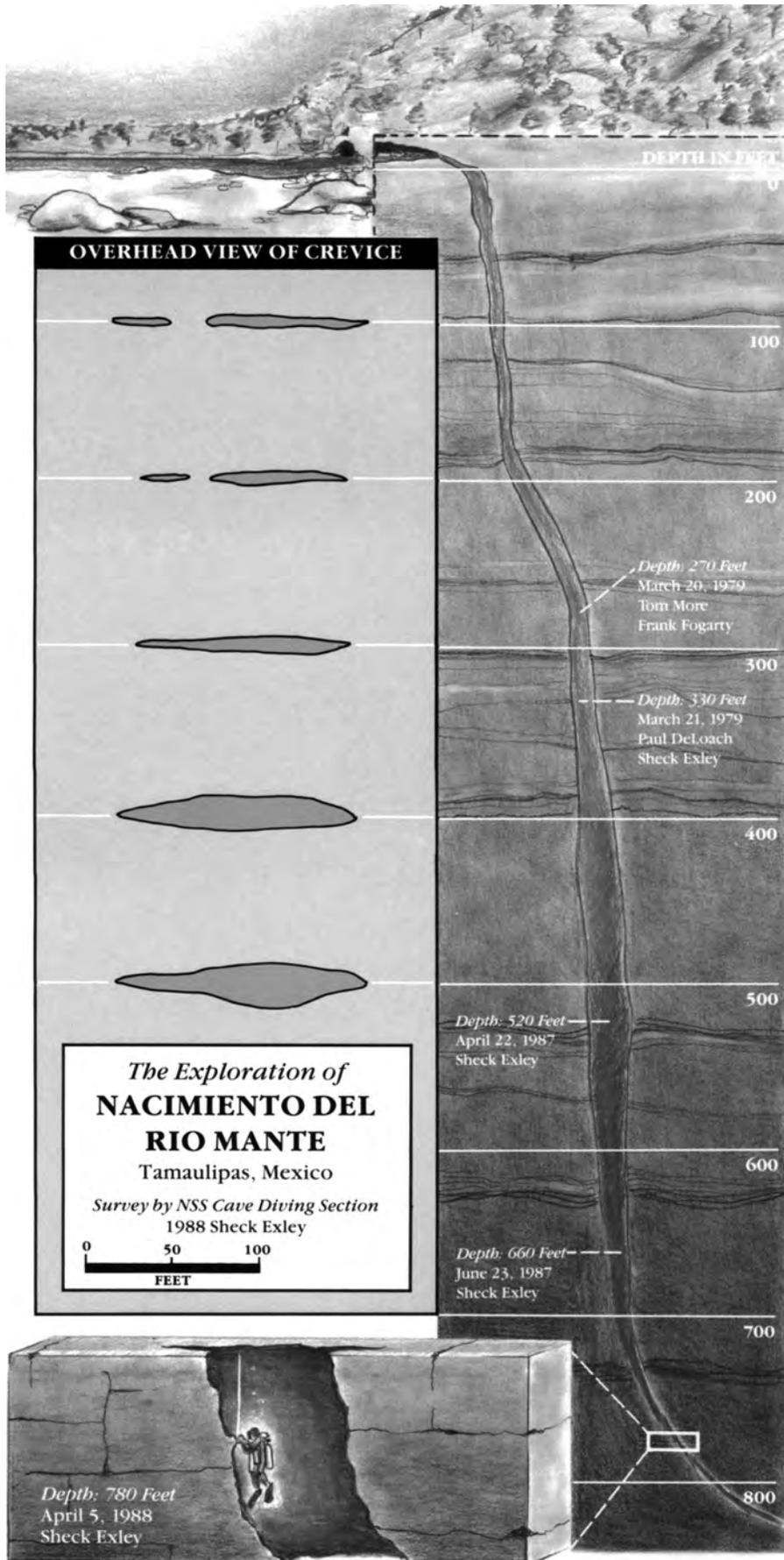
"Maybe; we'll see; I'm close now." He left the knife and stone in my hand and bounded across the room where he began to copy a duplicate set of decompression times on plastic tags.

"Hey, another day doesn't matter. Why not wait?" I asked.

He glanced in my direction. "To tell the truth, I don't want to think about it another day. We should be out of here in half an hour."

We arrived at the spring just before eight. Three sentences weren't passed between us on the ride out. His thoughts were lost in the dive. Not one of the dozens of important details could be forgotten or his attempt would end in failure. Like a team whose pitcher is going into the ninth inning with a no-hitter, Sergio, Ángel and I ignored Sheck. We sat twenty yards away, on the tailgate of their jeep, watching him ready his last equipment. Sitting there, my thoughts went back to a conversation I'd had with friends from Miami just before I left for Mexico. We were discussing Sheck's proposed dive. One of the questions they asked was, "How are you going to feel when Sheck actually starts down?" Then I was rather flippant with my answer, but now, close to the dive time and more educated about the difficulties involved, I began to rethink my position. Those who knew about decompression with mixed gases, both in the navy and the commercial diving business, gave Sheck no better than a 50/50 chance of surviving the attempt.

Decompression was only one



problem he had to overcome; there was also helium's high-pressure-nervous-system syndrome, hypothermia, oxygen poisoning, pulmonary edema, equipment failure, and, because he was using nitrogen in the deep mixture, narcosis. Sheck was learning how to put the entire package together, and now was the time to see if it worked.

He is not a daredevil; he is an explorer who has spent twenty years preparing himself mentally and physically for underwater challenges. In the years I have known him, I have acquired an almost mythical confidence in his ability to accomplish amazing dives. He is simply the best and most experienced diver in the world. If it were physically possible to pull off a 700-foot-plus dive, Sheck was the one who could do it. As I watched him make his final preparations, the question for me was not whether he would survive the dive, but how deep would he go.

At 10:45 a.m., when he finally entered the water, perspiration was beginning to soak the heavy wool overalls he wore inside the sealed dry suit. His face was scarlet. On his back were two 100-cubic-foot cylinders containing trimix. Slung under his chest and extending below his waist were two additional tanks, one filled with air to begin the dive, the other, trimix. With a nod he submerged.

From a narrow ledge above the cave I watched as he pulled himself toward the entrance. Once he was inside, I walked a distance down the Río Mante and sat alone in the shade of a palm thicket. I leaned back and began to imagine Sheck's present situation.

Eight minutes pass since he enters the cave. He is 100 feet inside the dry chamber, kneeling on a shallow rock shelf meditating. The brief rest allows his pulse to settle and his mind to clear of the pre-dive pressure. Periodically he plunges his maskless face into the cool water.

Two minutes later he turns on his four backup lights and the bright primary unit built specially for the 700-foot dive by English Engineering. With the regulator to the air tank gripped between his teeth, he

pushes his weight off the ledge, gains control of his awkwardly ballasted body, and swims 50 feet underwater to the lip of the drop-off. He checks the exact time and enters the figures on his slate, purges the last bit of air from his buoyancy vest and begins to descend into the crevice. Against the strong flow, he pulls himself down arm over arm, following the line on the south wall. Three minutes into the dive, at 190 feet, he skirts left over a rock promontory and then once again down. Here the passage widens to fifteen feet and the walls are much smoother; he is forced to kick to keep his pace. His pulse quickens slightly with the added exertion, and he slows his effort as he passes the stage bottles at 210 and then 240 feet.

Six minutes into the dive, 270 feet below the surface, he makes his first brief stop to exchange his air tank for a waiting cylinder of trimix. At the ten-minute mark he knows he is 400 feet down when he spots the blue garter left by Mary Ellen last June. The crevice walls are now separated by 30 feet of water, their widest point. His descent is in control.

At 520 feet he pauses briefly to attach his backup watch and two depth gauges to the line, and he begins to breathe the trimix on his back. The attached pressure gauge and his watch are now the only instruments to monitor his situation. Their readings are vital.

Six hundred sixty feet below the mountain he arrives at the end of his old line. It is 17 minutes since he started his descent. He attaches the line from his reel and begins his drop into depths never before reached by free-swimming man.

"As I entered the unexplored cave zone, I was concerned about my slower-than-expected rate of descent. I forced myself not to pick up the pace. Instead of continuing its vertical drop, the crevice began to narrow and run at a 60-degree angle. Flashes of narcosis were becoming more prominent. I glanced at my pressure gauge. I had a problem; the reading hadn't changed since my last check. I banged the unit on my tank. The needle jumped several hundred pounds lower. Pressure had forced the lens against the needle.

Was it stuck again? I had no way of knowing. A projection to tie off on was just below. I passed it and dropped deeper. The tunnel began to flatten out, falling at a 45-degree angle. I looked at the pressure gauge; it showed a third of the gas was gone. Was the reading correct? I had been down just over 22 minutes. It was time to get out.

"My light beam fell on an excellent tie-off 20 or 30 feet down. I took a breath and moved toward the projection, when suddenly a jolting concussion almost knocked me unconscious. I looked behind for a ruptured valve or hose. There was no leak. Something imploded from the pressure, but what? I drew another breath and kicked the last 8 feet to the tie-off. Quickly, I threw two half-hitches around the rock, reeled in the loose line, and made the cut. My down time was 24 minutes 10 seconds.

"I wanted to move up fast from the deep water, 120 feet per minute if possible. The current that I had battled during my descent helped to lift me up the incline. I drew a breath and felt a slight hesitation from my regulator. The next breath came harder. Was I out of air? Again, I hit the gauge on my tank, but this time the reading didn't change. If I was forced to use the gas in my belly tank, I would miss all my decompression stops below 330 feet, where my first stage bottle was tied off. I switched over to my backup regulator and with relief drew a full breath.

"At 520 feet I untied the depth gauges and started my decompression. It was strange to be decompressing at such a depth, knowing that only one other person had ever gone deeper. I remained for a minute and then began to ascend at the rate of 10 feet per minute until I reached 340 feet. When I saw my first stage bottle and knew that I had spare gas around me, I finally began to relax. My stress was gone, but the long decompression stops were only beginning.

"Now, with extra time, I began to search for the cause of the deafening implosion. The source was the large Plexiglas battery housing for my primary light. The pressure had been so great that the three-quarter-inch

lid had been forced into the casing, crushing the battery pack. Amazingly, the light still functioned.

"Next, I counted the knots on the line remaining in the reel. I factored in the angle of the cave's lower reaches and estimated that I dived to 780 feet [238 meters], a world's record depth for a surface-to-surface dive."

Three and a half hours after we had last seen Sheck, Sergio and Ángel made a dive to locate him and offer assistance if needed. They found him at 100 feet, suspended behind a cluster of twelve empty scuba tanks. Sergio handed him a slate with questions written in English. Sheck wrote the answers in Spanish.

At 9:30 p.m. he finally arrived back at the surface. Sergio, Ángel, and I were waiting in the light of a butane lamp. He had been underwater

for 10 hours and 43 minutes, but his decompression dues were still unpaid. For 30 additional minutes, he remained kneeling in the basin breathing pure oxygen.

When he emerged from the water, he resembled an old man. His face and hands were severely wrinkled and his walk faulty. He stopped three times on his way to the van to calm his racing pulse. Later, while he was struggling to free himself from the dry suit, I saw weariness set deep in Sheck's face like I had never seen on another man. What came to mind was Hemingway's description in *The Old Man and the Sea* of Santiago's utter exhaustion after his battle with the sharks.

We were up early the next morning. Sheck was surprisingly strong. He did most of the work repacking the van and drove 300

miles of Mexican highway before the day was over. At the beginning of our return trip, just after leaving Ciudad Mante, I asked him a question that had haunted me since the dive.

"Will you ever do it again?"

From behind the wheel he cocked his head, gave a sly half smile and answered. "I don't know."

An article by Sheck Exley on this dive appears in AMCS Activities Newsletter 17, pages 96–99.

Sheck did return. On March 28, 1989, he reached a new record depth of 867 feet (264 meters) in Nacimiento del Río Mante. Sheck Exley died on April 6, 1994, during a dive that reached –906 feet (276 meters) in El Zacatón, Tamaulipas. See AMCS Activities Newsletter 21, pages 38–43, 99.

*Sheck's autobiography, *Caverns Measureless to Man*, was published posthumously by Cave Books in 1994.*

El Buceo Más Profundo: Un Estudio en Paranoia Controlada

Esta es una reimpresión de un artículo sobre el buceo del Nacimiento del Río Mante por Sheck Exley en 1988. Alcanzó una profundidad de 238 metros, un record en el mundo del buceo. En 1989 Exley regresó y buceó a 264 metros.

THE DEPTHX PROJECT

William C. Stone

The NASA Deep Phreatic Thermal Explorer (DEPTHX) project has developed a fully autonomous underwater vehicle intended to demonstrate capabilities that would be needed for a Europa lander that would search for microbial life beneath the ice cap of that Jovian moon. DEPTHX has two principal objectives: First, to develop and test in an appropriate environment the ability of an untethered robot to explore into unknown three-dimensional territory, to make a map of what it sees, and to use that map to return home; and second, to demonstrate that scientific instruments can identify likely zones for the existence of microbial life, command an autonomous maneuvering platform to move to those locations and conduct localized searches, and autonomously collect microbial life in an aqueous environment. The concept and prototypes were tested in an unusual terrestrial analog that presents many of the likely morphologic regimes where life may exist on Europa: the 300-meter-deep hydrothermal cenote of Zacatón in Mexico, which contains diverse microbial mats, but remained uncharted, both spatially and biologically.

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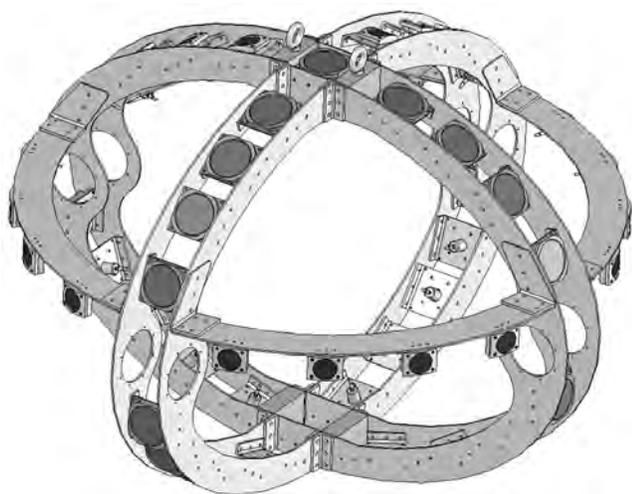
This article is condensed and revised from "Design and Deployment of a 3D Autonomous Subterranean Submarine Exploration Vehicle" *Proceedings UUST07*. Conference on Un-manned, Un-tethered, Submersible Technology, Durham, NH, August 20–22, 2007.

The vehicle design changed dramatically during the course of the project, and it will be worthwhile here to summarize how we arrived at the final design. Initially, the thinking had been to cannibalize, mainly to cut costs and reduce development time, a commercial remotely operated vehicle and add science and navigation instrumentation to that platform. This initial design used clustered banks of sonar transducers, with three clusters of eight serving as forward, port, and starboard obstacle avoidance arrays and a single sideways-looking array to be used for map building. A commercial ROV is not a very streamlined device, and an exterior shell was envisioned to cover the active components, both to reduce drag and to minimize the likelihood of a snagged vehicle during actual exploration in an overhead environment of the type that was anticipated at the Cenote Zacatón test site. A second-generation concept had the sonar clusters ungrouped and the discrete transducers mounted on the surface of a shell. This "potato" design had a sonar array with near 4π -steradian (full sphere) viewing. The operative word is "near." In the potato design there still had to be a propulsion system, and this occupied the stern of the craft, as in traditional ROV design, since in fact we were still thinking of an ROV chassis on the inside of the potato shell.

This remained the design through the spring of 2005, as hardware and code preparations for the May 2005 field campaign to Zacatón dominated work on the project. The express purpose of that expedition

was to obtain real data from Zacatón in a format that would allow testing of the crucial simultaneous localization and mapping (SLAM) software. [See "Mexico News," Tamaulipas, in *AMCS Activities Newsletter* 29.] While we were at Zacatón, there were a number of discussions about how the system was actually going to work on an exploration mission. The device used for the May 2005 expedition utilized the original barrel-scanner concept for map building. The data coming in from Zacatón, however, showed weaknesses in its ability to provide real-time 3-D maps of the vehicle's environment. A number of array concepts were sketched out at Zacatón. All of the sketches had the common concept of providing true 4π -steradian viewing, and ignored for the moment the issue of propulsion. Computer simulation of the SLAM problem favored one design that came to be called the three-great-circle concept. There were circles on three orthogonal planes, and it was on those circles that the discrete sonar elements would be placed. In this design the same sonar elements were used for both obstacle avoidance and mapping. During June 2005, the design gelled for a vehicle that incorporated this approach in a compact geometry that had effectively no bow or stern and could therefore maneuver in any direction should it enter a blind corner.

For maintenance and debugging, we needed a design that permitted all of the electronics and control systems to be accessible while still connected to the rest of the vehicle. This is frequently accomplished in



The "Great Circle" frame concept.



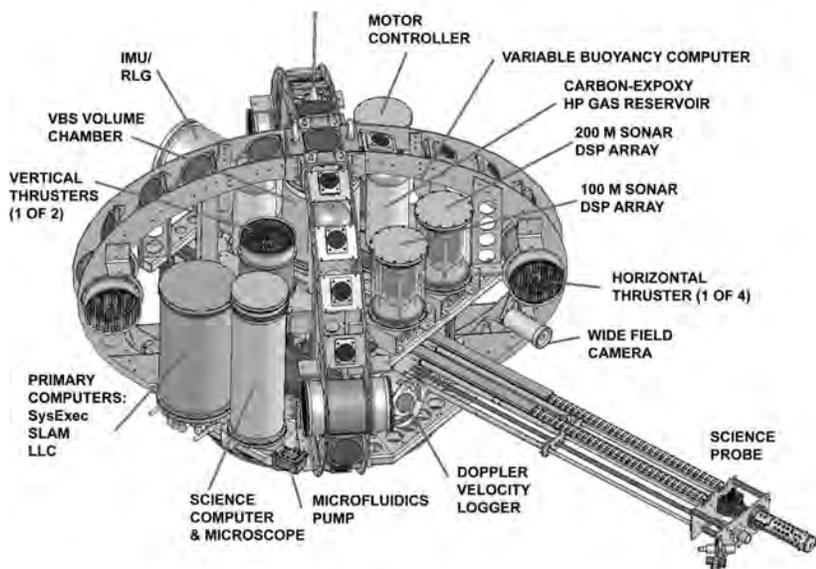
Final DEPTHX design in assembled form. Because of the foam top covers, the center of buoyancy is higher than the center of gravity, so the vehicle is stable in two of its three possible motions.

ROV design with swing-out housings that permit a pressure housing to be removed, leaving the end plate with its interface cables still attached and connected to the vehicle. We spent considerable time working on this problem before arriving at the solution shown. DEPTHX has eleven separate pressure housings. The depth rating for the entire vehicle is 1,000 meters, making it a robust design that will have access to many interesting biological sites on Earth besides Zacatón. The depth rating comes with a price: the average

weight of the housings is in excess of 50 kilograms. Taking this into account, we opted for the vertically loading configuration shown. This permits hoist removal of individual components and allows for precision re-fit, with minimum risk of damaging o-ring seals, when electronics need maintenance or repair. The buoyancy quadrants on top of the vehicle, which are molded from a foam of hollow glass beads in epoxy, are likewise designed for direct vertical removal. The overall diameter is 2.13 meters and the height is 1.52

meters. Modules are connected by 96 cables with a total length of 250 meters and containing a total of more than 400 electrical conductors.

The science mission of DEPTHX required the vehicle to be able to acquire both core samples from the wall and liquid samples from the water column. In order to do this without risking entrapment of the vehicle near an overhung or jagged wall, an extendable probe was developed that was able to reach 1.5 meters beyond the ellipsoidal shell. The vehicle can approach to a safe distance, as measured by the sonar arrays, extend the probe, and obtain the needed samples. Sampling can be triggered by either the presence of a gradient in one of the environmental parameters we measured (dissolved oxygen, pH, conductivity, dissolved solids, redox, temperature, and sulfide) or changes in wall coloration. During actual tests at cenote Zacatón, the latter failed, because there were no significant wall-color changes in the deep, anoxic zone of interest to the project scientists. The former, with sulfide in particular, was used as the basis for a science experiment described later.

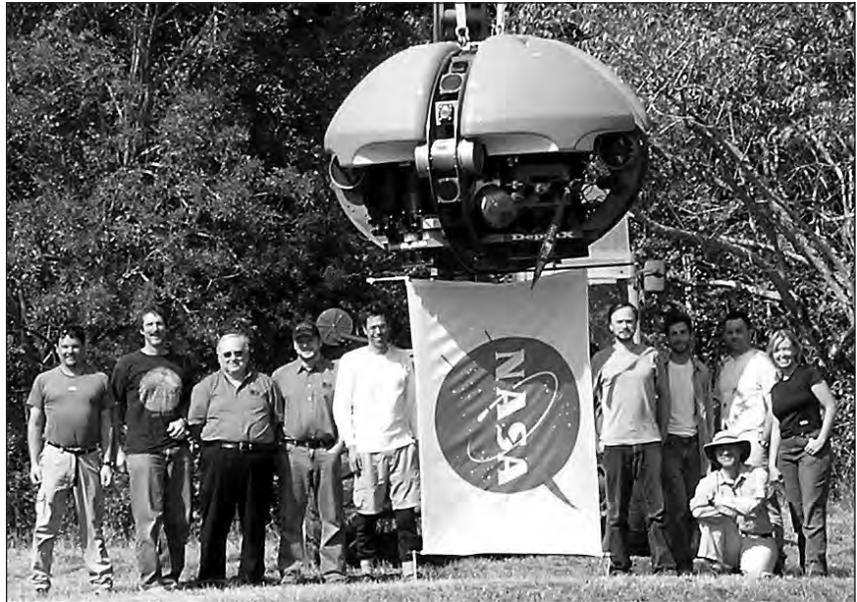


Vertical module design allows overhead access to electronics modules. The science probe is shown extended.

The DEPTHX team at La Palita in February 2007. From left: Marcus Gary, Bill Stone, Tom Lyons, Ian Meinzen, John Kerr, Nathaniel Fairfield, Dom Jonak, Dave Wettergreen, George Kantor, Vickie Siegel.

DEPTHX employs two separate navigation systems. The primary system is based on traditional dead-reckoning and uses as its primary input data from an inertial reference unit, a Doppler velocity log, and high-grade depth sensors. In practice the DVL dominates the calculation of the horizontal location, and the IRU is used for position input only in the absence of data from the DVL, which can occur if the vehicle is less than 1 meter from a target surface. The depth is provided by absolute measurement averaged from two depth sensors. Rotational orientation is obtained from the ring laser gyro portion of the IRU and is extraordinarily accurate, exhibiting drifts of less than 0.01 degree per hour. The pitch and roll of the vehicle are substantially damped by the flotation, so the three location values and the orientation are the only four motion variables.

The second form of navigation is based on full 3-D geometrical mapping. Simultaneous Localization and Mapping is the process of building a map of the environment and then using that map to locate the vehicle within it. Most work in this area has been directed toward following surface terrain or tracing office hallways, with some work in sea-bed tracking. All of these environments



are essentially 2-D in nature, and most of the efforts thus far have depended on high-resolution visual data. In the underwater domain it is not possible to obtain the high resolutions needed for feature recognition unless the water is very clear, and such conditions cannot be counted on, given the risk involved in losing an expensive autonomous underwater vehicle. For complex 3-D, underwater environments an alternative approach needs to be taken.

SLAM in 3-D requires that the vehicle simultaneously be able to sense new geometry as it moves into unknown territory and also be able to look back into terrain for which a map already exists. Because the

orientation of the vehicle relative to the map cannot be predicted ahead of time, the vehicle needs to effectively view 4π steradians around the vehicle. We used an equal-angle array of very narrow-beam sonar transducers. The transducers are a mix of 200-meter (330 kHz) and 100-meter (675 kHz) 2°-beam sensor designs similar to those used at Wakulla Spring in Florida. [See *National Geographic Adventure*, summer 1999.] A total of fifty-four such 2-degree transducers generate a continuous point cloud about the vehicle. To the author's knowledge, DEPTHX represents the first AUV designed from the ground up to implement 3-D SLAM.

In pure dead-reckoning mode,

John Kerr loading a charged Li-ion battery stack.



Vickie Siegel performing sonar maintenance.

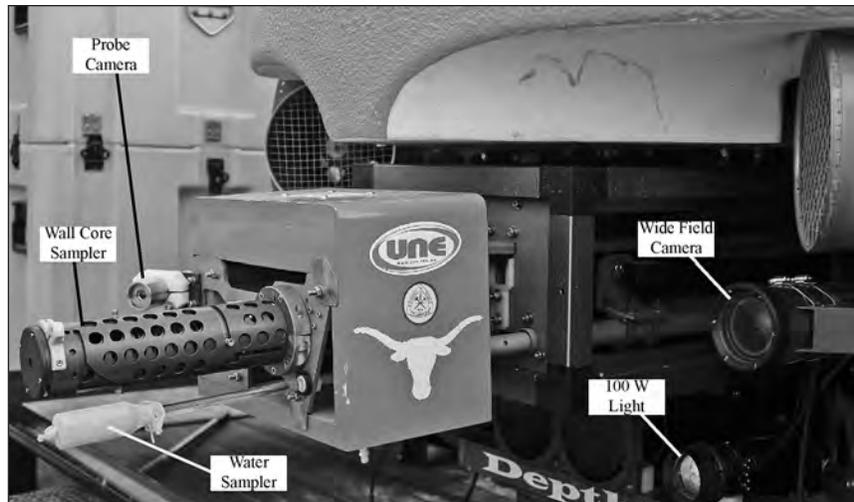


The DEPTHX science probe, with key components labeled. The science probe was built by Southwest Research Institute.

the motion controls take their inputs directly from the dead-reckoning system; in SLAM mode, the program uses the dead-reckoning system and the accumulated map to decide what motions to command, depending on the goals of the mission. The science objectives require the vehicle to approach a wall. Software enables DEPTHX to approach a target wall and then move along it horizontally or vertically, maintaining a constant distance.

There are some thirty-six processors on DEPTHX. The vast majority of all inter-device data transfer is accomplished via serial communications using a number of protocols driven by the smart sensors and actuators. The primary vehicle computer is an industrial cPCI controller rack with three cpu boards, a serial I/O card, and an Ethernet card. The System Executive runs on Linux. External communications can be maintained throughout a mission through an optional TCP/IP cable connection. This fiber-optic cable was particularly useful during the debug and code-development stage of the vehicle, since it allowed the programmers to “look over the shoulder” of the vehicle using special views of the real-time data.

The science probe extended to the wall during a shallow-water test in Poza La Pilita.



We chose to employ a parallel battery system for redundancy and capacity. Power consumption for all systems was determined, and a typical mission power-use profile was modeled. The total energy required was calculated to be in the 4 to 5 kilowatt-hour range. The vehicle was typically programmed to return home after depleting 30 or 40 percent of its energy supply. This fact, coupled with the energy needs noted above, set our total battery-capacity target to be in the 6 kWhr range.

Different battery chemistries were explored before settling on Li-ion. Each battery pack consists of thirteen cells in series, resulting in 48 volts, 60 Ahrs, 3kWs per pack, for a total of 6 kW of power. The packs, when new and fully charged, will store about

3.2 kWhr of energy. But unbalanced discharge during actual field exercises and non-optimal charge cycles led to the actual available power being approximately two-thirds of that. Great efforts were taken to monitor individual cell voltages, use cell balancers during charging, and develop a high-power disconnect system so that the robot could isolate a battery in an emergency. Battery status information is sent to the System Executive during a mission and was frequently grounds for a mission abort.

Power distribution from each battery is through size 10 AWG cables to the propulsion system and through size 14 AWG cables to all other systems. Every pressure vessel on board has a DC-to-DC converter to convert the battery voltage to the

The robot ascending from Zacatón on a crane cable, photographed from below.



appropriate voltage for the system it contains.

The propulsion system consists of six bidirectional thrusters and a variable-buoyancy system, although the latter was only used for a few field trials, because we discovered that fine trimming of the buoyancy before a mission was generally sufficient, given the stiffness of the foam and electronics housings. The thrusters are configured in pairs, two orthogonal pairs in the horizontal plane and the third pair aligned vertically. This gives significant redundancy; any two horizontal thrusters or any one of the vertical thrusters can be lost while still maintaining control over the vehicle. Simple hydrodynamic modeling of the vehicle was used to determine the basic thruster requirements. The maximum power consumption for the propulsion system was about 1.5 kW. This is a peak value and cannot be sustained, due to thermal issues. The maximum continuous power is estimated to be between 400 and 500 watts. The thrusters operate on

100 VDC.

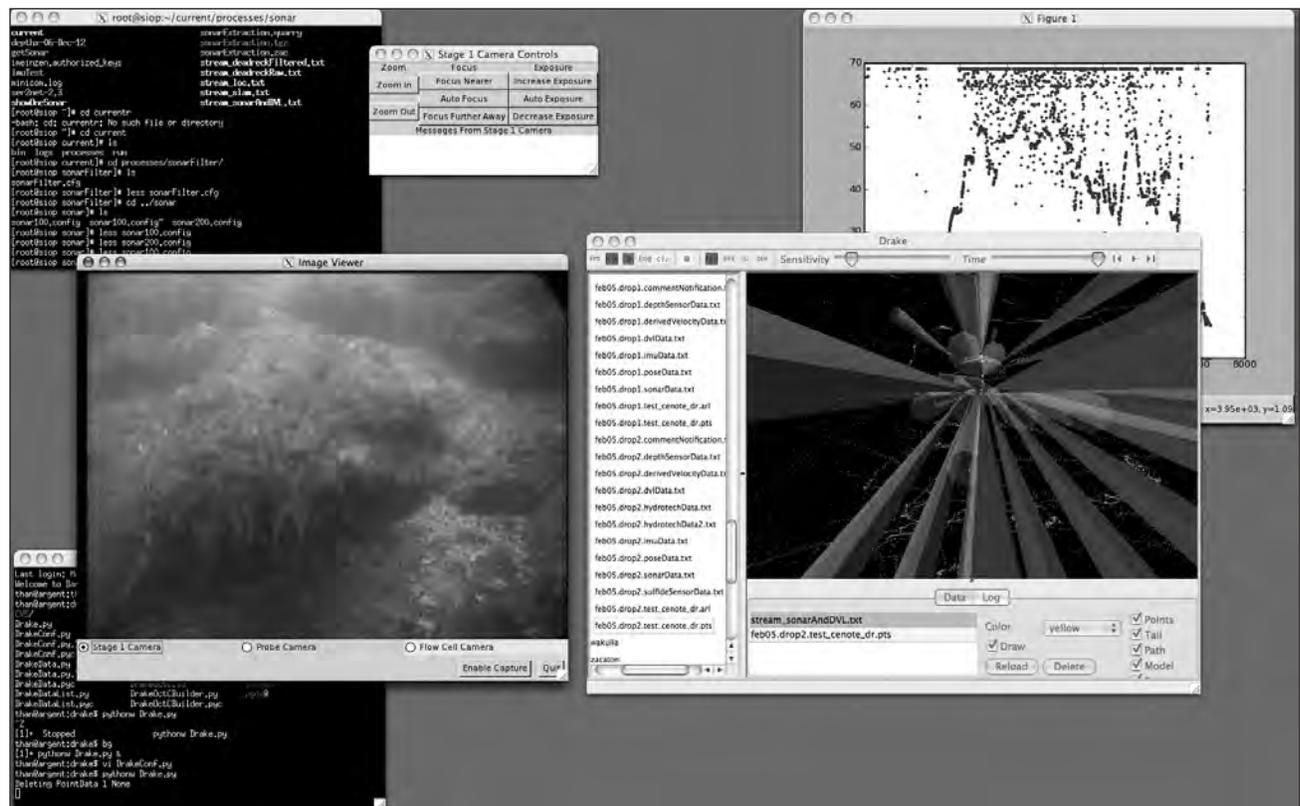
One of the paramount concerns for an autonomous underwater vehicle is the breach of the seal into one of the pressure housings. Catastrophic seal failure on DEPTHX should be extremely unlikely, given that each of the eleven housings with its relevant electrical and pneumatic cable penetrations was hydro-tested to 1,000 meters. However, routine access to the electronics can lead to minor degradation of o-ring seals over time, and those leaks are slow and pressure-dependent. Having a means to detect a slow leak and automatically terminate a mission was a required feature, since flooding of more than one housing could lead to a negative-buoyancy situation that would tax the vertical-movement systems.

