

A person wearing a red wetsuit, a red helmet, and yellow boots is rappelling down a dark, layered rock face. The person is positioned on the left side of the frame, with a rope extending from the top left. Below the person, a waterfall flows down the rock face, creating white foam. The background is dark and textured, suggesting a cave or a deep crevice.

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Association for Mexican Cave Studies
with assistance from William Russell

Editor

Carol Vesely

Assistants

Nancy Pistole, Peter Sprouse

Staff

Richard Chang, Bill Farr, Louise Hose,
Patty Kambesis, Susie Lasko, Bill Mixon,
Dale Pate, Bob Richards, Jim Rodemaker,
Bernie Szukalski, Terri Treacy

Translations

Katy Arens, Peter Bosted,
Renato Dale Mule, Peter Sprouse,
Marc Tremblay, Alejandro Villagomez M.



Front Cover

Bill Steele descending an eight-meter pit
on the way to the -958 Sump in
Sistema Cuicateca, Oaxaca. (Bill Stone)

Frontpiece

Mike Futrell in the Gorge, San Agustín,
Sistema Huautla, Oaxaca. (Jim Smith)

Title Page

Sótano de Cerro Vista, Cerro Rabón, Oaxaca.
(Ernie Garza)

Back Cover

Peter Keller rigging the 120-meter entrance
shaft of Oztotl's Window,
Cerro Rabón, Oaxaca. (Karlin Meyers)

Editorial:

As you can see, this issue of the *AMCS Activities Newsletter* is considerably longer than previous issues. This reflects not only the length of time since the last publication, but also the increasing number of major caving expeditions to Mexico. More and more, Mexico is attracting caving groups from around the world. As the pace of discovery of deep caves in Mexico increases (there are three new kilometer-deep caves since last issue!), this trend is likely to continue. Each new group seems determined to find a section of karst to call its own. Fortunately, there are still plenty of virgin caving areas left to explore. As each group stakes its claim, let us keep in mind that Mexico is not a distant planet where we can plant our flag, but a sovereign country with a rich cultural heritage.

Recently, there has been a trend towards increased international cooperation among groups exploring caves in Mexico. Swiss and American cavers worked together to explore the Cerro Rabón. French and Italian cavers joined forces in Chiapas. Cavers from the United States, Belgium, and Mexico explored Ocotempa. Americans participated on expeditions led by the Quebec cavers to Sierra Negra and the Australians to Chilchotla. Mexican cavers joined the PEP expedition to Purificación and the Sierra Negra trip. It is good to see cooperation rather than rivalry among groups. However, there is a danger that as competition to find kilometer-deep caves increases, and the amount of virgin caving territory decreases, the trend will shift from communication and cooperation to secrecy and scooping others' leads. We must not let this happen. We must all work together to set a good example for the rest of the world, and not let our quest for glory ruin our relationships.

Carol Vesely

Association for Mexican Cave Studies

P.O. Box 7672
Austin, Texas 78713

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MÉXICO

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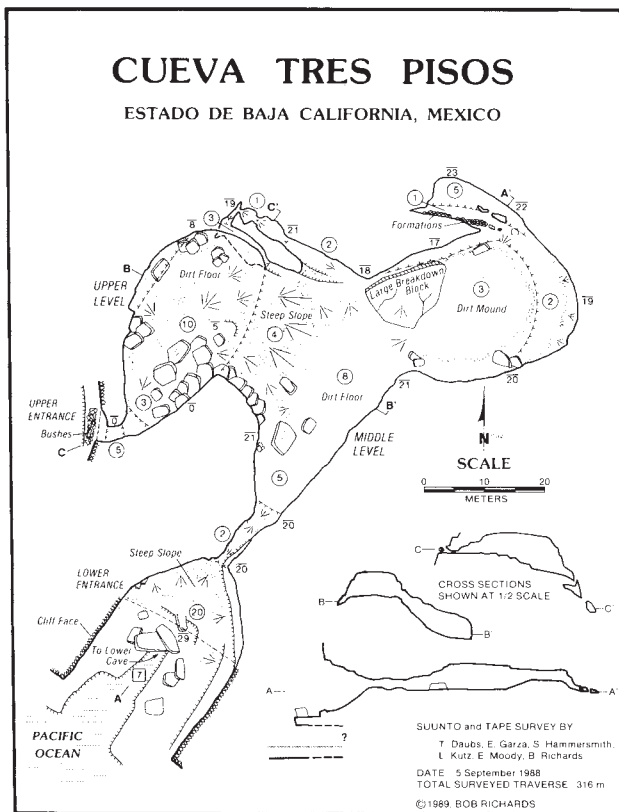
México News

BAJA CALIFORNIA

California cavers conducted a reconnaissance on Isla San Martín near San Quintín on the Pacific coast in May 1988. Amy Battista, Dave Bunnell, Ernie Garza, Susan Hammer-smith, and Bob Richards used two boats to make the five-kilometer voyage to the volcanic island. They hiked the whole five-and-a-half-kilometer circumference of the island, finding no sea caves. But a local fisherman showed them a lava-tube cave up on the lava slopes. The entrance was a classic lava-tube sink three by five meters across, with a three-meter climb-down. Exploring upslope from the entrance, they followed a tube for 60 meters to a four-meter-high lava falls. Beyond, it enlarged to six meters in diameter, then split into two passages. Another four-meter climb led them to a breakdown choke 180 meters from

the entrance. On the way out, Dave explored a large side passage for 60 meters, but they were out of time, and forced to leave the exploration and mapping for another trip. On a later trip, they were unable to get a boat to the island, but did find an unusual sea cave, with three levels, on the mainland. The main entrance is about 15 meters above the ocean level, with another entrance higher up. There are a few bats and flowstone formations in the cave. The surge channel at the lowest level of the cave was not checked due to the high tide. **Cueva de Tres Pisos** has 316 meters of mapped passage, probably making it the largest sea cave in Baja California.

source: Bob Richards
The Explorer, July 1987, November 1988 and
Ernie Garza and Carol Vesely

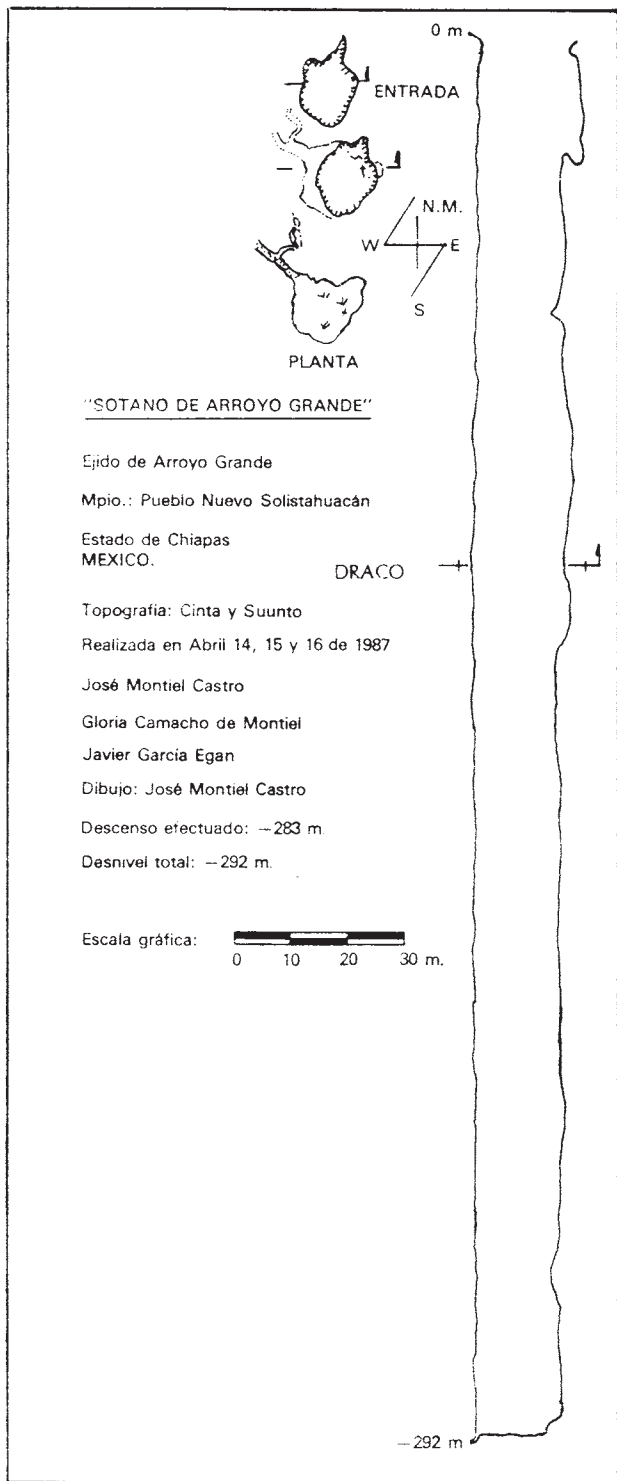


CHIAPAS

DRACO members bottomed **Sótano de Arroyo Grande** in April 1987, after running out of rope on a previous trip. It has a 15-meter-diameter shaft that drops sheer for 283 meters, and a total depth of 292 meters. It was explored and mapped by Javier García Egan, José Montiel Castro, and Gloria Camacho de Montiel, and is located in the Ejido de Arroyo Grande, Municipio de Pueblo Nuevo Solista-huacán.

source: José Montiel Castro
DRACO Folleto Informativo No. 2,
August 1988

In August 1987, Mauricio Tapie was invited by local residents to explore caves on the Rancho Monterrey near Ocozocuahtla, in the hopes of finding accessible water for use by the locals. Mauricio first checked **Cueva de Monterrey No. 1**, a well-decorated fossil cave. Large stalactites, stalagmites, and cascades are present, as well as fine helictites. Some human bones and vessel shards were also seen, some covered with flowstone. Map-

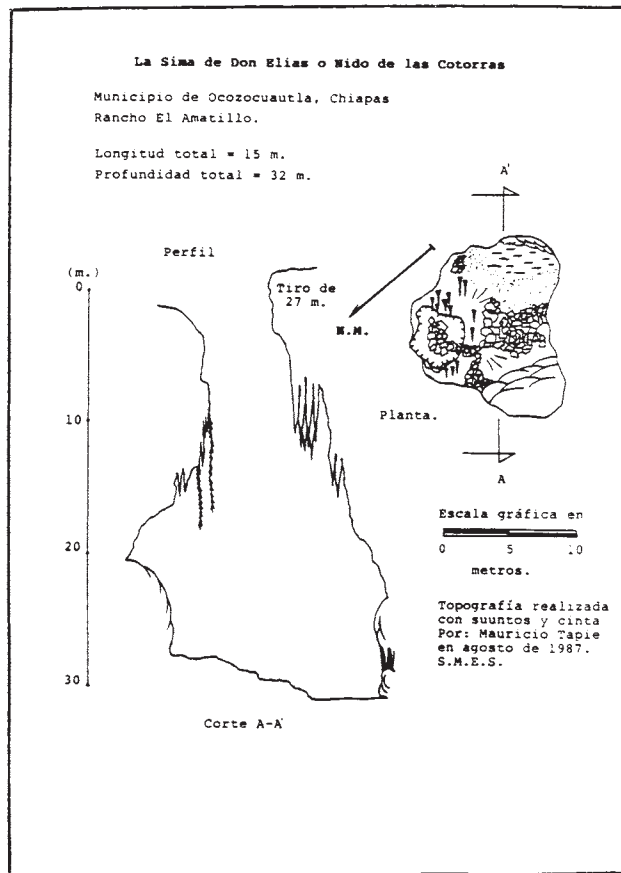


ping the cave with the help of local residents Ernesto López and Pedro Santis, Mauricio discovered an ancient stairway and the ruins of a wall scarcely 20 meters from the entrance.

Cueva de Monterrey No. 2 contains two large rooms up to 60 meters wide and ten meters high, at the end of which potsherds were also found.

Also explored were several pits, **Sima de Don Mauro**, **Sumidero de Don Adán**, and **La Sima de Don Elias**, the deepest of which was 32 meters deep.

source: Mauricio Tapie



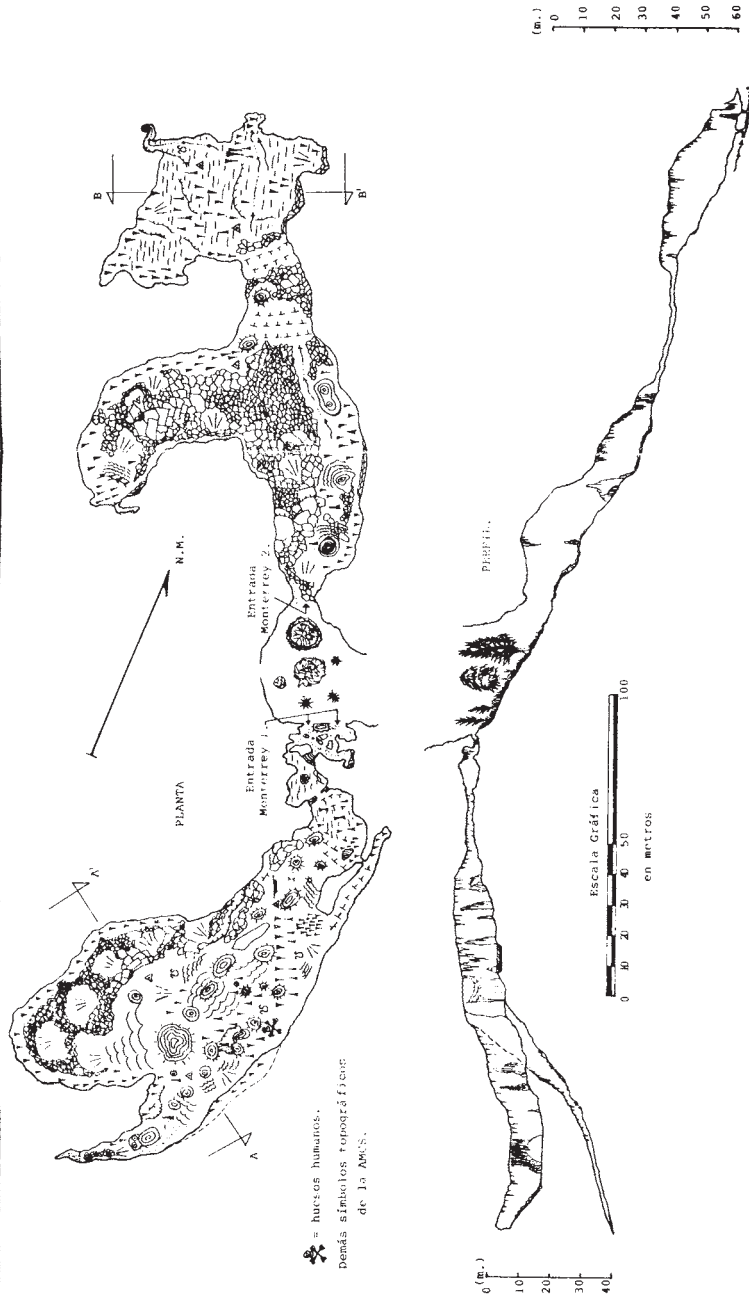
LAS CUEVAS DE MONTERREY 1 Y MONTERREY 2.

Municipio de Ocozacoautla, Chiapas
 Rancho Monterrey.

Monterrey 1.
 Longitud total = 140 m.
 Profundidad total = 40 m.

Monterrey 2.
 Longitud total = 190 m.
 Profundidad total = 60 m.