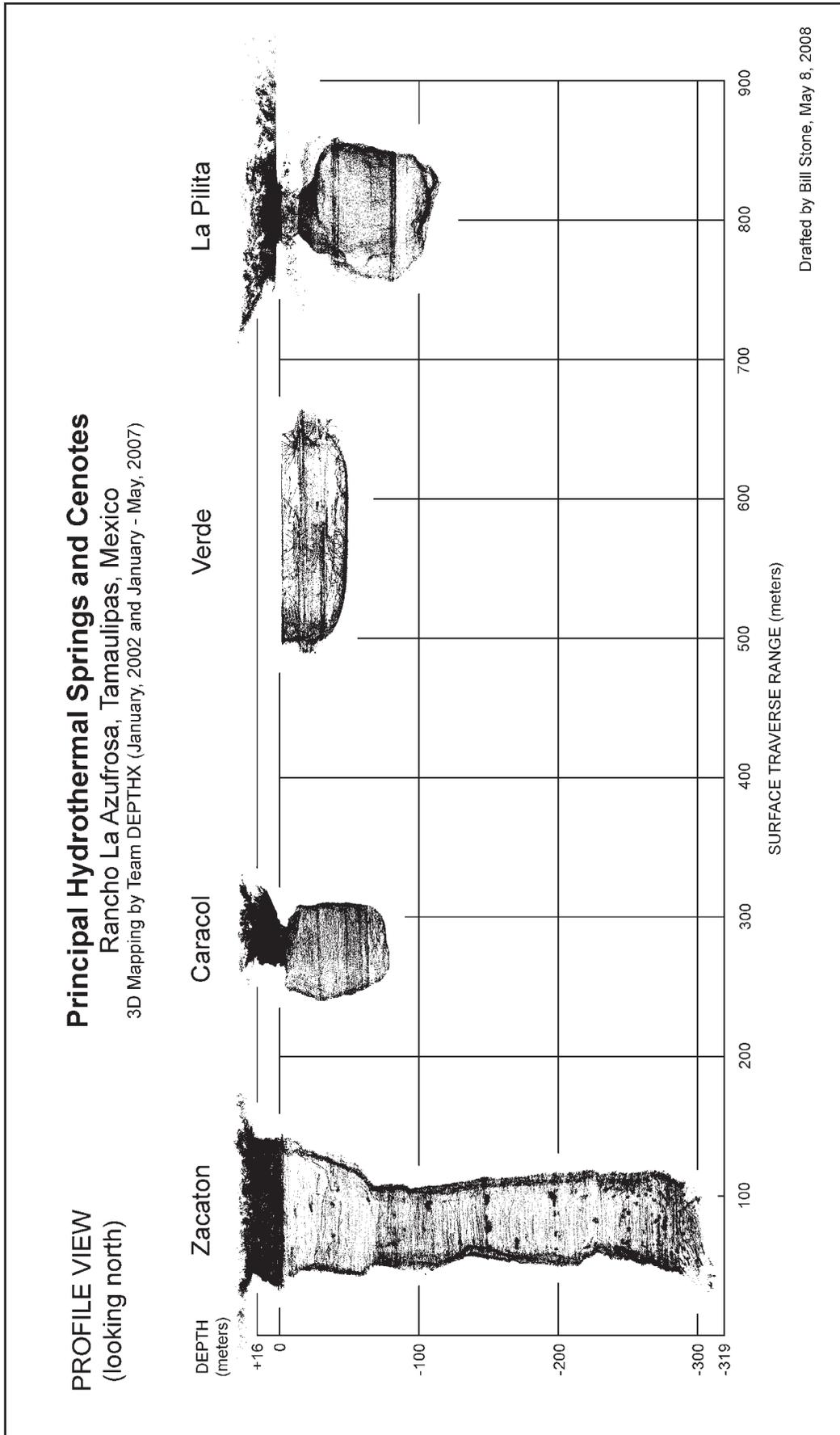
Off-the-shelf designs were unacceptable because of either high power consumption or the requirement of sufficient leaked water to short a probe. Stone Aerospace developed a custom design that uses a surface-mount sensor to detect changes in

the relative humidity of the gas in the pod. The pods are flushed with dry nitrogen prior to being sealed, so the RH should remain very close to zero during the mission, and in fact most remained in the 0 to 5 percent RH range throughout the entire project. The notable exception was the battery pods, in which, despite dry-nitrogen purging every time we charged the batteries, the RH was difficult to keep below 15 to 25 percent, even with bags of desiccant installed in them. The consensus was that the batteries themselves may be generating some moisture on discharge, though no formal test program to prove this was undertaken.

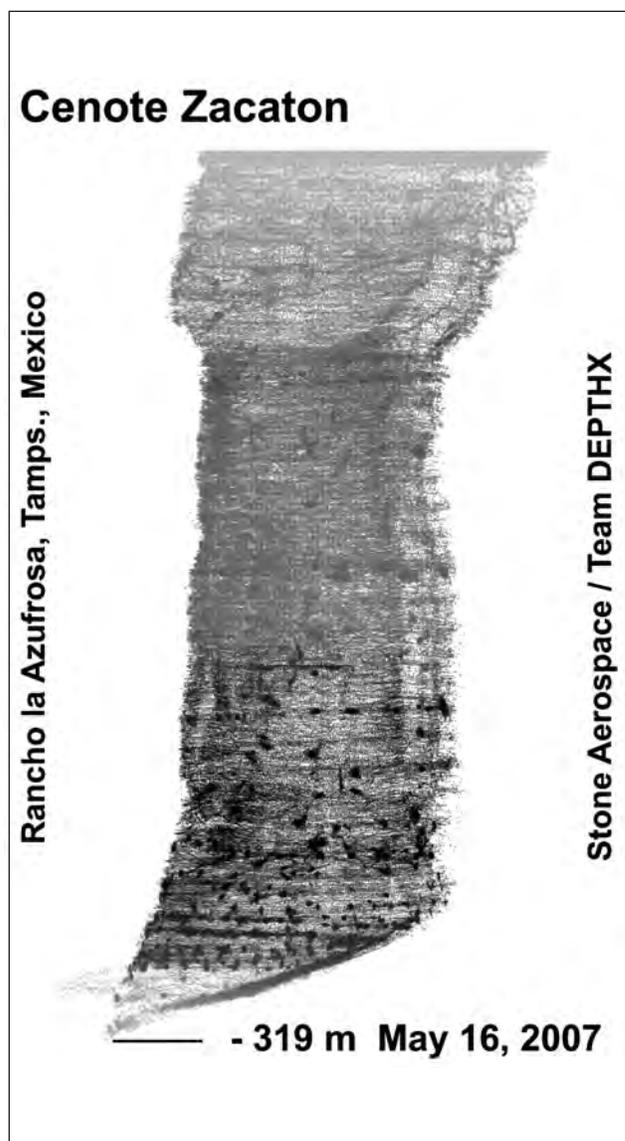
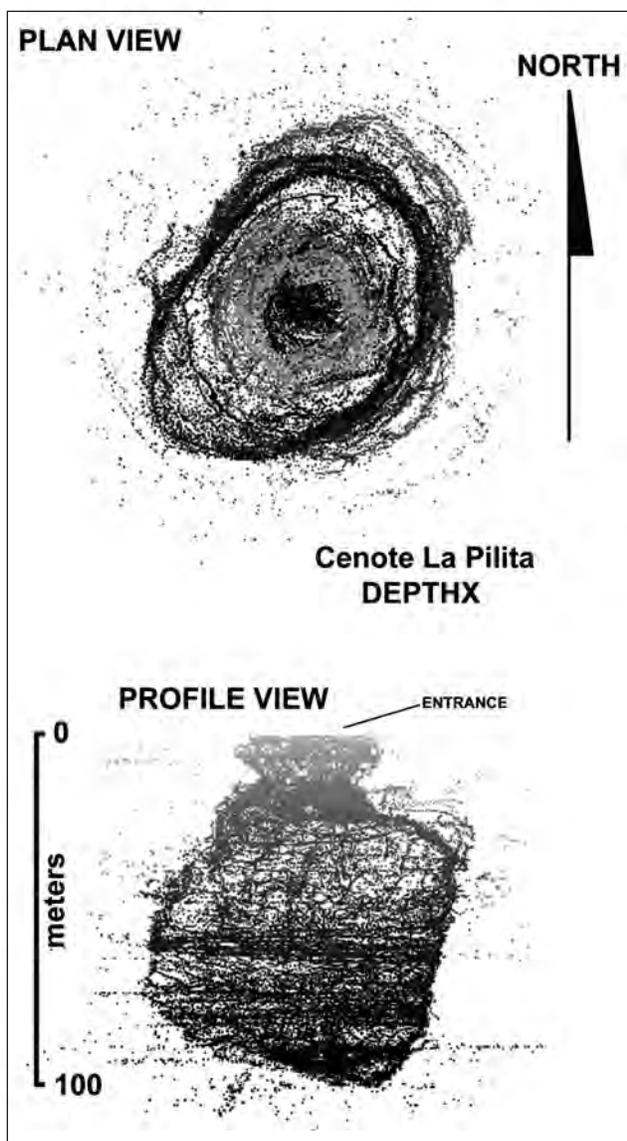
The preliminary field investigation for the DEPTHX project focused on deployment of the robot into the Poza la Pilita cenote, located on Rancho la Azufrosa, in Tamaulipas, Mexico, about six hours travel south of Texas. La Pilita has an entrance diameter of 20 meters and was only descended by sport divers to a depth of approximately

During testing with the fiber-optic tether, the performance of DEPTHX could be monitored on computers. Included in this screen capture are the view of the wall from the wide-field camera and a real-time diagram of the sonar beams and their lengths.





All four of the principal cenotes at Rancho La Azufrosa were imaged by the sonar on DEPTHX.



100 meters on a vertical line. Visibility is limited, and so no knowledge was available about the size of the room or whether there were any horizontal tunnels leading from it, such as are common in the cenotes of the Yucatan near Cancún, for example. We conducted approximately a dozen separate autonomous robotic missions in La Pilita in February and March of 2007. [See “Mexico News” in *AMCS Activities Newsletter 30*.] Half of these were for the purpose of testing SLAM navigation. Starting with no prior map of La Pilita, DEPTHX verified the depth to be 100 meters, but more importantly constructed a complete 3-D map of the cave without human assistance. Using this map, the robot subsequently returned to the entrance to within 15

centimeters of its starting position, despite having been underwater for as much as four hours. Thus, the exploration of La Pilita represented the first autonomous exploration of a subterranean cavern by a robot. In order to test the science autonomy capabilities of DEPTHX, water and wall samples were collected in both La Pilita and Zacatón at various depths. The robotic sampling arm and triggering system were autonomously applied at various depths and locations to characterize the varying environmental conditions and biologic activity. Unfortunately, what DEPTHX discovered was that the environment was . . . boring. Most sensor data showed insignificant variations in more than 300 meters of depth in Zacatón. The

sole exception was the sulfide level, which climbed very gradually with increasing depth. Coloration of the walls also proved to be boring—a monochromatic orange-brown from just below the photic zone to the maximum depths reached by the robot. Some of the most complicated missions took place in Cenote La Pilita. For example, DEPTHX ran untethered down to 40 meters depth, then maneuvered 20 meters horizontally under the ceiling of La Pilita to ascend into a dome at 30 meters depth. This can be seen in the profile map as a rise in the roof to the right of the entrance. There it automatically located the wall, moved in to 3 meters, and extended its sampling arm. It moved toward the wall until



The robot being lowered into Zacatón.

the coring mechanism was in contact, and, while the robot held position, it took a core sample, recorded video, and drew a water sample. The rover backed off, retracting the arm, and then dove down, out from under the dome, and returned to the surface. This was executed autonomously without a tether, so the results were known only after the rover returned to the surface and the data were examined. Eventually, samples were collected throughout the La Pilita cenote and, as well, to depths of 273 meters in cenote Zacatón. DNA extraction has already revealed several kinds of bacteria that live at that depth, many of a kind previously unknown.

Given the successful tests of autonomous mapping and SLAM, what remained was an unambiguous test of the science capability. We had, in the process of collecting the core and water samples in Zacatón and La Pilita, been exercising elements of the automated systems, but had not strung them all together. Complicating the matter was the homogeneity of the environmental variables and

the color of the wall surfaces, giving the robot few clues about where to seek the best samples. There was a slowly increasing trend in the concentration of sulfide with depth in Zacatón, but nothing like the hoped-for sulfide plume rising from a vent in the wall that could have triggered autonomous tracking behavior. An arbitrary concentration of 0.042 parts per million was selected as a trigger threshold for initiation of autonomous sample collection. On May 26, 2007, DEPTHX descended into cenote Zacatón, mapping along the way and maintaining a centered position for safety. At a depth of 114 meters it detected the sulfide threshold and began maneuvering towards the wall, entered into wall-tracking mode, extended the probe, and studied the wall using

previously tested methods. It then initiated its nominal exit procedure and returned to the middle of the shaft to ascend. There are, of course, many additional aspects of science autonomy to be developed on the path to a Europa mission, but DEPTHX went a long way towards building the foundation for that autonomous behavior.

DEPTHX achieved the two science goals that had been established

at the outset of the project, despite an extraordinarily tight time schedule and the complexity of developing a 3-D autonomous underwater vehicle from scratch. In the process of allowing physics and mathematics to drive engineering invention, a completely novel vehicle architecture emerged that was certainly not predicted at the time the original proposal to NASA was written. The axisymmetric shell concept led naturally to redundancy in thrusters, ability to avoid snags in complicated terrain, and, most importantly, the ability to call any direction on the vehicle its bow. There were unexpected and serendipitous consequences of going down this path. In a complicated situation involving entrapment and a few dead thrusters, DEPTHX could perform a yaw maneuver and still be fully functional, operating with only half its propulsion system. Because of the shape, yaw maneuvers came at almost no cost. Once the robot was rotating, it took very little energy to maintain that. Spinning the robot during ascent or descent turned the arrays of sonar beams into the underwater equivalent of a scanning LADAR. What resulted was "spin mapping," an extraordinary new and powerful technique for building full 3-D maps. The success of spin mapping was not confined to descents down hydrothermal springs with predominantly vertical morphology. It also worked for building detailed maps of lakes and quarries during testing. This latter capability will



Wide-angle view of Zacatón.

carry over into the ENDURANCE project, which will map the subsurface world of Lake Bonney in Taylor Valley, Antarctica, using a modified DEPTHX vehicle.

Acknowledgements

First and foremost, DEPTHX was a NASA-sponsored research activity, funded through the ASTEP program office, NASA Science Directorate under grant NNG04GC09G. The team would like to thank, in particular, John Rummel, Carl Pilcher, Michael Meyer, and Dave Lavery for their vision, support and guidance

throughout the project.

We would also like to thank the land owner of Rancho la Azufrosa (the field test site in Mexico) Lic. Alejandro Dávila López for his extraordinary efforts to make the project possible, the science attaché staff at the U.S. Embassy in Mexico City, and Ministro Juan Manuel Nungaray Valadez, Director General Adjunto para América del Norte in the Secretaría de Relaciones Exteriores in Mexico City for their help in making the field work at cenote Zacatón possible.

The team DEPTHX included, at

various stages, more than thirty researchers, engineers, software programmers, and three PhD students who are in the process of completing their degrees in relation to the project. Participants were affiliated with the following organizations: Stone Aerospace, Carnegie-Mellon University Field Robotics Center, Southwest Research Institute, University of Colorado Boulder, Colorado School of Mines, University of Texas at Austin, University of Arizona Lunar and Planetary Institute, Universidad de Nuevo León, and Universidad del Noreste.

El Proyecto DEPTHX

El robot DEPTHX, patrocinado por la NASA, exploró las dolinas inundadas del Rancho la Azufrosa en la primavera de 2007. Se utilizó un sonar para hacer mapas de los pozos. Se tomaron muestras del agua y las acumulaciones de bacterias en las paredes de manera automática en las profundidades de la Poza la Pilita y El Zacatón. El mapa por sonar del Zacatón muestra una profundidad de 319 metros. No se encontraron pasajes en las paredes de los cenotes.

VERACRUZ 2007

Wes Schumacher and Gary Franklin

In spring 2007 a group of American and Mexican cavers convened in southern Mexico outside of Orizaba to explore caves. Camped along a large spring-fed river, they spent a week surveying caves in the hills around and above the spring. Participants were Mark Strickland, Matt Oliphant, Herb Lager, and Nancy Pistole from California, Barbara Luke from Nevada, Matt Kramer from Minnesota, Seth Spoelman from Tennessee, Wicho Diaz from Oaxaca, Guillermo Gassós and Marsella Rios from Veracruz, and Peter Sprouse, Charley and Kara Savvas, Philip Rykwald, Stephen and Paul Bryant, Kori Jones, Jean Krejca, Aimee Beveridge, Sandra and Alicia Denny, Geoff Hoese, Gary Franklin, Sandi Calhoun, and Wes Schumacher from Texas.

Among the numerous caves in the area, the most spectacular were two river caves, Cueva del Ojo de Agua Grande and Sótano del Resumbador. They contained large streams with rapids and required much ropework to negotiate the obstacles.

The following trip reports were written by two members of the group. Unfortunately, none of the map have been drafted yet.

Some weeks prior to spring break I Sled a beginner trip to Maple Run Cave in south Austin, Texas, and met a very cute girl there by the name of Sandi who had just started caving. I hadn't spoken much to her on that

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 garyfranklin2@austin.rr.com
 Introduction by Philip Rykwald.
 Table of caves by Peter Sprouse.

trip, but she called me the night I was packing to leave for Veracruz and asked if there was a way she could get a ride. I told her I didn't know if there was an open spot in any of the vehicles. I knew the vehicle I was riding in was packed to the gills. I gave her the numbers of all those driving so she could check anyway. I continued packing and crossed my fingers hoping that someone had space for Sandi.

Jean Krejca, Gary Franklin, and I left promptly the next morning in Jean's Chevy S-10. I was in the back jump seat, since I was smallest. The idea of Gary, a rather tall guy, crammed back there made us laugh, and besides I didn't mind. I'm a claustrophile. We trucked on through the border, since we had all our paperwork done earlier. We later met up with Peter Sprouse and his caravan at a hotel on the route south. We slept there that night, and the next morning we ventured out to find breakfast and continue down the road in a string of caver vehicles. We went a little farther south and stopped by El Zacatón, the now-famous cenote where Bill Stone and the DEPTHX project were doing some test dives of their autonomous robot. We swam with the robot. I hear it's therapeutic. Watch out, Florida, there's a new game in town. We played with the *zacates*, or floating grass islands, by pushing them around in the water. We took lots of photos of the cenotes, the robot, and a nearby dry cave that was riddled with beautiful skylights with lanky trees growing out of them.

We stopped again at a seaside hotel the following night. The courtyard

in the center of the hotel surrounded a large orange tree in full bloom. Its sticky-sweet fragrance was overwhelming. We spent the evening drinking beer as cavers do, and even took a midnight stroll to the docks. Geoff Hoese got a wild hare and, regressing to his days back in Louisiana, went crabbing barefoot as we all watched from the shore. The next morning, while stopping for a late brunch in a bustling roadside *tienda*, our group spotted a Volvo station wagon full of *gringos* going down the street. We recognized them as cavers and waved them over. It was the late bus that had left Austin on Saturday instead of Friday, and out of it poured the weary souls who had driven through the night to catch up to us. I immediately recognized Sandi among them and went over to tell her how glad I was she had made it. She meekly waved at me in her sleep-deprived stupor and dazedly sat down for some authentic Mexican cuisine. We all ate a tasty brunch and quickly hit the road, stopping along the way at the ruins of El Tajín, a local archaeological attraction, to tour the pyramids and buy kitschy stuff. I bought two real organic vanilla beans for two dollars. I think that's a steal.

By the time we got back on the road it was dusk, and we didn't reach our final destination, Atoyac, until after dark. I was pleasantly surprised that the campground was a nicely manicured lawn that made setting up my tent relatively easy, even in the dark. The next morning we had the requisite group meeting where the local guides were introduced and we exchanged language barriers. We

then split up into groups to cover more ground, and to my secret joy, Sandi joined my group. Partly understanding our request, the guides led our group on a grueling recon hike up steep, but picturesque tropical mountainsides. We lost two cavers on the ascent. The jungle was just too stifling, and they had to turn back. Once a good ways up, we began to see coffee groves, and here and there some banana trees. There were large, suspended termite mounds in some of them. Getting a wild hare, I decided to try eating a termite or two. They are somewhat nutty and bitter. I also got to explain to Sandi what the infamous *mala mujer* plant was and why people should never touch it unless they desire nasty stings worse than that of any North American bull nettle.

For all our laborious hiking, we found only small fracture caves. They were mostly features created by rock movement down-slope on the steep terrain. We returned to camp tired and somewhat disappointed, but still in high spirits and happy we had gotten to see the flora and fauna. That night we had a good dinner to satisfy our caloric debt from the death-march. The others had had more luck. Peter had found out about some big caves nearby that he wanted to go back to. Aimee and Geoff had roamed the roads without a guide and found some promising stuff, too. Word got around that our camp was next to a spectacular resurgence cave named Ojo de Agua Grande that was the source of the Río Atoyac running past our tents. Sandi and I decided to take a look at it and hiked over to it, following a well-worn path. The cave entrance was a small, slippery hole above a roiling resurgence pool feeding a calm, azure river. After I coached Sandi into the cave, we immediately heard a low rumble that slowly grew into a deafening roar as we went farther in. Sandi shouted, "Oh my God!" as our head lamps began to illuminate a massive body of rushing, crashing water directly in front

The resurgence pool of Ojo de Agua Grande. The cave entrance is hidden in breakdown near the left-most caver.

Jean Krejca.

of us, the underground equivalent of class-4 rapids. We returned to camp in awe and resumed drinking beer with the other cavers.

In the morning our group, having had the worst finds from the recon day, split up and went on separate trips. I went with Peter Sprouse's team to survey Ojo de Agua Grande and was again pleasantly surprised that Sandi joined me. Along the trail I noticed we were walking through coffee groves, and we soon encountered a local harvesting beans. The bag he was using was very festive looking from the many shades of coffee beans. It was like a giant bag of M&Ms. Despite the ease of the hike, I found myself exhausted when we reached the cave. I didn't stop to think about it, writing it off simply as the lingering effects of the death-march from the day before. However, once inside the cave, I began to feel worse. I got a headache, and part way through had to stop and vomit. At this point I decided to leave the cave. The rest of my survey crew agreed to find Peter and continue helping his crew survey their portion of the cave. I went back to camp, where I promptly turned into a double-spouted human fountain. I slept most of the day, waking either to vomit or run to the toilet. When the others returned from their respective trips that evening, word got round that I was sick, and some

sulfa drugs were offered to me. I took them and within the hour was better. Sandi acted as my caretaker and nursed me back to health. I ate dinner that night, though warily. I had quite an appetite after losing all of the morning's calories, but still was not sure how long food would stay in my digestive system.

The next day a large group including Sandi and me set out to find a long cave system that Peter knew about from years past but hadn't mapped. During the drive out to the cave, we toured the Atoyac gorge and stopped at some other large resurgences to marvel at their size. The cave at our final destination followed the spine of an anticline, which made for vaulted ceilings, where the bedding arched over our heads. It was mud-floored and very sloppy. I did all I could to keep the survey book clean, but ended up with a few smudges on my sketch. We surveyed all day as we walked through one huge, muddy room after another. At camp that evening we had another awesome dinner, but drank the *tienda* out of beer. We had a cold dip in the Río Atoyac and supplemented our libations with local cane liquor.

On the last day of the trip, we went to a large pit some way up the mountain from Ojo de Agua Grande that was thought to contribute to its resurgent flow. The pit was called Cueva Cascada Grande. The pit was





Gary Franklin begins his rappel into Sótano del Resumbador. *Jean Krejca.*

quite impressive in size. Four rebays were rigged to get past a sketchy breakdown pile at the lip, but below that was an 80-meter free drop into a belled-out chamber. It was like a mini Golondrinas. Sandi had to stay on top, because she had had only minor instruction in vertical rope technique. She grumbled at being left out, but decided to take a GPS and hike the mountainside to see what might be interesting. At the bottom of the pit the roar of a distant river could be heard. I opted to survey the floor of the pit with Barbara Luke, as that seemed to be challenging enough and I had not brought a wetsuit. The river team came back with grand stories of deafening waterfalls and torrential rapids that made me glad of my decision.

At camp that night we traded stories about our respective trips. Jean Krejca photographed creepy crawlies while we sat around and talked. At one point a rather big spider she was handling got agitated enough to bite her, and she instinctively flicked her wrist to throw it off. It landed on Charley Savvas's neck, prompting him to swat it off across the table again. Everyone at the table was either standing or running at this point. I saw the spider dash for a nearby bush and swatted it back toward the table so we wouldn't lose it. This spider ping-pong went on for a few more seconds, until

Jean bagged it and put it up. It was exciting, to say the least, but some folks never returned to our table that night. Sandi and I hung out and had a good time. I felt like that day's trip had been one of the better trips I had been on that week.

The next morning we packed up camp, and I hopped into the back of the Chevy. It took us only two days to make the return trip, as we skipped all the stops. The only place we spent the night was a no-tell motel on the main highway. It didn't faze the manager to see a young boy, a big burly guy, and a woman ask for a single room. I guess he'd seen it all. Upon returning home, we all remarked how fun a trip it had been, and we had plenty of stories to tell. It was hands down one of the best spring breaks I have ever had, and now Sandi tends to come with me on almost every caving trip I go on these days. I guess I made an impression.—*Wes Schumacher*

I had no idea what I was in for when I started this epic journey. My life had recently been rearranged due to a life-changing event that was most likely triggered by my mid-life crisis of turning forty. I had quit my field job monitoring groundwater at the Texas Water Development Board, with all its travel, to settle into an office job at the Lower Colorado River Authority Environmental

Laboratory so that I could spend more time around the house. The local groundwater-district staff members convinced me to run for an open seat, so I threw my hat in the ring and quickly found myself a director of the Barton Springs-Edwards Aquifer Conservation District.

My first act as a director was to participate in an Earth Day event, where I decided to try out caving at Whirlpool Cave in south Austin. After all, my hydrogeological experiences related directly to the strata, so I wanted to see the aquifer layers firsthand. I found myself completely enthralled with the event, and constantly shared the experience with friends and colleagues. Carrie Beveridge, who was one of my clients, claimed that her sister Aimee was involved, and she suggested attending a UT Grotto meeting if I wanted to pursue more caving.

At my first meeting, I met one of the trip leaders, Tone Garot, and found myself engaged with many of the grotto members. The UT Grotto website encouraged participation in a group where members ranged from the raw beginner to hardcore international expedition cavers. Members shared trip reports of local and distant caving adventures that were both exciting and foreign to my imagination.

When Peter Sprouse first announced a trip for a week of caving in Veracruz, I was uncertain about leaving the sanctuary of the United States for unknown adventures down deep in Mexico. I wondered if my limited caving experience of just a few short months would be enough to navigate caves in Veracruz, and I was also uncertain about traveling in a foreign country. After all, my entire image of Mexico was forged from an afternoon trip into Nuevo Laredo, and I could not understand why anyone would go all the way to Mexico when there were so many caves in the Austin area. However, one of the best parts of any trip has to be the adventure involved in the journey. Driving exposes all of the changes in terrain and foliage, as well

Wicho Diaz pulls tape during the survey of Resumbador. *Jean Krejca.*



as exposing one to the village culture that Mexico has to offer. The best part of a trip is to share the experience with friends, so I signed up just to see what all the hype was about.

Jean Krejca had recruited Wes Schumacher and me to pack into her little Chevy S-10 pickup for the trip. We could not have ordered better weather for a spring-break getaway. The skies were clear and blue, with brilliant rays bathing the Texas hill country. We met up on Friday about 2:00 to get the truck loaded and on the road from Austin by 3:00. After some BBQ and a few hours, we got to the border. The guard looked in the back of the vehicle and asked a few questions before signaling us on. We were able to register, pay the fees, and pass through the border process with little delay. We drove on down to the town of San Fernando to meet up with the rest of the crew at a hacienda just after midnight. Motels in Mexico surround an interior courtyard, and they open a gate for you to drive your vehicle in. We recognized the vehicle of Aimee Beveridge and Geoff Hoese, who were already there. We made a quick sweep of the room, finding very pleasant bedding, and we were even more surprised that it aced the UV-light sweep for scorpions.

After a good night's rest and a hot shower, I toured the courtyard to

find that Peter Sprouse had arrived sometime during the night. While everyone else was busy getting up, Aimee went cruising the town to scope out a restaurant for breakfast, and she ran into another caver, Jim Kennedy, who was off to cave in Laguna de Sánchez. After a full breakfast, we rounded up the troops and began our convoy on down the road, ten cavers in three vehicles: Aimee Beveridge, Geoff Hoese, and Kori Jones in one; Peter Sprouse, Barbara Luke, Sandra Denney, and Alicia Denney in the second; and Jean Krejca, Wes Schumacher, and Gary Franklin in the third.

Each vehicle had adopted a team name, and we had two-way radios to help us keep up a dialogue about the sights along the way. Soon we came upon the Tropic of Cancer, the parallel at about 23.5 degrees north latitude, which was marked by a

2-meter yellow concrete sphere as a roadside attraction. We all piled upon the structure and posed for the cameras while giggling like children. By about noon, we had made it down to southern Tamaulipas to Rancho La Azufrosa. This ranch is home to several karst features called cenotes, which are essentially very large, deep water-filled sinkholes. We were excited to be greeted by the entire DEPTHX team, who were testing the Stone Aerospace underwater autonomous robot. The contrast of ten spring-break cavers intruding upon fifteen scientists was quite extreme. Everyone was gathered around the water's edge, since the robot was submerged in the Poza La Pilita cenote. As cavers often do, we wanted to plunge in for a quick swim, despite our fear of disturbing the testing. Our concerns were squelched when the scientists

Caves Visited during the Trip

NAME	LATITUDE	LONGITUDE	ELEV	LENGTH	DEPTH	LOCATION	MUNICIPIO
	NAD27	CONUS	M	M	M		
Sótano del Resumbador	18.9330328	96.8791047	760	793	166	Playa la Junta	Amatlán de los Reyes
Cueva del Ojo de Agua Grande (Gruta del Manantial)	18.9265197	96.8759407	558	882	17	Playa la Junta	Amatlán de los Reyes
Sótano de los Murcielagos	18.9265631	96.8718398	720	20	11	Cañada Blanca	Amatlán de los Reyes
Cueva de los Cuatro Mujeres	18.9105422	96.8943935	700	120	19	Ejido Felipe Carillo	Amatlán de los Reyes
Cueva de las Madres de Futbol Manejando Volvos	18.9116593	96.8925288	700	200	35	Ejido Felipe Carillo	Amatlán de los Reyes
Cueva el Encanto	18.9462828	96.8639956	650	500	57	Cañada Blanca	Amatlán de los Reyes
Cueva el Cuartel	18.9597528	96.8656944		35		Cañada Blanca	Amatlán de los Reyes
Cueva del Hongo					21	Cañada Blanca	Amatlán de los Reyes
Cueva Paisanos	18.97363	97.24003	3295	5		Volcan de Orizaba	Mariano Escobedo
Cueva del Murciélago Solo	18.94403	96.86431	607	30	7	Cañada Blanca	Amatlán de los Reyes
Cueva de David Sosa	18.9107336	96.894543		14	6	Ejido Felipe Carillo	Amatlán de los Reyes
Cueva del Nacimiento el Encanto	18.9058958	96.8727088		15		Ejido Felipe Carillo	Amatlán de los Reyes
Cueva del Cabrito	19.0393813	96.8309037	700	1528	26	La Palma	Tepatlixco

gave their blessing to swim so that we could escape the hot, tropical-jungle weather. I could hear and feel the humming of the impellers of the robot that echoed from the depths like a distant whale singing. I climbed out fully refreshed.

Robin Gary was cooking up enough tacos for an army on Marcus's propane-fired wok that we could all fill up on. The DEPTHX team had a list of tasks to accomplish that day, but only one had been crossed off by the 12:45 lunch break. As we filled our plates, we were called to the edge of the cenote to witness the robot surfacing. Barbara was still in the water and swam over to climb on top of the robot like a dolphin trainer at Sea World. Since the robot was the most advanced in the world, I thought that there would be concern about her injuring it, but no effort was made to expel her. Cameras were flashing as we all watched in awe as a giant forklift extracted the robot from the water. The scientists hooked up a data link and began to remove the collected samples.