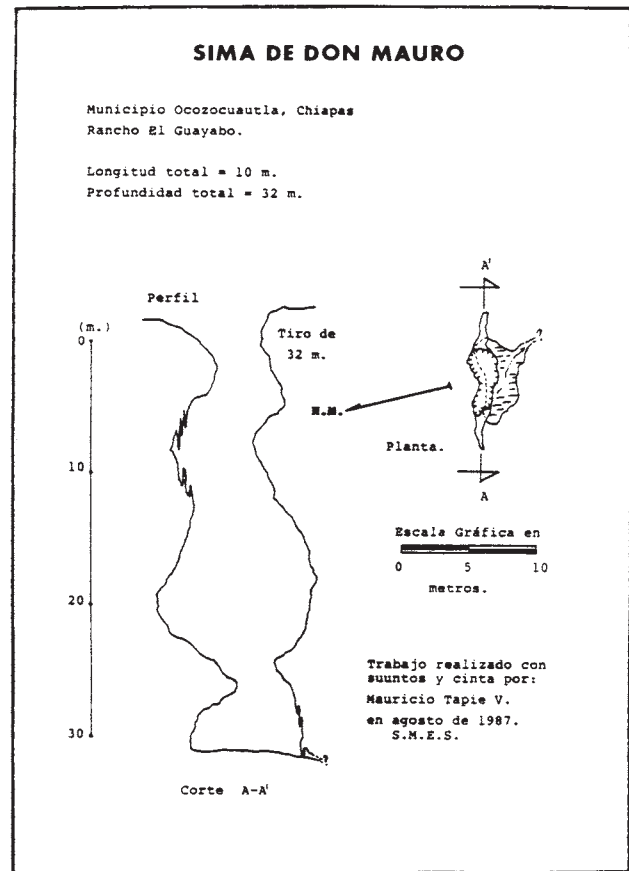
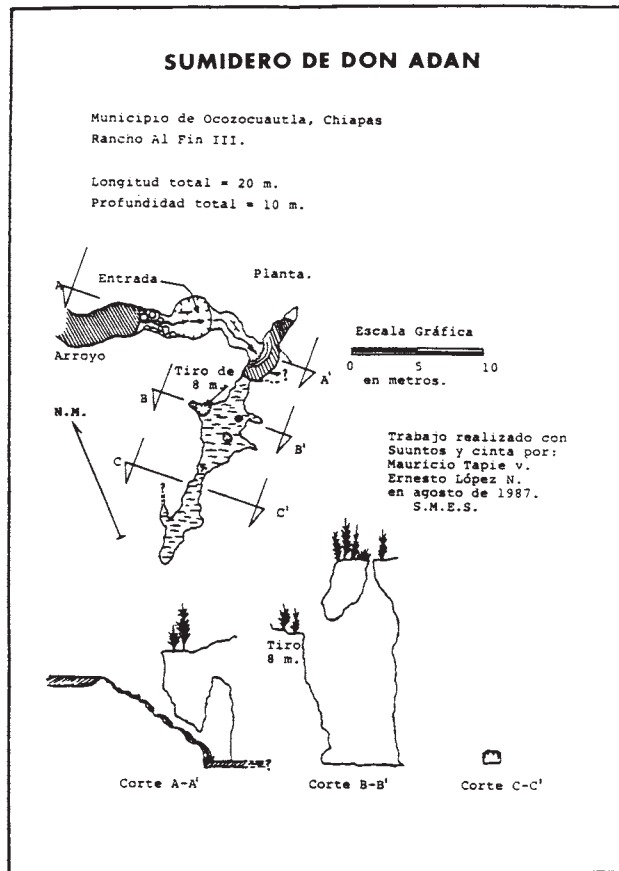
Trabajo realizado con
 auspicio y cinta por:
 Mauricio Tapie V.
 Ernesto López N.
 Pedro Santis M.
 en agosto de 1987.
 S.M.E.S.



☠ = huesos humanos.
 🐸 = Demásis anfíbulos rupestres fósicos
 de La Am.S.

Corte A-A'

Corte B-B'



COAHUILA

In November 1988, Houston cavers Mike Connelly, Dick Cruse, Charles Fromen, George Sanders, and Warren Shroeder checked leads in the Cuatrociénegas area. North of town, they checked a mined cave in a canyon on the north side of the Sierra la Madera. It consisted of one large room. Higher up in the same canyon, Mike and Dick were shown a well-decorated cave that had water in it, but it got too tight. To the southwest of Cuatrociénegas in the Sierra Australia, they were shown a cave six kilometers west of Cuates de Australia. It took the drainage of an arroyo and had good airflow. Unfortunately, they could not follow it far before it got too tight.

source: Charles Fromen

GUERRERO

SMES cavers investigating **Cueva de Agua Brava**, a resurgence near Chontal-coatlán, discovered that the cave continues past where Federico Bonet's map ends. They have found 100 meters more, and it continues. Near Iguala, they explored and mapped **Cueva de Agustín Lorenzo** to a depth of 148 meters. The last pitch, 109 meters, is the deepest so far in the state of Guerrero.

In August 1988, the SMES cavers returned to Chilacachapa, the mountain range above Aclalá (see review of *Tepeyollotli* No. 2). They explored 25 caves, ten of which still go. They consider five of them to be very promising. The caves take a lot of water and are very beautiful. They terminated explorations due to lack of rope and the upcoming rainy sea-

son. (*Compiler's note*: Resumidero de Aclalá was incorrectly located in *AMCS Activities Newsletter* No. 14).

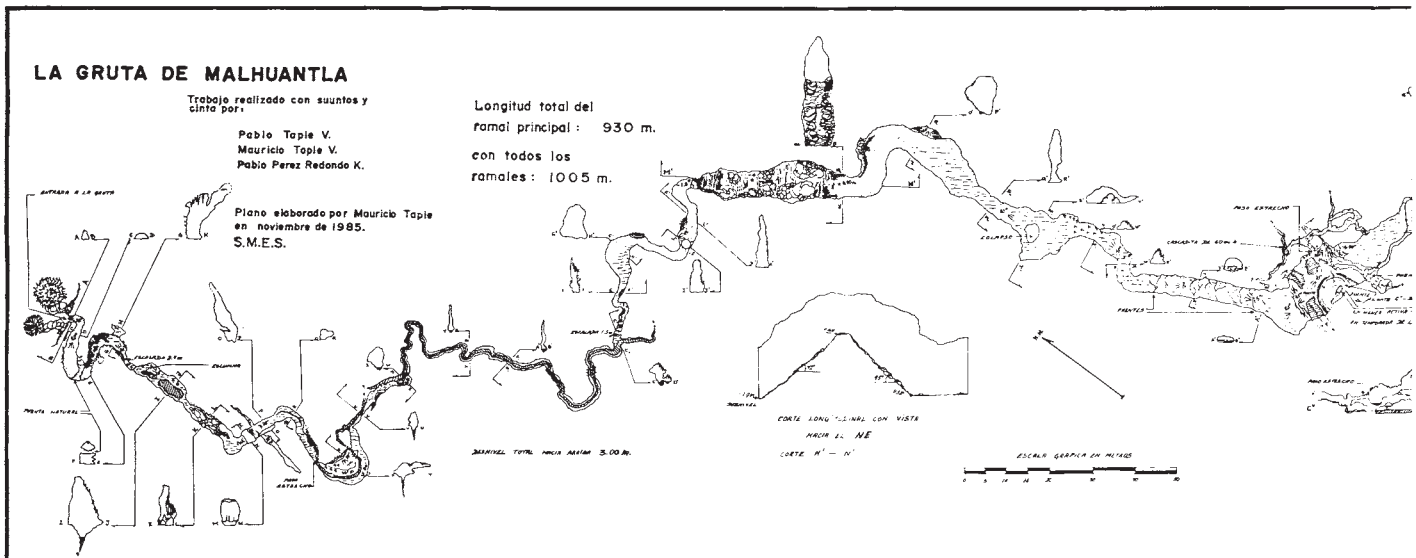
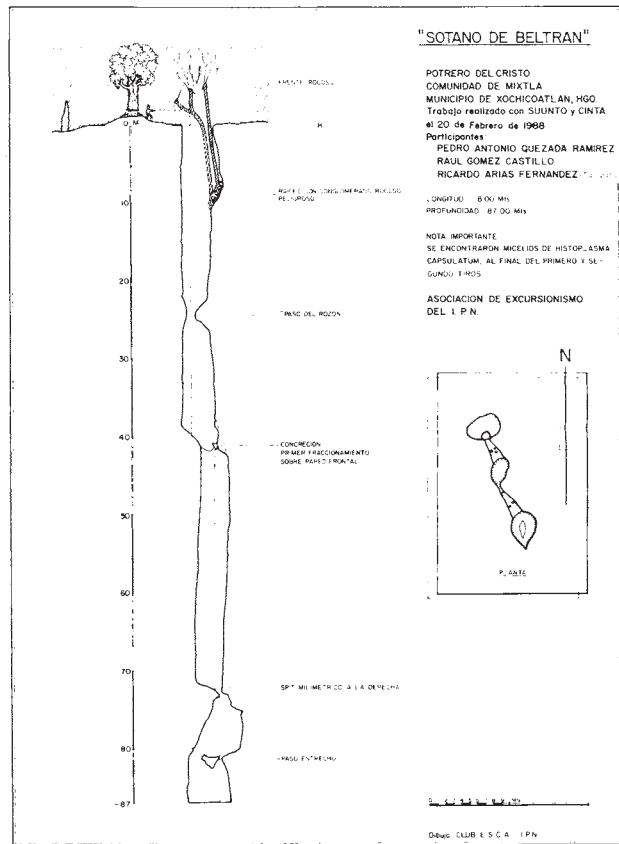
source: Ramón Espinasa

Pablo and Mauricio Tapie returned to the Tenerías area in May 1987, locating several small pits and doing additional surveying in **Gruta de Malhuantla**. In Malhuantla, they mapped a side lead located 500 meters from the entrance. This is a narrow passage that leads to a tight canyon that has an active streamway. It was explored a short distance upstream and downstream. They also located a drop that probably connects to this canyon, but were unable to explore it due to lack of time.

source: Pablo Tapie

DRACO cavers visited **Cueva del Diablo** near Acuitlapan in August 1987, resuming exploration started by Grupo Espeleológico Mexicano cavers in years past. They mapped to a sump, and they hope to add their survey to that of GEM's, if it can be located.

source: José Montiel Castro
DRACO Folleto Informativo No. 2,
August 1988



HIDALGO

A group of cavers from Mexico City explored 87-meter-deep **Sótano de Beltrán**, located near Mixtla in the Municipio de Xochicoatlán, on 20 February 1988. They had received the lead from Professor Claudio Beltrán, a native of the village, who owns the land on which the pit is located. The group traveling to the pit included Professor Beltrán, Ricardo Arias, Raúl Gómez, María Esperanza González, Eduardo Ortíz, Pedro Quezada, and Maximiliano Vilchis. From Mixtla they traveled uphill to the north for 15 minutes to Potrero del Cristo, a field planted in sugar cane. The pit is located at the north end, at the base of a rock wall, adjacent to a small cave.

Rigging off a large tree, they found the entrance drop to be 38 meters deep. After a short three-meter ramp, they descended the second drop of 35 meters to another three-meter ramp. From there, a final 13-meter pitch got them to the bottom. On the sandy bottom they found two animal skulls, possibly dog or coyote.

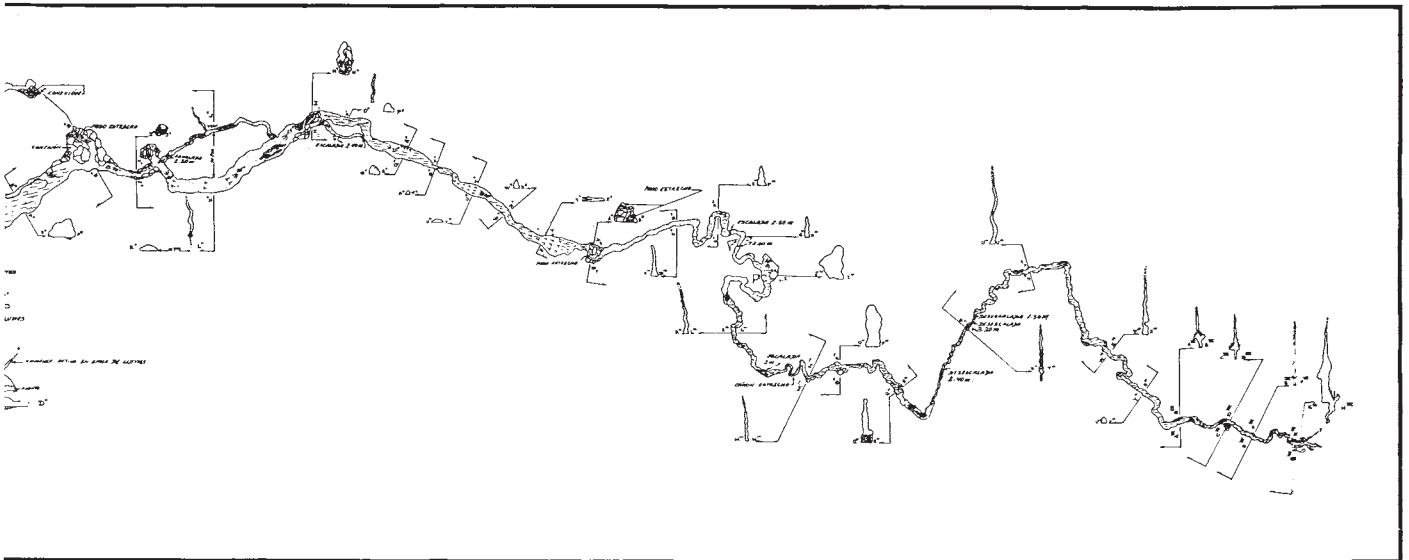
The pit contains formations and appears to be active in wet periods. *Histoplasma capsulatum* mycelia are present at the bottom of the first and second drops. María Esperanza González, who remained on the surface during exploration of the pit, contracted the fungus 18 days later. According to her doctors, it

may have been transmitted by contact with contaminated clothes.

source: Ricardo Arias Fernández

NUEVO LEON

Cavers of the Proyecto Espeleológico Purificación continued cave prospecting in the El Viejo area east of Zaragoza in October 1987. Allan Cobb, Jim Feely, Susie Lasko, and Peter Sprouse began by checking leads in the vicinity of La Escondida, site of the two previous trips to the area. First they checked **Cueva de los Frijoles**, an obvious entrance by the roadside that had somehow been overlooked before. Only 25 meters in, they were stopped by a tight, blowing bellycrawl that would have to be dug open. Next, they turned their attention to **Sótano del Jilguero**, a pit 30 meters wide with a vegetation-covered floor, which had been discovered on the first trip. Rigging on the low side, they descended a drop of 38 meters to a sloping floor that led down underneath the rig point. A tall, narrow passage led to several upclimbs and, finally, to a large room with a skylight entrance high overhead. They surveyed up the steep climb to the hole, which had to be enlarged for them to exit. Higher up on the east face of El Viejo, **Cueva del Soyate Viejo** was mapped. It is a well-decorated



chamber 30 meters long. Additionally, nine blind pits were checked near La Escondida, the deepest of which reached -42 meters.

Moving north to the village of Garza, they hiked down into the canyons to the east to investigate **Cueva del Mono**, which is developed in thin-bedded limestone near the shale contact. It consists of a maze of large passages leading off from several entrances along a cliff. It was being used by cattle for shelter, and also had a resident vampire bat colony, who obviously didn't have to go far for their meals.



Jim Feely stands underneath the thin dipping beds in Cueva del Mono. (Peter Sprouse)

The last area checked was east of El Viejo at Chupaderos, which had been given a cursory look in 1976 by a group hiking in from Peñuelos. The only cave known by the locals was **Cueva Humada**, which consists of a large passage that abruptly terminates after 100 meters. Numerous sinks were checked, finally resulting in the discovery of a cave that went. **Cueva de la Forja No. 1** split into several routes, all of which pinched, the deepest being 70 meters below the entrance. The total length was 326 meters.