After we had all filled up on the excellent tacos, we wanted to explore the rest of the ranch and headed off on the trail to see whatever else it had to offer. Rancho La Azufrosa has a series of cenotes. Plants in the tropics are quite different from Texas. The acacia were in full bloom, and the 2.5-meter yucca were displaying their half-meter blooms in full glory. We took a quick peak at Poza Verde before heading off to the grandest cenote. El Zacatón is a cylindrical sinkhole that is over 100 meters across and has a depth that had only been explored to about 280 meters. There were several floating grass islands, *zacates* that ranged from 3 to 12 meters across, and they were rounded from being windblown against the steep walls. The water level in Zacatón is about 16 meters down from ground level, so we all had to climb down a tree to the water's edge to take another plunge to escape the heat. We decided to push one of the *zacates* from the group of several bunched together along the edge and propel it toward the center of the pool. The *zacate* that we were tug-boating was about 3

meters across and weighed more than a van. A great time was had by all, including Geoff, who was almost knocked off the ledge where he had climbed out of the water to check out a passage lead. He had to quickly duck down to allow a great horned owl to fly by. As he turned to watch the spectacular flight, the owl's mate emerged unexpectedly, and he was almost knocked into the water as it flew by, nearly grazing him. We dried off and hiked around to take in more of the ranch scenery.

There was a horizontal dry cave, Cavernas Cuarteles. As we walked down the entryway, we could see a huge passage that included several skylight openings where a tree could grow out of the cave floor toward the opening. There was a narrow beam of sunlight in one of the openings that looked like a stage spotlight. Roots from the overlying foliage hung down from the roof. Of course, thrilling adventures began, as Jean grasped a 10-meter root and scampered up to the edge of the room to jump off and swing like Tarzan. Wes gave it a whirl as well, while the cameras snapped the buffoonery. The cave passage opened into a sink that was filled with exotic foliage and unrecognizable trees.

After another quick dip in La Pilita, we bade farewell to the DEPTHX crew, then hit the road for a few hours. About dusk, we stopped at a hotel in Tampico Alta that bordered a lagoon. The resort building by the water's edge was surrounded by shrubbery that looked like Edward Scissorhands was the gardener; there was a giant shrimp and other animals sculpted out of the bushes. We gathered on the motel balcony to drink beer and view trip photos before turning in for the night.

Shortly after starting out the next morning, we passed Seth Spoelman's vehicle, with Stephen Bryant, Paul Bryant, and Sandi Calhoun, on the road where they were changing drivers after their

marathon non-stop ride from Austin. We gladly accepted another vehicle to expand our convoy to four in our journey, which was now headed to see the pyramids of El Tajín, the city of the thunder god. When we got there, it was a festival with food and vendors, and we noticed musicians perched atop a 25-meter pole. The drummer and flute player kept time, while the *voladores*, tethered to the pole, slowly spun and unwound like ancient bungee jumpers before they finally descended to the ground. There were many ancient pyramids and courtyards from a society that had thrived in the jungle over a thousand years ago.

We hit the road again, and as we passed through another checkpoint, we spotted Matt Oliphant and Nancy Pistole, who joined our convoy down the Gulf Coast highway. We pulled off for a rest break at the lighthouse in Boca de Oveja to eat some snack food and take a plunge in the ocean. The crew gathered seashells and took photos while the sun began to set, and then we headed out to try

Nancy Pistole and Guillermo Gassós rigging in the lower part of Sótano del Resumbador.
Jean Krejca.





Nancy Pistle traverses around rapids in Ojo de Agua Grande. *Charley Savvas.*

and reach our destination. In the last town, our vehicle split off from our five-car convoy to stop for money and whiskey. All of the downtown streets were barricaded and filled with locals, bands, and vendors for a festival. With some directions from the friendly folks, we found an ATM and a liquor store. We stocked up and headed off in solo search of the campsite. Luckily, we had a GPS to guide us down the dusty, bumpy roads to the correct turn through the sugarcane field to the camp. Although it was close to midnight, I could see that there was a flat clearing of groomed grass surrounded by a perimeter of trees, with a lazily flowing stream along one side. This stream is actually a resurgence of an underground river system that we would explore at numerous points during the upcoming week. The campsite was perfect for my tired bones, which were ready for some horizontal time. I slept completely through the night, to awake to cackles and howls of what sounded like a toucan singing to the morning, along with all of the other jungle creatures helping bring light to a new day. After a quick breakfast, we assembled under the pavilion. Ten local environmentalists had arrived, along with the *presidente* of the region. They were cheerful and excited to meet us. The *presidente* had

a whole lot to say. The blank-faced crowd listened politely, since most of us did not speak Spanish. Then Peter introduced himself and us as an expedition that would explore, and document the local caves. The crowd clapped with appreciation, and we all began to mill about.

Peter assembled all of us for a brief overview of the day's tasks. These local environmentalists knew the area and were going to act as our guides for the day. The plan was to scout the entire area for leads and record their GPS coordinates. We would spend the rest of the week exploring and mapping these finds. Peter handed out area maps and issued sketchbooks and instruments while grouping us into teams.

We then headed off into the surrounding unknown. One group of a dozen left in vehicles, while I went with a group of about fifteen to march up into the hills bordering the camp. The fast-paced hike up the trail quickly turned into a forced death-march. We forged up the rocky trail and passed by some coffee plants in the hot and humid jungle. The pace grew beyond the capability of some of the group, who fell out of the journey. We were hot on the trail of unknown caves and were excited to have the guides who were leading the pack. Having

donned my thickly padded caving pants, I was having trouble staying cool and keeping up with the group. I stopped often for water and brief rests to catch my breath while the group ventured farther and farther away. About the time that I was ready to fall out for the last time, I heard a caver whoop that indicated a find. Paul and Stephen Bryant scouted around inside the cave for a few minutes, reporting that it was a crevice cave that pitched down for over a hundred meters and was worth surveying. The passage sloped down along a line that maintained about a 30-degree downward trend for most of its length. I enthusiastically volunteered to stay and help map the cave while the rest of the group marched on through the jungle to mark more leads. Barbara Luke, Stephen, Paul, and I headed down between the limestone walls that rose up 10 meters to the open jungle canopy before the passage jogged over into the darkness. Barbara named the cave Volvo-Driving Soccer Moms. Huge, vehicle-size breakdown descended to a sloping floor that trended downward for a couple hundred meters. There were some pottery shards toward the back of the cave, suggesting an area of offerings, but there was no evidence that this was a burial site. We took a lunch break at another entrance of the cave that was probably only a couple hundred meters from where we had entered, but the jungle was so dense that we decided to trek back through the cave and leave where we had entered. As we headed back down the trail on our way back to camp, we had to rely on the local coffee bean pickers to keep us on the right trail.

Back at camp, folks were gathering under the cabana. Peter Sprouse had a laptop and card reader to capture the digital photos that had been taken over the course of the day. He also had set up a projector to show everyone's photos to help conjure up interest in the various caving options available for the next day. The group of cavers watched the show while eating dinner, visiting about

their day's adventures, and setting agendas for the rest of the week.

The second day, I went with Aimee Beveridge, Geoff Hoese, Kori Jones, and Barbara to Cueva el Encanto a few kilometers up the road. The vertical entrance passage was at the foot of a limestone cliff and descended back under the hillside at a steep angle for a hundred meters before leveling out into the flat, silt-covered floor of a single tall dome that was about a hundred meters wide. The floor had stalagmites growing out of it that were jagged and rough, which was probably due to how far the drops fell and splattered to create them. The survey was dubbed New York, since one of the formations looked like the Statue of Liberty. The draperies that lined a section of the wall extended up several meters, where there was an area to climb and corkscrew around to a balcony that looked over the entire room. It was odd to look out and not be able to see the walls or ceiling across this vast cavern. After a full day of surveying, we headed back to camp.

That evening, while telling the story of how he had scraped up his hand, Philip Rykwaldler described a ferocious underground river that got my adrenaline pumping and convinced me that water caving was the way to go. The next day, I joined up with Philip, Matt Oliphant, Nancy Pistole, Charley Savvas, Herb Laeger, and others to explore a cave at the resurgence just upstream from camp, Cueva del Ojo de Agua Grande. I had experience in the lazy water passages of Honey Creek Cave, which was similar to this cave, but only at the wide points. Here, where the passage narrowed the water turned into wild rapids. As I followed the more experienced members of the crew, I had trouble hanging onto the edge, and I slipped and fell into the water. After floating downstream a few meters, I was able to grab the bank and try again. We surveyed upstream, with Matt setting bolts for traverse lines in the water-scalloped limestone walls. The passage terminated where the water rose and where we took a break for lunch. We scouted and surveyed up dry side passages in attempts to find

a way around the sump, but these all ended, which finished off our surveying for the day. As we were leaving, I was trying to traverse back up the ledge around a white water, when the fast-flowing water knocked my feet out from under me, and I bounced around in the foaming water, still tethered to the traverse line. Everyone watched me struggle for a minute that seemed like an eternity before I finally got a grip on the shore and climbed into a pocket that was just centimeters above the water line. Matt and Herb then jumped down to rescue me and help me out of the little cubbyhole that I managed to crawl into. I was embarrassed to have fallen in again, but I was glad that they were able to assist me. We made it back to camp before dusk.

The next day was incredibly exciting. Sótano del Resumbador was the coolest pit that I had ever dropped into. In fact, it was the first, because at the time, my only vertical experience was either at rope night in the trees or at the Urban Assault Wall back in Austin. Jean Krejca had led a team into the pit the day before, and the ropes had been left set up. The line of rebelay's down the edge of the pit gave me no trouble, since each of the rebelay's followed only a few meters of down-slope walking. Then I reached the edge of the pit, which was a 42-meter drop to the jagged rocks below. Although I had a comfortable ledge to stand on while passing the rebelay and rig my gear, it was difficult to hide my fear. As I weighted my descender, I was able to conjure up enough courage to focus on the task at hand. Practicing in the trees had instilled the basic steps to follow. I worked more on form and tried to keep a constant speed for a controllable descent, while still noting how the rocks below were rapidly approaching. Upon touchdown, the adrenaline was flowing through my heart, which was beating like

a pump jack, but viewing the moss-covered rocks on the floor while a gentle breeze swirled through the pit was calming. I scampered across the loose rocks along the edge of the floor, since the entire sloping floor was in the fall zone for any rocks that might get knocked loose above.

The previous day, Jean's team had surveyed the one-hectare floor of the pit, and Paul had found a passage that led off to another big drop. Charley Savvas, Philip Rykwaldler, Stephen Bryant, Matt Oliphant, Nancy Pistole, and a Veracruz caver named Guillermo Gassós were on a team that descended first to rig and descend the second drop. Jean, Seth Spoelman, and I started to survey the passage that led from the bottom of the entrance pit. It was basically a corridor that remained relatively flat. There was a waist-deep pool of standing water filling a short section that we had to wade through, but the survey advanced quickly, with Jean encouraging us to move on as she sketched. We stopped just before the second drop for lunch, and we could hear and feel the ominous rumbling of water below. Our 2-meter-high passage ended about two-thirds of the way up a 60-meter dome pit. The

Paul Bryant and Stephen Bryant sit at the top of a waterfall in Sótano del Resumbador. *Jean Krejca.*



view was breathtaking. A mist filled the room and hid much of the view. An underground river was gushing out of the side of the dome in twin waterfalls from openings below us and was roaring and raging as the water spewed into a plunge pool that fed violent rapids. We could see the headlamps of the advance-team members surveying on the floor 39 meters below. Our team's task was to survey to the bottom of the drop. Armed with only a 30-meter tape, we were going to have to measure in stages. Seth had explained the elaborate signals needed to communicate over the roar of the waterfalls. He was to descend down to 30 meters and tug on the tape three times, and I would release the end of the tape. He could then measure from that point to the floor. As he bounced on the rope during the descent, it felt like three tugs, and then another three tugs. So I let go of my end, but he

was only half way down.

Then it was my turn to rig in. I was concerned that the water running down the rope would make it slippery. As I weighted my descender, Jean recognized my fear and tried her best to calm me by saying, "It's all you Gary!" I really wanted to say how scared I was, but instead I put confidence in my gear and started down. As the rope fed through my descender, the water sprayed off like from a bicycle tire through a puddle. Philip saw us dropping in and came back to show us the route to the survey crew. The walls along the floor were a series of rimstone dams that held back hot-tub-size pools. We made our way along a ledge to a short gap across a 6-meter drop. It was just beyond stepping distance, and it took some encouragement for me to jump across. The survey was running down a whitewater passage where there were elaborate traverse

lines rigged. Since we could see that it was going to sump in a hundred meters, Seth and I started heading out so that we could try again to measure the depth of the second drop and not cause a bottleneck for the advance team. The ascent was just as scary, but I had the task of measuring the drop to occupy me. My legs felt rubbery as I made it up the second climb and out of the entrance pit. A satisfying rush of accomplishment flowed through me as I removed my vertical gear before hiking back to camp to share my experience.

I had no idea what I was in for when I started this epic journey, announced as Caving in Veracruz. My level of caving experience increased from a novice to an advanced intermediate in one trip. I had a great adventure that I shared with some incredible folks.—*Gary Franklin*

Veracruz 2007

Espeleólogos de los Estados Unidos, Veracruz y Oaxaca visitaron un área cerca de Orizaba en la primavera de 2007. Exploraron alrededor de 3 km en siete cuevas y visitaron algunas otras. Dos espeleólogos relativamente nuevos reportan sus impresiones del viaje.

FAUNA OF VERACRUZ-AREA CAVES

Jean Krejca
photos by the author

During the spring 2007 Veracruz trip led by Peter Sprouse [see trip reports in this issue], we encountered several cave species I'll briefly comment on here. Many cavers were involved in documenting the species there, but I'd like to particularly thank Goeff Hoese for his excellent observational skills and assistance with photography.

Figure 1 shows an aquatic isopod from Cueva el Encanto, probably *Brackenridgia bridgesi*. Figure 2 shows another aquatic isopod from the same cave, probably *Cyathura sbordonii*. Figure 3 is a crayfish,

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probably *Procambarus rodriguezii*, which we found both in Cueva el Encanto and Sótano del Resumbador. Moving to arachnids, Figure 4 is an amblypigid from Cueva el Encanto, possibly *Tarantula fuscimana*, and Figure 5 is a bug's-eye view of the same amblypigid from another cave, Cueva del Cabrito.

From Cave of the Volvo Driving Soccer Moms, we saw a scorpion, probably *Vaejovis gracilis* (Figure 6), and a harvestman, possibly *Stygnopsis robusta* (Figure 7). A close-up of a male of the same harvestman from Cabrito shows enlarged palps and sharp dorsal spines (Figure 8). The same type of harvestman were seen

but not photographed in Cueva de los Cuatro Mujeres.

At Cueva de los Cuatro Mujeres, Sandra and Alisa Denny and Kara Savvas helped me examine the bat population. We found both *Artibeus* and an extremely small vespertilionid, probably a *Myotis* (Figures 9 and 10). Finally, from the entrance areas to most caves there, no caver (particularly Charley Savvas, whose neck was the landing spot of a spider I was handling when it bit me and I flung it across the room) will forget the exceptionally large, black, hairy ubiquitous fishing spiders in the family Pisauridae (Figure 11).

Fauna de las Cuevas del Área de Veracruz

Fotografías de los animales vistos en las cuevas durante el viaje al sur de Veracruz en 2007.



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9

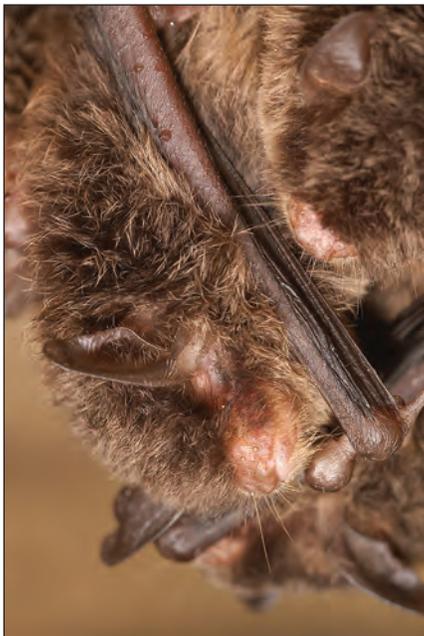


Figure 10



Figure 11



EL RESUMIDERO DE PIEDRA AGUJERADA

Miguel Ángel Blanco Rodríguez,
Cuauhtémoc Sánchez Arellano,
and Sergio Sánchez-Armáss Acuña

Since 1987 members of the Asociación Potosina de Montañismo y Espeleología have known about the obvious *dolina* near the entrance to Resumidero El Borbollón in San Luis Potosí. Three small seasonal streams enter the sinkhole, but the area where the water sinks was covered with sediments deposited over the decades. In 1994, Vico Jones and Sergio Sánchez-Armáss checked the sinkhole and talked about digging where the water sank. A couple of years later, Raúl Puente Martínez, Gretchen Reinhart, and Sergio visited the sink, and again thoughts of digging were prompted by the possibility that the water that sank there might flow into Resumidero El Borbollón, whose entrance was just 320 meters away and 26 meters lower than the bottom of the doline.

In August 1998, eager to find a connection into the Norbert Casteret Section of Borbollón that had been discovered by the APME in March (see *Tsaval* 6 and "Mexico News" in *AMCS Activities Newsletter* 23), Cuauhtémoc Sánchez Arellano, Salvador González Murillo, Juan Cancino Zapata, and Sergio went to check the sink, because it had been raining non-stop in the Sierra de Álvarez for several days. At the bottom of the sink there was a lot of water rushing into a pool about

4 meters in diameter and 1 meter deep. After four hours of looking for other caves in the area, they returned to find the pool half its earlier size. Quite excited, they began to plan the digging operation.

On September 6, 1998, Miguel Jones, Celeste Rosas, Rocío Medina, Miguel Blanco, Luis López Romero, Enrique Mancera, Guillermo Martínez, Gerardo Morrill Corona, Cuauhtémoc, Juan, Salvador, and Sergio began digging. During the second weekend, they got down to rocks and a small opening about 20 centimeters in diameter from which air was blowing. Shovels and picks were exchanged for sledge hammers, and the work continued for several weeks. Miguel Jones was the one hauling out the blocks, and Luis became an expert at cracking rocks with the hammer. On November 8, Salvador suggested recruiting two quarry workers from Guadalcázar, Benito García and Urbano Vázquez. With their help, rapid progress was achieved that day. Toward sunset, a big rock was removed, exposing a vertical crack through which a small chamber was seen.

Salvador was the first one to go through the crack, and Celeste and the others followed. Celeste soon found a very narrow, twisted crawlway, and without thinking twice, she went in. Everybody was waiting expectantly, listening to her grunting, when suddenly she yelled that she was standing in a fair-sized chamber. The team joined Celeste, and Salvador reported that at the other end of the chamber there was a 10-meter pit.

Everybody gathered at the edge of the pit and listened to stones that fell into water. They celebrated by splashing themselves with water found in a nearby pond.

Back outside, they admired the excavation. It measured 4 by 2.5 by 4 meters in length, width, and depth, respectively, and around the hole lay 150 sacks, weighing 50 kilograms each, filled with dirt. That night, nobody was able to sleep for thinking about what lay beyond the pit.

Monday night, November 9, at 10 p.m., Celeste, Cuauhtémoc, Guillermo, Rocío, Luis, Salvador, Miguel Jones, Miguel Blanco, Enrique, and Sergio prepared to descend the pit. The honor of being first fell to Cuauhtémoc, who won the lottery. Screams of "keeps going" and "another pit" dispelled their worst fears. The third pit dropped them into the center of a very cold lake with water to their chests. The next pit led them to a half-moon pool, with water to their waists and no obvious place to go. Maybe it was a sump, the caver's worst nightmare. Cuauhtémoc thought the way on was near one corner, and Guillermo gave it a try, but could not get through. Everybody was cold and tired, and it was already 4 a.m., so, quite disappointed, they left, telling themselves they would come back soon. At least the cave was about 40 meters deep, so even if they could not get through the sump, the digging had still been worth the effort.

During the next regular APME meeting, the name Resumidero de Piedra Agujerada was chosen

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Reprinted from English version of an article, translated by Omar Sánchez-Armáss Cappello and Sergio Sánchez-Armáss Acuña, in *Tsaval* number 7, July 2007.

because of the nearby big rock with a hole in it that since 1988 had been the symbol of the Proyecto Espeleológico Sierra de Álvarez.

On November 28, Charley Savvas of the AMCS, Vico Jones, Oscar Berrones, Cuauhtémoc Sánchez Arellano, and Rosa María Balbanera

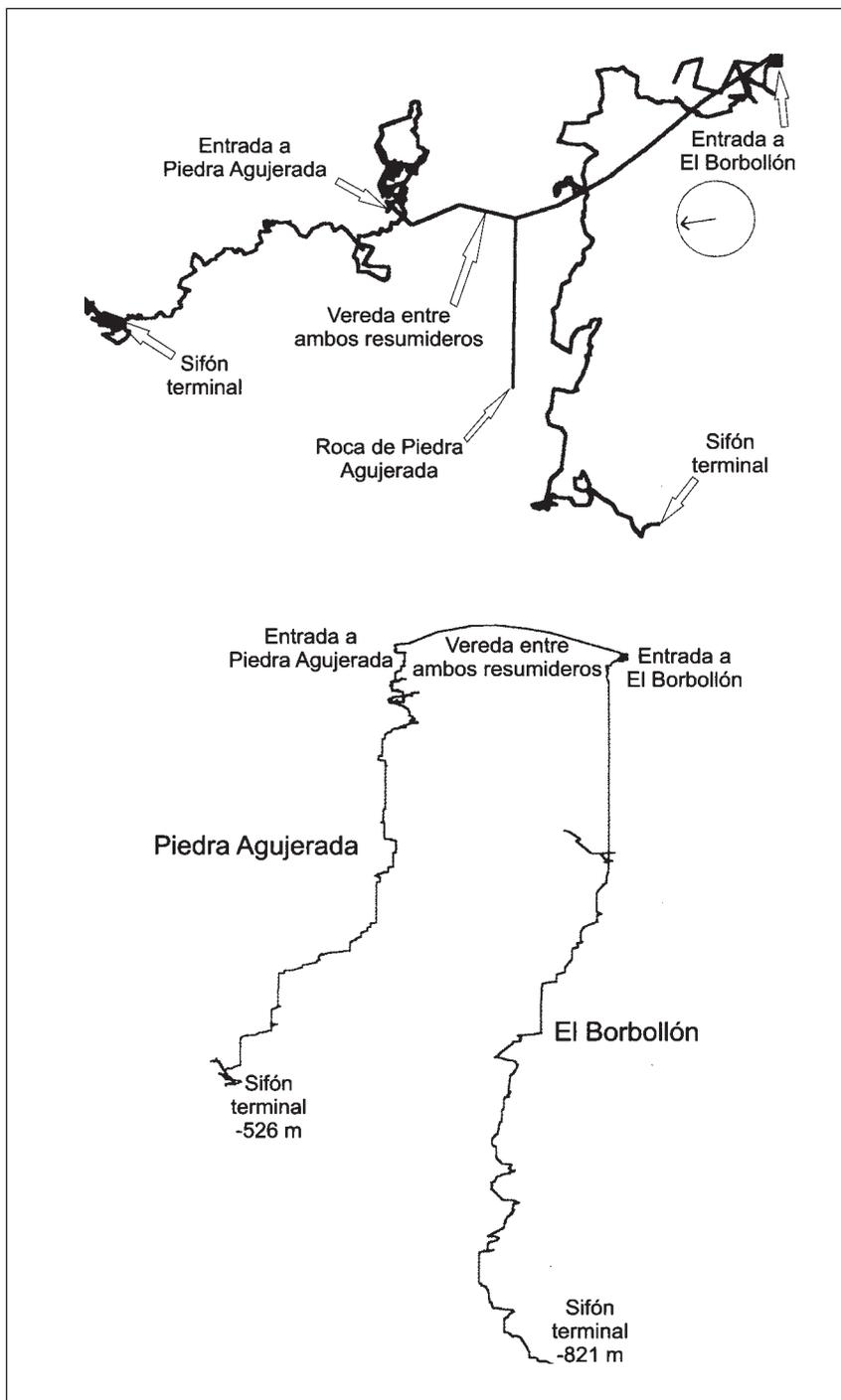
went to the cave. Oscar succeeded in passing the sump and broke the rim of a gour to lower the water level. Charley and Cuauhtémoc followed him, and they noticed that it had not really been a barrier, because a vertical crack hidden behind a wall led to a bypass. This passage came from a big room with very

large gour. Following the water a short distance, they came to a climb down a wall to a pool and a series of smaller gour that took them to a room with a large mass of flowstone and another sump. The explored part of the cave was now about 50 meters deep.

On December 13 and 29, Juan Cancino Zapata, Raúl Puente Martínez, and Sergio Sánchez-Armás surveyed the cave up to the second sump and also made a surface survey from the Piedra Agujerada entrance to that of Borbollón. Everybody hoped that the two caves would connect, but the second sump was a big problem. The pool was ellipsoidal in shape, 3.2 by 2 meters and 1.5 meters deep. One side of the pool was delimited by the submerged part of the flowstone. Despite the fact that the water got muddy very quickly, various attempts were made at different places to probe for a continuation, without success. Cuauhtémoc believed the passage ran under the flowstone ceiling and made several attempts there, but the visibility dropped to zero. In one of these attempts he saw a large air bubble clinging to the ceiling that seemed to indicate the direction where the passage lay.

At APME meetings a plan was devised to lower the water level in the second sump. The idea was to use four hose sections, each 3 meters long and 10 centimeters in diameter, to siphon the water out of the large pools located below the third and fourth drops. If this large volume of water did not increase the level in the second sump but flowed on through it, we would then try to pump the water out of the sump up into the pools just emptied. Easier said than done, because the higher empty pool was 6.5 meters higher and 15 meters away from the sump, and the other was 5 meters higher and 11 meters away. Obviously, we needed help from Mr. David Solís, a very good friend of the APME.

On January 17, 1999, David Solís lent us the hose we needed. Celeste Rosas, Enrique Mancera, and Rosa María drained the higher pool, and simultaneously Luis López Romero and Cuauhtémoc drained the lower pool of the first sump. Salvador



Area plan and profile showing the relationship between Piedra Agujerada and Borbollón. The profile is looking west.



Celeste Rosas placing a bolt. *Sergio Sánchez-Armáss.*

González Murillo and Sergio sat by the second sump listening to the rumble of water rushing down the pits, watching it fill the gour before rushing into the sump pool. They checked the water level, previously marked, and happily verified that the water did not rise.

According to the plan for pumping the water, the submersible pump needed to be 129 meters from the entrance at a depth of 50 meters. We needed gasoline for a generator, 140 meters of power wire, and a similar length of telephone wire. We went again to talk to David, who lent us the generator, the water pump, and a pair of marvelous old World War II telephones. Very enthusiastically, APME cavers planned and organized for the big day. Everyone's collaboration would be required for the myriad tasks.

On January 31, Celeste Rosas, Rocío Medina, Nataly Ibarra, Miguel Jones, Enrique Mancera, Miguel Blanco, Luis López Romero, Juan Cancino Zapata, Salvador González Murillo, Gerardo Morrill Corona, Gustavo Samperio, Rafael Esparza, Jorge Landeros, and Sergio Sánchez-Armáss gathered at the

Speleothems that look like pottery. *Sergio Sánchez-Armáss.*

cave's entrance with all the necessary equipment for the task. Once the electric and telephone lines were laid, the water pump tested, and the hoses to the pool at the bottom of Tiro de la Poza were installed, the team gathered at the entrance for a well-deserved meal and some rest. Salvador and Sergio entered the cave around 10 p.m. to man the pump. We would alternately pump water from the sump up into the lower of the reservoir pools and then from it to the higher pool. They needed to stop the generator frequently to check its oil and gas levels, so the phones rang frequently when we needed to turn the pump on or off or move the pump to a new location. After eight hours, quite excited, they called the surface team to let them know that the water level was low enough to attempt passing the sump, and that they would call back again with news of what lay beyond.

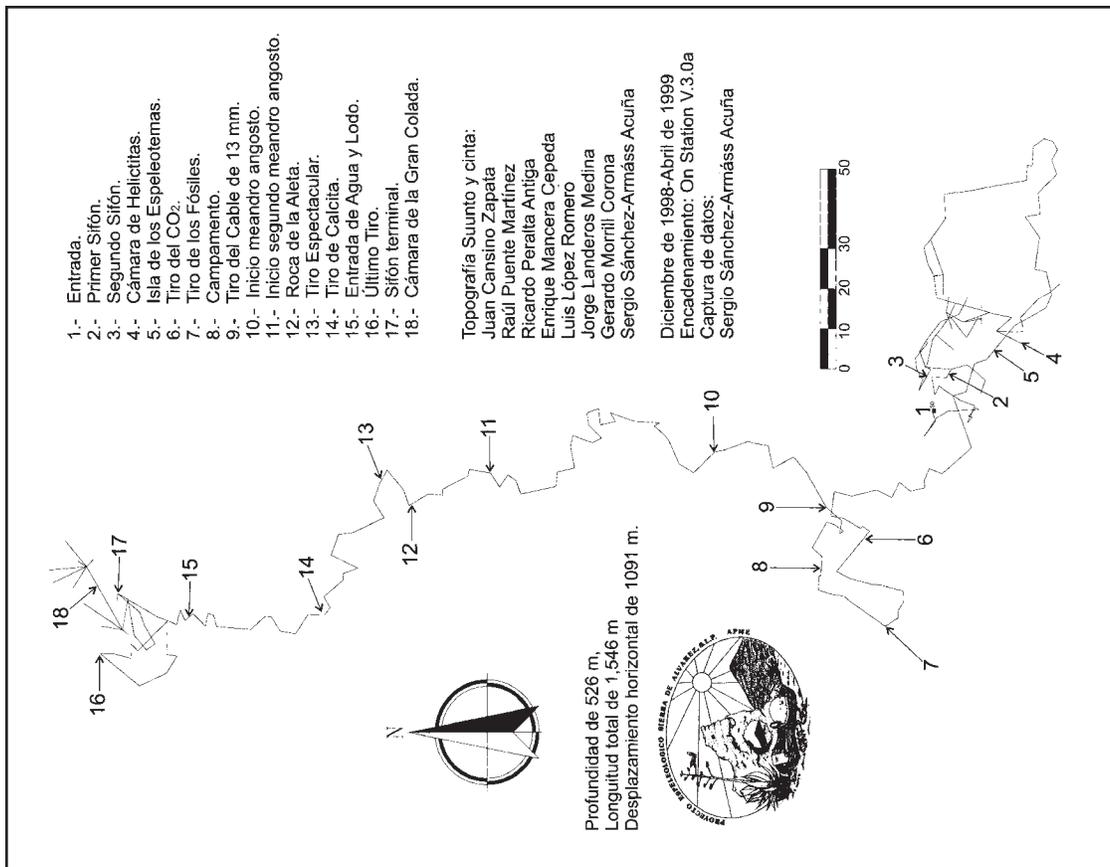
The space between the ceiling and the water was so small that they had to take off their helmets to pass the 3-meter-long pool to a partially flooded 4.5-meter-long passage with gour. Beyond the last gour, there was a large pond with water up to the chest. It led to a small room and a very narrow passage that took them to a large gour at the top of a 12-meter drop. Enthusiasm exploded, and they quickly returned to the phone to tell the anxiously waiting surface team the excellent news and ask them to bring down some ropes. The dam downstream of this sump, too, was later modified so that the sump would not refill during the

next rainy season.

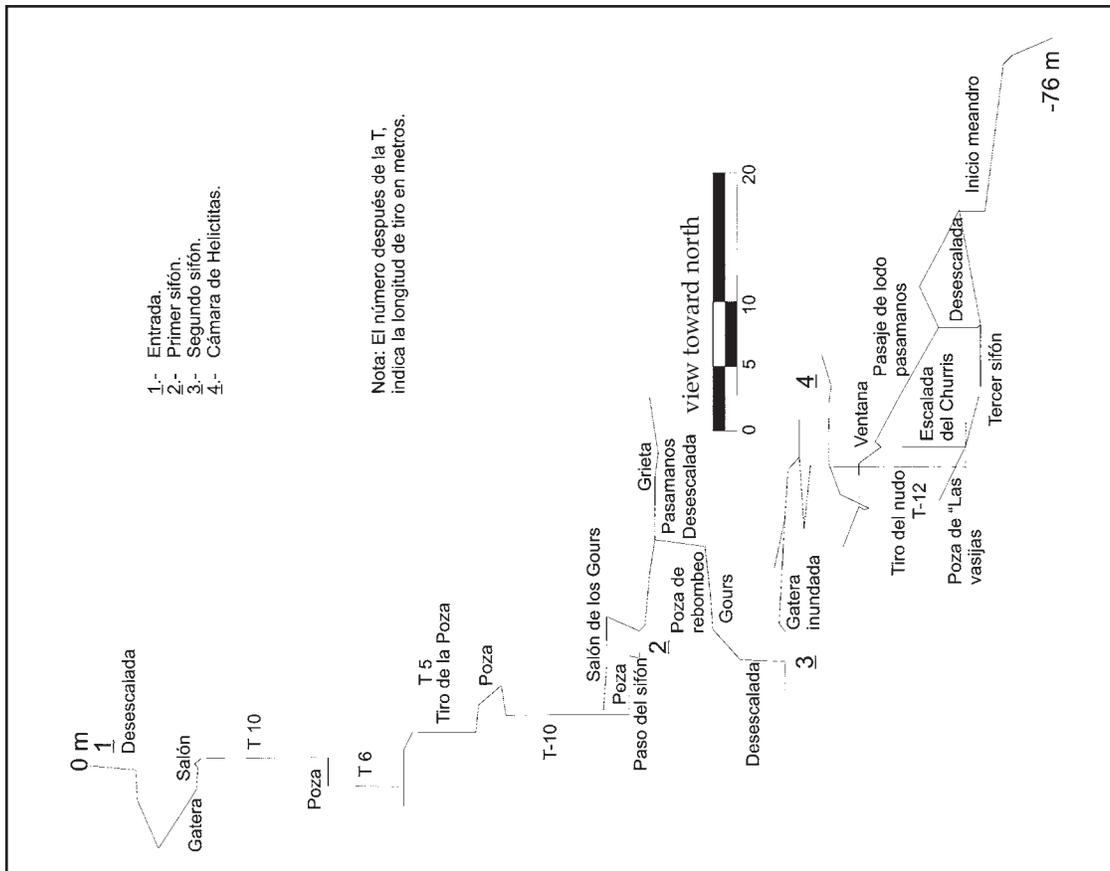
While waiting for the others to arrive, Salvador and Sergio had some hot coffee. Jorge, Gerardo, Luis, Miguel Blanco, and Enrique arrived shortly. The group descended the new pit to a shallow pool where they saw several strange formations that resembled bowls or ceramic pots. There was a large room that went nowhere, but the trickle of water guided them to . . . another sump! They could not believe such bad luck. There was no place nearby to pump water into, and this third sump was too deep in the cave, anyway, for us to pump out with the available equipment. Frustrated and desperate, Salvador and Sergio had started to remove mud from the sump to make its entrance larger when Gerardo told them that there was a window about 7 meters above them and that he would try to climb to it. In a heartbeat, Gerardo reached the window and was out of sight. A few moments later he came back and told them that there was a passage that bypassed the sump. Due to Gerardo's climb, the situation had changed completely. They could not believe their good luck.

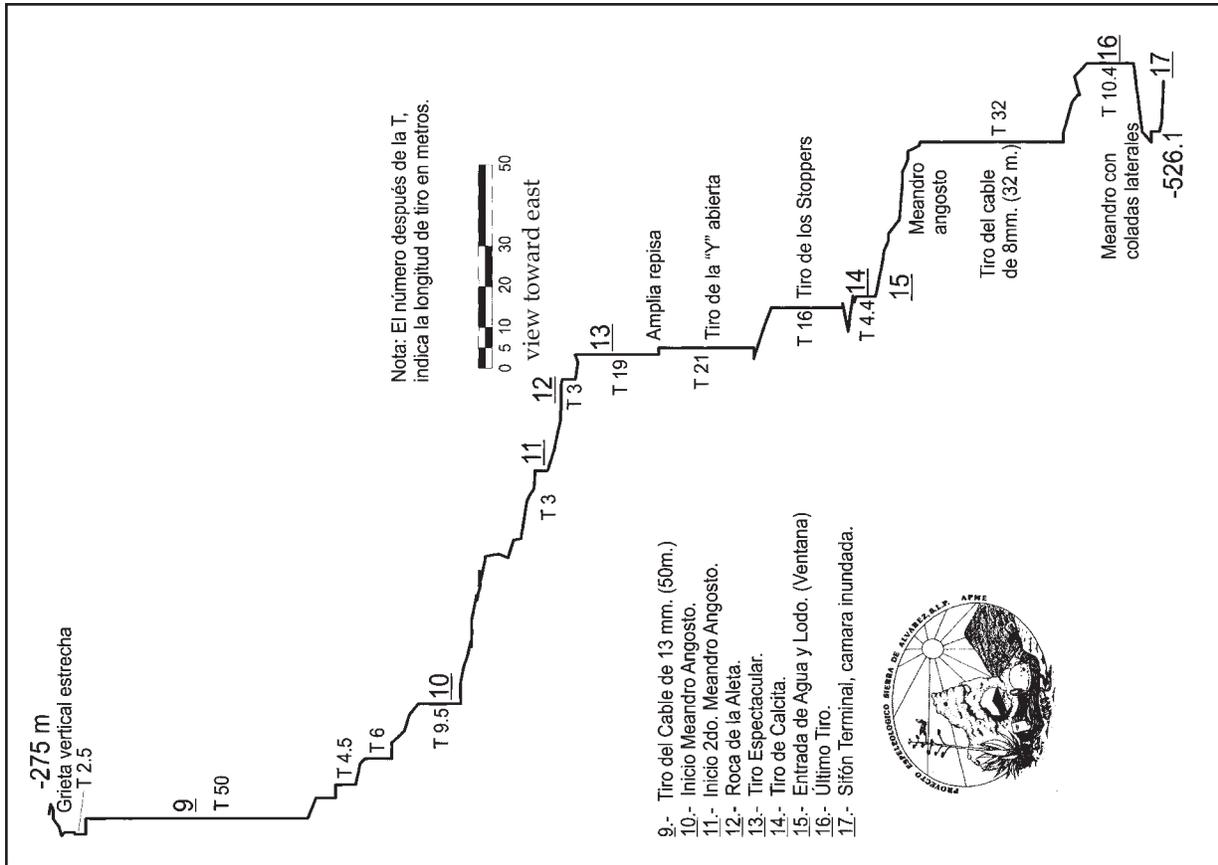
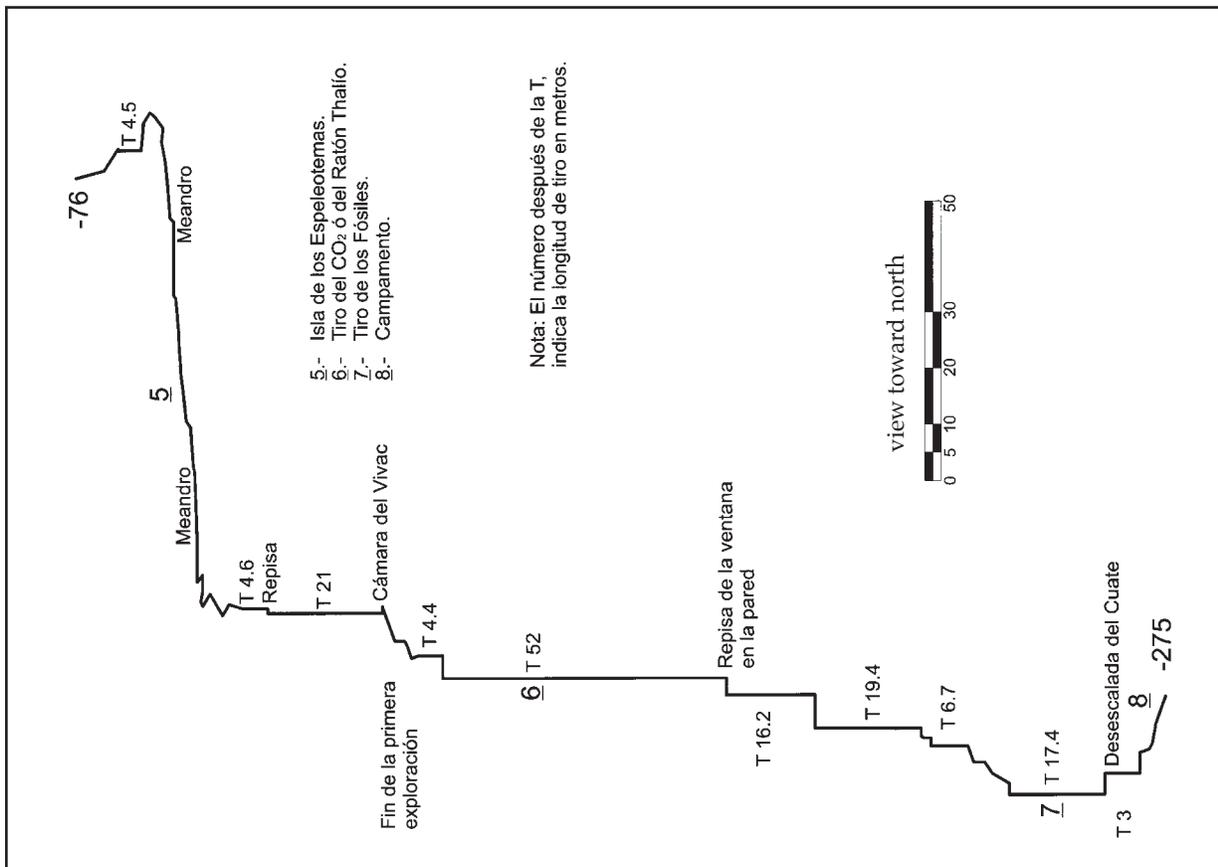
Gerardo rigged a rope, and they all went up. To the right of the window there was a chamber full of helictites, the most beautiful of which were a three-cycle sine wave, a three-fingered claw, and an omega figure. To the left of the window was the long passage that finally took them to the other side of the third sump, which was at least 10 meters long. Jorge, Gerardo, and





Plan and profiles of Resumidero de Piedra Agujerada.
Note that the partial profiles are all to different scales.





Sergio followed the stream for a while, until they detected a high CO₂ level. They kept going, down one pit and to the rim of a second, where they were out of rope. Tired but happy, they returned. Beyond the first sump, they caught up with Miguel, Luis, Enrique, Celeste, Rocío, Nataly, and Cuauhtémoc, who were carrying out the pump, phones, and other equipment.

Gerardo Morrill Corona, Sergio Sánchez-Armáss, Miguel Blanco, and Miguel Jones continued the exploration on February 7, reaching a pit with walls of calcite flowstone, where the effect of CO₂ on breathing rate was more pronounced. On February 14, Miguel Blanco, Celeste Rosas, Miguel Jones, and Enrique Mancera descended the Calcite Pit and found another drop, estimated to be 70 or 80 meters deep. This was a serious problem, because of the danger that the CO₂ concentration would increase suddenly at any point in the rappel. This pit was named Tiro del CO₂. At an APME meeting, it was decided that a rescue-hauling system had to be rigged at the top of that pit and a few meters down, so that we would be able to rapidly extract a caver who lost consciousness. No one would go down the pit before the rescue system was ready.

Some APME members entered the cave at 6 p.m. on February 20. Juan Cancino Zapata, Ricardo Peralta, and Enrique surveyed from the second sump to Gerardo's climb. Juan, Ricardo, and Sergio Sánchez-Armáss surveyed the Cámara de las Helictitas. At 6 a.m., Juan and Enrique headed out. Ricardo and Sergio extended the survey to near Isla de los Espeleotemas. Ricardo turned back at that point, but Sergio decided to check on the team that was rigging Tiro del CO₂. When he reached them, Gerardo was finishing placing a rebelay 10 meters below the top of the pit. Sergio asked about the rescue system, and Miguel Blanco told him that it was not feasible to install an adequate hauling system because of the narrow opening at the top of the pit and the bad rock in the

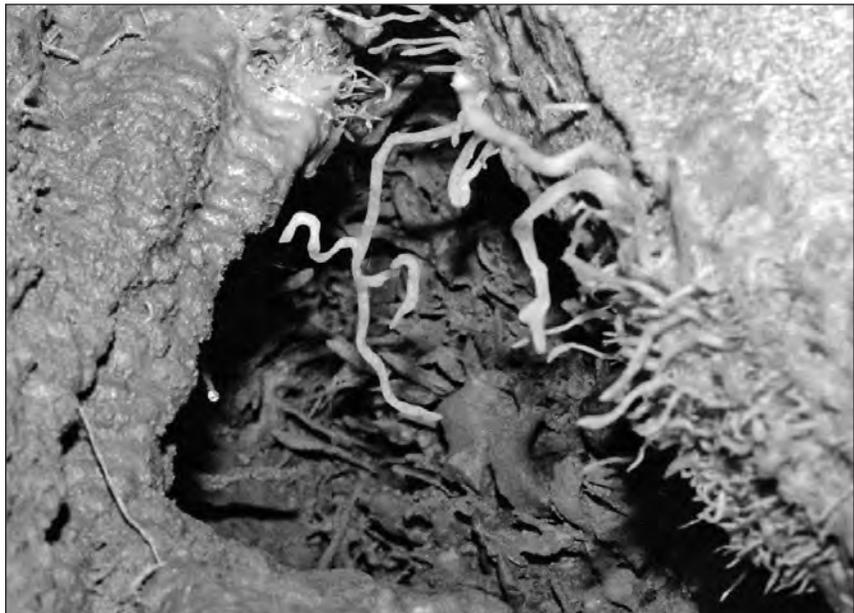
top 10 meters. So they had decided to rig the pit without it. Gerardo climbed back out of the pit, hyperventilating and saying that he had a terrible headache and would head out with Celeste, who was not feeling well either. Who would go down? Sergio had been surveying all night and was tired. Miguel decisively broke a long silence by saying that he would go down. Wishing him good luck, Gerardo left.

Sergio, giving "psychological support" to Miguel, told him to maintain communication at all times during the descent, to check his pulse from time to time, and to start back up the rope at the slightest sign of dizziness. Miguel went down slowly, and eventually he reached a ledge 52 meters down, where he reported that the air was about the same and there was another pit about 20 meters deep for which he needed more rope. Sergio, as if a spell had been broken, forgot his tiredness and fear and joined Miguel at the ledge. What a view! The cave opened up, with high clean walls. Sergio commented that it would have been nice to have a test-mouse, like in Borbollón, but, on second thought, it wasn't necessary because they had a "Thalio-mouse"—Miguel's nickname, which became the pit's official name. Miguel did not appreciate the thought and, grunting, he started to place a bolt. They rigged the drop with a Y and went down.

They noticed that still the CO₂ level did not seem to be increasing. Although they were breathing heavily, it was not as bad as at the bottom of Borbollón, so they kept going through some meanders and down two more pits before running out of rope at -239 meters and starting the long trip out.

They reached the surface after a thirty-nine-hour trip. The weather was very cold and windy, with poor visibility in the fog. Slowly they climbed out of the doline, and Sergio said that it would be fantastic if there was a campfire near the cars, but since it was well past 10 p.m., surely nobody would be around. But they kept walking and suddenly saw a big camp fire where Celeste, Luis, and Gerardo were waiting for them with hot soup—true friendship among cavers.

The following weekend, Miguel and Sergio reached the bottom of Fossil Pit, where Rocío Medina and Cuauhtémoc Sánchez Arellano joined them. Cuauhtémoc climbed down a 3-meter tube a short distance away and vanished into the meanders. He came back saying that about 40 meters ahead there was another deep pit. On March 6 and 7, Salvador González Murillo and Gerardo rigged that 50-meter pit with a 13-millimeter rope that was very hard to descend with rappel racks. Nataly Ibarra and Cuauhtémoc joined them, and the



Sinusoidal helictite in the Salón de las Helictitas. Sergio Sánchez-Armáss.



Formations in the Isla de Espeleotemas. Sergio Sánchez-Armáss.

team descended four small pits to about -390 meters before turning back. On March 13 and 14, Salvador, Miguel Blanco, Cuauhtémoc, and Enrique set up a camp at -275, at a lake above the Tiro del Cable de 13-mm. There were five hammocks. Due to the low oxygen and high CO₂ levels, it was quite hard to light the propane/butane gas stoves. The weekend after that, Jorge Landeros, Enrique, Cuauhtémoc, and Sergio extended the survey from Isla de los Espeleotemas to Tiro del CO₂ at -143 meters.

The weekend of March 27 and 28, Gerardo Morrill Corona, Celeste Rosas, Guillermo Martínez, and Sergio Sánchez-Armáss carried more ropes into the underground camp, where they slept for a few hours. Below, beyond the 13-mm pit, they found a long section of very narrow canyons where they suffered while moving ropes and cave packs. Beyond, they descended a 19-meter drop, Tiro Espectacular, to a wide ledge with a beautiful view of walls of thick-bedded limestone. The next pit, 21 meters, was rigged with a very wide Y-hang. After

two more pits, they found a zone of breakdown in a descending canyon. Along here there is a large room with walls covered by mud and a large, high window from which water trickles and that was not explored. The descending canyon was narrowing, making them fear that the passage would end abruptly. Fortunately, the cave opened back up at the top of a 30-meter new pit. A few meters beyond the bottom of that was a 10-meter drop, at the bottom of which was a narrow stream passage with water above their knees and bounded on both sides by flowstone. After following this for about 50 meters, they found a small pool 1.5 meters in diameter. Another sump! Contributing water to the sump was a side-passage covered with thick mud. Thinking that it might bypass the sump, they

followed it. At the other end they found a room where a small stream falls in on the right side. Gerardo climbed the 3-meter wall and entered a steep crawlway. Beyond was a large room that was named Cámara de la Gran Colada for its huge flowstone 18 meters high and 12 meters wide and the long curtains hanging from the ceiling. Sadly, exploration of the chamber revealed no way on at floor level. Celeste and Guillermo returned to camp. Gerardo climbed the flowstone, making a traverse from left to right halfway up, and then climbed straight up, with Luis and Sergio following behind.

The top of the flowstone was covered by gours, and there was a central column that grew below a window in the ceiling. The back walls were covered with small helictites. Gerardo climbed the column and vanished into the window. He told them that it was at the bottom of a 20-meter-high dome down which water was dripping. Clearly, the only available option was to find a way to bypass the sump; otherwise Piedra Agujerada was finished. They wondered what the total depth was.

On April 3, Cuauhtémoc Sánchez

Arellano and Miguel Blanco descended to the terminal sump to look for a way on. Once in the pool, Cuauhtémoc thought that it might be passable, because he saw a flooded area with 2 centimeters of airspace that could be worth exploring. However, visibility was lost, and they started the very long trip back to the entrance. From April 10 to 13, Jorge Landeros, Luis López Romero, Enrique Mancera, Gerardo, and Sergio extended the survey from the Tiro del CO₂ to the camp, where they slept for a few hours before going to the terminal sump. Sergio added 10 milliliters of fluorescein in a dense sucrose solution to the sump. The idea was that the dense mixture would keep the dye from diffusing too quickly, and we would be able to observe its drift with the current, but the fluorescein slowly descended straight to the bottom. Luis and Enrique returned to camp, while Jorge, Gerardo, and Sergio surveyed from Cámara de la Gran Colada back to camp. When they arrived, Luis and Enrique left for the entrance. In the comfort of the hammocks, Gerardo, Jorge, and Sergio slept for seventeen hours. Finally, they left the cave after an eighty-one-hour trip.

Cuauhtémoc, Miguel, and Sergio entered the data into *On Station* v3.0a. They contemplated the result with satisfaction. Resumidero de Piedra Agujerada has thirty-three pits, the longest being 52 and 50 meters. It has a total depth of 526 meters, a survey length of 1,546 meters, and a horizontal length of 1,091 meters. Digging out the entrance and emptying the second sump were well worth the effort.

Once the cave had been derigged, one important task remained. In order to prevent the cave entrance from being blocked again in the imminent rainy season, a wall surrounding it needed to be constructed. Funds were raised from APME members, as well as Charley Savvas and Terry Raines of the AMCS. The wall, resembling the top of a well, was finished on June 26, 1999. It was 6 meters tall and extended 1.3 meters above the ground.

In April through June of 2004, Piedra Agujerada was rigged again,

and an attempt was made to pass the final sump. Cuauhtémoc Sánchez Arellano and Enrique Mancera reached the sump, and Cuauhtémoc free-dived with a powerful dive light to explore the flooded chamber. He could not see any obvious place to go. All the water in the 50 meters of passage there is either static or else flows out somewhere through the flowstone around the lake.

Others involved in the rigging and derigging in 2004 were Alfredo Silva, Luis López Romero, Salvador González Murillo, Sergio Sánchez-Armáss, Cyntia Chincilla, Yazmín Ávila, Miriam Oyarvide, Claudia Arriaga, Francisco Delgado Palomo, Fernando Manzaneque, Gustavo Samperio, Guillermo Martínez,



Gerardo Morrill Corona, Jorge Landeros, Miguel Blanco, Ricardo Peralta, Omar Gutiérrez Tapia, Israel López Cabello, Eleazar González Ochiui and Omar Sánchez-Armáss Cappello.

We do not believe that Piedra Agujerada is a closed chapter. It is possible that the water level in the final sump may be lower or even dry up some day, or we may follow up some of the unexplored leads, including the high window near the bottom.

We want to thank Mr. Matías Alvarado for allowing us to dig and camp on his land during the exploration and Mr. David Solís for his support and friendship.

El Resumidero de Piedra Agujerada

Espeleólogos de la APME en San Luis Potosí exploraron esta cueva hasta una profundidad de 526 metros en 1998 y 1999. La entrada fue encontrada al excavar en un dolina no muy lejana al Resumidero El Borbollón. A pesar de los altos niveles de CO₂ en el ambiente en las partes profundas de la cueva, se estableció un campamento a -270 m durante la exploración. La cueva fue visitada de nuevo en 2004, pero no se encontró una ruta alterna para evitar el sifón final. Sin embargo, la cueva podría aún continuar.

MEXPÉ 2006

Doug Monroe



In April, the Société Québécoise de Spéléologie ran Mexpé 2006, its fourteenth annual expedition to the Sierra Negra in Mexico. An international group of fourteen cavers, including four first-timers like me, spent nearly a month camped out in the jungle, finding and mapping about 8 kilometers of cave, and bringing the Mexpé total to roughly 60 kilometers since 1987. Along the way I did bigger and badder caving than I'd ever done before, was pushed to the limits of my endurance, learned a variety of new and exciting French phrases that can't be used in polite company, and got completely hooked on expedition caving.

When planning for Mexpé 2006 kicked off in October of 2005, the expedition team settled on three main goals for the expedition:

- To re-locate Sumidero del Año Nuevo, a cave discovered on one of the earlier expeditions, and to look into an apparent lead that had never been followed up. Steve Worthington, who had been in the party that had discovered and surveyed the cave, had noted that the main passage seemed to continue on the other side of an 80-meter pit. We planned an attempt to bolt our way around the edge of this pit and explore this continuation.

- To explore areas of the Hoya Grande, a large depression south of the village of Tepepa, that had not

previously been explored. The size of this sink, almost 1 km long by several hundred meters wide, meant that its lowest point had not yet been seen. A particular focus of this effort was to attempt to find a connection between Gimnastica Selvática and La Ciudad farther south, or, failing this, establish that La Ciudad was part of a different hydrological system than Selvática, Las Brumas, and the Sistema Tepepa.

- To investigate some interesting leads to the south of the main expedition area, near the village of Buenavista, notably Las Tres Quimeras, which cried out for a proper exploration and survey. Following a rescue-turned-national-scandal involving a team of British cavers in 2004, Mexpé 2005 wound up being a scaled-down ridge-walking trip by four SQS members, and they found these leads.

With these goals in mind, all we needed was a plan and a whole lot of gear. Fortunately, we received generous sponsorship from Mountain Equipment Co-op, Calgary-based Textile Outfitters, Puget (the French maker of *maillon rapide* quicklinks), and Biotek, a Quebecois energy bar company. Their donations of equipment, camp supplies, and food made for a well-supported expedition, but, as always, we had our work cut out for us to organize the myriad other things upon which a successful expedition depends. Luckily, there were enough participants to spread the work around. The expedition team consisted of Chris Chenier and me from the Ottawa/Gatineau area; Guillaume Pelletier, Matthieu Lévesque, Pierre Provost, Michel

Cadieux, Daniel Caron, Jocelyn Moreau, Gaël Hervé, and Luc Le Blanc from Montreal; Diana Gietl, a long-time SQS member now residing in North Carolina; long-time French SQS member La Rouille (known to very few by the more pedestrian name of Jacques Orsola) and his acquaintance Bruno Formento; and Gustavo Vela Turcott of Mexico City's SMES, who joined us straight from Bill Stone's annual expedition in J2, near Cheve.

A three-person advance team hit the ground in Mexico on April 4 to handle food and equipment purchasing and to tour the various municipal officials whose permission we needed before the expedition could get under way. Almost immediately the realities of Mexico began to derail our plans, and Guillaume, to whom had fallen the task of buying food, found himself trying to wing substitutions for goods which we had assumed would be available in Mexico. While he got better acquainted with the markets of Tehuacán, Pierre and Michel went ahead to the Sierra Negra to get reacquainted with our hosts in the village of Tepepa.

I arrived with the second wave of the expedition a few days later, on April 8. After meeting up at the airport, Chris, Gaël, Jocelyn, La Rouille, Bruno, and I hit the road for the Sierra Negra. Along the way, the buses got smaller and dodgier while our baggage got bigger, particularly in Tehuacán, where we met Guillaume and several duffle bags full of food. Eventually we jumped out of the back of a pickup truck in

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Tepepa, just in time to whip up a quick dinner and have a beer with Eligio, our host in the village. The next day, we loaded mules hired from the village and, in twos and threes, trekked up—way, way up—into the mountains to base camp. Having grown up in Alberta, I was in awe of the green riot of the jungle we were walking through, though most of my memory of that hike is of watching the heels of La Rouille's boots and cursing myself for thinking I was in shape.

The expedition had barely begun when things suddenly took a turn for the worse. While the rest of us began to set up base camp, Guillaume and Pierre went into a nearby pit to retrieve equipment cached there in 2003. We were in the middle of sorting out tents, food, and the main shelter when Pierre called us on the radio with bad news: The cache was gone, including camp fuel, the wooden frame for our stretcher, a variety of rigging tackle, and 1200 meters of rope. All that were left were the remains of some rope pads and some dried-up tubes of paint for marking cave entrances. The loss of this equipment put a dent in our plans for the expedition. The

most serious was the lack of rope, as the new rope we had brought with us would be woefully inadequate. Luckily, the third wave of expedition members hadn't left home yet, so they begged, borrowed, and stole all the rope they could lay their hands on in the forty-eight hours before they left. For all our debating over its merits beforehand, the satellite phone we had brought with us proved its worth that day. Diana cleaned PMI out of all the 9-mm rope they had in stock, while Luc and Daniel brought their own supplies, along with ropes donated by other SQS members in Montreal. With the rope and some additional food, Matthieu, Diana, Daniel, and Luc wound up serving as a vital re-supply, and they also provided the camp with a crucial piece of kit, a coffee press.

By the end of the first week of the expedition, base camp had become very comfortable indeed. With tarps and mosquito netting donated by Textile Outfitters, Chris Chenier had created a massive main shelter (roughly 5 by 8 meters) that we furnished with two tables, a stand for our stoves, and two sets of shelving all lashed together with twine and

accessory cord. A generous pile of gear rested under tarps at one end of the shelter, while we arranged our tents along its side in the shade of some of the huge trees that dotted the clearing.

With supply concerns more or less taken care of by the reinforcements en route, the expedition got properly under way on April 11. Personally, I was already in very new territory just with the camping and managing our food supplies; spending a day stomping through the jungle with Chris looking for pit entrances made for a learning curve as steep as the hillsides. Though much of what Chris said about jungle navigation and ridge-walking in the sierra took several days to sink in, the first rule of jungle navigation stuck quite clearly in my mind: Don't get too close to the guy with the machete. As for caves, the mountainous karst of the Sierra Negra didn't disappoint. Almost every doline had at least one pit at the bottom, although getting down to them often meant hanging onto fist-thick vines or weaving through and around fallen trees and gnarled roots as we picked our way down the steep slopes. We quickly

The principal results obtained during the Mexpe 2006 expedition.

N° code	Nom	Secteur	Alt.	Nouv. dév. (m)	Déniv. (m)	Terminé?
BV-C2-01	Tres Quimeras	Buenavista	1 440	155	-106	non
CT3-06-06	CT3-06-06	Secteur CT3	1 779	689	-241	non
TP6-06-04	La Ciudad	Hoya Grande (sud)	1 432	890	-186	oui
TP6-06-05	La Ciudad	Hoya Grande (sud)	1 457	352	-158	oui
TP6-06-09	La Ciudad	Hoya Grande (sud)	1 521	414	-193	oui
TP6-06-13	TP6-06-13	Hoya Grande (sud)	1 454	55	-19	oui
TP6-06-17	Sistema Brumas Selváticas	Hoya Grande (sud)	1 434	1 672	-408	oui
TP6-06-22	Les amonts des Galérics (Sistema Tepepa)	Mygalo/Galérics	1 506	1 182	-121	oui
TP6-06-25	La Ciudad	Hoya Grande (nord)	1 477	182	-65	oui
TP6-06-31	Les puits des «17 secs»	Mygalo/Galérics	1 513	145	-51	oui
TP6-06-111	Gimnástica Selvática	Hoya Grande (nord)	1 472	115	-35	oui
TP7-07-01	Cueva de las Círuelas	Secteur TP7	1 520	341	-131	oui
TP7-07-02	TP7-07-2	Secteur TP7	1 530	234	-69	oui
TP7-07-05	La Ciudad	Secteur TP7	1 538	1 659	-248	non
			TOTAL	8 085		

Sous Terre 20(2)31 2007



Luc Le Blanc demonstrating the huge size of Mexican caves during Mexpé 2006. *Guillaume Pelletier.*

wrote off many of these pits as dead ends after one of us dropped in, but a few merited closer inspection. By the end of the first day's ridge-walking, the expedition team had turned up enough leads to keep us occupied for the next few days.

Most of the exploration efforts focused on the area surrounding La Ciudad and the southern ends of Sistema Tepepa and Gimnastica Selvática. A few of us spent several ridge-walking days searching for entrances between La Ciudad and Gimnastica Selvática, in a bid either to locate a connection between the two or at least determine if they were part of the same hydrological system. It was in searching this area that I got my first taste of the big-time caving that the Sierra Negra had to offer, as Chris, Michel, La Rouille, and I went to a cave that had already been the subject of a day's exploration and seemed to have plenty of going passage.

We were going like gangbusters, with La Rouille and Michel cruising along up ahead rigging and Chris and me coming along behind them surveying. We dropped several short pits before coming to the edge of what seemed to be a massive drop. La Rouille enthusiastically rigged up a beautifully free-hanging rope, and we bombed down into a vast room. I held on to a boulder on the floor as I looked around, feeling a rush a vertigo as my light tried to find the ceiling. Chris recognized the place almost immediately as being the main chamber of La Ciudad, a large irregularly-shaped breakdown room roughly 100 meters by 200 meters, with the ceiling 80 meters overhead. Our enthusiasm slightly

dampened, Michel and Chris tried to find a permanent survey station somewhere in the room to make a formal connection with our survey data. That done, it was back out to the surface, passing another promising lead on the way. After ten hours underground, the short hike back to base camp in the dark seemed like a death march to the rookie of the group. It was also that day that I learned the second rule of jungle travel: During the day, you think you are being far too lavish with the flagging tape; going along the same route at night, you realize you hadn't been nearly lavish enough.

About mid-way through the expedition, two of our members ran afoul of that second rule. Usually the first one awake at camp, I was surprised to be awakened by Guillaume's voice in the next tent. Once his words "they didn't come back last night" filtered through my sleepy brain, I was up like a shot, and within minutes so was the rest of the camp. It turned out that Luc and Jocelyn hadn't returned from an exploration trip the night before, and we quickly began organizing a rescue. Within half an hour Pierre, Michel, and Guillaume had set out with a generous supply of rope and rigging gear, first aid equipment, hot soup, and one of the radios. Gael and I laid out

a quick breakfast, while the rest of the team readied the stretcher, spine board, and power drill. We had all just finished packing up our caving gear and getting ready to go when Guillaume's voice came over the camp radio. To our great relief, the advance party had found Luc and Jocelyn on the surface not far from the cave entrance. They were tired, cold, and hungry, but fine. It turned out that they had gotten to the surface without any trouble, but in the dark were unable to find their way back to the local footpath that lead to camp. Jocelyn had even been able to get a GPS fix on their position (a rare event, with the thickness of the tree cover in the Sierra) and thus had a straight-line bearing to base camp, but to follow it they would have had to hack their way through some thick jungle on some very steep terrain, in the dark. After they had gotten back and gone to sleep in their tents, the rest of us stood down from rescue mode and, having prepared our gear in record time, had the earliest start of the expedition.