Another arroyo entrance across the road was not checked until 14 July 1988. Allan Cobb, Chuck Kennedy, Susie Lasko, Linda Palit, and Peter Sprouse found that **Cueva de la Forja No. 2** actually has two small entrances not far apart. The cave trended down immediately, and the rig team was out

of rope after three short drops. The next day, they mapped down three more drops to where the cave leveled out. A narrow stream passage led to a muddy sump at -93 meters. The two Forja caves intertwine and are 15 meters apart at the closest point.

source: Peter Sprouse

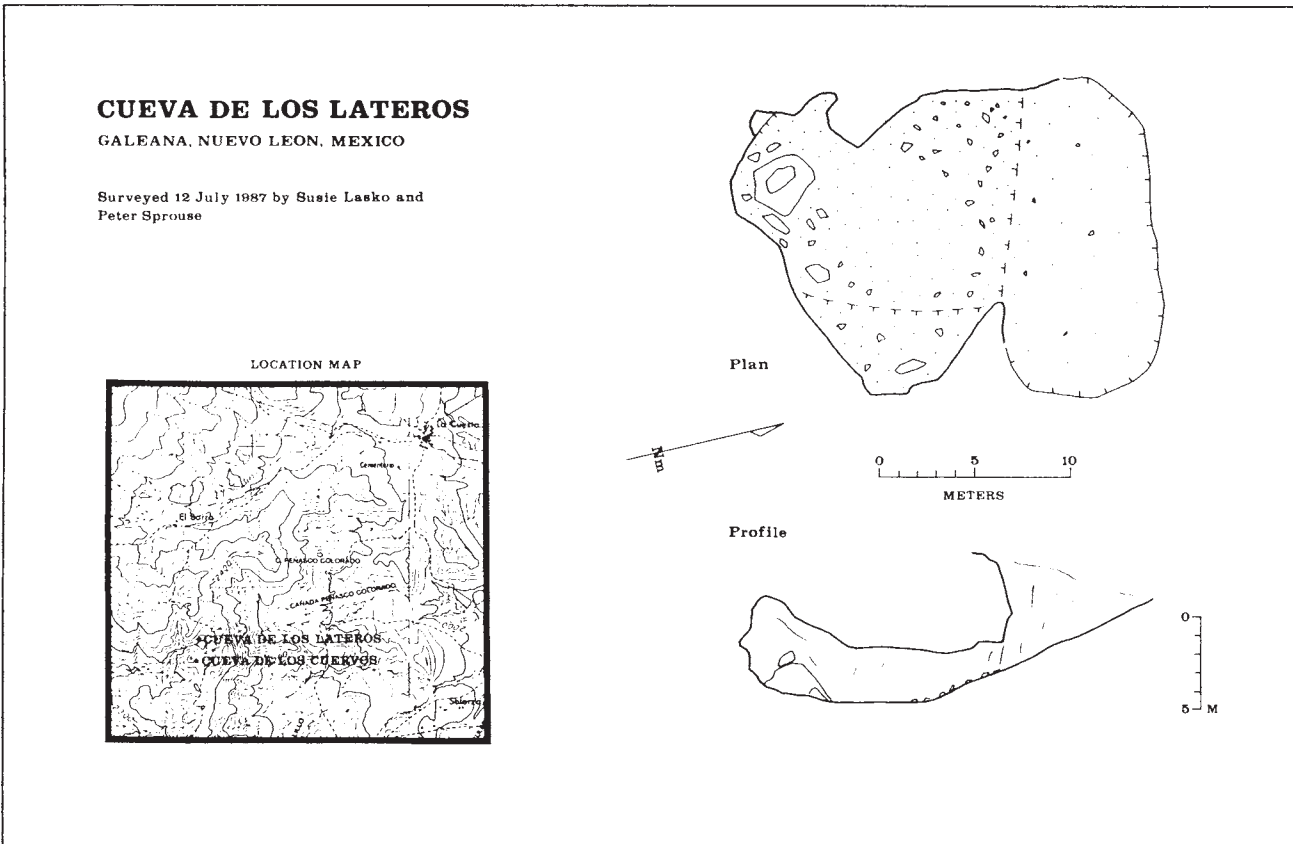
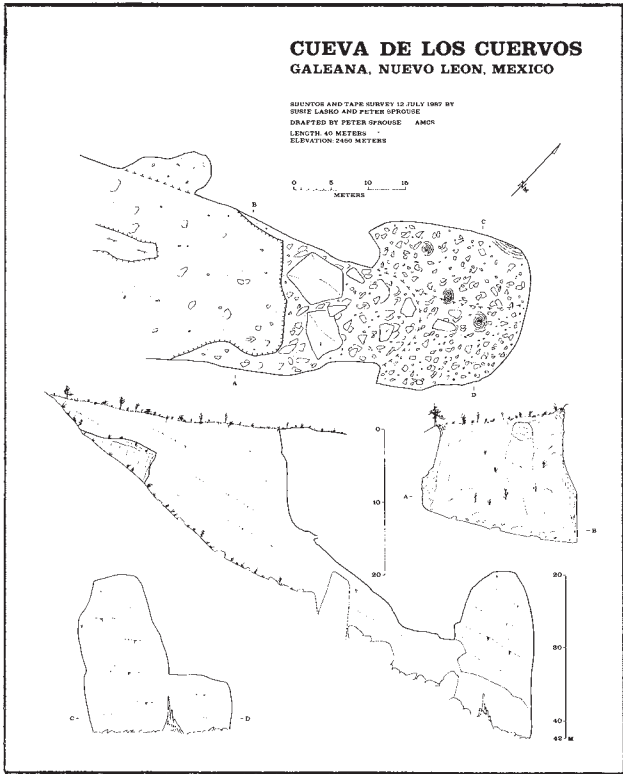
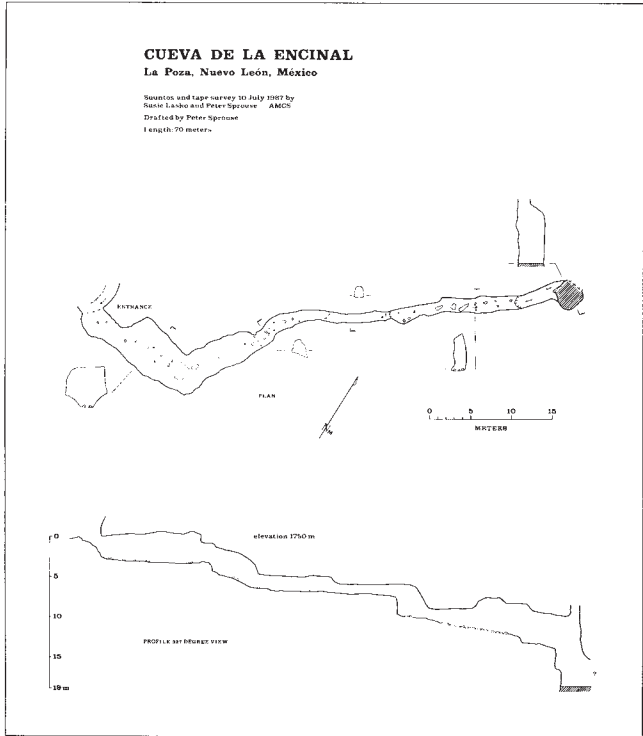
In October 1988, cavers from Austin explored a pit west of El Potrero on the Sierra de Gomas south of Bustamante. Brian Burton, Sarah Gayle, Mark Minton, and Nancy Weaver found the initial drop of **Sótano de San Isidro** to be 25 meters, followed by another drop of nine meters. They stopped at the top of a third drop, of about 30 meters, due to lack of rope. In a nearby mine, they explored several natural cave passages that the mine intersected, but none went very far.

source: Brian Burton

Susie Lasko and Peter Sprouse explored several new caves in the Galeana area in July 1987. Just east of the village of La Poza, they were shown the entrance to **Cueva de la Encinal**, a gypsum sink. This consisted of walking-size passage that descended gradually to a six-meter drop, located about 70 meters in from the entrance. A lake could be seen at the bottom, with no obvious way on, but the drop was not descended. West of Galeana, they checked an area of mixed gypsum and limestone on the ridge above La Cuesta. Several sinks were checked, and two caves were sur-



Jim Feely underneath a skylight entrance in Cueva Humada, Chupaderos, Nuevo León. (Peter Sprouse)

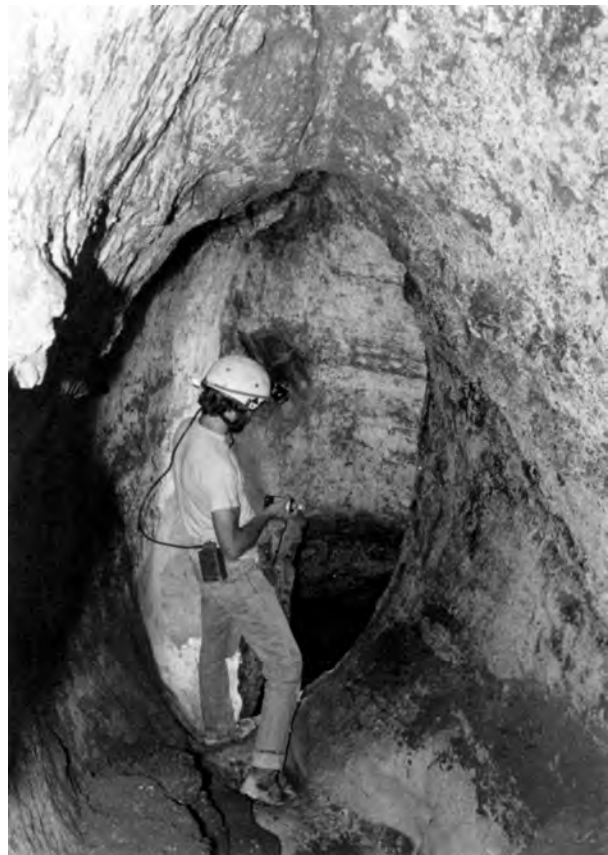


veyed. **Cueva de los Cuervos** has a large sink entrance that slopes down underneath the overhung low side to end in a formation room at -48 meters. A small one-room cave just to the north, **Cueva de los Lateros**, was also mapped.

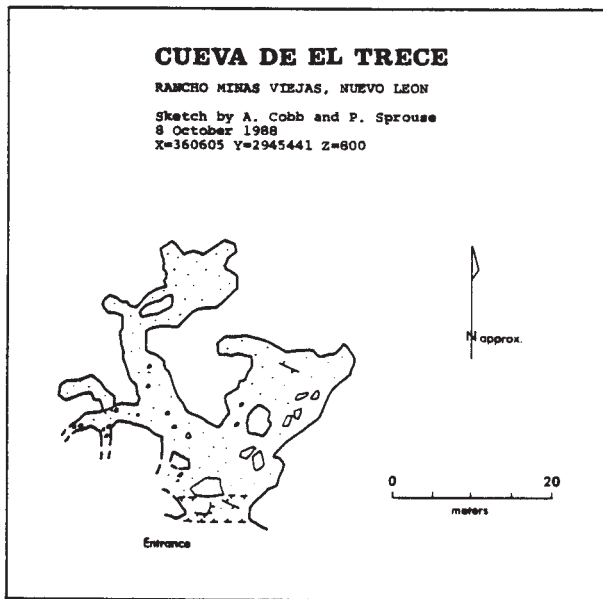
source: Peter Sprouse

On a trip to the Minas Viejas area northeast of Bustamante in October 1988, a group of cavers from Austin and San Antonio climbed up to two caves in the side of the canyon that leads into the mountains. The first cave is plainly visible on the south wall of the canyon, but the cavers were unable to climb the last ten meters into the entrance due to a lack of adequate climbing gear. Another entrance, on the north side of the canyon, proved easier to get into. Doug Allen, Allan Cobb, Susie Lasko, Linda Palit, Peter Sprouse, and Roy Wessell explored this cave, which was named **Cueva de El Trece**. It turned out to be a dusty cave consisting of several short passages. Although no artifacts were seen, worn bedrock in several areas indicated extensive past use of the cave.

source: Peter Sprouse



Peter Sprouse in Cueva de la Encinal. (Susie Lasko)



OAXACA

Mike Futrell and Ed Holladay discovered a new cave in the Huautla area near **Sótano de Agua de Carrizo** on 13 February 1988. En-

tering **Hell's Hammer Hole**, as it was later named, the two slid down a steep crawl to a climbable chimney, which was followed by a seven-meter drop. At the bottom, a small stream entered from the left, which may have come from another entrance that they had noticed nearby. However, this infeasible soon became too tight. Downstream, they descended a wet climb and crossed a small pool to arrive at another pit. Chimneying out in a ceiling channel, they rigged a free line down the 11-meter drop. At the bottom, the route doubled back under the waterfall and led to a tight, slimy slot with good airflow. They were able to pass the Unfortunate Dig by moving rocks and mud, providing access to a small, drippy dome room. The way on was only one meter high and 30 centimeters wide, and they proceeded by bashing the protrusions with a hammer. Eventually, they reached a pit after a lot of hammer work. Ropeless, they called it a day.

Returning the next day with Keith Goggin and Lee Perry, they descended the virgin 21-meter waterfall drop, but were disappointed to

find that the passage pinched. The survey showed Hell's Hammer Hole to be 300 meters long and 99.5 meters deep.

source: Mike Futrell

QUERETARO

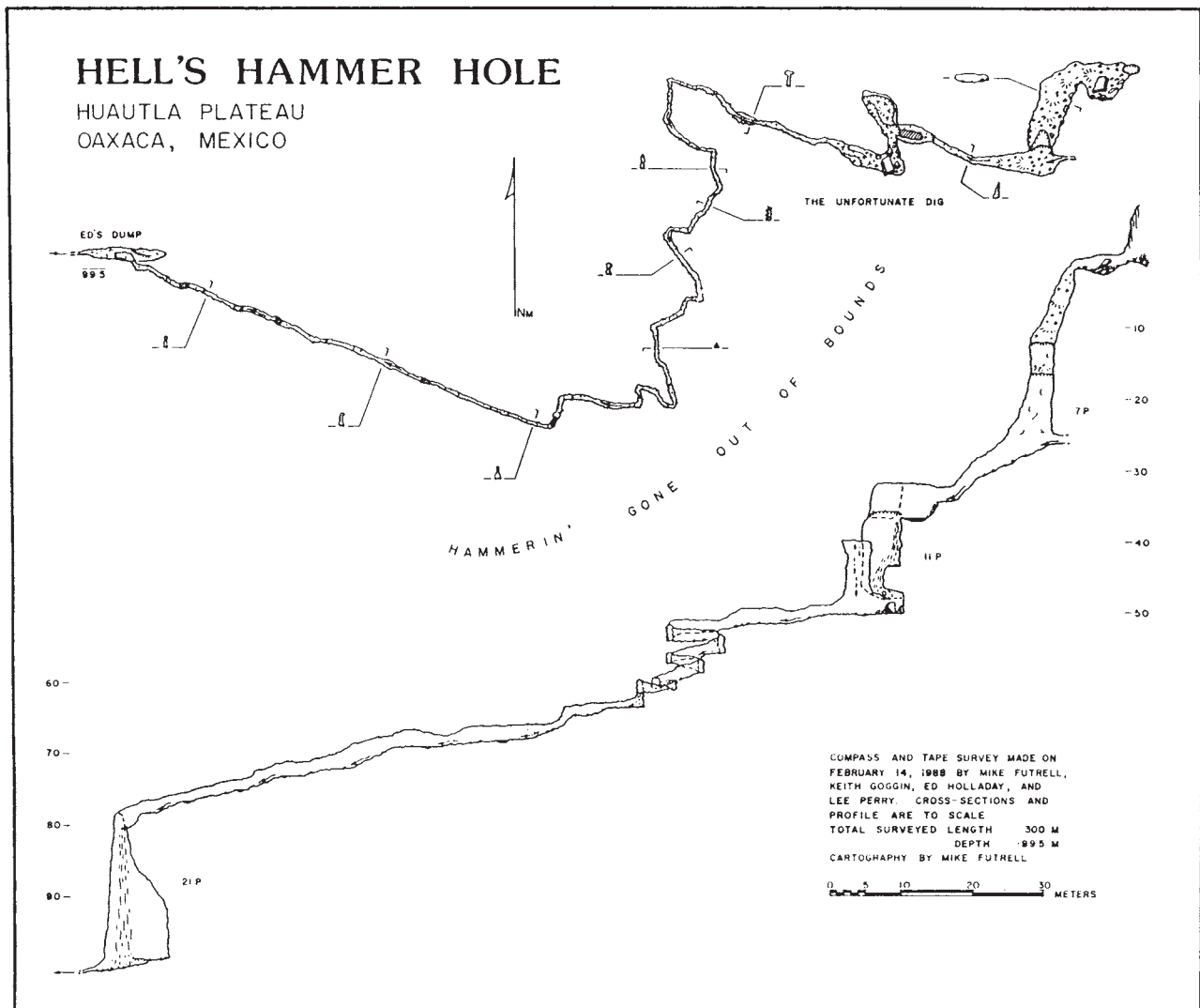
On 3 June 1988, Dave Bunnell, John Fogarty, Susie Lasko, Peter Sprouse, and Cyn-die Walck explored three pits east of Jalpan. Along the road to Tres Lagunas, they explored a 15-meter-deep pit, **Sótano del Jaguey del Monte**, which had bad air at the bottom. North of the village of Pinalito de la Cruz, they checked **Sótano del Mesa Grande**, a 24-meter pit with a total depth of 30 meters. Another pit, at a lower elevation,

Sótano del Asseradero, was located north of La Fábrica (El Madroño). The entrance was a 52-meter shaft about 20 meters in diameter. The lowest point of the generally flat, dirt floor was at -60 meters.

source: Peter Sprouse

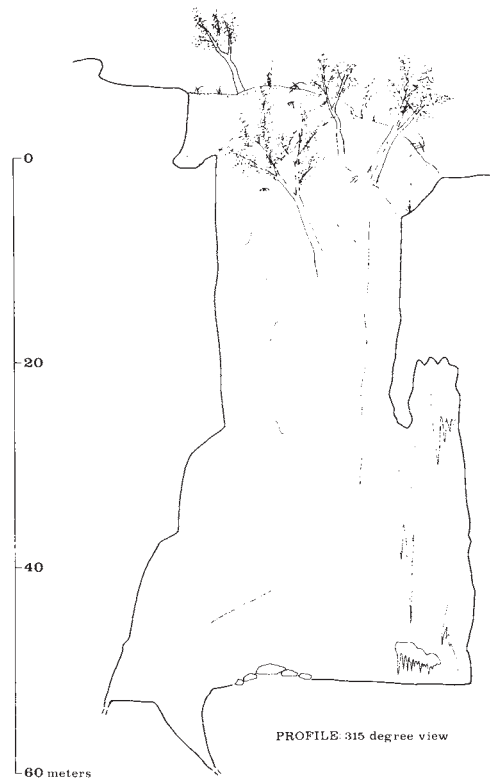
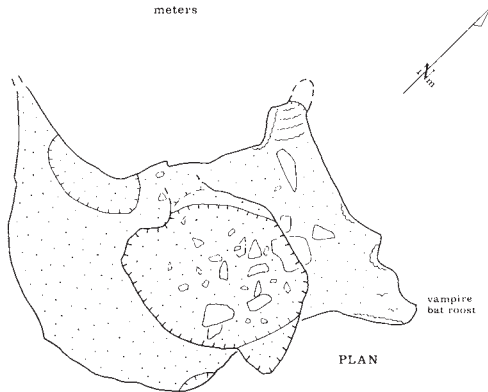
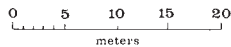
QUINTANA ROO

In November 1987, divers Denny Atkinson, Mike Madden, Juan José Tucac, and Ron Winiker began exploration of **Nohoch Nah Chich**, a huge underwater cave system near Tulum. Burros were used to transport diving gear on the two-kilometer hike from the road. From the large collapse entrance, there are two air-filled passages leading to sumps on either end. Entering the upstream sump, the divers



SOTANO DEL ASSERRADERO
El Madroño, Querétaro

Soundings and tape survey 3 June 1988 by
 D. Bunnell, S. Lasko, P. Sprouse
 Drawn by P. Sprouse
 X-485800 Y=2355635 Z=1780



found that the well-decorated passage did not exceed six meters in depth, eliminating decompression and greatly increasing exploration range. After 244 meters of swimming, they reached Heaven's Gate, two massive columns nine meters high. At 450 meters, the passage was over 100 meters wide with crystal-clear visibility. Rapidly expending their dive reels, they had to turn back with only their safety reels in hand, after laying 808 meters of line in 75 minutes.

In February 1988, Steve Gerrard joined Mike Madden and Juan José Tucac in their ongoing exploration at Nohoch Nah Chich. At 1100 meters penetration in the upstream route, they stopped for lunch at an airbell that had a circular shaft to the surface. Ten minutes later they were at the end of the permanent line, now 1372 meters in. Madden then began laying the first of their seven reels of knotted line. The cave went and went, and they finally called the dive halfway through the sixth reel due to air supplies. Surveying their line on the way back, they determined they had laid 1250

meters of new line, which they claim as a world record.

They had brought the total surveyed line length of Nohoch Nah Chich to over 6096 meters, with 2926 meters in the main upstream passage, 1067 meters in the downstream passage, and the remainder in side passages.

sources: Mike Madden
NACD News, January-February 1988
 Steve Gerrard
NACD News, March-April 1988

Explorations during 1987 in **Carwash Cenote** near Xel-ha have increased the length of that underwater cave to over 800 meters. Participating divers were Jim Coke, Paul DeLoach, Mike Madden, Tara Tanaka, Parker Turner, and John Zumrick.

On Isla Cozumel, Jeff Bozanic, Parker Turner, and Dennis Williams have continued diving efforts in **Cueva Quebrada**, which now stands at 5000 meters in length.

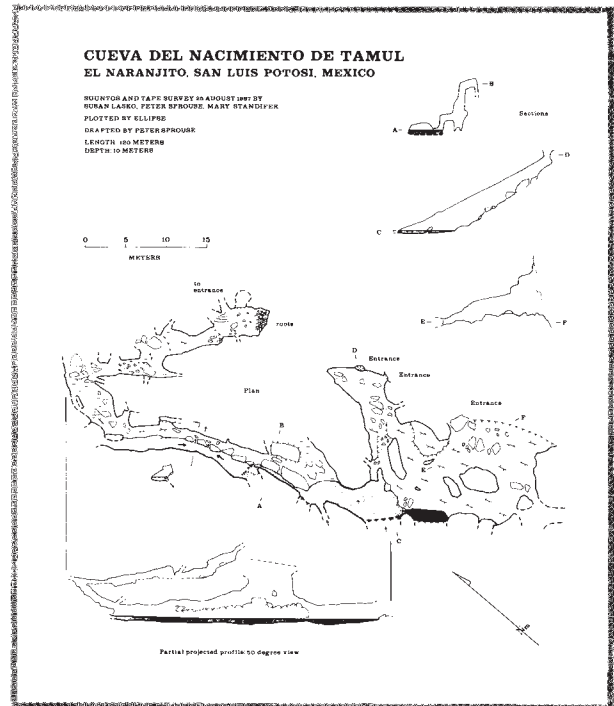
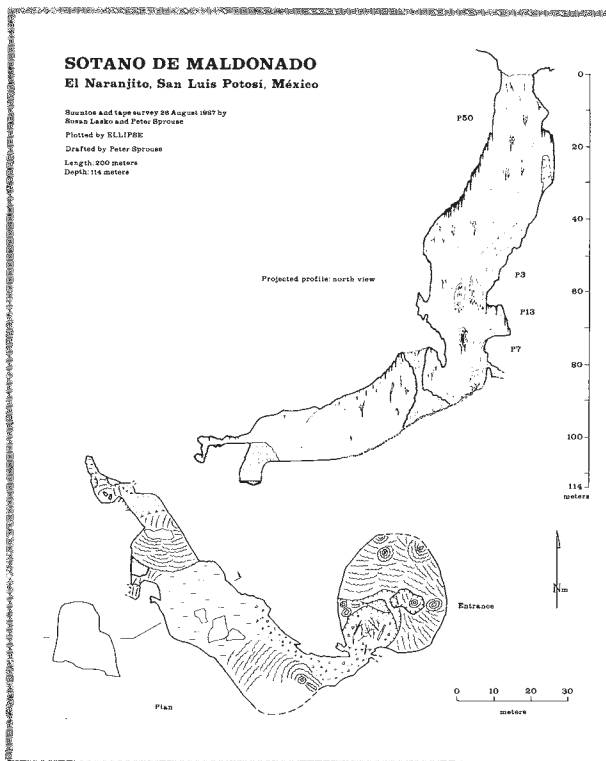
Cenote Nonec, located near Xcaret, has

been pushed 1000 meters upstream by divers Hilerio Hiler, Noel Sloan, and John Zumrick. Along with Hector Aguilar, these three have connected the cave with other cenotes, resulting in a system 2000 meters long. Disturbance of material from the chalky ceiling by the divers' exhaust bubbles hampers further exploration of the main lead, which continues as a low, wide tunnel. In the southern part of the state near Bacalar, a deep cenote has been dived by Ned DeLoach, Paul DeLoach, Mike Madden, Clark Pitcairn, and John Zumrick. At -85 meters there was no sign of a bottom.

source: Bill Stone
Descent, August 1987

Jim Coke and friends have located a "dry" cave a few kilometers from a village two kilometers west of Akumal. Called **Casa de Maya** by a local guide, it consists primarily of one main passage averaging five meters high and up to 30 meters wide, divided in places by large columns. A short distance in is a large lake with large calcite rafts. It is at least a kilometer long, but has not been mapped.

source: Dave Bunnell
The Explorer, March 1988



SAN LUIS POTOSÍ

Members of the Cruz Roja Mexicana de San Luis Potosí, affiliated with the Socorro Alpino de México, have discovered a deep pit, **Resumidero el Borborllón**. Lacking proper techniques and equipment, they contacted the Club Tequitepetl in Mexico City, who in turn invited DRACO to help. These groups joined the SLP group at the pit in April 1987, agreeing that, if possible, a SLP caver would be the first on bottom. The first descent was to -100 meters, where a rebelay was installed. In March 1988, the SLP group apparently put one person on bottom, estimating the drop length at 250 to 350 meters.

source: José Montiel Castro
DRACO Folleto Informativo No. 2,
August 1988

In late August 1987, Susie Lasko, Peter Sprouse, and Mary Standifer explored several caves west of Ciudad Valles. On the Río Santa María just upstream from the spectacular Cascada Tamul, they mapped **Cueva del Nacimiento de Tamul**, an overflow entrance to a spring that emerges at river level. This 120-meter-long cave sumped upstream and disappeared into boulders en route to the nearby spring. Three kilometers to the north, they sur-

veyed 114-meter-deep **Sótano de Maldonado**. This consisted of drops of 50, 3, 13, and 7 meters, which essentially comprised one drop divided by small ledges. A large, sloping passage at the bottom led to a short drop into a lake that did not appear to go, although it was not checked.

Next, the group drove west to investigate an area near Cárdenas, at a village called Pasito de Francisco. They were shown an entrance taking a small stream. The cave quickly became quite complex. Several parallel, wet routes were explored with no obvious way on, but a more thorough investigation could turn up something, especially considering the presence of some airflow. They named it **Sumidero de Montezuma**, after the landowner, but did not survey it.

source: Peter Sprouse
Texas Caver, April 1988

South of the town of San Francisco, Municipio de Zaragoza, Allan Cobb, Joe Ivy, and Linda Palit checked several leads near **Cueva de la Puente** in December 1987. Three shallow pits were checked and sketched, as well as a cave about 60 meters long that contained a colony of Mexican Freetail bats. Another cave, near La Puente, was pushed and takes floodwater at times. Twice they had to move rocks to continue, and they finally turned around in a clean-scoured passage about 200 meters from the entrance.

source: Joe Ivy
Texas Caver, April 1988

TAMAULIPAS

In November 1987, a group of Texas cavers continued explorations in **Sótano de Las Calenturas**, in the Purificación area. The primary objective was to dive the upstream sump in the Blazer Borehole. Diver Jim Bowden penetrated approximately 250 meters of large underwater passage at depths up to 13 meters before tying off his dive line in continuing passage. In the lower part of the cave, all remaining leads in the downstream Turkey Sump area were checked and found to end.

Another project was an attempt to explore farther in **Cueva del Nacimiento de San Antonio**, a spring cave in the canyons to the

north of Calenturas. The water level in the cave was lowered about a meter by notching a trapezoidal dam at the entrance. However, this effort succeeded only in moving the sump 30 meters farther back into the cave.

source: Gerald Atkinson

Explorations continued in **Calenturas** in November 1988, when Jim Bowden returned with a dive team consisting of Karen Hohle, Allen Jackson, Ann Kristovich, and Peter Oliver, with assistance from a group of "dry" cavers. They surfaced in dry passage after 290 meters of diving through the Blazer Sump, passing a long airbell along the way. A short section of breakdown was followed by a long lake with a low ceiling that looked as though it sumped but still went.

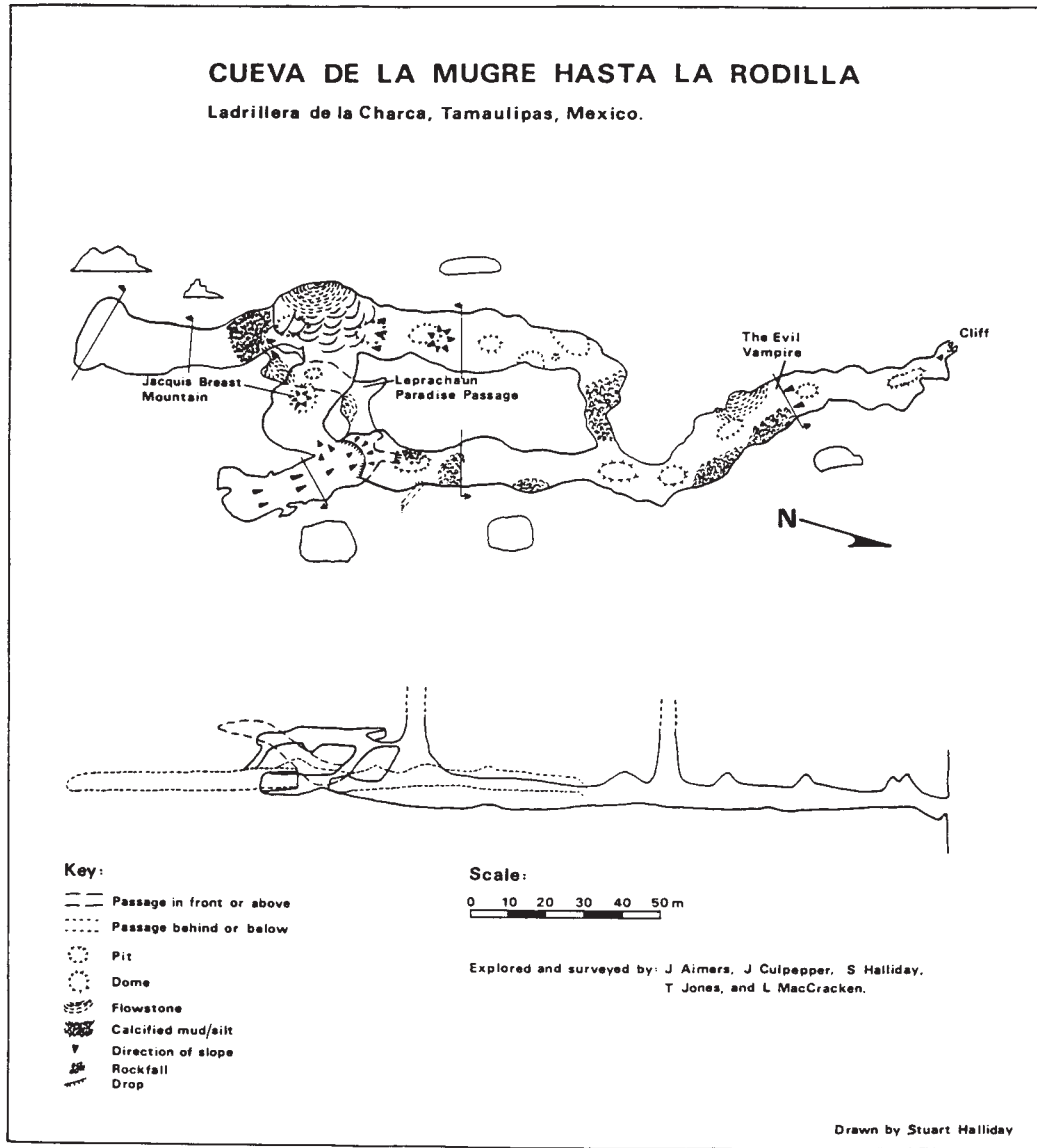
Another spring cave north of Calenturas, **Nacimiento del Río Corona**, was also dived by Jim Bowden. After a dive of at least 60 meters, Jim surfaced at the end of the sump, but was at the bottom of a short climb, so could not get out of the water. However, Brian Burton and Terry Raines simultaneously rechecked the back of a dry overflow passage above the spring and found a route through, apparently reaching the same stream passage Jim had surfaced in, and explored a total of 180 meters up several cascades.

source: Jim Bowden

In November 1988, a PEP team entered the **Cueva del Brinco** entrance of **Sistema Purificación** to set a camp in the upstream World Beyond area to facilitate pushing leads in the Dragon River area. With sherpa assistance from Larry Bean, Allan Cobb, and Peter Quick, six cavers carried camp gear to the Mud Funnels area at -200 meters. Below the funnels, however, they found the passage completely sumped, possibly due to the effects of Hurricane Gilbert two months before. So John Fogarty, Bill Farr, Susie Lasko, Nancy Pistole, Peter Sprouse, and Carol Vesely set up camp above the Mud Funnels and contemplated alternatives. Realizing that the strong airflow had disappeared somewhere along the way in the upstream World Beyond, Bill and Nancy backtracked and located an obscure lead in an airbell near the Earduct low airspace. Wind whistled up a short muddy climb, the Califor-

CUEVA DE LA MUGRE HASTA LA RODILLA

Ladrillera de la Charca, Tamaulipas, Mexico.



nia Dream, that led to a three-meter drop into a stream passage paralleling the World Beyond.