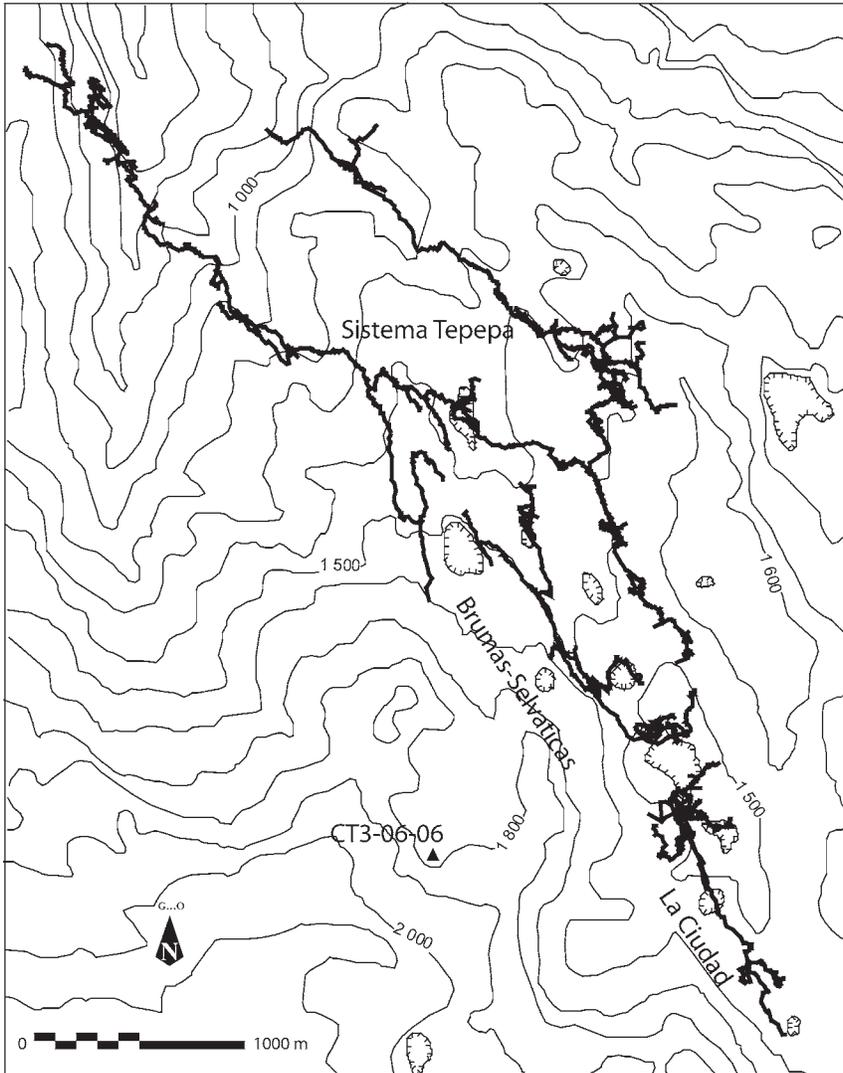
In the end, the stated goals of the expedition were mostly accomplished. Working from old expedition reports, we found Sumidero del Año Nuevo in the hills above base camp, and after a daring bolt traverse by Bruno, the rumored continuing trunk passage proved to be an optical illusion created by the shape of the pit itself. The Hoya Grande proper was the subject of several days of exploration, with new entrances to both La Ciudad and Gimnastica Selvática found, as well as a fossil offshoot of La Ciudad discovered by Jocelyn and me, christened Beginner's Luck. Las Tres Chimeras, a spectacular pit discovered near the neighboring village of Buenavista, was dropped and explored on a last-day push and yielded continuing trunk passage that had to be left to future years of exploration. However, the two biggest stories of the expedition were two new finds.

The first was a cave that won the title of "most dubious prospect



Société québécoise de spéléologie

Main Caves Explored or Revisited by Mexpé 2006



Chris Chenier, Doug Monroe, and Gaël Hervé at the bottom of Beginners Luck. *Chris Chenier.*

explored." In the last weeks of the expedition, Daniel and Bruno found a tiny belly crawl of an entrance at the bottom of a depression that had been torched to make way for crops. In what must have been a fit of optimism, they pushed their way in and were rewarded with a cave that went on and on and on. Six days of exploration later, the romantically named TP6-06-17 connected with both Las Brumas and Gimnastica Selvática. After a 75-meter pit, several 20- to 30-meter drops, some apparently sporty squeezing, and Pierre getting hit in the face with a rock when an anchor gave way, Brumas-Selváticas was born. Let it not be said that blood, sweat, and tears were not shed in this expedition.

The second, a cave known as TP7-06-05, began as a fairly routine find far to the south of base camp, toward the village of Buenavista and Las Tres Chimeras. Also discovered by Daniel and Bruno, and explored over the course of several days toward the end of the expedition by Daniel, Michel, La Rouille, Chris, and me, the cave was offering steady and varied going of chimneying through canyons, some tight, vertical passages, and active streamways when La Rouille, Chris and Daniel

opted to spend their last expedition day pushing it as far as they could. Several hours in, while La Rouille was rigging a pit, Chris plotted out their survey so far against the other known caves in the area, which he was able to do thanks to the expedition's near-total usage of Auriga, Luc Le Blanc's Palm-based cave-survey software. Surprisingly, he found that they were 30 meters above and 500 meters southeast of the southernmost extremity of La Ciudad and on the same general northwest/southeast axis that characterizes the Sistema Tepepa. To Daniel, Chris ventured a guess that the pit ahead of them likely dropped 30 meters into a trunk passage that would extend north towards La Ciudad and south towards Las Tres Chimeras. Moments later this hunch was confirmed, when they dropped the pit and caught up with La Rouille, who was beaming at the size of the trunk passage he stood in. La Rouille reportedly took issue with having his discovery somewhat deflated by Chris's deductions, exclaiming, "there's hardly any bloody point in exploring the caves with Auriga. Why not just sit at home and let the machine do all the work?"

The team explored northwards

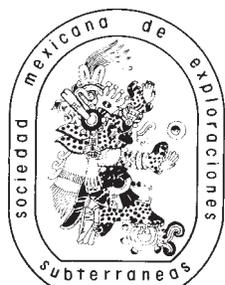
in the trunk passage through winding canyons that were carved in meters-thick depositions of mud and abruptly gave way to a low, watery duck. The duck turned out to be a some-time sump. On the other side was a permanent station in La Ciudad. Elated by their discovery, Chris, Daniel, and La Rouille turned around and boogied back to the bottom of their 30-meter pit. After a bite to eat, they decided to push south and see how far they could get. Several hours and countless full-tape-length survey shots later, the team turned around in a large room and more trunk passage, left for later expeditions to pursue.

All in all, with 8 kilometers surveyed, a nice connection made, and several going leads for future exploration, Mexpé 2006 closed on a strong note. As for me, my first foray into expedition caving in the Sierra Negra was deeply challenging, but also deeply rewarding.

For more information on the Mexpé project, visit <http://www.mexpe.ca>. The author would like to thank Chris Chenier for peer review, and Claire Riley for un-splitting his infinitives.

Mexpé 2006

La expedición Mexpé 2006 organizada por la Société Québécoise de Spéléologie en la Sierra Negra de Puebla logró conectar Gimnástica Selvática y Brumas cuando una nueva entrada, TP6-06-17, llevó a pasajes que conectaron con ambas cuevas. También se hallaron muchos nuevos pasajes en las partes sureñas de La Ciudad y del Sistema Tepepa. Se topografiaron 8 kilómetros de cueva, llevando al total de las expediciones Mexpé a alrededor de 60 kilómetros.



THIRTY YEARS EXPLORING MEXICO: A REFLECTION

Carlos Lazcano

These lines are a short tale about a singular journey, an underground journey. I always liked caverns, and my love of nature started precisely there, in the underground environment. I soon learned to visit and explore them and be in contact with nature in this way. I became a speleologist, someone who studies caves and their manifestations, and I made exploration a way of life. I don't regret it, because it enriched my life in a way I didn't think was even possible.

In 1976 I joined UNAM's Organización de Montañismo y Exploración. After vacillating between the Grupo de Alta Montaña and the Grupo de Espeleología, I opted for the latter. Mountains had always fascinated me, but I also realized that I was deeply attracted to the unknown, and that was something the mountains couldn't offer me, but that the caverns of Mexico could, very much. So it was because of my taste for the unknown that I entered the world of speleology. From my earliest years I knew I was in love with pure geographic exploration. Unveiling mysteries was what I liked. By then all the mountains had been climbed; only the crumbs were left. This hadn't happened in speleology, and to this day there is still a lot to be discovered.

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From the proceedings of the VIII Congreso Nacional Mexicano de Espeleología, Cuetzalan, Puebla, February 2007.

Translated for the AMCS from Spanish by Nico Escamilla.

It was clear to me from the start that I wanted to be an explorer of caverns, not just a visitor, so I gave priority to the search for previously unknown caves. For this I used my knowledge of geology, because back then I was studying geology at UNAM. I was seeking to contribute new knowledge, to walk paths never before lit. I developed this vision and vocation thanks to two people I consider exceptional, whose open minds toward challenges was beyond that of the majority of people who engage in outdoor activities. They were Manuel Casanova Becerra, founder of the modern Organización de Montañismo y Exploración at UNAM, and Alejandrina Pérez-Casar, founder of the speleology group in that organization. They were the most important teachers in my decision to adopt exploration as a way of life. UNAM gave me the tools and discipline. At the time I made the decisions that determined the course of my life, almost nothing in speleology was being done by Mexicans. Easy "spelunking" was being practiced instead; certain caverns were being regularly visited, but of exploration there was nothing.

Some speleology had been done by geologist Federico Bonet and later by Jorge de Urquijo and the Grupo Espeleológico Mexicano during the 1960s. But almost nothing later. Some groups were just visiting the most interesting caves that had been found and explored by Americans of the Association for Mexican Cave Studies. The AMCS started in the early 60s precisely because of the lack of speleologists in Mexico. This group

has made and continues to make most of the notable speleological finds in Mexico.

That was the state of Mexican speleology when several friends and I from the Grupo Espeleología at UNAM and the Sociedad Mexicana de Exploraciones Subterráneas planned a systematic exploration of new caves. We traveled widely in the Sierra Gorda for seven years, making interesting finds in Querétaro, Guanajuato, Hidalgo, and San Luis Potosí. There we cast light on several hundred caves, some with depths in excess of 600 meters, including big pits, rooms, lakes, and underground waterfalls, a series of marvels that I summed up in two of my books, *Las Formas Karsticas del Área de La Florida* (UNAM, 1985) and *Las Cavernas de la Sierra Gorda* (Universidad Autónoma de Querétaro, 1986). Later we visited large parts of the states of Guerrero, Veracruz, Chiapas, San Luis Potosí, Oaxaca, Yucatán, Colima, Jalisco, and Campeche, where we worked in association with cavers from other countries (Italy, France, Poland, the US) in some cases and were able to announce very significant discoveries, such as Yaax-Nik in Yucatán, one of the most beautiful in Mexico, Hoyo de San Miguel, at 450 meters deepest in Guerrero, Sótano de San Agustín in Oaxaca, Fosa de las Cotorras and Sótano de la Lucha in Chiapas, Resumidero del Pozo Blanco, a 233-meter pit in Jalisco, and Resumidero de Toxín in Jalisco. The investigations in Jalisco and Colima led to the publication of my *Las Cavernas de Cerro Grande*,



La Gruta de Yaax-Nik, Yucatán.
2008 photos by Carlos Lazcano.



published by the Universidad de Guadalajara in 1988. Chihuahua deserves special mention, because I announced in 2000 the famous Cueva de los Cristales, considered among the most beautiful and extraordinary caves in the world. Along with Italian and Spanish speleologists, we continue research in this cave today. Also in Chihuahua I made some notable archaeological finds, discovering small towns of the Casas Grandes culture inside large caves and shelters among the ravines in the northern Sierra Tarahumara. This led to my book *Explorando un Mundo Olvidado: Sitios Perdidos de la Cultura Paquimé*, published by México Desconocido magazine in 1998.

Cave exploration is in reality just a facet of my wider vocation, geographical exploration. In my years of most intense caving, I thought that it would be very hard to discover hidden things. But I soon realized that this was not so. Even in broad daylight, new and notable geographical finds can be made. You only need to look and observe. I figured this out because for personal reasons I had to move to Baja California and Chihuahua, northern regions of Mexico where speleology isn't practiced much due to lack of suitable conditions for the formation of large caves. In Baja California I discovered new sites of monumental rock art and impressive canyons never before descended, like El Chorro, which presents the grandest waterfalls in the state in a landscape unusual for the peninsula. I traveled the peninsula on foot, together with Carlos Rangel, in a wonderful and hallucinatory trip that led me to further discoveries. The gorges of Chihuahua allowed me to make truly impressive journeys, like traveling the deepest canyons in the state, over 2000 meters deep, like Sinfrosa, where I located large waterfalls and archaeological sites of great interest. But the gorge that gave me the most discoveries was

Pino Paz rappelling beside La Cascada de Piedra Volado, Chihuahua, at 453 meters the highest waterfall in Mexico. *Carlos Lazcano.*

Candameña, 1750 meters deep, where we found the Cascada de la Piedra Volada, falling free 453 meters, the highest in Mexico and number 10 in the world. In the same gorge I found Peña del Gigante, with a completely vertical wall about 1 kilometer tall, the only place in Mexico where "big wall" climbs have been made. In that gorge and in Oteros, 1650 meters deep, I found more southerly Paquimé towns located in caves and rock shelters very hard to reach. Some of these things are reported in *Candameña: La Barranca de las Cascadas*.

In 2002 in the state of Durango, I continued to explore gorges. There

we also made extraordinary discoveries, such as Quebrada de Piaxtla, 2500 meters deep. We also found the highest waterfall in Durango, 180 meters. But most noteworthy is our reaching some of the most inaccessible archaeological sites in Mexico. In the walls of the gorge are caves with adobe houses, traces of ancient towns of a previously unknown culture we just recently announced finding. We are really just beginning in Durango.

After thirty years of exploration and being privileged to made such finds, I wonder what's next. I remember meeting Nobert Casteret,



considered to be the father of modern speleology, in 1982. I had thought he was dead, because his books report discoveries made in the 1920s, 30s, and 40s. Nevertheless, there he was, alive and kicking and in a cave. He told me that he never thought about retiring and that he would explore and study caves as long as he could. At the time, he was over eighty years old. It was then that I lost any doubt that I would never let go of my passion. All these years I've tried to be faithful to my vocation of exploration, but it hasn't been easy. At the beginning of my life as a speleologist, I justified my efforts by the research that we accomplished. But there came a time when I realized I didn't need to justify exploration. Now I explore for the joy of it. I still do the studies, but they are just part of the project, not the justification for it.

In the last thirty years, the attitude about outdoor sports has changed. Terms like *adventure*, *extreme*, and *ecotourism*, and others that didn't

exist when I became a speleologist are used by marketers to penetrate these circles. Commercialization and aggressive competitiveness have been seriously affecting the sports. Rock climbing and mountaineering have been the most affected. Competitions of the "eco challenge" or "extreme" types have developed and taken nature as their race track. These new trends have affected outdoor activities in several ways, among them minimizing, deforming, or annulling respect for and contact with nature. They turn nature into merchandise or competition ground. Nature is seen as something that we are not part of and that is to be "conquered." The fellowship and friendship that were part of outdoor sports have faded, too. In my opinion speleology can only be practiced as a team, and it generally takes years to complete exploration projects. The deepest and longest caves in Mexico have been explored for over thirty years, with no end in sight. Several generations

of speleologists and explorers have traveled through them. I hope that love of nature, fellowship, cooperation, and friendship continue to reign in speleology.

Some previous AMCS publications by Carlos Lazcano:

Carlos Lazcano's books on Cerro Grande and the Sierra Gorda have been reprinted as AMCS Reprint Series numbers 4 and 5, currently available as PDF files on a CD.

"Tilaco Area" (Querétaro) *AMCS Activities Newsletter* 12.

"Sótano de las Coyotas" (Guajuato) *Act. Nl.* 13.

"Resumidero de Pozo Blanco" (Jalisco) *Act. Nl.* 13.

"Deep Cenotes" (Yucatán) *Act. Nl.* 15.

"La Fantástica Gruta de Yaax-Nik" (Yucatán) *Act. Nl.* 17.

"Cueva de los Cristales" (Chihuahua) *Act. Nl.* 25.

Treinta Años Explorando México: Una Reflexión

Este artículo es la traducción de uno que apareció en las memorias del VIII Congreso Nacional Mexicano de Espeleología en 2007. Carlos Lazcano describe su historia como espeleólogo y como explorador de las montañas y barrancas de México.

RESULTS OF THE BRITISH '85 MEXICO EXPEDITION

Running across an article about the British 1985 Mexico expedition in an old issue of the *Bradford Pothole Club Bulletin* for 1989 reminded me that the AMCS has not published anything (other than a short review of their expedition report in *AMCS Activities Newsletter* 16) about the results of that expedition to the Xilitla highlands in San Luis Potosí. This article contains the lists of caves explored, the cave-location maps, and the cave maps from that report. Some re-lettering of the cave maps has been done for legibility. The book was very carelessly prepared, and there were some obvious errors in the grid references in the lists; I believe I have corrected those based on the location maps, which are probably a more reliable source than the lists. There were also numerous discrepancies between the length and depth figures in the lists and on the maps. I have changed the lists to reflect the figures on the maps, but of course I had no other information for the caves lacking published maps, so beware.

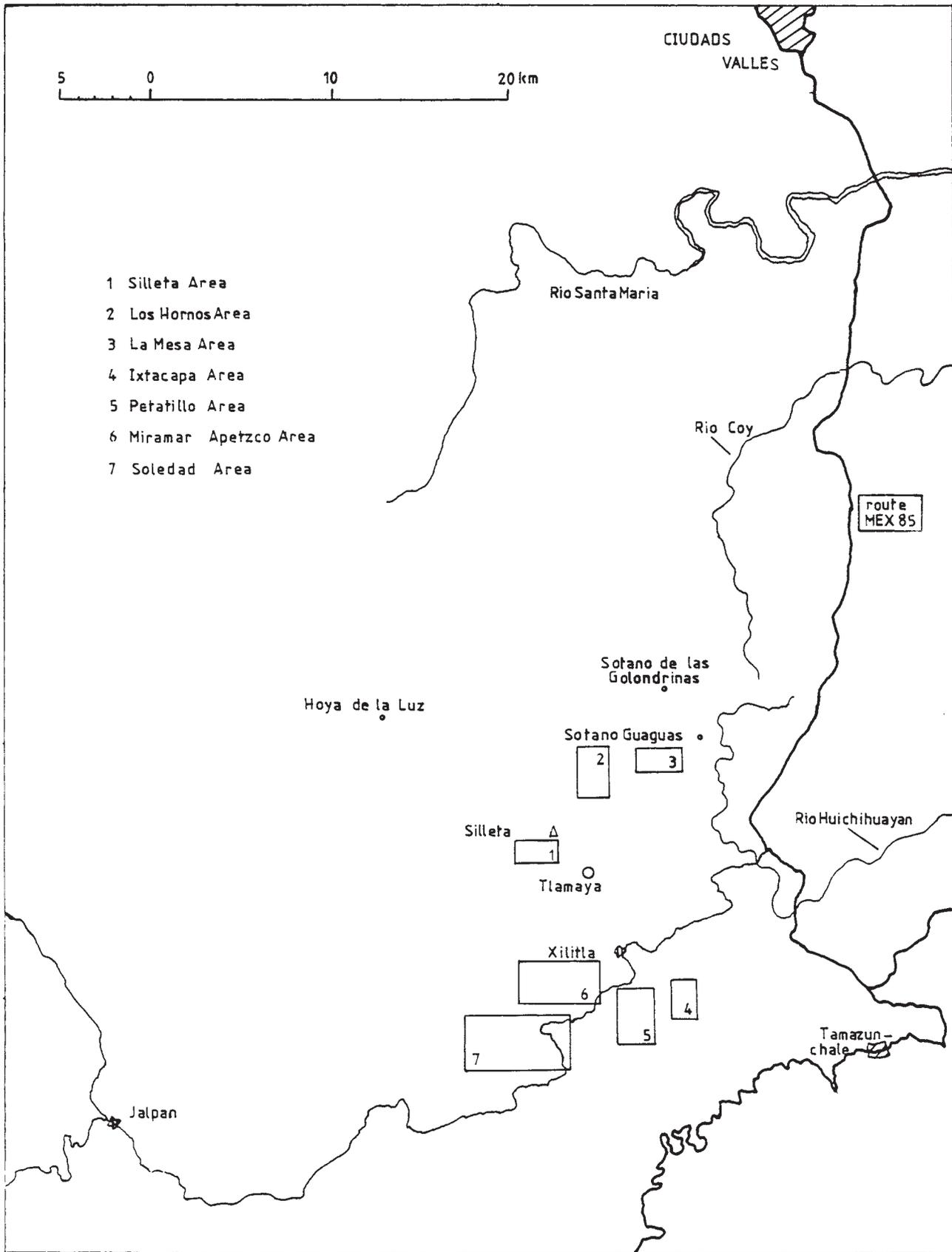
The Brits' "grid references" are partial UTM coordinates as in the following example: grid reference 058 628 = UTM 505800 E 2362800 N.

The report contains some exploration narratives for the caves. Anyone wishing more information may contact me.—Bill Mixon

Resultados de la Expedición Británica México '85

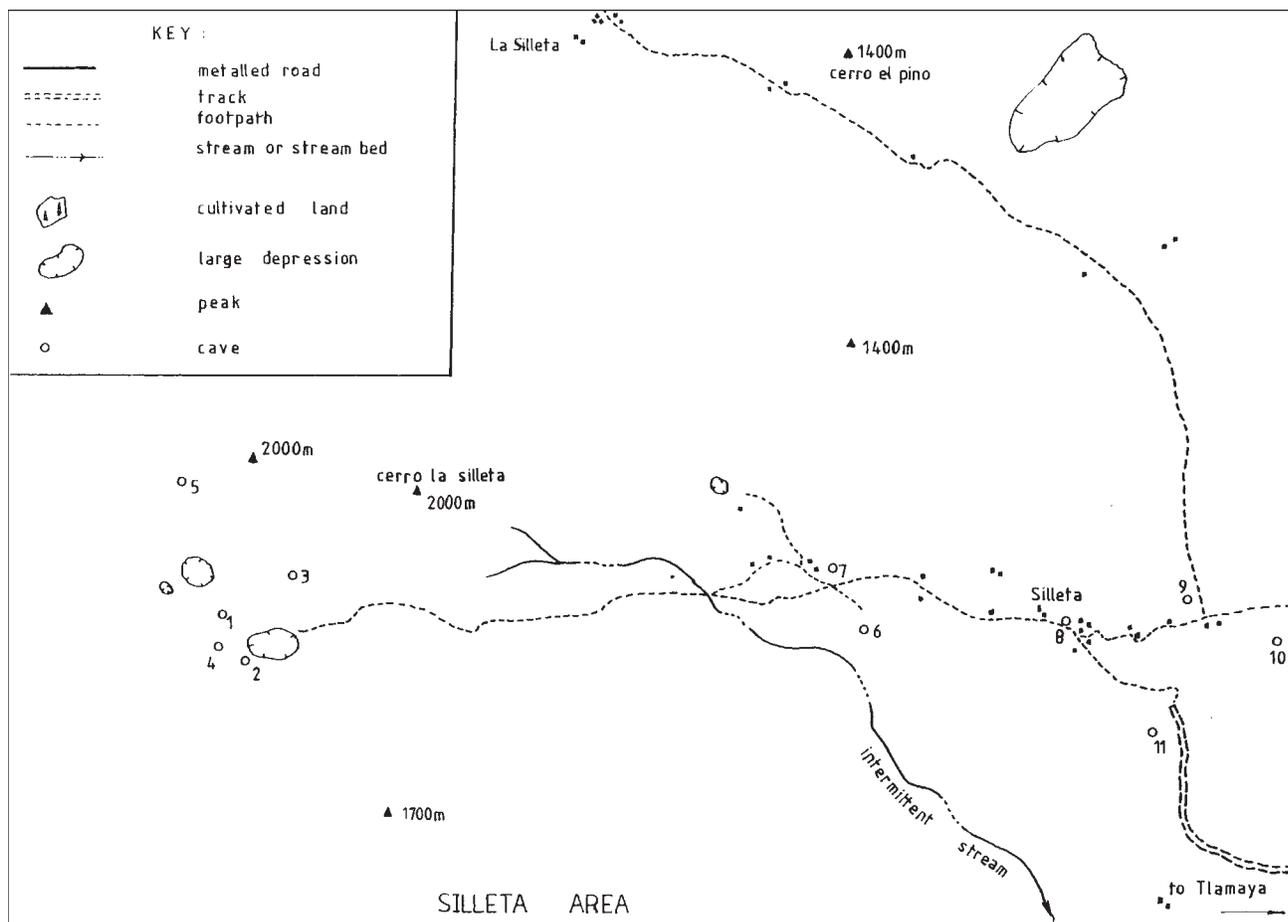
El encontrar un artículo sobre la expedición británica a México en 1985 en un número del *Bradford Pothole Club Bulletin* de 1989 me recordó que la AMCS no ha publicado nada (además de una breve reseña de su expedición en el *AMCS Activities Newsletter* 16) acerca de los resultados de la expedición a la zona de Xilitla en San Luis Potosí. Este artículo contiene las listas de cuevas exploradas, los mapas con ubicaciones de las cuevas y los mapas de cuevas incluidos en ese reporte. Algunas anotaciones en los mapas se han cambiado para mejorar su legibilidad. El libro fue preparado sin mucho cuidado y habían algunos errores obvios en las referencias tabuladas en las listas. En mi opinión, he corregido todos ellos en base a los mapas de ubicación, que son probablemente una mejor fuente de información que las listas. Habían además varias discrepancias entre las cifras de longitud y profundidad de las listas y las de los mapas. Cambié las de las listas tomando como referencia los mapas, sin embargo carezco de otra información al no haber mapas publicados, así que sirva esto de advertencia.

Las "grid references" británicas son coordenadas UTM parciales, de acuerdo al siguiente patrón: grid reference 058 628 = UTM 505800 E 2362800 N.



LA SILLETA AREA CAVES

	grid. ref.	length m	depth m
1. Cueva de Psychobilly	943 712	425	60
2. Cueva de Daddy Long Legs	928 710	100	25
3. Sótano de Poquito Alum Pot	930 710	65	20
4. Sótano de Mini-Sink	931 711	10	10
5. Sótano Dragon	932 704	70	70
6. Cueva de Food of Jah	928 710	150	50
7. Sótano Tres Mille Metres	928 695	20	20
8. Sótano Silleta	918 672	undescended	
9. Sótano Wardy's Forehead	917 670	5	8
10. Sótano Cafe Plantation	916 666	25	20
11. unnamed cave (possible dig)	917 674	10	-

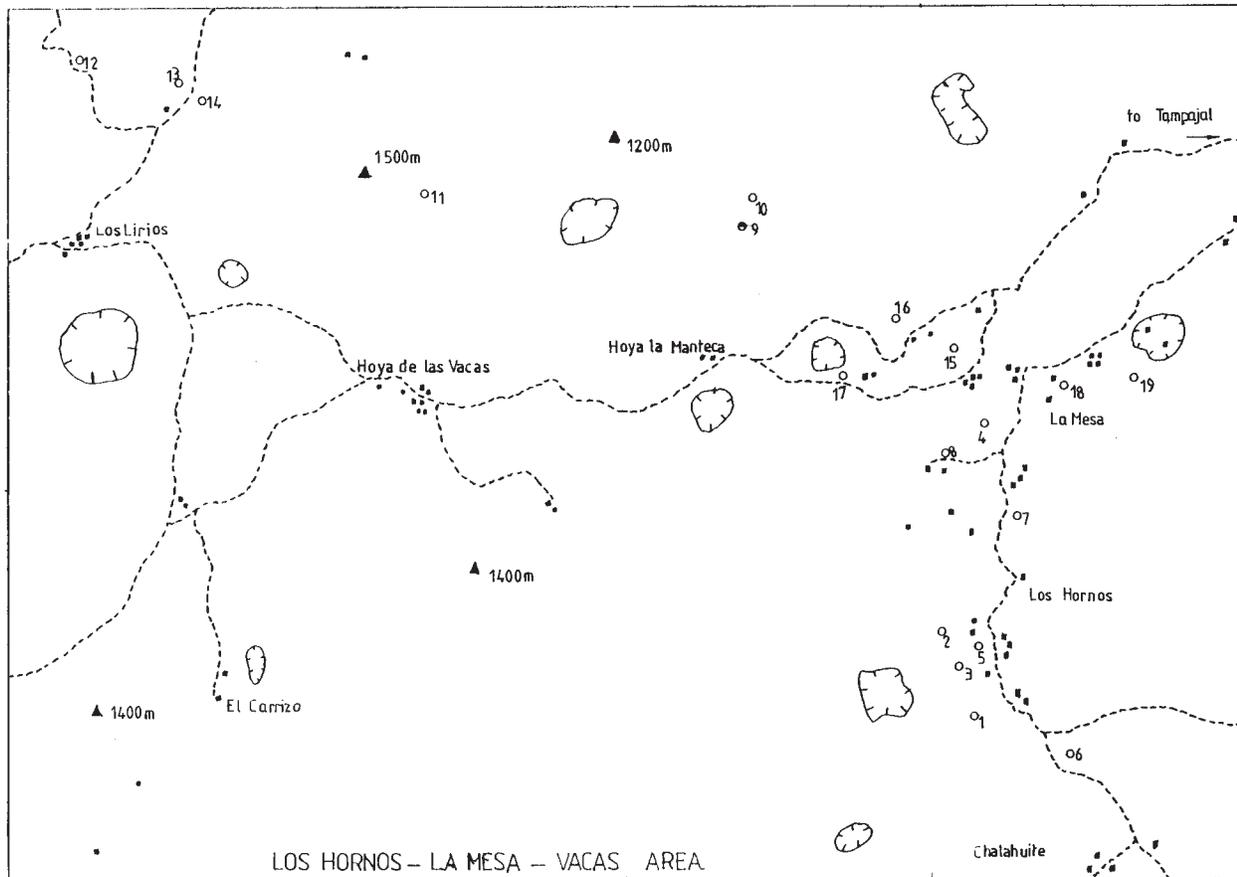


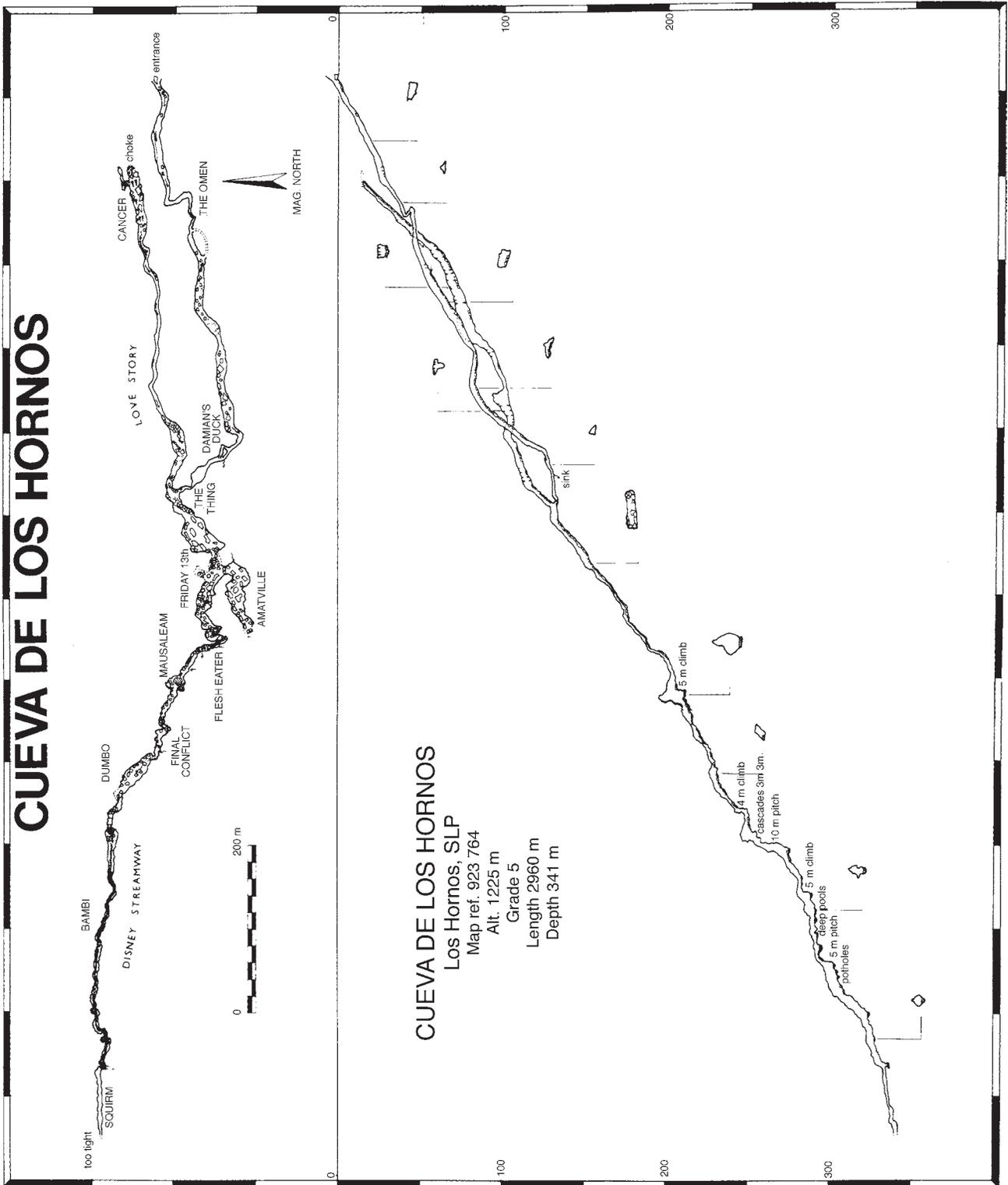
LOS HORNOS-LA MESA AREA CAVES

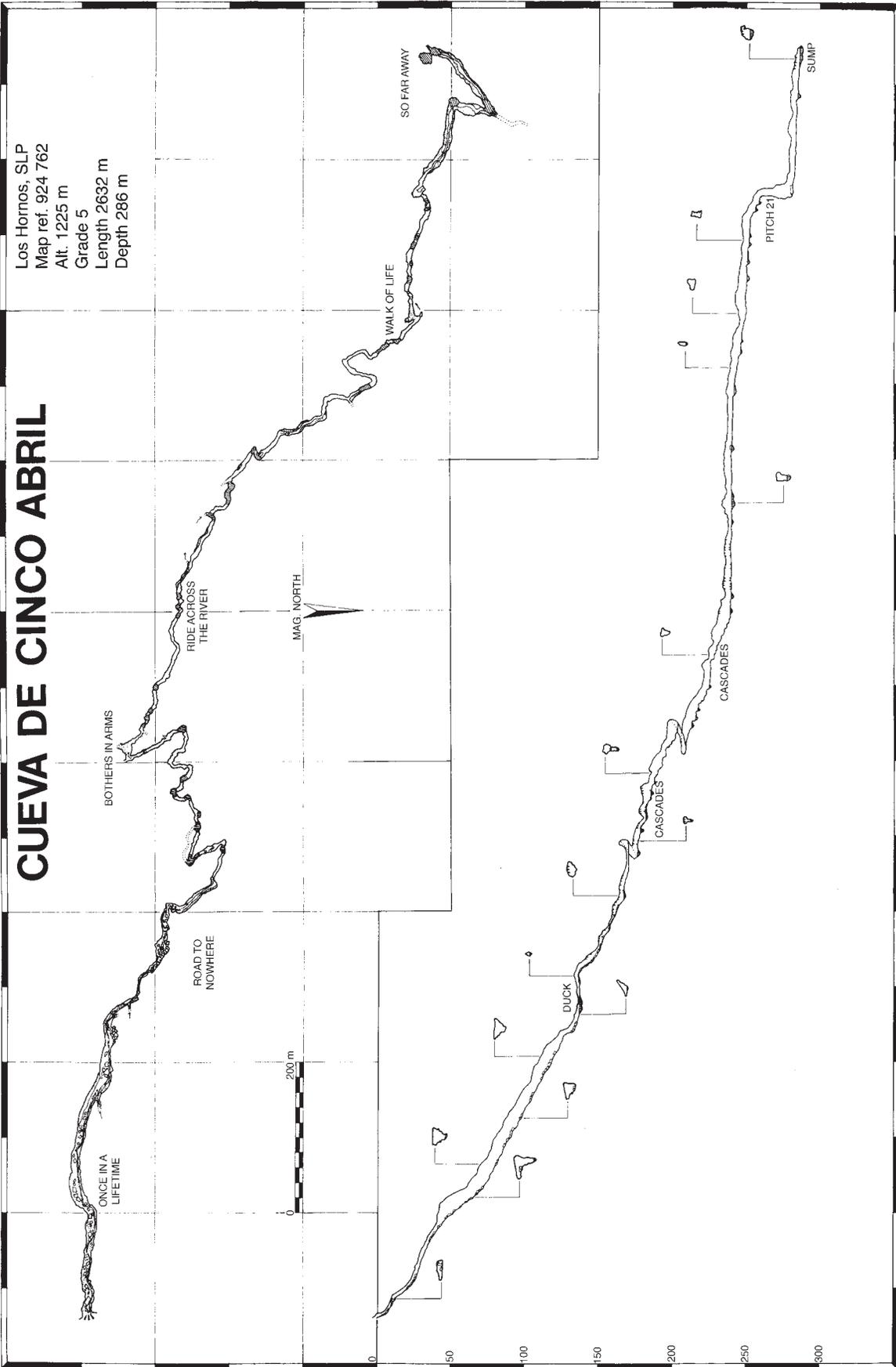
Los Hornos		grid. ref.	length m	depth m
1.	Cueva de Viejo Resto	924 759	118	28
2.	Cueva de Los Hornos	923 764	2960	341
3.	Cueva de Cinco de Abril	924 761	2632	286
4.	Cueva de Miguel	925 776	322	51
5.	Cueva del Erizo	925 760	599	135
6.	Arriba Suyo Sótano	931 755	1126	563
7.	Sótano de Los Hornos No. 5	926 770	30	20
8.	Sótano de Los Hornos No. 6	921 773	-	25

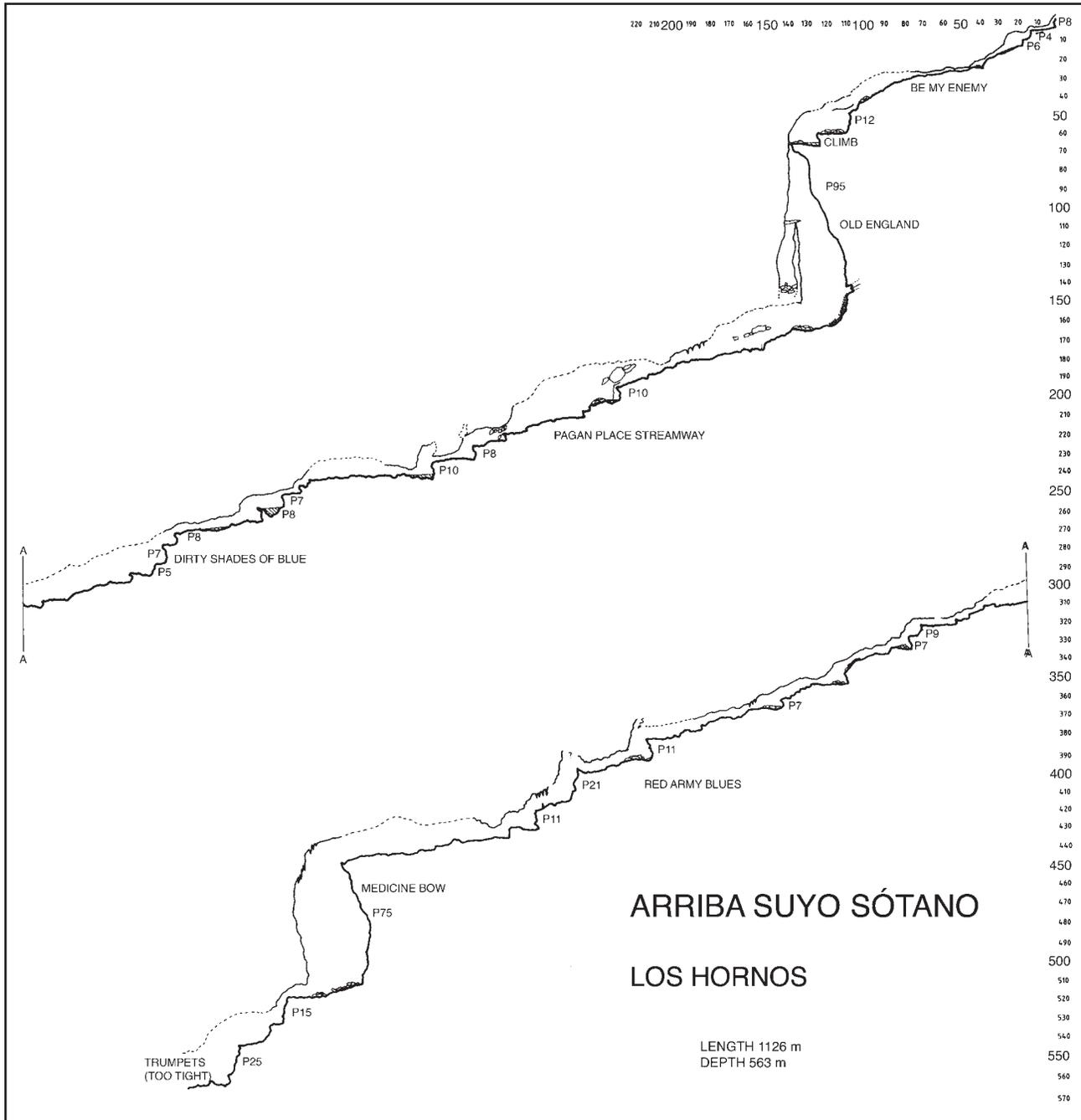
La Mesa

9.	Cuevas de La Monteca No. 1	909 789	-	35
10.	Cuevas de La Monteca No. 2	909 790	undescended	
11.	Cuevas de La Monteca No. 3	885 789	50	10
12.	Hoya de Las Vacas No. 4	862 799	10	2
13.	Hoya de Las Vacas No. 5	870 795	150	20
14.	Hoya de Las Vacas No. 6	872 794	35	5
15.	Cueva de Tang-Go-Jo	923 782	530	405
16.	Cuevas de La Mesa No. 8	919 782	10	35
17.	Cuevas de La Mesa No. 9	915 776	10	-
18.	Sótano de Reefer Madness	928 778	1006	411
19.	Sótano de los Bíbaros Muertos	933 780	670	250

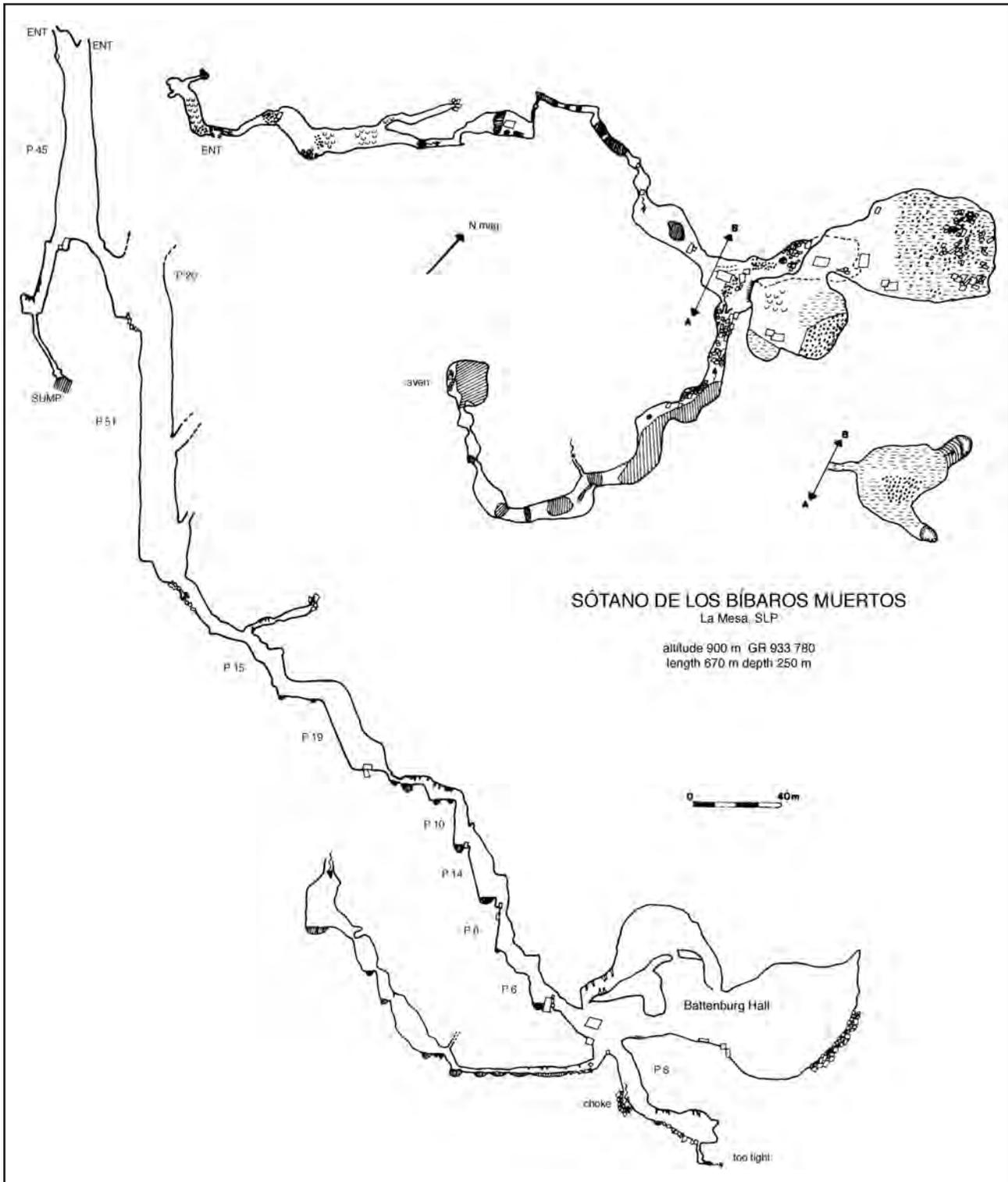








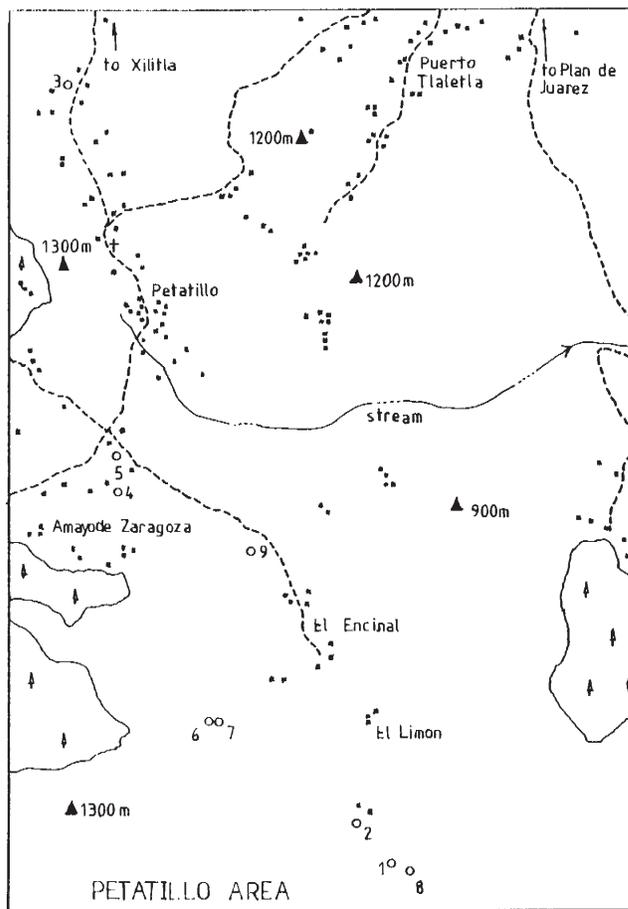
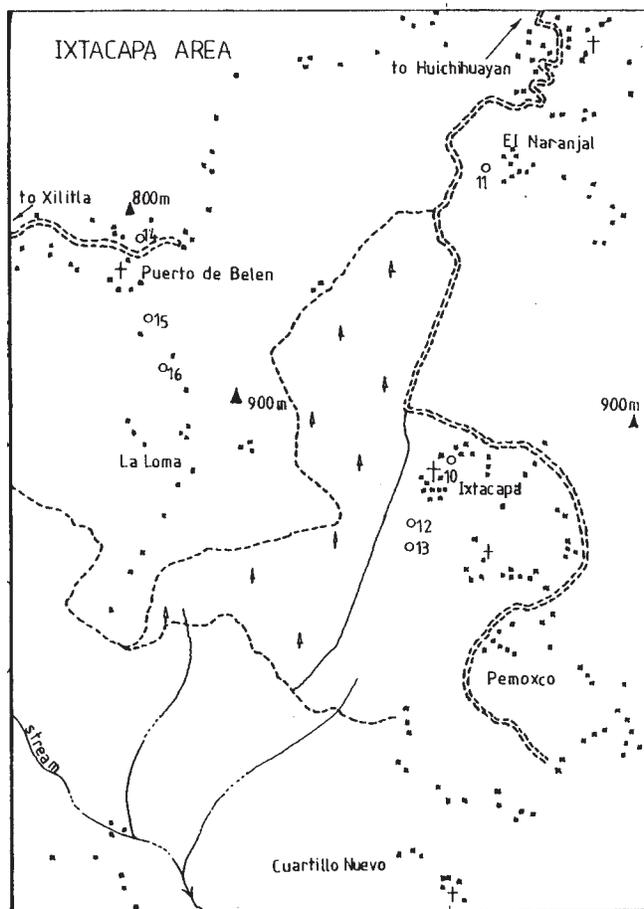


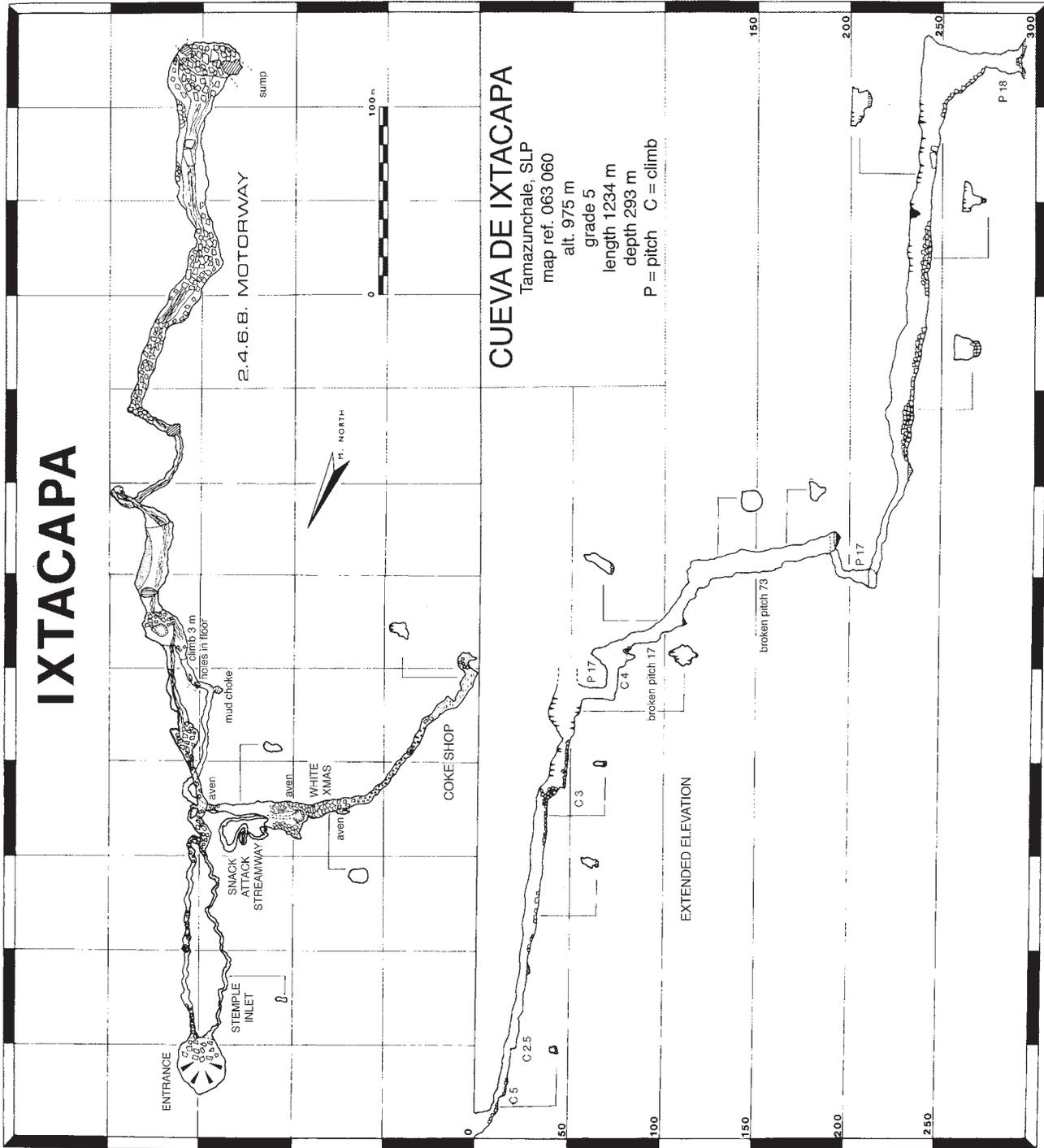


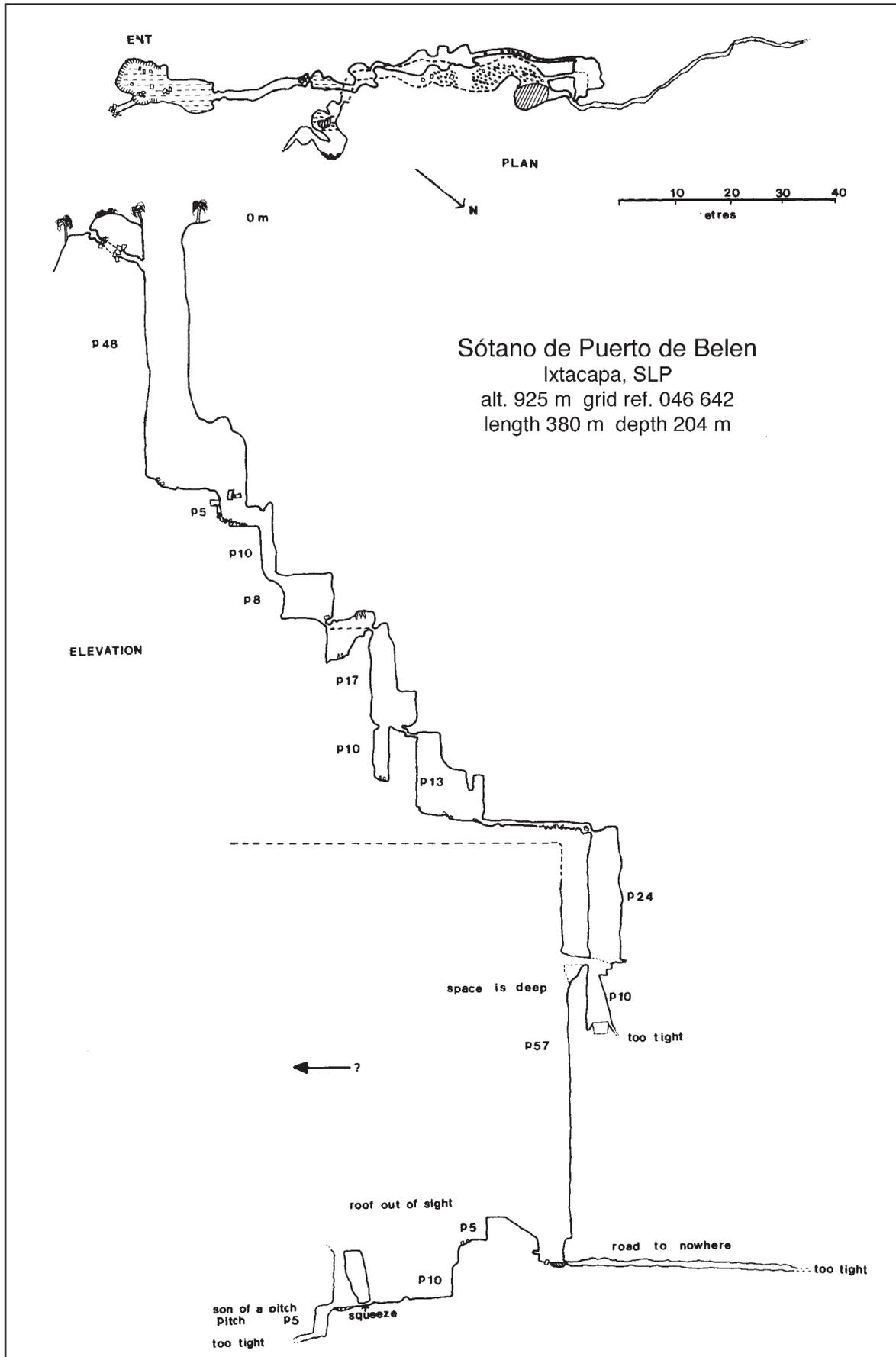
IXTACAPA AND PETATILLO AREA CAVES

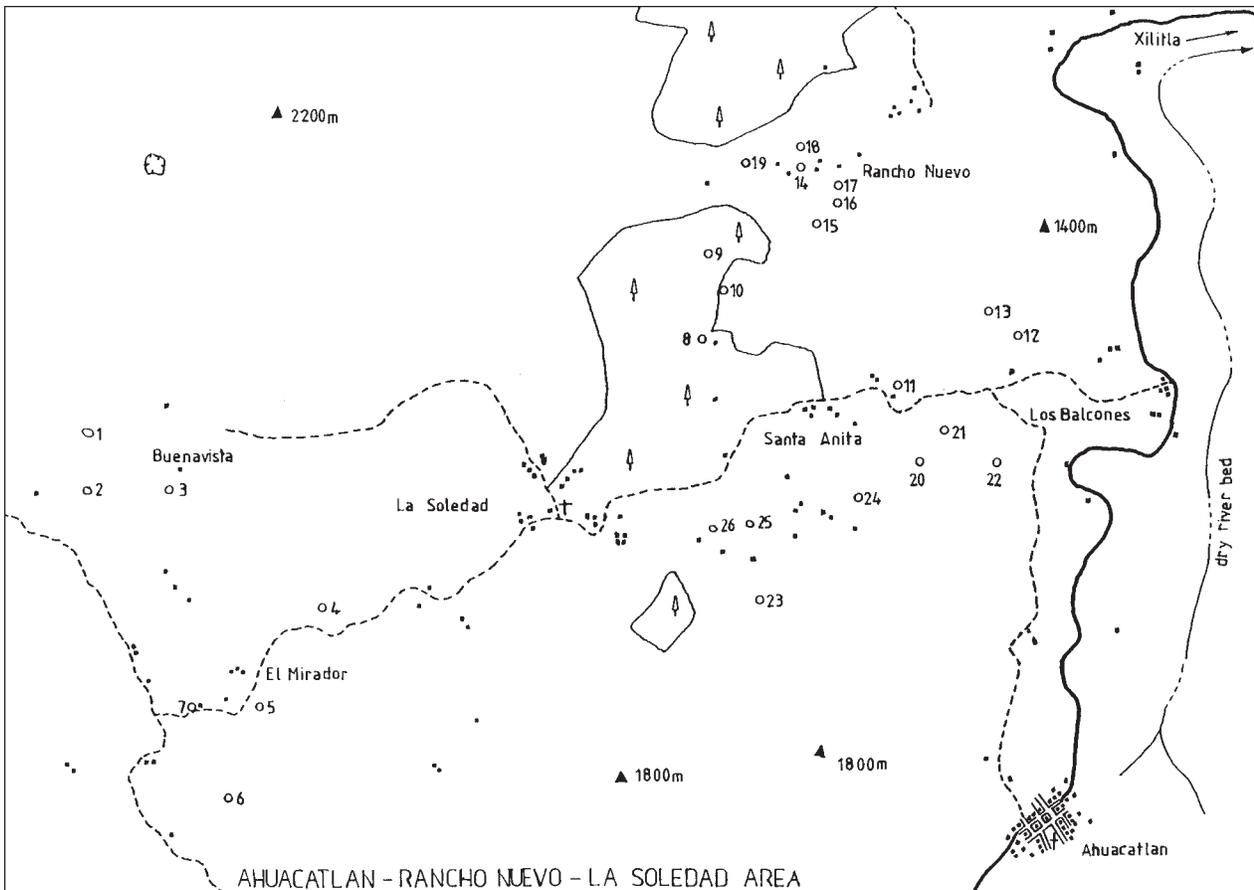
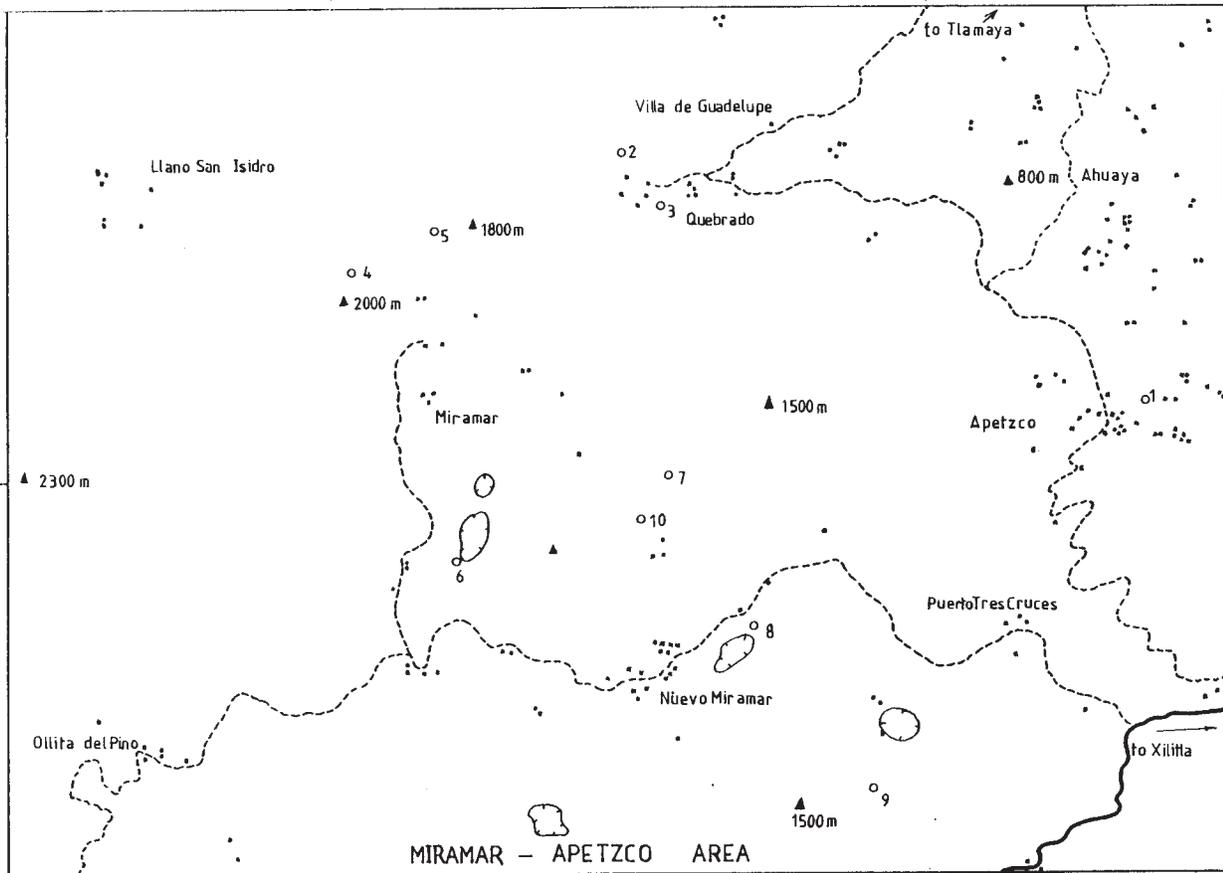
Petatillo		grid. ref.	length m	depth m
1.	Cueva de Kirby	018 562	71	6
2.	Cueva del Limon	018 564	398	67
3.	Cueva Petatillo	003 596	545	92
4.	Cuevas Petatillo No. 1	006 579	-	34
5.	Cuevas Petatillo No. 2	006 580	20	5
6.	Cuevas Petatillo No. 3	010 570	-	20
7.	Cuevas Petatillo No. 4	010 570	-	10
8.	Cuevas Petatillo No. 5	018 562	-	50
9.	Cueva del Luchuza	011 577	392	43