This passage, named the Tequila River, is similar to the nearby World Beyond, although it generally has a lower ceiling. The flow comes from the south through a series of long lakes, sumping at the three-meter drop to presumably reappear on the other side of the California Dream as the flow in the World Beyond. About 500 meters upstream, the stream sumps at a point very close to the Canal, a long lake that is fed by the Río Verde stream coming from upper Brinco. So the Tequila River flow may be fed by the Río Verde. The strong airflow in the Tequila River goes into two upward-trending side passages. The first of these is a dome on the right side about 350

meters from the beginning, where a muddy passage goes through several crawls before opening up into a high canyon. After about 100 meters, John, Peter, and Susie found the way on too steep to climb. The second side passage is on the left just before the sump. It begins as a wet crawl, then climbs into a small convoluted passage trending steadily up. Bill, Carol, and Nancy surveyed and hammered through about 100 meters of the Minnesota Reality before abandoning it. Both side leads appear headed back toward the upper levels of Brinco. Altogether the expedition added 740 meters to the length of Sistema Purificación, making it 72,309 meters long.

source: Peter Sprouse

A return trip was made to **Sótano de Trejo** from 19 to 23 November 1988 by PEP cavers Doug Allen, Jerry Atkinson, Paul Fambro, Terry Gregston, Erika Heinen, Dale Pate, Scott Scheibner, Terri Treacy, and Cyn-die Walck. Several downtrending leads were pushed to grim crawls, while an upstream extension was explored and surveyed to a tight mud crawlway. Several loops in the lower part of the cave were also surveyed, bringing the length to 1104 meters, and the depth to 81 meters.

source: Dale Pate

A new underwater cave was explored in April 1988 by divers Jim Bowden and Steve Gerrard at the **Nacimiento de Santa Clara**, a spring at the base of the Sierra de El Abra. Working in conjunction with biologists Robert Hershler and Jerry Landye of the Museum of Natural History, and with support from divers Karen Hohle and Todd Sympson, they were able to penetrate 150 meters into the spring. The site is used as a local water supply, and permission was obtained from the manager of the pumping station to dive when pumping was not taking place. From the three-meter-diameter opening, a clean-walled tube takes off, with the divers encountering no silting problems. At 120 meters penetration they reached a T-intersection that is apparently a drainage divide. Downstream to the left, the passage narrowed to a keyhole. Upstream to the right, they continued to a point 150 meters from the entrance, having gone no deeper than 46 meters on the dive. The divers also successfully collected some rare spring-dwelling snails, which they had not been able to find during searches at other area springs.

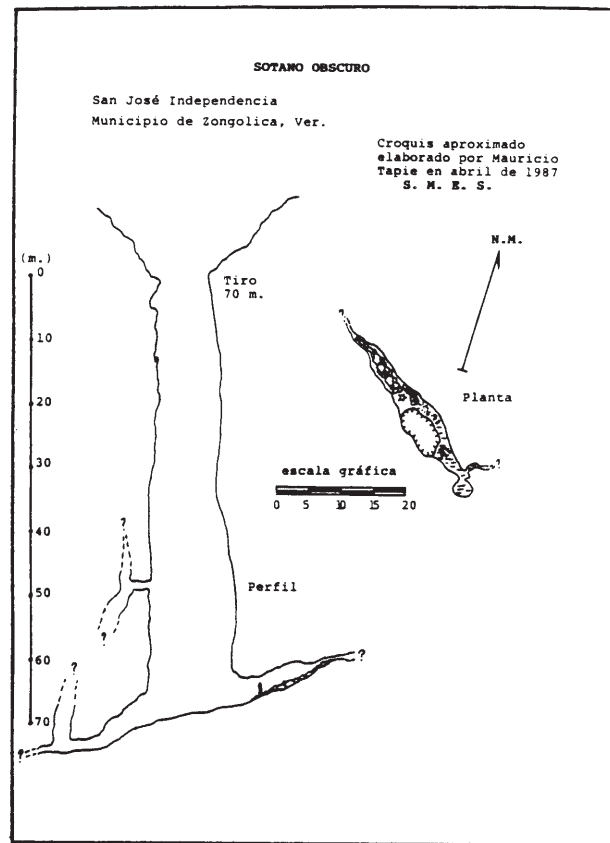
In June 1988, Jim and his diving team returned to Santa Clara, pushing the back of the cave an additional 150 meters, halting exploration at a depth of 34 meters. Several side passages were passed along the way, and they plan to return to continue explorations.

source: Jim Bowden

Cavers of the Aggie Speleological Society have been discovering new caves and pushing some previously known ones in the Sierra de Guatemala. Recently a number of caves have been found near the Río Capote at the south-

ern end of the sierra. The longest of these is **Cueva de la Mugre Hasta la Rodilla**, a phreatic tube system that at one time contained a large bat population. A previously known pit just north of the Río Capote, **Sótano Malpais**, was rediscovered and is being mapped. It is in a heavily weathered karst area, and it leads to a large trunk passage. The Aggies plan to attempt dye traces between a couple of the southern water caves and the **Nacimiento del Río Frío**.

source: Tim Jones



VERACRUZ

SMES cavers Eusebio Hernández, Sergio Lozano, and Mauricio Tapie were shown a new pit while conducting a photo trip to **Sótano de Tomasa Kiahua** in San José Independencia, Municipio de Zongolica. Mauricio rappelled into **Sótano Oscuro**, which enlarged into a long fissure of about 20 meters before he reached the bottom. Downhill from the rope was a muddy slope leading to a squeeze. Uphill, Mauricio explored to a collapse, which may continue.

source: Mauricio Tapie

DEEP PITS OF MEXICO

Compiled by Peter Sprouse 31 December 1988

	<u>Cave Name</u>	<u>Drop Name</u>	<u>State</u>	<u>Depth</u>
1	El Sótano (Sótano de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de Tomasa Kiahua	Entrance drop	Veracruz	330
4	Sótano de Alhuastle	P'tit Quebec	Puebla	329
5	Nita Xonga	Psycho Killer	Oaxaca	310
6	Sotanito de Ahuacatlán	Second drop	Querétaro	288
7	Sótano del Arroyo Grande	Entrance drop	Oaxaca	283
8	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
9	Sistema Ocotempa	Pozo Verde	Puebla	221
10	Sótano de los Planos	Second drop	Puebla	220
11	Sótano de Coatimundi	Entrance drop	San Luis Potosí	219
12	Sótano de Sendero	Entrance drop	San Luis Potosí	217
13	Nacimiento del Río Mante	Macho Pit	Tamaulipas	206
14	Hoya de las Guaguas	Entrance drop	San Luis Potosí	202
15	Sistema de la Lucha	Entrance drop	Chiapas	200
16	Sistema H3-H4		Puebla	200
17	Sótano de Soyate	Entrance drop	San Luis Potosí	195
18	Sótano de Alpupuluca	Entrance drop	Veracruz	190
19	Cuaubtempa	Pozo con Carne	Puebla	190
20	Sótano de Puerto de los Lobos	Entrance drop	San Luis Potosí	189
21	Kijahi Shunthua	Sixth drop	Oaxaca	188
22	Hoya de la Luz	Entrance drop	San Luis Potosí	180
23	Ahuihuitzcapa	Entrance drop	Veracruz	180
24	Sótano de la Cuesta	Entrance drop	San Luis Potosí	174
25	Sótano de los Monos	Entrance drop	San Luis Potosí	171
26	Sótano de Otates	Entrance drop	Tamaulipas	171
27	El Socavón	Entrance drop	Querétaro	171
28	Sótano de los Ladrones	Entrance drop	Oaxaca	170
29	Nita Diplodicus	Entrance drop	Oaxaca	170
30	Sótano de Agua de Carrizo	Flip Pit	Oaxaca	164
31	OC8	Entrance drop	Puebla	160
32	OC4	Entrance drop	Puebla	160
33	Ventana Jabalí	Skylight drop	San Luis Potosí	153
34	Sótano de Coatituesday	Entrance drop	San Luis Potosí	147
35	Sótano de Milpa	Entrance drop	Veracruz	146
36	Sótano de Paila	Entrance drop	Querétaro	143
37	Sótano de los Guacamayos	Entrance drop	Tamaulipas	140
38	Sótano del Río Iglesia	Xmas shaft	Oaxaca	140
39	Sótano de Gadsden	Entrance drop	San Luis Potosí	137
40	Aztotempa	Seventh drop	Puebla	134
41	Sótano de Agua de Carrizo	Sima Larga	Oaxaca	134
42	Nido-Ntau	Tag Shaft	Oaxaca	133
43	Illusive Pit	Entrance drop	Coahuila	133
44	Sótano de Otates	Entrance drop	Querétaro	133
45	Sótano de Arbol Sangre	Second drop	San Luis Potosí	132
46	Sótano Rolling Stone	Entrance drop	Oaxaca	131
47	Sótano de Aguila	Entrance drop	Querétaro	128
48	Sótano Sin Nombre	Entrance drop	Chiapas	128
49	Sótano de Cepillo	Entrance drop	San Luis Potosí	126
50	Pozo de Montemayor	Fourth drop	Nuevo León	126

DEEP CAVES OF MEXICO

Compiled by Peter Sprouse 31 December 1988

	<u>Cave Name</u>	<u>State</u>	<u>Depth</u>
1	Sistema Huautla	Oaxaca	1353
2	Akemati	Puebla	1135
3	Sistema Ocotempa	Puebla	1064
4	Sistema Cuicateca	Oaxaca	1038
5	Sonconga	Oaxaca	943
6	Guizani Ndia Guinjao	Oaxaca	940
7	Sistema Purificación	Tamaulipas	904
8	Nita Cho	Oaxaca	894
9	Sótano de Agua de Carrizo	Oaxaca	836
10	Sótano de Trinidad	San Luis Potosí	834
11	Nita Ka	Oaxaca	758
12	Sistema H31-HU32-H35	Puebla	753
13	Sonyance	Oaxaca	745
14	Nita Xonga	Oaxaca	740
15	Yuá Nita	Oaxaca	704
16	Aziotempa	Puebla	700
17	Sótano de los Planos	Puebla	694
18	Sótano de Tilaco	Querétaro	649
19	Nita Nashí	Oaxaca	641
20	Sistema Atlalaquia	Puebla	623
21	Cueva de Diamante	Tamaulipas	621
22	R'ja Man Kijao	Oaxaca	613
23	Nita Hé	Oaxaca	594
24	CH54 (Meadre-Qui-Traverse)	Puebla	588
25	Sistema Cuetzalan	Puebla	587
26	Sótano de las Coyotas	Guanajuato	581
27	Sótano Arriba Suyo	San Luis Potosí	563
28	Sótano del Río Iglesia	Oaxaca	531
29	Sótano de Nogal	Querétaro	529
30	Sótano de Ahuihuitzca	Veracruz	515
31	Sótano de las Golondrinas	San Luis Potosí	512
32	Hoya de las Conchas	Querétaro	508
33	Sótano del Buque	Querétaro	506
34	Nita Chaki	Oaxaca	493
35	Hoya de las Guaguas	San Luis Potosí	478
36	Cueva de San Agustín	Oaxaca	461
37	Sótano de El Barro (El Sótano)	Querétaro	455
38	Hoyo de San Miguel	Guerrero	455
39	Sótano Itamo	Veracruz	454
40	Cueva de la Pena	San Luis Potosí	448
41	Sótano de Tlamaya	San Luis Potosí	447
42	Osto del Puente Natural	Oaxaca	442
43	Sótano del Pueblito	Veracruz	438
44	Sistema H3-H4	Puebla	430
45	Cueva de la Llorona	Tamaulipas	412
46	Cueva del Reefer Madness	San Luis Potosí	411
47	Cueva Tan-go-jo	San Luis Potosí	405
48	Sótano de Alhuastle	Puebla	404
49	Sumidero Santa Elena	Puebla	400
50	Atepolihuit de San Miguel	Puebla	399

LONG CAVES OF MEXICO

Compiled by Peter Sprouse 31 December 1988

	<u>Cave Name</u>	<u>State</u>	<u>Length</u>
1	Sistema Purificación	Tamaulipas	72309
2	Sistema Huautla	Oaxaca	52110
3	Sistema Cuetzalan	Puebla	22432
4	Coyalatl	Puebla	19000
5	Cueva del Tecolote	Tamaulipas	13550
6	Sistema Cuicateca	Oaxaca	9180
7	Sumidero Santa Elena	Puebla	7884
8	Cueva de la Peña Colorada	Oaxaca	7793
9	Atepolihuit de San Miguel	Puebla	7700
10	Sótano del Arroyo	San Luis Potosí	7200
11	Actún de Kaua	Yucatán	6700
12	Sumidero de Jonotla	Puebla	6381
13	Sótano de Las Calenturas	Tamaulipas	6322
14	Nohoch Nah Chich	Quintana Roo	6096
15	Gruta del Río Chontalcoatlán	Guerrero	5827
16	Sistema H31-H32-H35	Puebla	5745
17	Gruta del Río San Jerónimo	Guerrero	5600
18	Grutas de Juxtlahuaca	Guerrero	5098
19	Cueva Quebrada	Quintana Roo	5000
20	Vesh Tucoc	Chiapas	4930
21	Sac Actún	Quintana Roo	4633
22	Cueva del Nacimiento del Río San Antonio	Oaxaca	4570
23	Sistema Atlalaquia	Veracruz	4530
24	Sótano de la Tinaja	San Luis Potosí	4502
25	Sótano de Japones	San Luis Potosí	4500
26	Cenote Najaron	Quintana Roo	4500
27	Sistema San Andrea	Puebla	4471
28	Sistema Ocotempa	Puebla	4335
29	Sótano del Río Iglesia	Oaxaca	4206
30	Sistema Zoquiapan	Puebla	4107
31	Sima del Borrego	Guerrero	4087
32	Aztotempa	Puebla	4000
33	Sumidero San Bernardo	Puebla	3931
34	Sumidero de Pecho Blanco No. 2	Chiapas	3790
35	Sótano de Agua de Carrizo	Oaxaca	3748
36	Nita Nashí	Oaxaca	3524
37	Cueva de la Llorona	Tamaulipas	3491
38	Cueva del Río Jalpan	Querétaro	3440
39	Akemati	Puebla	3356
40	Actún Xpukil	Yucatán	3353
41	Cueva de la Laguna Verde	Oaxaca	3350
42	Sumidero Yochib	Chiapas	3316
43	Cueva de El Chorreadero	Chiapas	3280
44	Resumidero la Joya	Guerrero	3245
45	Atepolihuit de Nauzontla	Puebla	3066
46	Sótano de Tlamaya	San Luis Potosí	3057
47	Cueva de la Puente	San Luis Potosí	3030
48	Sistema de Montecillos	San Luis Potosí	3022
49	Resumidero de Toxin	Jalisco	3005
50	Sótano de Huitzmolotitla	San Luis Potosí	3002

The World's Major Caves: How Does Mexico Rate?

Peter Bosted

I have recently finished translating and updating the *Atlas of Long and Deep Caves of the World*. As I was typing in all those numbers, I became curious as to how Mexico compared with the rest of the world in percentage of long and deep caves. I therefore compiled the lists shown in Table I and Table II.

Long Caves Of The World

It can be seen in Table I that the United States completely dominates the list of long caves, with 30% of the caves over three kilometers long, 33% of those over ten kilometers long and a whopping 43% of those really long caves over 30 kilometers. Mexico does reasonably well on this list, with 4% of the caves over 30 kilometers long. This is comparable to a typical European country, such as Switzerland.

It is interesting to note that the percentages for three kilometer, ten kilometer, or 30 kilometer caves do not vary much for a given country. This shows that a more-or-less universal curve describes the relative number of caves versus length, even though geologic settings can vary dramatically. Over 90% of the long caves are found on just two continents: America and Europe, roughly equally divided between the two. While geologic conditions make it unlikely that Africa could ever compete, Asia and Australia may well take a larger share in the future as exploration increases in countries such as China, Borneo, and Papua New Guinea.

Deep Caves of the World

Table II shows that almost all the deep

**Table I. DISTRIBUTION OF
LONG CAVES**

Country/Area	>3K	>10K	>30K
	%	%	%
United States	30	33	43
France	15	13	11
Spain	8	8	7
Austria	4	5	9
Mexico	4	2	4
Italy	4	3	2
USSR	3	5	6
United Kingdom	3	4	4
Romania	3	3	2
Switzerland	2	2	4
Yugoslavia	2	1	0
Asia	5	2	2
Australia	4	5	4
Central America	4	5	0
Rest of Europe	4	4	2
Africa	3	4	0
South America	2	1	0
Total # of caves =	1236	240	46

**Table II. DISTRIBUTION OF
DEEP CAVES**

Country/Area	>300m	>700m	>1km
	%	%	%
France	23	18	18
Spain	18	19	28
Austria	11	18	21
Italy	14	16	3
Mexico	8	10	12
USSR	5	7	12
Yugoslavia	5	3	0
Switzerland	3	3	3
Papua New Guinea	3	0	0
New Zealand	1	2	0
Asia	2	1	0
Rest of America	3	0	0
Africa	1	2	3
Rest of Europe	3	1	0
Total # of caves =	716	116	33

caves are found in just six countries. Five of them are European (France, Spain, Austria, Italy, and U.S.S.R.) and the only non-European country is Mexico! Both Mexico and the U.S.S.R. have substantially increased their share compared to five or ten years ago. They should both continue to increase their share in the future, as deep caves seem easier to find there than the more-thoroughly explored Western Europe.

As was the case for long caves, the percentage of caves greater than 300 meters, 700 meters, or 1000 meters deep seems to be relatively constant for a given country, showing that the distribution function for depth is fairly universal. One exception is Italy, which would be expected to have five kilometer-deep caves based on the number -300 meter and -700 meter caves, rather than only one.

Major Systems of the World

Another thing that interested me was caves that are both very deep and very long. These caves are presumably among the most difficult and time-consuming to explore. I rather arbitrarily picked cut-off points of 700 meters deep (116 in the world) and 20 kilometers

long (also about 100 in the world). The 15 caves that met both these criteria are listed in Table III, ranked in order of the product of their length and depth.

The two major cave systems in Switzerland clearly dominate the list, with Siebenhangste being the only cave in the world both 100 kilometers long and a kilometer deep – truly an impressive system. Mexico holds its own on this list, with its two major systems, Huautla and Purificación, found in the top six on the list. It is interesting that all but three of the caves are found in the Pyrennes and Alps of Western Europe. Besides the two in Mexico, the only other cave is Nettlebed, in New Zealand, which recently became the deepest in the southern hemisphere with the addition of an upper entrance.

Interestingly, neither the deepest nor the longest caves appear in Table III. The reaseau Jean Bernard is 1535 meters deep, but the length figure I have from 1986 is 17.9 kilometers. Mammoth Cave System is over 530 kilometers long, but its vertical extent is only 116 meters. With ongoing exploration in caves such as Sistema Cuicateca and Tecolote, Mexico certainly has the potential to add more caves to Table III in the future.

Table III. CAVES >20 KILOMETERS LONG AND >700 METERS DEEP

<u>#</u>	<u>Cave, Country</u>	<u>Length</u> <i>meters</i>	<u>Depth</u> <i>meters</i>	<u>LenxDepth</u> <i>km²</i>
1.	Hölloch, Switzerland	133,000	867	115.4
2.	Siebenhengste-Hohgant Höhlensystem, Switzerland	110,000	1020	112.2
3.	Systeme de la Coume d'Hyovernéde, France	82,500	1004	82.8
4.	Sistema Huautla, Mexico	52,111	1353	70.5
5.	Reseau de la Pierre Saint-Martin, France	51,200	1342	68.7
6.	Sistema Purificación, Mexico	72,309	904	65.4
	Compleso di Corchia-Fighiera, Italy	45,000	1215	54.7
8.	Dachstein-Mammuthohle, Austria	38,529	1180	45.7
9.	Raucherkarhöhle, Austria	44,111	725	32.0
10.	Jagerbrunntrogsysteem, Austria	25,315	1078	27.3
11.	Gouffre Berger, France	20,665	1248	25.7
12.	Grotta di Monte Cuccu, Italy	26,135	922	24.1
13.	Sistema Cueto Coventosa, Spain	27,260	815	22.2
14.	Nettlebed Cave, New Zealand	23,400	889	20.8
15.	comlesse di Piagia Bella, Italy	25,000	755	18.4

THE NANTA CONNECTION

Huautla's Super System Comes Together

Mark Minton



Anthodites in Anthodite Hall, San Agustín. (Allan Cobb)

Sótano de San Agustín was buzzing with activity. After four preliminary trips to rig the cave and haul in the necessary supplies, eight people (Don Broussard, Alan Cressler, Ed Holladay, Hal Lloyd, Doug Powell, Jim Smith, Bill Steele, and Paul Wojtkowski) had taken up residence in the newly established

Camp IV at the far end of Kinepak Kanyon (-600 meters). Simultaneously, a large international group (Don Coons, Ernie Garza, Pierre-Yves Jennin, Karlin Meyers, Judy Ogden, Philippe Rouiller, Ursi Sommer, Jasmin Ustundag, Nancy Weaver, Urs Widmer and I) was based at Camp IIA (-530 meters). Most

of this crew was about to head home after a successful trip to the highlands east of Huautla on the Cerro Rabón plateau, but they jumped at the chance for a quick tour of San Agustín. Nancy and I were their guides. Three more people (Pam Duncan, Linda Gough, and Sherri Engler) were on a day trip to Camp I (-260 meters). Never before, with the possible exception of the rescue of the Polish caver in 1980, had there been so many people in the cave at the same time. The air was charged with excitement!

Connection!

Over the past six years, we had talked frequently about setting up a remote camp near the Fracture of the Deep, where four very deep caves, San Agustín, La Grieta, Agua de Carrizo, and Nita Nanta, come tantalizingly close together. Bill Steele and I had scouted the site in 1981, but until now we had opted to operate out of Camp IIA rather than carry heavy loads through the awkward squeeze, slippery breakdown, and menacing bedrock scimitars found along the canyon route. This time the main objective was to dive Scorpion Sump, the upstream end of San Agustín, which demanded a fresher team and required heavy loads, so Camp IV became a necessity.

Once everyone had settled in, they got right to work preparing for the dive. The day after arriving in camp, they carried the dive gear through the crawl to the nearby sump, and Jim suited up. The population of five-centimeter-long blind cave scorpions (*Alacran tartarus*) seemed to be out in full, patrolling the walls and ceiling even underwater, adding to the anxiety of the situation. It has never been determined how bad the sting would be, and this was not the place to learn. It was 8 p.m., 26 March 1987, when all was finally ready, and Jim disappeared beneath the water. He surfaced less than a minute later, only ten meters away in the terminal sump chamber of Nita Nanta, -1098 meters below its entrance. It took a moment to recognize, but that was it, the connection we had worked so hard for ever since the discovery of Nanta back in 1980. It was the connection of a lifetime, and the first ever joining two caves each over 1000 meters deep. The length of Sistema Huautla also grew by 50 percent in one fell swoop.



Ed Holladay preparing to descend. (Jim Smith)

A second dive was made the same night, by Jim and Doug, to push the unstable breakdown separating the Nanta sump from the rest of the cave. This passage had been reported collapsed when last visited, in 1985, by a tired survey team. Much to Jim and Doug's delight, the route was open after all, and they even found a survey station, making a direct tie-in possible.

The Tour

Meanwhile, we tourists from Camp IIA had rigged down to the -648 Lake, through the Gorge and Metro (-740 meters), and up to the Sala Grande de la Sierra Mazateca (Camp III) and Anthodite Hall. We were amazed at how hard the Swiss cavers worked to stay dry, including rigging a low-hanging tyrolean across the lake. They didn't wear wet suits, and their years of alpine caving at home had instilled in them a loathing for underground wetness, even though here it was a relatively balmy 19 degrees Celsius. We had a great time marvelling at the formations, as the Swiss exclaimed alternately, "Oh, we have those" or, "Ah, we

do not have these!" Urs, who had several cameras along, nevertheless complained that no one had told him it would be like this, and that he had all the wrong cameras. Some of the group rigged the lower Gorge all the way down to the terminal sump (-841 meters), while the rest took pictures or returned to camp.

The following day we took the other leg of the tour, to Kinepak Kanyon. This time the Swiss were halted by the Waist Lake, where they contemplated an aid route across the ceiling, until Nancy dove in, and they relented. Imagine our surprise upon reaching Camp IV and learning that the chief objective of the expedition was already accomplished! A party and plenty of photos ensued, after which we visited Loggerhead Hall and let the dive crew go back to well-earned sleep.

In the remaining days at Camp IV, everyone but Paul was shuttled through the sump, and the tie-in survey with Nita Nanta was completed. Mop-up survey was also done in La Grieta via the recently discovered Petty Connection, and another disappointing search was made for the link to Sótano de Agua de Carrizo – now the only remaining holdout for a con-



Mark Minton holds a blowing piece of flagging tape at the entrance to the Fool's Day Extension. (Jim Smith)

nection in the area. Finally, the campers headed out, groaning under their burdens, the price to be paid for a deep, remote camp involving scuba.

Fool's Day Extention

One person groaned more than most. Don Broussard injured his back and decided he needed to bivouac on the way out. Bill came up to the fieldhouse in the night for supplies, then valiantly returned to the cave to stay with Don in the Sand Room, a short way inside. The following morning, Doug and I went in to help with Don's gear, and Nancy stood by at the entrance to give Don encouragement and help at the lip; he insisted on climbing out on his own. While Don climbed, the three of us remaining below checked the breakdown mountain in the Sala Grande. We'd all wondered what was at the top of the pile, but had never bothered to check. Following the breakdown against the back wall, Bill noticed airflow. We found a way into a lower pocket of the room, where the wind was literally roaring out of the rocks. In fact, Bill and I debated whether the sound was from a waterfall on the other side. After considerable digging and poking, I found a devious route through the pinch and found myself standing in an ancient, dry borehole. Bill and Doug followed, and we elatedly scooped to the head of a pitch.

When we returned to the fieldhouse with our tale of virgin borehole practically within sight of the entrance, there was considerable skepticism. After all, it was 1 April, and we played on that fact. However, all doubts disappeared the following morning, when people saw how much rope we intended to carry in. The pinch was blasted open for easier access and named the Dust Devils for the swirling sand picked up by the wind when anyone crawled through. Two teams leapfrog-surveyed down the ten-meter-high, three-meter-wide flowstone-floored trunk for 850 meters to a T-intersection at -300 meters. Here one side dropped away down a deep shaft, but the other, smaller side could be followed down more drops for another 170 meters before the rigging tackle ran out after a total of 18 pitches for the day. This was Huautla caving at its finest!



Mike Futrell at the Grand Cascade. (Jim Smith)

Two days later, the big shaft was descended 100 meters to the top of another pit. Drop after drop, the Bowl Hole series was descended, until again the tackle was depleted at the top of a huge shaft. The five short ropes remaining were tied end-to-end, and Doug descended until he was hanging, spider-like, in a huge void with a river roaring in the distance. The survey indicated that this was Tommy's Borehole, a previously known fifty-meter-wide passage at -615 meters. This was confirmed when the 70-meter drop was fully descended and tied in two days later. This pit, Cha Ses Bowl Hole, has been called the most spectacular of the well over 600 drops known in Huautla. The connection back into known cave, while somewhat disappointing, nevertheless provided an easier route to the bottom of San Agustín and will facilitate future work there.

New arrivals Sarah Gayle and Andy Grubbs completed the first crossover trip on 6 and 7 April: in via the new route, a side trip to

Anthodite Hall at the bottom, and out through the original Fissure route in 23 hours. A week later, the smaller branch of the T was pushed through tight, gritty passage and down flaky pits to another drop, which was never descended for lack of gear, but overlooked Tommy's Borehole. Including side passages, over three kilometers of survey were added to San Agustín in the Fool's Day Extension.

Ridge Caves

With two deep routes in San Agustín, we had our work cut out in derigging, especially since some of the team had to return to the States. Several trips were made to haul out the last of the camp supplies and a mountain of PMI rope.

Several small caves were also pushed, but nothing went far until we had a go at Bernardo's Cave, discovered by Nancy the previous year, but not entered. Located on the ridge

above La Grieta, Bernardo's has a classic four- by five-meter entrance set in a heavily wooded bluff at the end of a small arroyo. Inside, the passage quickly assumes the usual character of the *nitas*: high narrow canyon with small stream and vigorous airflow, heading steadily down at a 40 degree angle. A depth of 315 meters was reached after three trips.

Another nearby cave, Nita Ina (Fern Cave), was also pushed, and on the second trip two teams simultaneously tied into Bernardo's at known points not far apart. The combined group pushed on and finally ran out of rope in a large shaft series at a depth of over 520 meters. It was a good day's work, with 155 stations set for a total of 1260 meters of new survey. One of the Ina routes was the easiest way deep into Bernardo's and was used for the final pushes. Paul did a solo derig of upper Bernardo's, while Ed, Jim, and visiting Swiss caver Peter Keller pushed the bottom to a connection with a fossil section of lower Nita Nanta at -650 meters. Thus, two new entrances, 3.1 kilometers of new passage, and another deep route were added to Sistema Huautla.