Ixtacapa		grid. ref.	length m	depth m
10.	Cueva de Ixtacapa	063 060	1234	293
11.	Cueva de Pedro	066 644	100	10
12.	Sótano de Rythmic Rebelay	058 628	120	90
13.	Cueva de Vermino	057 628	194	87
14.	Sótano de Puerto de Belen	046 642	380	204
15.	Sótano de Rubbish Tip	045 638	-	15
16.	Sótano de Lavabo	047 636	60	40







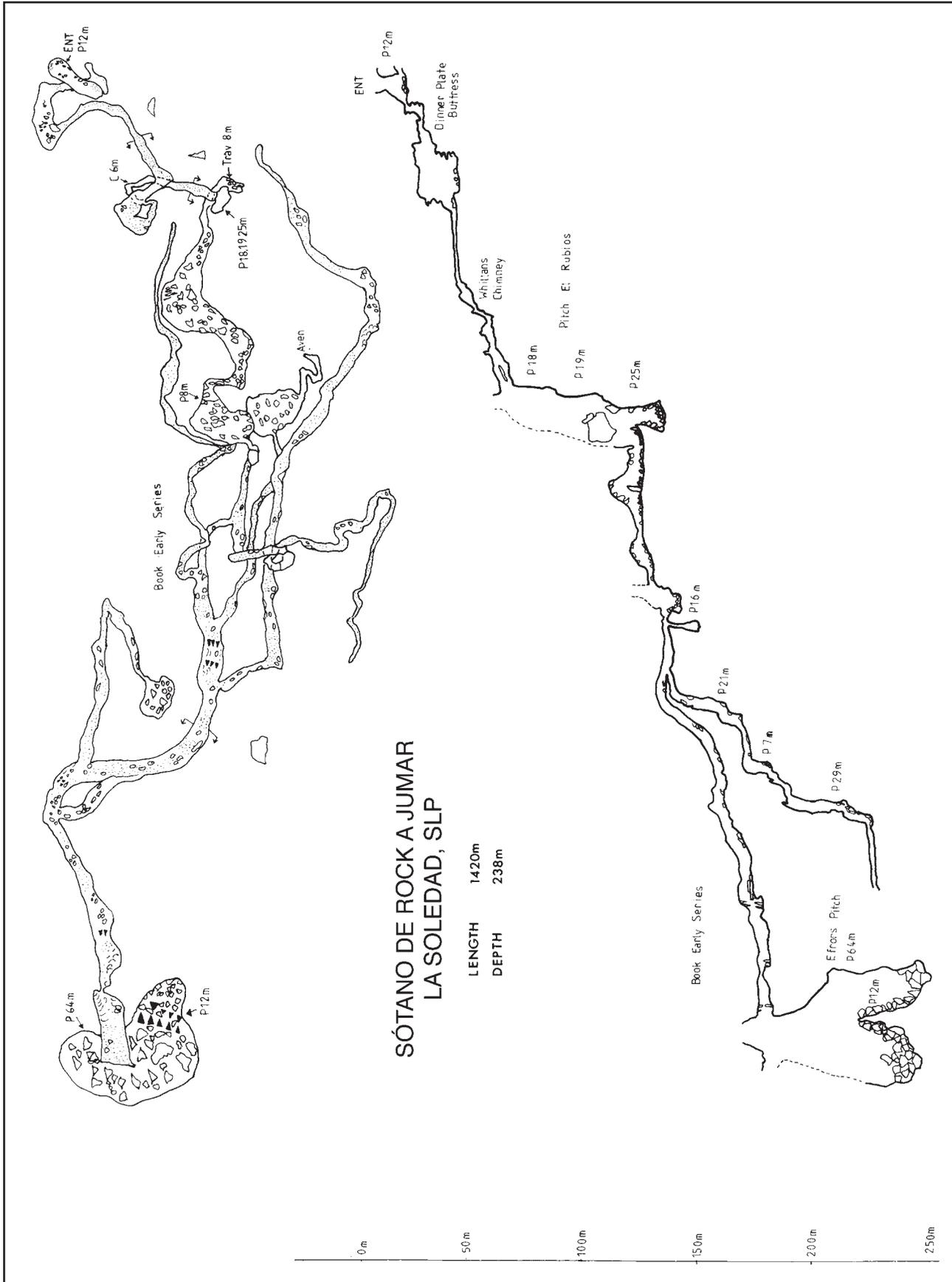


MIRAMAR-APETZCO AREA CAVES

		grid. ref.	length m	depth m
1.	Cueva de Apetzco	993 657	40	–
2.	Sótano de Muerta Vaca	960 672	–	17
3.	Sótano de Quebrado	963 668	–	50
4.	Cuevas de Quebrado No. 2	943 662	–	12
5.	Cuevas de Quebrado No. 1	948 667	8	–
6.	Cueva de los dos Peros	948 648	150	55
7.	Sótano Mirmar	954 651	–	7
8.	Sótano Nuevo Miramar No. 1	973 646	30	25
9.	Sótano Nuevo Miramar No. 2	971 648	–	10
10.	Sótano Nuevo Miramar No. 3	977 639	12	5

AHUACATLAN-RANCHO NUEVO-LA SOLEDAD AREA CAVES

		grid. ref.	length m	depth m
1.	Cueva de Noddy	855 552	3	20
2.	Cueva de Big Ears	855 553	4	20
3.	Cuevas de La Soledad	892 593	10	55
4.	Cuevas de La Soledad	902 588	–	15
5.	Cuevas de La Soledad	899 582	4	12
6.	Cuevas de La Soledad	896 576	5	16
7.	Cuevas de La Soledad	892 582	–	45
8.	Cuevas de La Soledad	924 599	32	10
9.	Cuevas de La Soledad	924 603	30	16
10.	Cuevas de La Soledad	925 602	–	30
11.	Cuevas de La Soledad	937 599	–	25
12.	Sótano Tres Posos	943 603	220	110
13.	Cuevas de La Soledad	941 606	10	–
14.	Cuevas de La Soledad	930 610	100	5
15.	Cuevas de La Soledad	932 606	–	100
16.	Cuevas de La Soledad	934 607	20	35
17.	Cuevas de La Soledad	934 608	2	4
18.	Cuevas de La Soledad	930 611	15	20
19.	Cuevas de La Soledad	925 610	35	10
20.	Cuevas de La Soledad	938 595	–	60
21.	Cuevas de La Soledad	939 597	10	–
22.	Cuevas de La Soledad	943 595	10	–
23.	Cuevas de La Soledad	927 587	30	5
24.	Cuevas de La Soledad	934 592	35	5
25.	Sótano Polo Conzapaterio	946 617	230	153
26.	Sótano de Rock a Jumar	952 615	1420	238
caves not on map:				
27.		850 662	20	60
28.		846 657	50	–
29.		849 643	15	20
30.		855 636	20	30
31.		865 635	17	5
32.		869 626	–	8



HUAUTLA, OAXACA DECEMBER 2007

Bill Steele

Our plan was four-fold: to check out a lead noticed twenty-seven years ago in the Sótano de San Agustín section of Sistema Huautla, to go out the new road north of the village of Agua de Cerro seeking permission to look for caves in that area and perhaps find some entrances, to meet Tony and Marion Akers after Christmas and go caving with them in the Ayautla area, and for James Brown to dive the Nacimiento del Río Uluapan* and scope it out more thoroughly than had been done in the past. None of our plans worked out very well.

Diana Tomchick, James Brown, Don Broussard, Ernie Garza, and I met up at Don's place in the country west of Austin, Texas, on December 14. The next morning we were on the road. We planned to take the central-highlands route to the vicinity of Mexico City, skirt it trying not to get lost along the way, and then arrive in the Huautla area by way of Tehuacán, Puebla.

The first night we camped just south of Bustamante, Nuevo León. We sought what we termed a "Strickland approved" campsite. Finding such a campsite is an art. You take a dirt farm road and look for a lesser-used side road off of it. It's a method that's worked every time I've ever tried it, without any problem, ever.

speleosteele@tx.rr.com
Reprinted from *Oztofl Caver*, volume 27, number 3, March 2008.

*This has been misspelled *Uruapan* by cavers for many years. See note in "Mexico News," Oaxaca.

In the morning we headed to Monterrey. Before we got there, however, we were pulled over for speeding. The usual negotiations ensued, with Ernie as our chief negotiator and me not able to resist getting involved. Finally we agreed to the fine, a convenient system wherein you are able to negotiate what the fine will be, then pay it in cash, with no record of it going to your insurance company.

A couple of days later we arrived in Huautla. There we visited some American expatriates I know who have adopted two Mazatec kids. We then saw the *presidente* of the Huautla area, got a letter of permission from him to be in the area, and pushed on to the village of San Agustín Zaragoza, perched on the ridge above the deep, funnel-shaped, giant sinkhole at the bottom of which is the awesome entrance to Sótano de San Agustín. We rented a large room above a store, which is attached to the home of the owner, and late in the day we hiked down 150 meters in elevation to the entrance of San Agustín. We found three bolts and hangers from the 1994 expedition that we would use for rigging the next day.

Our lead was above Camp I, about 250 meters deep. Our plan was to rig to that depth on the first day, take a good look at the lead, said to be 10 meters up the wall, with strong lights, and then

come in and do an aid climb.

The water was higher than normal in the entrance pit; this would be a factor at lower levels in the cave. Actually, it caused us to not make it to the lead. When we got to the fourth drop, the bolts there were old and untrustworthy, so I put in a new bolt. As everyone waited for me to get the bolt placed by hand, James Brown got extremely cold, so he and Ernie headed out. Don descended the next pit and in the process got soaked. In about an hour he came back up, shivering uncontrollably, saying that he had gone the wrong

James Brown begins his ascent of the waterfall drop in the entrance to Sótano de San Agustín.
Ernie Garza.



way as he descended. He was very cold and wanted to leave the cave.

That night I slept restlessly, thinking about how few we really were on this trip, how the water was high and the bolting up the wall to the lead would take a lot of time with

Photo-montage of the waterfall drop in the entrance to Sótano de San Agustín.
Diana Tomchick.



self-drive anchors. By morning I had thought it through, and I convinced everyone to abort this part of the trip and go on to our other objectives.

That day we took a tourist trip to Millipede Cave, a short cave high in the Sótano del Río Iglesia dolina.

Iglesia is the cave more than 500 meters deep that we connected to Sistema Huautla on our spring 2007 expedition [see article in this issue]. In Millipede Cave we searched hard for leads and took numerous photos of a large, ancient clay vessel I had seen on previous trips.

The following day we de-rigged San Agustín. While James Brown and Don Broussard went deeper to remove the ropes, Ernie, Diana, and I climbed up to the top of the massive breakdown and dirt wall at the base of the second drop, where in 1987 Doug Powell, Mark Minton, and I had discovered the Fool's Day Extension route to the lower cave. Once up high on the end of the huge Sala Grande, we realized the date: December 21, the winter solstice, the day the sun is at the lowest point in the sky for the year. The view was breathtakingly beautiful, with low-angle sunbeams lighting entrance waterfalls that are non-existent during the dry season. Many photos were taken.

The next day we headed to an area named Llano Verde, at the end of the newly bulldozed road to the north of the ridge that contains the highest entrances to Sistema Huautla. It is very karsty there, and I described it to everyone as an illustration one might see in a Dr. Seuss book, with houses perched precariously on karst pinnacles. Diana and I had driven out this road when we had been caving in Huautla in the spring. When we got to the tiny village of Llano Verde, no one was there. Finally we

found someone, who wasn't very friendly, and she fetched the *jefe*, or the elected head of the area. He was a little friendlier, but he didn't give us permission to be in the area. He said that there were bad people around there and that he needed to get permission from the people in the area for us to hike around and look for caves. He said we could come back in a year and see what the people had decided at a town meeting.

With two of our four objectives down, we looked forward to meeting up with Tony and Marion Akers. We were given the name of an *amigo* of theirs in Huautla to contact, and in a couple days' time we rendezvoused with them. Tony and Marion are cavers who have bought land near Ayautla, which is about a half-hour drive from Huautla, east toward the coastal plain. Tony is originally from Indiana, and Marion is from Georgia. They now live in Ohio part of the year and Mexico part of the year, and they import garden pottery from Mexico into the US for a living.

We met up with them and followed them to the tiny village of La Carlota, where we were going to camp in buildings built in the 1890s as part of a German coffee plantation. Our main caving objective in the area was to climb up to a giant cave entrance in the cliff face above the old plantation. We also hoped to visit other caves in the area.

We set up camp in the electrical generator building, where the owner, Waldo, and his brother, who live at the plantation, had installed a new toilet for us. In addition to Tony and Marion, their five-year-old son Simon was with us, a clever kid, who held his own matching wits with all of us. Also along was Jill Hemperly's son Jonathan Dible (JD), who was working for the Akers. He's a strapping young man in his early twenties, and I sized him up as the person to carry the big coil of rope up to the cave entrance high above La Carlota.

The entrance is named Cueva de Águila, or Cave of the Eagle. It was said that when the coffee plantation was in full swing, a large eagle lived in the cave. It would occasionally swoop down and pick up a dog or



Simon Akers being lowered into Cueva de Cafetal Carlota by Bill Steele. *Diana Tomchick.*

goat, and they worried that a child might be next. So they hid a man in a large basket under a blanket with a goat tied on top of the blanket. When the eagle came after the goat, the man stabbed it with a spear.

Once we'd settled in, Tony headed to Oaxaca City to obtain permission for us to go caving in the area. While he was gone, we took a day-trip to the Presa Miguel Alemán, the large reservoir that flooded out fifty thousand Mazatec farmers in the 1950s. We hired a boat to take us to an island with a village on it, said, according to legend, to be the first Mazatec village. However, before our hired boat showed up to give us our ride, we had time to eat a delicious meal of fried fish, locally caught from the lake. After the boat came for us, we clipped fast across the water to Isla del Viejo Soyaltepec, which is perched on a hill that is now an island in the *presa*. My guess is that around eight hundred people live on the island. We hiked around, causing a stir, because very few, if any, *gingos* have ever been there.

The next day, Tony had not returned from Oaxaca City, so we were unable to check out Cueva de Águila, and we decided to go check out a small cave on the coffee plantation,

Cueva de Cafetal Carlota. Marion and Tony had been in it before and described a promising but tight lead. Simon went with us. I tied up a Swiss seat harness for him, and he hung off a tether as I rappelled into the 10-meter entrance pit. At the bottom of the pit was a crawl, but then it opened up to walking passage. Marion said that they had seen a crab in the cave on previous trips, and we also saw it. Who has ever heard of a crab in the dark zone of an inland cave? It was about 4 inches wide and very lively. Diana took a short video of the crab defending its territory as I jabbed a finger at it; you can even hear my screams as it attempted to pinch me.

Next we came to a couple of climbs. One was about 6 meters deep, slick, and overhung. James Brown was in the lead. Marion said that they'd done the climb before with no rope, but after James descended it partway, he climbed back up and declared that it was a tricky climb that he wasn't sure Ernie and Don could do, because, being shorter than the rest of us, they would have a hard time getting back out. I was at the rear in the narrow passage leading to the pit when I heard my name called. They wanted me to look at the pit and see what I thought. As I passed Marion, she whispered that they had free-climbed it twice before, and had even passed Simon down and back up.

I took a glance and didn't like the looks of it, but after what Marion had said to me, I decided to climb it. It looked worse than it was. Once on the bottom, I climbed back to the top. I told everyone that it was okay, and then climbed back down it halfway, Marion passed Simon down to me, and then she climbed to the bottom. I passed Simon on down to her and then descended another 3 meters to the bottom. Diana was next.

I was looking up at Diana as she slipped off the climb and fell head-first down it. In less than a second, I made the decision to remain at her landing zone, and not sidestep and let her land on the floor. Diana disputes what I say happened next. In the instant that she fell on top of me, I flipped her in midair so that she landed on her butt rather than her head. She can't dispute that she landed on her butt, and she knows it happened somehow, but she can't bring herself to believe that I consciously pulled it off. I say I didn't do it consciously, I did it instinctively, with years of caving behind me, as well as from watching many Bruce Lee and Jackie Chan movies. If they can make lightning moves in their genre, why can't I in mine?

Anyhow, Diana hurt her wrist and got a huge, triangular-rock-shaped bruise on her thigh. Don and Ernie left the cave and sent JD, who had remained at the surface, back to our camp for a rope to rig the climb so Diana could climb out. She got herself out of the cave and wasn't hurt nearly as much as she might have been from falling headfirst down a pit.

The next day Tony returned from Oaxaca with the official permission letter, and then he and Ernie went into Ayautla to obtain local permission for us to cave in the area. The plan for the day was to support James Brown in a cave dive in the resurgence cave Nacimiento del Río Uluapan. While we busied ourselves loading caving and diving gear into the trucks, Tony and Ernie returned with the local permission.

The feisty Oaxacan cave crab. *Diana Tomchick.*



Ten minutes later two trucks full of local "bosses" arrived at the coffee plantation. A long conversation ensued, but in the end we did not have permission to hike across any private land. The big hassle was due to the turnover in the local political administration at the approaching end of the year, and the lame-duck politicians didn't want to be responsible for giving us permission. We couldn't go caving.

We decided the next day, our last in the area, to take a drive around the north side of the Presa Miguel

Alemán. It is thought that the resurgence of the 1,223-meter-deep Kijahe Xontjoa is forever submerged in this area of the *presa*. Swiss cavers explored the Kijahe, and I had camped over 1,000 meters deep in that cave for five days in 1993. On a boat trip in a cove in 1995, James Brown had located an underwater cave using a sonar fish-finder. He wanted to get a GPS location from the shore near the dive site, as he had collected a new species of fish in this location. The road had been extended around the cove, and we

drove to its end. It had been many years since the dive, and the area had changed greatly, so James took a GPS reading in the place that seemed the most likely location.

We left Ernie behind to spend another week with the Akers; they hoped to go caving after the first of the year, once the local government changed hands. Diana, Don, James, and I returned north by way of the coastal road, taking two days to get back to Texas, and arrived in time for the cavers' New Year's Eve party at Pete Strickland's place in Austin.

Huautla, Oaxaca, Diciembre de 2007

Espeleólogos de Texas visitaron el área de Huautla. Intentaron alcanzar un pasaje sin explorar a -250 metros en el Sistema Huautla pero no lo lograron debido a la gran presencia de agua en la cueva. Otros objetivos del viaje, incluyendo el buceo del Nacimiento del Río Uluapan, no fueron alcanzados debido a los problemas para obtener los permisos locales.

MÚSQUIZ CAVING

Philip Rykwaldler and Peter Sprouse

It was a wet year across Texas and Coahuila, and this was evident on our Labor Day caving trip to Coahuila. We loaded up twelve people in four Toyotas for the departure from Austin: Aimee Beveridge, Grace Borengasser, Joe Datri, Jubal Grubb, Geoff Hoese, Kori Jones, Saj Pierson, Patrick Rhoades, Philip Rykwaldler, Mark Sanders, Peter Sprouse, and Matt Zappitello. On 30 August 2007 we got as far as the town of Múzquiz. The next morning we met members of the Enríquez family, whose ranch we would be visiting. They led us northwest on the highway toward Boquillas del Carmen. The landscape was green as far as the eye could see, and we crossed numerous clear streams coming off the Sierra Santa Rosa. Our hosts said they hadn't seen it like this for ten years. After we had passed the Río Sabinas, which emanates from a major resurgence

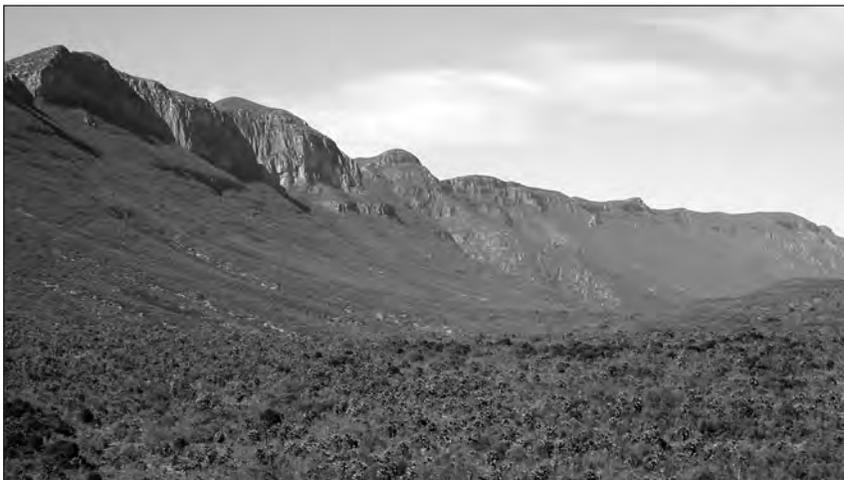
livetocave@hotmail.com
petersprouse@yahoo.com

called Kickapoo Springs, we took a left through a ranch gate.

We then passed through many intervening ranches and gates on the two-hour drive to the 5000-hectare Rancho las Águilas. Entering the Cañón el Eje, we began to see scattered fan palms on the steep limestone walls of the canyon. As we climbed higher into the hills, the vegetation grew taller. We stopped to look briefly at a horizontal cave in a cliff face that seemed to have good cave fauna. Mark took pictures of a *Myotis* bat and a mother spider with young. Soon we reached the ranch cabin, a curious structure built around an old bus. The ranch crew, which included some Coahuila state wildland firefighters, prepared a lunch for us of tacos with a spicy salsa made from native chiles piquins, which grew in abundance in the area. Then we drove up the canyon a bit farther to where the trail to several known caves took off. Our primary lead was a large

pit that some climbers from Saltillo had been down the year before. Two other leads are indicated on the topo map as sinks by contour lines. Our guides took us up a canyon onto a plateau, where they used machetes to open up the trail. The landscape was reminiscent of the Sierra de El Abra in Tamaulipas, not the desert we had come to expect in Coahuila. The thick scrub was topped off by oaks and tall yuccas. Soon we were at the deep pit, known as Sótano de los Enríquez. This has a very large entrance and a prominent opening in its south wall. Rocks dropped in fell a long way. Then we used GPS to reach the other sink, which was even larger. Along the way Geoff stumbled upon a small pit on the trail that sounded fairly deep. The big sink was about 100 meters across, with sheer limestone walls that only allowed one walk-in route down to what appeared to be a dense oak forest. We left all of these projects for the next day.

We got an early start and made our way back up the trail to Sótano de los Enríquez. We started clearing a spot over the high-side headwall to rig what looked like a nice clean drop. Philip dropped over the edge to work on rigging. Below the sunny 20-meter wall the pit belled out into an inviting open-air pit, but down below the sound of buzzing bees was ominous and forced a retreat. We circled back to the north side and descended a steep gully down which surface runoff flowed at times. An 8-meter drop got us to the real pit.

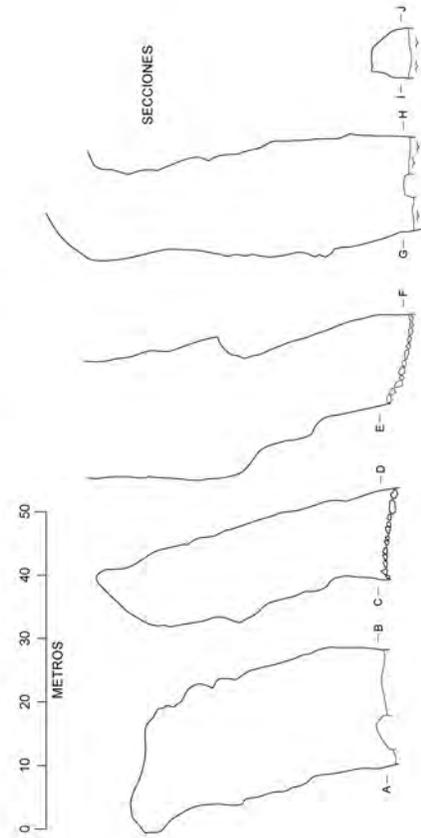
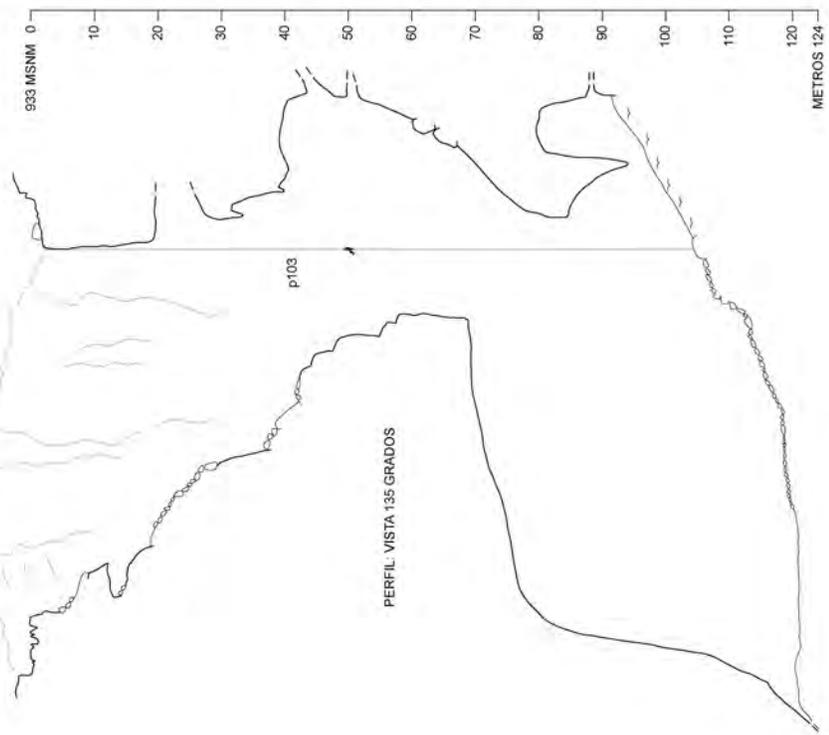
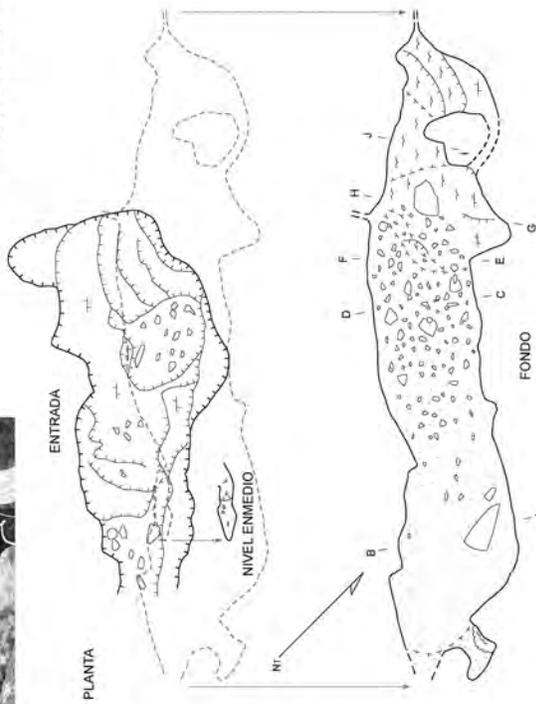


The Sierra de Santa Rosa.
Peter Sprouse.



**SOTANO DE LOS ENRIQUEZ
MUZQUIZ, COAHUILA**

TOPOGRAFIA CON SUUNTOS Y CINTA
1 SEPTIEMBRE 2007
GRACE BORENGASSER, JUBAL GRUBB
PATRICK RHOADES, PETER SPROUSE
LONGITUD: 225 M PROFUNDIDAD: 124 M
COORDENADAS UTM NAD27 225987 3129821
DIBUJADO POR PETER SPROUSE

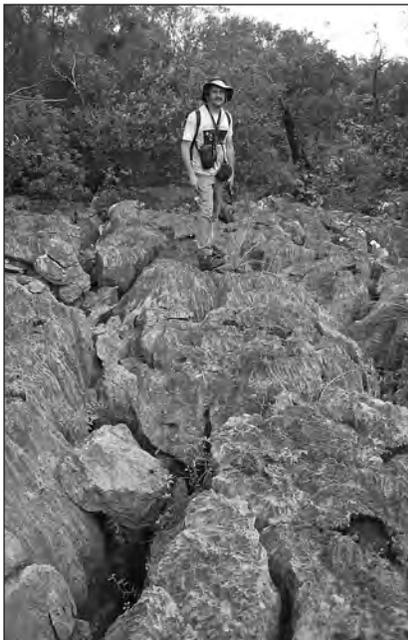


Philip at Pozo Medio Vacio.
Mark Sanders.

Philip rigged several short pitches, drilling bolt holes with the hammer-drill to reach a ledge from which a final spectacular 50-meter free drop reached the floor, a wide canyon. A slope up to the south led to an abandoned bat roost with guano a meter deep. To the north the dimly lit gallery was 15 meters wide by 50 meters tall, ending at a silt plug where the water line from recent tropical storm Erin could be seen over a meter up on the wall.

Meanwhile Aimee, Geoff, Kori, Mark, and Saj had gone to check out the oak forest sink, which did not go, and had been joined by Rick Enríquez and the firefighters, who worked on chopping a trail to another pit they knew about. They failed to find it, but Geoff did come across a new pit in which rocks fell about six seconds, so we had a new lead for the morrow. After we hiked back down to our camp, where some partook of swimming in a 250,000-liter stock tank and the ranch owner invited us to dinner. We hadn't quite made it to the ranch cabin before the sky opened up, soaking us completely, but we warmed quickly in the cabin. We had a nice slide show party and enjoyed more

Mark Sanders on the karst.
Peter Sprouse.



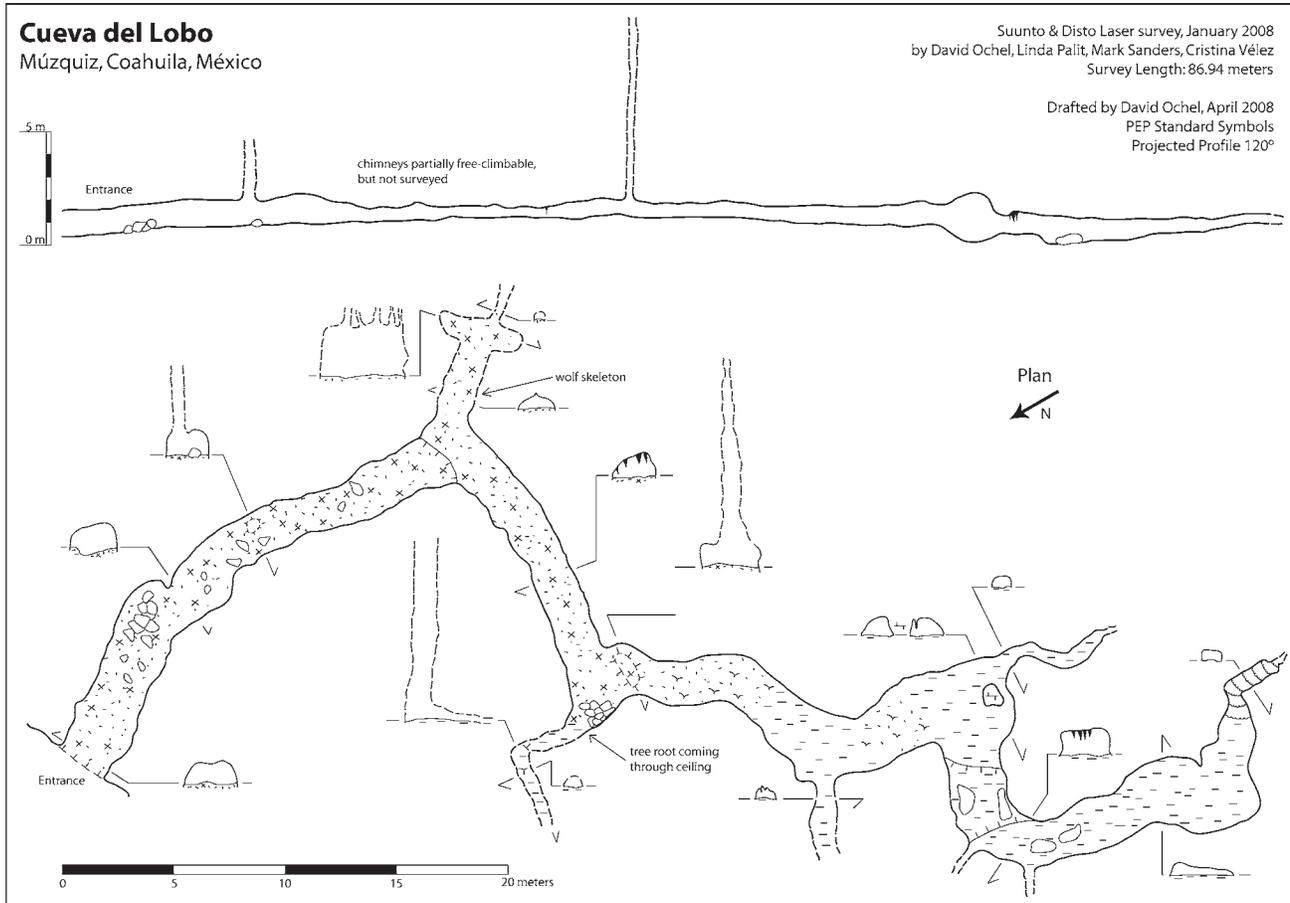
fresh chile piquín salsa with our dinner. It rained several hours into the night, and when we returned to camp we all found our tents in various stages of flood. Some slept quite wet that night.

Sunday we awoke to a muddy world. Philip, Mark, Geoff, and Aimee went to do the six-second pit, which ended up being called Pozo Medio Vacío. Finding little in the way of natural anchors on the surface, Philip tied the rope to some scrub, placed a bolt, and set off down a series of three pitches, placing rebelayes as he went. The first was a smooth-walled 27-meter pitch. It was followed by an 8-meter pitch to a cobble slope. A slot in the south wall opened immediately to a free, 30-meter blind pit and the end of the cave. Philip, Geoff, and Mark surveyed their way out of the 75-meter-deep cave.

Meanwhile, Peter, Jubal, Kori, Joe, and Grace explored the small pit near Oak Forest Sink that had been found along the trail on Friday. By the time we had cleaned loose rock from the entrance it was quite a bit larger. We rigged off a large boulder, and Jubal headed in with a pile of slings. He found a nice rebelay just inside, which got him down the first drop, then belayed again off a large stalagmite to get down the second

pitch. Kori and Peter mapped behind him. A lot of loose rocks were cleared from the top of the third drop, then Jubal rigged off a thread to get down a few meters to where a large bedrock horn provided a bomber anchor to get down what turned out to be the last pitch. The floor was composed of loose rocks that could be dug, but there was no airflow. Joe came down to photograph, and Grace made it partway down, before we all started up, dodging rocks. We named this cave Pozo Cornucopia. We found our guides in the area still working on chopping a trail westward to the elusive third pit. They had run across a 20-meter pit along the way, and some of us joined them in continuing the search effort. As the new trail continued west across well-developed karst, 8- and 21-meter pits were passed. Finally a canyon stopped progress, and the effort was abandoned. As the last of us made it to camp before dark, the rain started again, and it had us huddling under a tarp while inches of water fell.

The next morning we packed up our soggy tents and drove back down to the cabin, where our new friends made us chilaquiles with—what else—chile piquín. When we started the two-hour drive back to the highway, the rain returned. This made for a very muddy road with



lots of slipping, sliding, and a few stuck moments, but we eventually reached the highway. We stopped to swim at the Río Sabinas before heading for the border and the long holiday queue, to end a wet and enjoyable weekend of caving in Coahuila.

After the success of the Labor Day trip we were soon planning a return to the Rancho las Águilas. Fifteen cavers met up in Múzquiz on the night of 17 January 2008. Mónica Ponce, Pedro Ramírez, and Cristina Vélez came from various parts of Coahuila, while the rest of us were from Texas: Don Arburn, Grace Borengasser, Joe Datri, RD Milhollin, David Ochel, Linda Palit, Ryan Reid, Mark Sanders, Vickie Siegel, Peter Sprouse, Drew Thompson, and Heather Túček. The following morning we gathered for breakfast at Martha's Restaurant, where we met several people who told us about caves in the area. We picked up the keys from the rancher and headed out the highway to our turnoff. After

some distance on the ranch roads we took a detour to Rancho la Mariposa, where Peter had seen what looked like a resurgence on Google Earth. We parked at a stock tank and walked 1000 meters across scrubland to an arroyo. We followed this upstream and soon came to a large depression, the source of the arroyo. It was about 20 meters across and 15 meters deep, with slopes of dirt and slumped slabs. At the bottom was a mass of clean, rounded cobbles. Warm air blew out through these, and pebbles bounced down through them. We soon began removing rocks, some of them shaped perfectly like dinosaur eggs. But the bigger ones were impossible to budge without tools, and there was little space to pile the rocks at the bottom of the funnel. So we reluctantly left the Embudo de Huevos for another time.

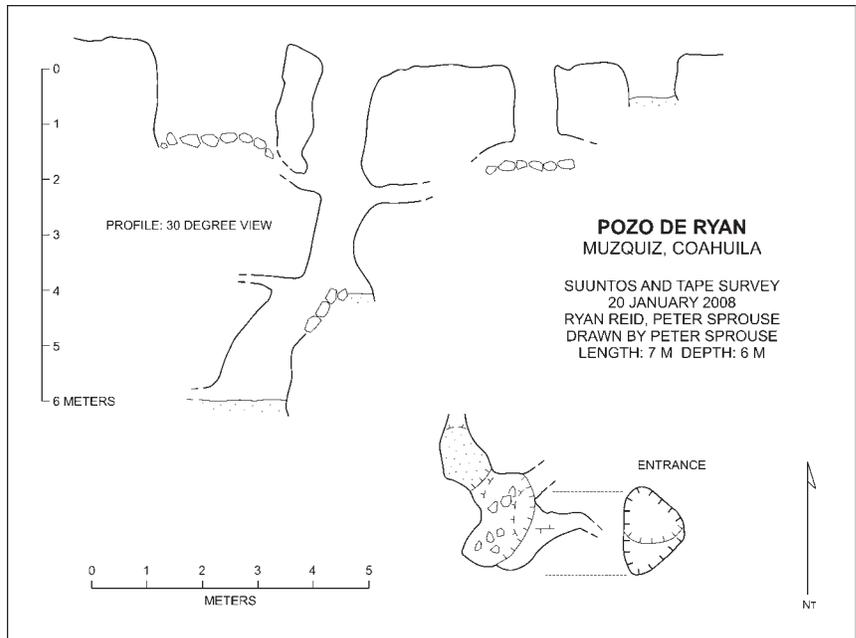
We got back on track and soon entered the Cañon el Eje and Rancho las Águilas. We set up camp at the

The bottom of Sótano de los Enríquez.
Peter Sprouse.



same spot we'd used a few months earlier. The next morning we split up. David Ochel led a team consisting of Mark, Cristina, RD, and Drew back down the canyon to map a cave we'd been shown by the rancher on our previous trip. This horizontal cave in the canyon wall is about 85 meters long. It turned out to have some interesting biology in it. A bear skull found in it was initially thought to be that of a wolf, and the cave got named Cueva del Lobo as a result. RD and Drew then chopped a trail up onto the ridge above the cave to look for a lead we'd seen on aerial photos, but they ran out of time before reaching the spot. The rest of us hiked up the trail toward Sótano de los Enríquez. As we crested the mesa, we veered to the right off the trail to look for more aerial-photo features. We located and dug in several sinks, one with airflow, but didn't get into any caves there. We headed on over to look at the spectacular entrance to Sótano de los Enríquez, and then

Philip rappelling in Sótano de los Enríquez.
Peter Sprouse.



we split up into two teams. Vickie, Heather, and others went to check a pit we'd found on the previous trip that had been estimated to be 8 meters deep. Peter, Mónica, Pedro, and Don chopped a trail to the east to look for another aerial-photo lead. We didn't get as far as the lead, but did run across a small pit. Cueva de la Bolsa went down two climbs and a pit to pinch at a depth of 18 meters.

The next day teams split up for various objectives again. Ryan, Linda, Peter, and Grace drove up the ranch road to the north, aiming for some aerial-photo leads. This road climbs a steep gully to end on a ridgetop at the foot of the Sierra Santa Rosa. There were spectacular views of the palm-covered flank of the sierra. The ridge we were on was riddled with

sinks and karst features, but after a long hike and trail-chop, the lead turned out to be merely a meadow. On the hike back we checked a small pit in the karst area. Pozo de Ryan was a climbdown to a small room, 6 meters deep. RD and Drew went back to the ridge they had chopped up the day before, accompanied by Monica and Pedro. They checked a number of small caves and pits, Pozo del Lobo (distinct from Cueva del Lobo), Cueva Pinche Uña de Gato, Pozo Pierna de Perro, and Cueva Centeno, but none went. Don, Vickie, David, and Cristina went back up to continue Don's chop of the day before, still not getting to the photo lead, but finding a pit nonetheless. They got about 50 meters down this, but there was another drop and they were out of rope, so this would have to wait for another trip. The next day the crew made the long drive out of the ranchlands and the short drive back to Texas.

Espeleología en Múzquiz

Espeleólogos visitaron el Rancho Las Águilas, al norte de Múzquiz, Coahuila, a finales de agosto de 2007 y nuevamente en enero de 2008. Se encontraron y exploraron varias cuevas pequeñas.



MEXIQUE 2008

Richard Grebeude

The Groupe Spéléo Alpin Belge held its 2008 Mexico expedition between February 10 and the beginning of March. The GSAB's exploration zone is located in the general area of Zoquitlán in the Sierra Negra in Puebla, north of Huautla and south of Zongolica.

During twenty-eight years of GSAB expeditions in the Sierra Negra, a great many caves have of course been discovered and explored, including three of the nine -1000-meter Mexican caves. So far, close to 200 kilometers of passage has been discovered by the GSAB in this huge massif. Over the past ten years, we have mainly been trying to find caves with the potential to connect with the vast Coyolatl resurgence cave, which we had explored to 20 kilometers in length in the mid-1980s. Gouffre Esperanza (TZ57) was discovered in 2003 near the known upstream reaches of Coyolatl, and it was explored in 2005 to a depth of 540 meters. In 2006, an additional 500 meters was explored and, finally, the first connection between a pit located on the massif and Coyolatl became a reality, bringing the total length of the system to 23 kilometers. [See *AMCS Activities Newsletter* 29, pages 37-41.] The actual traverse between Esperanza and Coyolatl is 7 kilometers long and 620 meters deep.

After several consecutive years of having established base camps at an elevation of 1000 meters near the center of the village of Tepepan Zaragoza, this year's expedition

moved away from this area, which had been thoroughly explored during the past few expeditions, in order to be more secluded and at a higher elevation. Therefore, a new base camp was established on a saddle at 1400 meters, well away from any village.

This 2008 expedition was the shortest of all Sierra Negra expeditions so far. Indeed, without counting the days needed to reach the massif from the Mexico City airport with all the gear and food, this year we had only sixteen days to spend on site. Already handicapped by so little available time, the expedition was also slowed down by an epidemic of influenza, probably contracted on the plane, which took five of the ten participants out of commission for five to six days. Apart from these details, all went perfectly well. The first few days were devoted to prospecting, as well as to the difficult rigging of a large, spiraling pit whose walls were sometimes quite rotten. In addition, Cueva Roberto (TB3), explored to a depth of 350 meters in 2000, was rerigged, because besides good airflow, it contained a large pit and passage at the -300-meter level that had not yet been explored. An additional 500 meters of passage was discovered there, for a new depth of 400 meters, but the newly explored lead did not reach a hoped-for main stream passage.

Later during the course of the expedition, while searching for a pit likely to join Coyolatl at the level of the infeeder "La Fluette," a new cave blowing a gale of air was discovered, and so started the adventure of Tepetzala. After a few hundred meters

of large meanders punctuated by small pits, a 100-meter-deep vertical series gave access to large passages, often about 30 meters wide and over 40 meters tall. In just a few trips, we were able to explore nearly 3 kilometers of passage, 2.5 of which were practically linear and devoid of pits, heading straight down into the heart of the mountain mass we are exploring. The current depth is 272 meters, and we turned around at the end of the expedition in going passage.

The river, small during the dry season, that traverses Tepetzala is joined along its length by various infeeders, some of which come from caves that we had explored before. Hydrologically, Tepetzala is an infeeder to Coyolatl, which it will join sooner or later, but far upstream of the main drain in Coyolatl in passages that are still unknown. Moreover, Tepetzala heads directly towards Akemati, a system over 1200 meters deep that we discovered and explored in 1988. [See also article on Akemati area in this issue.] A connection with that cave in addition to Coyolatl would mean a 35-kilometer-plus system, with a total traverse depth of 1450 meters.

This year's discovery is thus undoubtedly an important and major element of the hydrologic puzzle that we have been trying to figure out for nearly thirty years. We are of course very anxious to continue this exciting exploration on our next expedition.

richardgrebeude@skynet.be
Translated from French by Yvonne Droms.

Mexique 2008

El Groupe Spéléo Alpin Belge realizó su expedición a México 2008 en febrero. Acamparon en un área nueva a 1400 metros en la Sierra Negra de Puebla. La Cueva Roberto, que había sido parcialmente explorada en el 2000, fue extendida por 500 metros de topografía hasta una nueva profundidad de 400 metros. Tepetzala, un nuevo descubrimiento, tiene ahora casi 3 kilómetros de pasajes y alcanza una profundidad de 272 metros. Esperan poder conectar el pasaje fluvial de Tepetzala a Coyolatl en algún punto más allá de la exploración actual.

FIFTH ANNUAL TULANE MAYA SYMPOSIUM AND WORKSHOP

Sacred Cenotes, Hidden Caverns: Rituals, Beliefs, and Everyday Life Relating to Caves and Cenotes among the Maya



This symposium, hosted by the Stone Center for Latin American Studies at Tulane University, was held on February 15–17, 2008. The abstracts for the papers and workshops follow. These abstracts are reprinted from <http://stonecenter.tulane.edu/MayaSymposium/bios.html>, where additional biographical information on the authors can also be seen.

PAPERS

The Hole Truth: Reflections on Fifty Years of Maya Cave and Cenote Research
Keynote Lecture

George E. Stuart
Boundary End Archaeology Research Center

The modern age of exploration, documentation, and interpretation of cenotes and caverns in the Maya area began in earnest with work carried out at Dzibilchaltun and Balankanche Cave, Yucatán, a half century ago under the direction of E. Wyllys Andrews IV of Tulane University. The discovery of Naj Tunich cave in Guatemala in 1979 led to broader studies of Maya sacred geography by James Brady, Andrea Stone, and others. Dr. Stuart participated in each of these discoveries and will share his experiences on those occasions in a talk supplemented by photographs of those endeavors, many of which have never been published.

Prohibido Tocar Este Cenote: The Archaeological Basis for the Titles of Ebtun

Rani T. Alexander
New Mexico State University

Ebtun, Kaua, Cuncunul, Tekom, and Tixcocalcupul comprise one of the few groups of related communities on the Yucatán peninsula for which we have a substantial and long-running (1600-1833) corpus of Maya-language documents, originally published by Ralph Roys (1939) as *The Titles of Ebtun*. Although the towns were created after the conquest by forcibly moving native inhabitants to these locations, the Maya retained private and municipal ownership of their lands, which largely corresponded to the boundaries of the prehispanic native province of Cupul, into the 20th century. Roys located many of Ebtun's cenotes, wells, dependent settlements, and agricultural parcels on maps, but contemporary works have placed little emphasis on the material underpinnings, places, and spatio-temporal contexts of the events and discourses represented in historical sources.

Cenotes, in particular, are touchstones of social memory and historical meaning across this landscape. My goal in this paper is to explore the transformation of Ebtun's cultural geography by analyzing archaeological variation in the life histories of cenotes and important places over the last 500 years. As new plants, animals, technologies, and forms of

transportation were adopted after the Spanish invasion, organizational relationships within the landscape changed, and named locations took on new purposes and meanings.

Today, local control of this landscape is threatened by urbanization and rapid development of tourist infrastructure serving the Chichén Itzá archaeological zone. To forge meaningful and long-term collaborations for the conservation and management of archaeological resources, archaeologists and members of native descendant communities must work together to understand how post-conquest histories and identities are related to the distribution of cultural resources in space and time.

Emerging from the Dark: The Development of Maya Cave Archaeology

James E. Brady
California State University, Los Angeles

The investigation of Maya caves has a long history dating back to the pioneering explorations of John Lloyd Stephens and Frederick Catrwood in the 1840s. During a brief period in the 1890s, early archaeologists produced a number of exceptional studies that demonstrated the wealth of material in caves, the ritual nature of these deposits, and the close association of caves with site architecture. Unfortunately, these studies did not change the widespread conceptualization of caves as habitation sites, nor did they excite further research. As a

result, cave investigation was not incorporated into the research agendas of the large institutional projects that dominated Maya archaeology during the first three quarters of the 20th century. Cave studies all but disappeared from the literature between the World Wars and only began to make a tentative resurgence after World War II. The revival was short lived, however, due to the untimely deaths of Dennis Puleston and Tulane University's E. Wyllys Andrews IV, and the passing of J. Eric Thompson in the 1970s—all the archaeologists actively working on Maya caves at the time. The study of cave archaeology developed from the work of a number of graduate students who entered the field in the 1980s and set the foundation for the sub-discipline that emerged only a decade ago.

At the heart of the new field of Maya cave archaeology is the recognition that caves are an essential feature in the validation of settlement space. This role is based on indigenous beliefs that *Earth*, as an animate entity, is the most sacred and powerful force in the universe. Human beings themselves are born from the *Earth*, emerging onto the surface from caves. Westerners have failed to appreciate the importance of places of origin in the validation of space. Ironically, the essential role of caves is best illustrated in areas that do not have caves. Since the 1990s, I have documented the construction of artificial caves in non-karstic regions of Guatemala and Mexico. Artificial caves are interesting precisely because they are human constructions whose layout reflects cultural ideals; they therefore tell us what caves in general meant to the ancient Maya.

Cenotes and Caves of the Maya Region: Natural Archives of Paleoenvironmental Information

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Archaeologists have long recognized the importance of cenotes and caves in the lives (and deaths) of the ancient Maya. Cenotes and grutas were invaluable water sources for prehistoric communities and influenced the distribution of early Maya settlements. Flora and fauna of aquatic ecosystems provided protein for local inhabitants. Caves and sinkholes also served as connections to the "underworld." In some cases they have yielded caches of ritual materials and mortuary remains. For earth scientists, *cenotes*, *aguadas*, *lagunas* and caves represent potentially rich natural archives of paleoenvironmental information. Since the late 1950s, investigators have used sediment cores from continental water bodies to gain insights into environmental conditions before, during, and after dense human occupation of the Maya lowlands. These aquatic ecosystems can accumulate sediment in an ordered, rapid (~1mm/yr) fashion. Sediment profiles from such systems contain a record of environmental changes that occurred in and around the water body. Stratigraphic study of proxy environmental variables in the cores (e.g., sediment chemistry, pollen, and other microfossils) can shed light on past relations among climate, humans, and environment. Similarly, studies during the last decade have shown that speleothems (stalagmites) from caves in the Maya area can yield high-resolution records of past environmental conditions. Changes in the stable oxygen isotope signature, i.e., the relation between ¹⁸O and ¹⁶O in the calcite along the growth axis of the stalagmite, can be used as an indicator of shifts in past rainfall amount.

Here we present seismic imaging and sediment core results from Lake Salpeten, Peten, Guatemala that enabled us to quantify the relation between prehistoric land clearance and soil erosion. Our data indicate that the most rapid loss of soil occurred in Preclassic times, before large population densities were attained. The results suggest that even low numbers of settlers can have profound impacts on tropical environments. We also present stable oxygen isotope data from

speleothems collected in two Yucatan caves (Tzabnah, near Tecoh, and Las Columnas, near Tzucacab). Both speleothems show evidence of late Holocene dry episodes, and in particular, of terminal Classic drought. These results are consistent with strong evidence for a series of terminal Classic droughts that comes from nearby Lake Chichancanab.

Giving the Devil His Due . . .": Ah Tanlahob Chac (The Servants of Chac) and Colonial Yucatec Maya Rituals and Offerings in Caves and Cenotes, 1550-1750

James F. Chuchiak
Missouri State University

Caves and cenotes served as important sacred spaces where the Maya could come in contact with their gods throughout the colonial period. Maya temples and shrines were also built in close proximity to caves or cenotes, further emphasizing the sacred nature of caves in colonial Maya ritual. The modern Maya continue to go to caves to offer petitions to the gods, as well as their ancestors, who are believed to live there.

Cave rituals, due to their secret nature even today, are poorly understood. Eyewitness accounts are important sources of evidence since old remains and offerings are often swept away and disposed of before new ceremonies were held. The same is true for colonial ceremonies held in caves. What little we know about these cave or cenote ceremonies comes from eyewitness accounts written down in the documentary record during ecclesiastical idolatry trials. One seventeenth century account reported that the Maya most often "held their idolatries in caverns as they call them, in the forests, hills and caves." Therefore, cave shrines and cave worship were important factors in both pre-Hispanic and colonial Maya religion. The mouths of caves themselves were believed to be the entrance to the Maya underworld, called Xibalba, where the death gods Ah Puch, or Cizin, and Uac Mitun Ahau dwelled. The archaeological remains of ceremonies and rituals, including ritual

paraphernalia from stingray spines to copal incense, have often been found inside caves.

This presentation examines the nature of colonial Maya cave worship and illustrates how caves and cenotes remained important sacred spaces in which colonial Maya rituals continued to be performed. Numerous reports of cave rituals and what the colonial clergy called acts of "idolatry" occurring in caves signal the central importance of caves and cenotes to the worship of the Maya rain god Chac. By examining the ethnohistorical evidence for Maya cave rituals and the information on Maya ritual specialists who served as Ah Tanlahob Chac (or 'the servants of Chac'), this presentation illustrates the continuities and changes that occurred in Maya cave worship throughout the colonial period.

Modern Kaqchikel Altars: Making and Re-making Sacred Spaces

Judith Maxwell
Proyecto Lingüístico Francisco Marroquín, Guatemala

Traditional Mayan religio-spiritual practices have undergone a revitalization in Guatemala since the mid-1980s. The ranks of daykeepers (Mayan ritual specialists) have swollen and now include many young people, young women and young men alike. The federal government has officially recognized the rights of these practitioners to perform ceremonies at designated sacred sites. Court cases are currently pending to force private landowners to conserve altars on their lands and to allow free passage to them. Still, many altars have been deactivated, either through modernization projects that build over the sites or through desuetude. Other altars have been relocated, reconsecrated, and reactivated. Altars that have been "continually" in use are often in remote areas. Many are on mountaintops or escarpments. Each *municipio* typically has four guardians, associated with four prominences, as aligned with cardinal points as the local topography allows. These prominences often have calendrical names. "Caves" or rock overhangs

are also ritual spaces, portals for communication with ancestral spirits and the divine. These rock sites may also have calendrical names; others are eponyms of historic personages or events, though always with an associated calendar spirit. Many archaeological features, associated directly with the ancestors of the Kaqchikel and other Mayan peoples, are also considered sacred spaces. Indeed, the term *k'ox tun*, which meant "wall or tower" in Colonial Kaqchikel, is now a general term for a Mayan temple or site appropriate for worship. Over the past four years, I have been documenting the sacred sites in the Kaqchikel area, locating, photographing, and recording accounts of usage. Unsurprisingly, usage patterns have shifted as *evangélico* and *católico* injunctions have influenced public religiosity. Revitalization movements, uneasily allied with international *espiritistas*, have bolstered the importance of particular shrines, while marginalizing others. Social action groups tend to adopt a local altar or activate new spaces, often invoking spirit owners of neighboring traditional worship sites. While the *ab'* (cf. Yucatec *haab*) months are not currently used, the *cholq'ij* (cf. Yucatec *tzolkin*) day names are actively employed in naming of sites, in assessing proper days for particular kinds of petitions, in the lay-out of the offerings and in the invocations. Care of an active site is often a semi-hereditary responsibility; sites with no active caretaker may require special care for visitation and use. The most powerful sites have anterooms in which prayers must be offered for admission. In this presentation, I will map out the Kaqchikel sacred space, aligning known modern sites with those mentioned in colonial documents, with the archaeological built landscape, and with natural portals: mountaintops, escarpments, and "caves."

Rituals and Meanings Related to Maya Human Disposals in Caves and Cenotes

Vera Tiesler and Andrea Cucina
Universidad Autónoma de Yucatán

Like cenotes, dry caves were conceived by the ancient Maya as sacred spaces. Both were held to be thresholds, which linked the realm of the living with the underworld. It is in this light that we explore the different mortuary pathways that are the origin of human assemblages found in caves and cenotes within the Maya area. Utilizing historical, geological, taphonomic, and archaeological evidence, we highlight ritual conduct involving posthumous body processing and deposition. These inform us about the circumstances and meanings of human disposals in wet and dry caves. We pose new questions regarding the role of caves as human depositories and propose some ideas for future recovery techniques and analysis of human remains.

Caves, Sinkholes, and Springs in Maya Art and Writing

Marc Zender
Harvard University

Much of the Maya area is underlain by a karstic limestone landscape of fissures, holes, and caves. These include not only the ubiquitous hill caves of southeastern Mexico and the Maya Mountains of Belize, but also the enormous underground caverns and sinkholes of Yucatán. Caves play vital roles in Maya ritual life, and archaeological evidence indicates that the use of caves for pilgrimage centers, shrines, and even tombs dates back to at least the Middle Preclassic period. It should come as little surprise, therefore, that caves are a frequent topic in Maya art and writing.

In Classic Ch'olti'an, the word for "cave" was *ch'een*. Central to the most common glyph for "cave" is a rocky overhang (also featured in the signs KAB "earth," WITZ "mountain," and TUUN "stone") and a shadowy zone peopled by bones, mandibles, and disembodied eyes (features also shared with the iconography of bats, tombs, and the underworld). This iconography is arguably focused on dry hill caves as places of burial and ritual. Yet there are other signs for "cave" in the versatile and calligraphic Maya

script. One of them is the well-known superfix to the Uayeb month glyph, probably reading WAAY “cistern, cenote” and narrowly referencing sinkholes. Another, the so-called “portal” sign, represents a quatrefoil frequently qualified by the HA’ “water” glyph. While the phonetic reading of this sign remains somewhat uncertain, contextual evidence suggests that it privileges associations with wells and springs.

Intriguingly, these signs share many features with Highland Mexican depictions of caves, particularly the Preclassic art of Chalcatzingo and the OZTO “cave” sign common in Aztec codices of the Late Postclassic and early Colonial era. These widespread conventions for the depictions of caves, cenotes, and springs are as surprising as they are compelling, and suggest deep historical connections behind some of these signs and pictorial conventions.

Contemporary Stories: Ancient Themes
Poster Presentation

Marianna Kunow
Southeastern Louisiana University

My research in Yucatan examines the ways in which the Maya people of the peninsula use the plants in their environment. In the field people often told me bits of local stories and I began to record them. It was apparent that ancient themes appear in the contemporary Yucatecan folktales. One cluster of stories focuses on the related topics of winds, caves, and *cenotes* (sinkholes). My illustrated poster (re)tells two of these tales. They will be included in a volume featuring my translations and illustrations.

Geographically, Yucatan is a flat limestone plateau punctuated by

cenotes that provide access to underground water. There are no rivers there, and sufficient rain is a critical issue. People have built their lives around cenotes for many years. The area is also characterized by a large number of dry caves. Wind is, of course, a natural feature. In the Yucatec worldview, winds are connected to cenotes, caves, and the supernatural world.

Wind may be regarded as a generalized movement of air, a supernatural entity in itself, an after-effect or phenomenon that results from contact with supernaturals, or as a part of symptoms that make up diseases. Winds are connected with wells, caves, and water in general.

Caves are entrances into the underworld, and therefore are logical points of connection to supernatural beings in many Mesoamerican cultures. Some scholars believe that the ancient Maya universe was divided into an Overworld, a Middleworld, and an Underworld: the latter could be entered by means of either a cave or through bodies of standing water, such as the ocean or a lake.

The stories I retell and illustrate here demonstrate the ways in which the old and the new combine in contemporary tales from Yucatan.

WORKSHOPS

Caves, Cenotes, Cosmology, and Calculations

Anthony Aveni
Colgate University

Join Dr. Aveni in examining where images of caves and cenotes occur in the Maya codices, making use of the Maya Hieroglyphic Codices website (www.mayacodices.org). The discussion will focus on the contexts in which the images occur, what they might mean, and how the

numbers behind the almanacs shape our interpretations of them.

Maya Glyphic Inscriptions in the Naj Tunich Cave

Markus Eberl
Tulane University

Guatemala’s Naj Tunich cave contains a large number of painted glyphic texts. They provide important insights into the ways in which the ancient Maya used this cave. The workshop offers an introduction to texts from Naj Tunich and embeds them into the political and metaphysical landscape of the Late Classic. It targets those who have some previous experience working with hieroglyphic texts.

The Maya Underground: An Introduction to the Ancient Maya and Their Ideas about Caves, Cenotes, and the Underworld

Bryan R. Just
Princeton University Art Museum

This workshop will introduce participants with little or no prior knowledge to ancient Maya history, art, and religious ideas, with special focus on how they involve caves and cenotes. How were these geographical features represented? What did the Maya do in them?

After a two-hour section exploring these and related questions, participants who are teachers will be offered a special section addressing ways to involve the Maya in primary-level and secondary-level classroom lessons in a variety of subjects. Other participants will have the opportunity to explore cave and cenote imagery highlighted in the collections of Tulane’s Latin American Library.

Quinto Simposio y Taller Anual Maya en Tulane

El tema de este simposio en Tulane University en febrero de 2008 fue “Cenotes sagrados, cavernas ocultas: rituales, creencias y vida diaria relacionadas con las cuevas y cenotes entre los mayas.” Estos son los resúmenes de las presentaciones en el simposio.

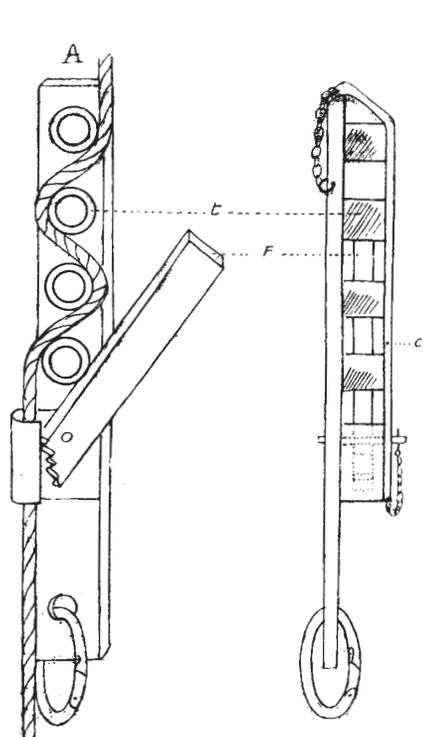


Fig. 26. — Frein de descente.

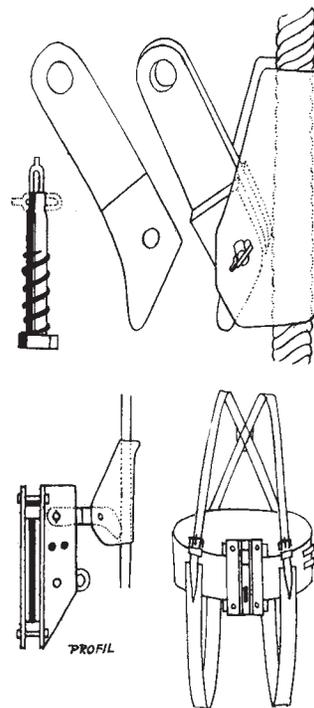


Fig. 27. — « Singe ».

Spéléologie: Le matériel et son emploi les explorations.

Henry P. Guérin.

Éditions J. Susse, Paris.

1944.