In early May it was time to derig, break camp, and head for home after one of the most memorable Huautla expeditions ever. Over 7.5 kilometers of new survey, including two kilometers of true vertical traverse, were added to the area total, now well in excess of 70 kilometers. The integrated Sistema Huautla comprises 17 entrances and 52.7 kilometers of

passage (including 600 meters added in 1988) to a depth of 1353 meters. This most complex vertical system has more independent deep routes than any other cave in the world: two routes over 1000 meters deep, two over 900 meters, two over 800 meters, one over 700 meters, and two over 600 meters. A spectacular crossover trip could be made: 1225 meters down via Nita Nanta's highest entrance, through the best of San Agustín, and 1100 meters back up Li Nita, all without retracing a single footstep! Such a trip is unlikely to be done, however, due to the logistics of rigging well over 100 pitches and diving two widely separated sumps in the middle.

Although we enjoy steady progress toward our goal of making Sistema Huautla the deepest cave in the world, glory can be brief in the realm of deep caves. At our current mark of 1353 meters, sufficient for a world record only ten years ago, we remain in sixth place. In the past two years, ten more caves have been added to the ranks of those surpassing a kilometer in depth, and, in this year alone, three of those were found in Mexico.

Acknowledgements

The Huautla Project would like to thank our sponsors for their invaluable contributions: Bob & Bob, Dogwood City Grotto, The Explorers Club, GTE Sylvania, the National Speleological Society, Oregon Freeze Dry, Pigeon Mountain Industries, Speleo Press, and Star Food Processing.

CONEXION HUAUTLA-NANTA

En 26 marzo de 1987, Jim Smith buceó el sifón "Alacrán", estableciendo una conexión entre Sótano de San Agustín (Sistema Huautla) y Nita Nanta, sumandose así -1353 metros de profundidad. Por otro lado, mientras tres espeleólogos esperaban el ascenso de un compañero herido en la zona de entrada de San Agustín, descubrieron un nuevo pasaje llamandose así Fool's Day Extension, un pasaje seco el cual se conectó con Tommy's Borehole a -615 metros. Este nuevo descubrimiento añadió 3 kilómetros en longitud al sistema, e incluye el tiro más bello (Cha's Borehole, 70 metros) de todo el sistema. En adición dos cavernas más, Cueva de Bernardo y Nita Ina, fueron exploradas y topografiadas, añadiendo 3.1 kilómetros al sistema cuando hicieron su conexión a -650 metros.

The 1988 HUAUTLA EXPEDITION

Jim Smith



Camp III climb. (Keith Goggin)

Field activities for the Huautla Project began 1 January 1988, with a skeleton crew of Phil Reeder, Randy Villa, and myself (co-leader), all graduate students studying under Dr. Nicholas C. Crawford, Center for Cave and Karst Studies, Western Kentucky University. My goal was to begin a hydrogeologic study of the Sistema Huautla karst drainage basin in preparation for my master's thesis. We were to geologically field map the basin along lineaments traced onto the Huautla provisional topographic quadrangle in preparation for qualitative dye tracing to determine the location of Sistema Huautla's resurgence. In addition, we would begin exploration of a 16-year-old lead in the Canadian Tubes of La Grieta, Sistema Huautla.

On 7 January, Phil Reeder and I concluded exploration in La Grieta's Canadian Tubes on a 17-hour trip that netted 284 meters of survey in 116 meters of vertical loss to a depth of 357 meters. The vertical route terminated in a flowstone constriction after descending virgin shafts of 16, 2, 15, 7, 47, and 15 meters. The next day, Phil and Randy left for the United States, and Don Coons joined the team.

Geologic field mapping indicated a westerly dip of lower Cretaceous limestone units across the hypothesized drainage basin. Two major lineaments were recognized to cross the drainage basin at the junction of the east-west-trending Río Iglesia Dolina and north-south-

trending San Agustín Dolina. The north-south trend was interpreted to be a high angle thrust fault bounded by an east-west-trending tear fault. From this data, it was highly unlikely the resurgence would lie on the eastern edge of the Sierra Mazateca. The best possible location for the springs of Sistema Huautla was along the Río Santo Domingo to the south. Based on preliminary geologic field mapping and the unpredictability of hydrologic flow routes, potential spring locations on the east and south side of the range would need to be field checked and bugged with charcoal dye receptors for a qualitative dye trace.

In Search Of Springs

On 13 January, Don Coons and I hiked from San Agustín down to Peña Colorada Canyon, a distance requiring six hours of hiking and a drop of 1400 vertical meters, to set charcoal dye receptors in Cueva de la Peña Colorada, surface streams, and smaller springs discharging into the canyon. We followed the cave-like canyon to its confluence with the Río Santo Domingo, a kilometer-and-a-half farther. Near the junction of the two canyons, on the north wall, a large spring with an estimated discharge of 1.25 cubic meters per second, called the Southern Resurgence by Bill Stone, was bugged with charcoal dye receptors.

On 14 January, three springs located to the west of Peña Colorada Canyon, HR Resurgence Cave, Western Resurgence, and Agua Fría, were bugged with charcoal dye receptors. Temperature recordings indicated the Southern and Western Resurgences to be the coldest, suggesting drainage from highland karst regions to the north in the Sierra Mazateca, and to the south in the Sierra Juárez, respectively. We continued following the Río Santo Domingo downstream to the east side of the range. During three days of following 40 kilometers of river through intermittent narrow canyons, we encountered rapids that were negotiated by body surfing, twisted our ankles and knees along boulder-filled shore lines, and made dozens of river crossings through a landscape that changes from cactus and scrub to virgin rain forest.

We left the Río Santo Domingo on the eastern side of the range, unsuccessful in finding

any more large springs. Bugs were set at the Nacimiento Uruapan, believed to drain the Cerro Rabón. Our journey took us to Jalapa de Díaz and Ixcatlán on the Presa Miguel Alemán, where we hired a motorboat to cruise the shoreline of the lake in quest of more large springs. We were disappointed and relieved to be unsuccessful in finding any. Our boat let us off at Capana. The next day we hiked to Tenango in six hours along the karst valley of the east-west lineament and caught a bus back to San Agustín. We had spent six days traversing a 140-kilometer loop in search of springs.

The Crew Arrives

By 18 January, most of the Huautla Project personnel had arrived and rented a house. Bill Steele (co-leader) brought with him Janet and Audry Steele, Allan Cobb, Scott Rote, Lee Perry, and Mason Estes from Texas, and Jay Arnold from Washington D.C. Mike Futrell and Keith Goggin arrived from Virginia, and



Tasmanian Stephan Eberhard negotiates a tight passage in Nita Ntonsoo. (Keith Goggin)

Ed Holladay and Bob Runsor from Tennessee hiked in from Chilchotla, Zongolica, after participating on the Australian expedition. Colorado cavers Rod Frank and Todd Warren were the last expedition members to arrive.

The expedition was fielded with three goals: to support my master's thesis research, make a 16mm color movie of Sistema Huautla's Sótano de San Agustín, and continue exploration to increase the depth and length of the cave system. With the objectives defined, Sótano de San Agustín was rigged to Camp III in the Sala Grande de la Sierra Mazateca at -720 meters on 22 January. Additional rigging was required in anticipation of carrying heavy loads, and the presence of high water. In order to film Anthodite Hall and the Gorge, a camp would be established at Camp III.

On 22 January, Don Coons and I carried 18 kilograms of fluorescein dye into Sótano de San Agustín to the system's largest stream located in the Gorge at -620 meters. The dye was then injected into the hydrologic system to identify the spring or springs of the drainage basin.

Moviemaking

By 24 January, Camp III had been prepared for movie making and exploration, with several loads of PMI rope, heavy movie lights, and climbing equipment staged in advance of the camping team. The idea of making a movie had always been repulsive to most of the Huautla Project team because of the time required for filming, and the interference to exploration that would result. This year presented the best opportunity for filming, because we were embarked on a type of exploration, dome climbing, involving a lot of waiting. The extra manpower would be utilized to assist Jay as actors, light men, and sherpas.

Due to the luxurious accommodations in Camp III and the necessity of manpower, the camping team was not limited in size. Twelve cavers volunteered: Jay Arnold (film maker), Ed Holladay, Mike Futrell, Todd Warren, Bill Steele, Bob Runsor, Mason Estes, Don Coons, Lee Perry, Allan Cobb, Keith Goggin, and me. The team would enter the cave in two groups on successive days. The film crew entered on 25 January. En route to Camp III, we filmed



The camp team of Steele, Arnold, Perry, Runser, Smith, and Goggin before heading in for a week of exploration and filming.
(Keith Goggin and Mike Futrell)

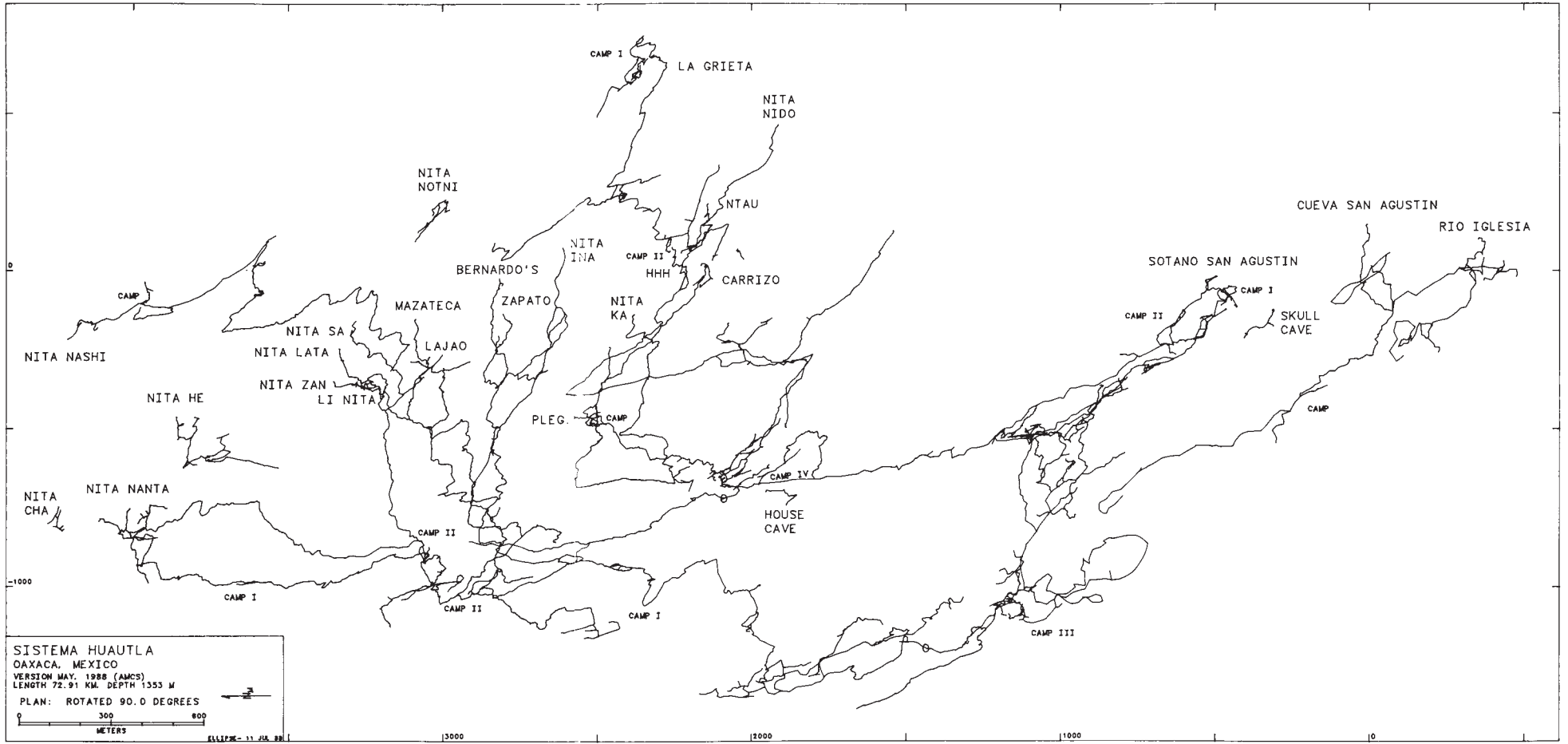
the Bowl Hole shaft series down to Tommy's Borehole, taking more than 12 hours. At the photographer's request, we camped overnight on a house-sized block of limestone, short of our goal of Camp III. The next day, Tommy's Borehole and the huge shaft, Cha Seis, were filmed, and camp duffles were packed down the Gorge to Camp III.

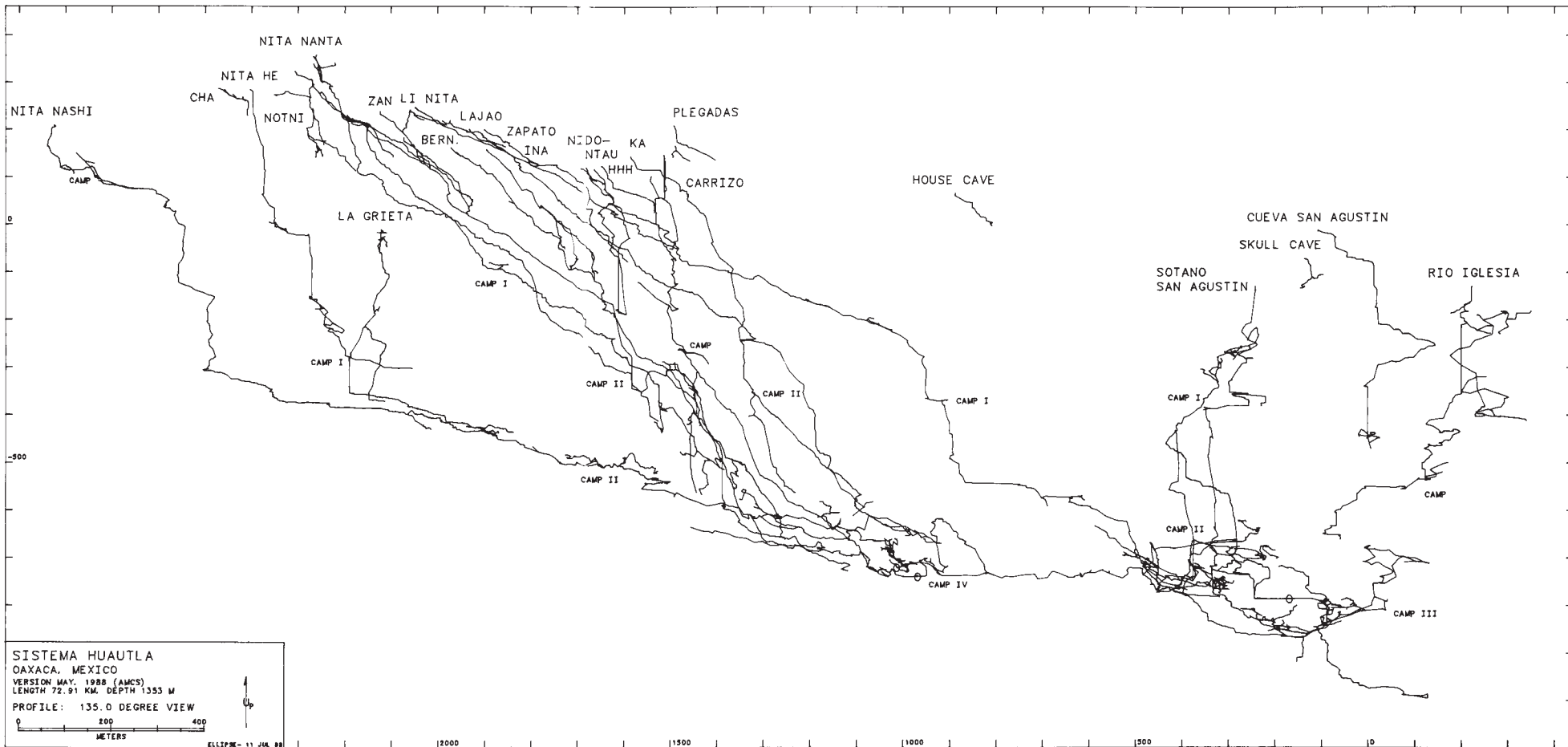
Technical Climbing

Two spry young climbers, Todd and Mike, teamed up to climb four major leads in the Sala Grande de la Sierra Mazateca, with the goal of trying to bypass the terminal sump of the system. They used big-wall climbing techniques, employing bolting, clean-climbing aids, and daring free climbing on notoriously loose walls of folded and fractured rock. The lengthiest climb involved four pitches totalling 60 meters. Their efforts netted 800 meters of new passage, but unfortunately no bypass was found to the terminal sump.

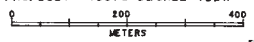
Cinamax Boredom

Movie making began to take its toll among the deep campers, creating the newest term in the movie world: cinamax boredom. We constantly waited, waited, and waited for something to happen. While waiting, we froze. Every scene had to be carefully staged and often reshot. In addition, there was the arduous aspect of filming deep in a cave. Besides haul-





SISTEMA HUAUTLA
 OAXACA, MEXICO
 VERSION MAY. 1988 (AMCS)
 LENGTH 72.91 KM. DEPTH 1353 M
 PROFILE: 135.0 DEGREE VIEW



ELLIPSE-11 JUN 88

1200

1500

1000

1300

10

ing photographic equipment into and out of the cave, shuttle runs had to be made to the surface with nine-kilogram NiCad batteries for recharging. The spectacular aspect of cave cinematography was the brilliant lighting, enabling the cave to be seen as never before. None of us had ever assisted in the production of a cave movie, and the experience gave each caver a greater respect for cave cinematography. Some people vowed to never do it again. Film was shot at Camp III of the technical climbing episodes, the Gorge, and vast Anthodite Hall and its aragonite formations. After nine days of camping, the last explorer, Jay Arnold, left the cave proclaiming this trip to be the pinnacle of his caving career. His closest state-side advisors had told him he would not leave Sótano de San Agustín alive!

The Sistema Huautla Resurgence

After the lengthy cave camp, Lee and I drove to Camerón on 4 February, and hiked down to Peña Colorada Canyon to retrace the steps of the first adventure, and recover the bugs. There had been a lot of rainfall, and I did not anticipate any problem with dye hung up in the aquifer. One dye receptor was almost abandoned, as a large black fer-de-lance, the death adder, investigated the bug with interest. After the snake disappeared into the spring, expendable Lee fished the receptor from the water. At the field house, dye was eluted from the charcoal with a potassium hydroxide and isopropyl alcohol solution. Only one detector was positive. It was from the Southern Resurgence, a spring not considered to be the outflow of Sistema Huautla by previous investigators. All other bugs were negative, indicating a single perennial outflow for the Sistema Huautla drainage basin, as opposed to a distributary system of springs analogous to a river delta complex. This spring was appropriately renamed the Sistema Huautla Resurgence.

During the month of February, the next phase of the hydrologic study would be within Sistema Huautla's drainage system in an effort to link surface streams and cave streams of the major unconnected caves to the system. This data would further our knowledge of the hydrologic network, define the limits of the drainage basin, and serve as a valuable explor-

ation tool in efforts to link known caves into the system.

Nita Zan, an entrance to Nita Nanta, was rigged by Don Coons and me on 15 February. After rappelling 48 shafts, we placed charcoal dye receptors at -910 meters in the Nanta Gorge stream and at -950 meters at the ED survey confluence. Multiple dyes were injected into three cave entrances, Nita Zan, Nita Hé, and Nita Nashí, using optical brightener, fluorescein, and Yellow Dye 96, respectively. It was hypothesized that Zan's water, lost in Nanta's Football Stadium breakdown at -600 meters, would resurge in the Nanta Gorge stream. The hypothesis was rejected when the ED survey bug was positive. The Nita Hé and Nita Nashí hydrologic flow route was hypothesized to link to the ED survey confluence because there were no other known infeeding streams from the ED confluence to Scorpion Sump. This hypothesis was also rejected because the bugs were negative. This led to the hypothesis that one or more additional hydrologic flow routes exist parallel to the Nanta Gorge stream, confined to flow along basal shales, contributing input to other streams in the system.

Sótano de San Agustín was reentered, and dye receptors were placed at six locations, involving a nine-kilometer circuit to -600 meters. Dye was then reintroduced to Nita Nashí and Nita Hé. The dye traveled from both of the caves to Kinepak Kanyon, proving that Nita Nashí and Nita Hé are two hydrologic routes in excess of 1000 meters deep.

While diving the Scorpion Sump in 1987, I had seen at least one underwater conduit with a ripple-marked midchannel bar. It is likely that Scorpion Sump is the junction for many more ridgetop vertical drainage systems, as indicated both by convergence of major survey traverse lines and the density of known cave.

In addition, fluorescein dye injected into Nita Hé was traced through the -805 Sump of Sótano de San Agustín to the Lower Gorge. The Lower Gorge is the master drainage conduit for the hydrologic system, receiving input from Li Nita, which has the second largest stream in the system, and most of the known vertical conduit drainage in the basin.

Río Iglesia Dye Trace

The next dye tracing experiment involved injecting rhodamine WT in the Río Iglesia dolina. Río Iglesia, the largest surface stream in the drainage basin, collects discharge from numerous seepages and streamlets as perennial flow from a clastic caprock aquifer in Middle Jurassic age rocks. It was hypothesized that the hydrologic route of Río Iglesia would not enter Sistema Huautla at any known confluence, nor flow to the Sistema Huautla resurgence. In order to test this premise, dye receptors were placed at all the major confluences and at the Sistema Huautla Resurgence. Upon recovery and analysis, it was concluded that all bugs were qualitatively negative. A second trace in April revealed identical results. At Western Kentucky University, a fluorometric quantitative analysis yielded concentrations of dye not visible in the Sistema Huautla Resurgence charcoal elutant. Thus, it was concluded that Río Iglesia enters the main hydrologic flow route between the explored areas of the system and the resurgence.

Back To Cave Exploration

By 23 February, most of the Huautla Project personnel had returned to the United States to jobs. This left a small but very strong cave team of Don Coons, Ed Holladay, Lee Perry, Mason Estes, and me to continue exploration and thesis work. A new cave, Nita Ka (Fire Cave), was discovered and explored down 16 shafts to a depth of -523 meters and still going, but that's another story.

After the last set of dye receptors was recovered from Sótano de San Agustín on 1 March, the five man crew left the Huautla region to head to the Sierra Juárez to participate in the March Cueva Cheve Expedition, but that's another story, too. The trip to the Sierra Juárez allowed me to investigate the geology and its relationship to speleogenesis as I had done on the Ocotempa expedition. Based on this, I should be able to formulate an overall theory of large, deep cave system development for the Sierra Madre del Sur. The brief respite from caving in Huautla also provided



Andy Grubbs injecting fluorescein dye in San Agustín dolina. (Jim Smith)

enough time for the hydrologic system to decontaminate itself of dye.

Return To Huautla

By 11 April, Ed Holladay and I were the last remaining Huautla Project members in the area. We arrived that evening at the field house to discover that rats and mice had multiplied and ruined most of our stashed food. Besides fouling the house with their excrement, they harbored a pestilence of fleas. The mammals were so numerous they could be easily killed with a broom. The whole next day was spent trying to improve living conditions.

My primary goal upon returning to Huautla was to continue my master's thesis research and the exploration of Nita Ka. There were only two of us now. Despite our top physical condition, after nearly four months of caving with as many as 18 trips to over 500 meters deep, we knew we had to be especially careful.

On 13 April, Ed and I hiked from Camerón to the Sistema Huautla Resurgence to retrieve and set charcoal dye receptors for additional dye tracing experiments. Sistema Huautla Resurgence bugs revealed all qualitatively perceivable dye had left the hydrologic system. The next day rhodamine WT and optical brightener dye was injected into Río Iglesia and the farthest easterly resurgence, Agua Carlotta, in an attempt to redefine the drainage boundary. As previously stated, the rhodamine trace was qualitatively negative, but positive when subjected to quantitative analysis. The Aqua Carlotta trace also proved negative. Either there was not enough time for the dye to travel to the resurgence due to base flow conditions, or it traveled to another spring.

On 15 April, Andy Grubbs stumbled into the field house awakening Ed and I from an early morning sleep. That day, Ed and I re-rigged Sótano de San Agustín, collected and set bugs at the six sampling locations, and returned to the surface in less than 12 hours from 800 meters deep. In the two-and-a-half-kilometer-long San Agustín dolina, two perennial streams sink at the north and west edges.

It was hypothesized that these streams would follow the westerly-dipping limestone under the clastic caprock aquifer to join the western-most passage, Li Nita, instead of dropping vertically into Sótano de San Agustín's Kinepak Kanyon. The north resurgence was dye traced, using fluoroscein, to the Li Nita Waterfall Room confluence. It is likely that the dye traveled through Red Ball Canyon, a large infeasible to Li Nita, even though this is purely speculative.

The western resurgence was injected with optical brightener. Analysis revealed a negative test, indicating a potential parallel hydrologic flow route bypass, or that the dye was hung up in the system. A third dye trace, using rhodamine WT, was conducted by injecting dye into the main stream of the Fissure Series in Sótano de San Agustín. Water from this route siphons at -620 meters. It was hypothesized that the water would re-emerge at the -648 meter lakes. This trace also proved negative. This concluded dye tracing experiments of the 1988 Huautla Expedition.

One more deep trip was undertaken to retrieve bugs, the results of which have previously been discussed. In all, 15 cave trips in excess of 500 vertical meters were required to gather data. During the course of four-and-a-half months of caving, Ed and I undertook 22 trips over 500 meters deep, and, including lesser trips, traversed a total of 18 vertical kilometers of cave.

Acknowledgements

I would like to acknowledge all supporters of my research, beginning with my wife Pam Smith, whose love and understanding supported me during the lengthy absence; the Huautla Project who provided the team work and moral support to make this my greatest adventure in caving and research—in particular, Bill Steele, Ed Holladay, and Don Coons, my most reliable companions and supporters in the field; Mark Minton for untold hours of number crunching on the computer; my thesis advisor, Dr Nicholas C. Crawford of the Center for Cave and Karst Studies for advice and encouragement; and last of all, to the grantors who made research in a foreign country possi-

ble. Thanks to the Richmond Area Speleological Society, Cave Research Foundation, The Explorer's Club, Dogwood City Grotto, Chattanooga Grotto, Pigeon Mountain Industries, Star Foods, Sylvania, Bob & Bob Enterprises and individual contributors.

The results of this study will be published as a master's thesis. This article merely attempts to inform in general of the activities of this expedition and summarize the results.

HUAUTLA 1988

La expedición a Huautla, Oaxaca en 1988 tuvo tres objetivos principales: el estudio hidrológico de la región, la elaboración de una película en color de 16 mm sobre el Sistema Huautla, y la continuación exploratoria de dicha caverna. En la última, realizaron escalamientos a pasajes que pudieron esquivar el sifón del -860 metros en Sótano de San Agustín. Un campamento de profundidad fue establecido para la filmación de la sección llamada "The Gorge", "Anthodite Hall", y ciertas escaladas. A la vez, colorantes fueron usados para así localizar la resurgencia del Sistema Huautla en el cañon del Río Santo Domingo. Nita Ka (Cueva de Fuego) fue encontrada y explorada. Detalles sobre el estudio hidrogeológico aparecerá en el futuro en la tesis escrita por Jim Smith.

Huautla Project: 1988 Recipient of NSS Certificate of Merit

Bill Steele

On 1 July 1988, at the closing banquet of the annual convention of the National Speleological Society, the ongoing project to explore and study the caves near Huautla de Jiménez, Oaxaca, Mexico was awarded a Certificate of Merit. The recommendation for the award, written by Bill Mixon of Austin, Texas, reads as follows: "For about the last ten years, a shifting group of cavers, mostly Americans, has had annual spring expeditions to the caves near the village of San Agustín, Oaxaca, and this effort culminated last spring in the long-sought connection between Nita Nanta and Sótano de San Agustín, making the system the third deepest in the world, with a total depth of 1353 meters. The length of the system stands at 52.11 kilometers, but that figure understates the magnitude of the work that has been accomplished, since these are extremely vertical caves, and 50 kilometers in them is not at all like 50 kilometers in Mammoth Cave. For instance, the system contains what is indubitably the most vertical potential through-trip in the world. One could go in one entrance, descend 1225 meters, then as-

cent 1100 meters to another entrance, without retracing a single step. (The trip, which would also involve diving two sumps, has never been done – although all the passage has been explored and mapped – and probably won't be done very soon.)"

At the time of this writing, exactly one year later, Sistema Huautla ranks as the world's sixth deepest cave. The exploration of deep caves is moving along quite rapidly. In March 1980, when Sistema Huautla surpassed the magic 1000-meter-deep mark, it was the seventh cave in the world to have done so. Eight years later there are 32. One year ago there was one cave in the Western Hemisphere over 1000 meters deep. Now there are four.

The acceptance of the Certificate of Merit was done with great pleasure. The Huautla Project has strived to address all aspects of speleology. The caves have not only been explored and surveyed, but graduate work has been conducted by project members in biology, archaeology, geology and anthropology.

Sistema Huautla:

THE MOVIE

Produced by:
Directed by:
Written by:
Jay Arnold



Jay Arnold filming at the bottom of
Cha Mo Bowl Hole. (Jim Smith)

Sistema Huautla is a dramatic place: it's big and deep, and it has a colorful 25-year history of exploration that makes it one of the world's premier caves.

To me, it seemed an obviously attractive subject for a movie. But although there had been limited efforts over the years to shoot movie footage in Sistema Huautla, no one to

my knowledge had ever gone there with the intent of documenting the complete story.

That was my goal on my first trip to Huautla in the spring of 1984. At that time I accompanied Bill Stone and crew on the epic Peña Colorada diving expedition that was the first attempt to explore the presumed resurgence to the Huautla system. Using a 15-year-old Bell

& Howell Filmo camera and a borrowed tripod and lights, I shot a bunch of 16mm footage on that trip, during which the divers reached Sump VII in Cueva de la Peña Colorada.

Cut to January 1988: Jim Smith and Bill Steele were heading an expedition to Sistema Huautla. A primary goal was to try again to find a bypass to the -861 Sump, the deepest known point in the 1,353-meter-deep system. Another goal was to support Jim's hydrological study of Sistema Huautla. The third goal was to continue the movie.

On this trip I had the same aging but reliable camera, but with a new tripod and movie lights, thanks to generous financial backing of about 60 NSS members and organizations. However, financing was the least of my worries, since making movies, as someone once said, is like making a controlled airplane crash – and I bet whoever came up with that phrase would never even dream of making a cave movie.

Consider the possibilities. Besides the usual caving hazards and the chances that heavy rains could flood key sections of the cave, there were also the chances of a camera breakdown, film ruined by water, batteries or lights failing – or ME failing in a cave that had wrought a heavy physical toll on much stouter cavers than I. But my fears proved to be mostly unjustified, mainly because of the tremendous support I received from the "Huautla Marines" during my three-week stay in late January to early February.

The trip did have its moments, however. It rained nearly every day I was on the surface, thereby severely limiting chances to document the Mexican countryside and its people. Also, one of the six batteries for the movie lights broke en route to our underground camp. Finally, we lost at least two days' filming time in that camp, 700 meters below the Sótano de San Agustín entrance when a portable stove exploded in Bill Steele's face, causing an unscheduled trip to the surface and loss of important manpower; and high water made it impossible to even approach the -861 Sump. Plus, there just wasn't enough time to do everything.

But there were many good moments too: movie lights illuminating the vast expanses of Anthodite Hall, Tommy's Borehole and the Sala Grande de la Sierra Mazateca; seeing the cave's awesome stream passage, the Gorge, in flood; Jim rappelling through the middle of the Grand Cascade; and the incredible winds whistling through the Dust Devils in the new Fool's Day Extension.

I successfully filmed Jim's grand rappel, and I got enough of the Gorge – under dreadfully bad filming conditions – to suggest the mind-numbing beauty and horror of that splendid streamway. I got the Dust Devils; I got the big rappels in the Cha series of pits that drop spectacularly into Tommy's borehole. And I got the shimmering purity of the anthodites in Anthodite Hall.

But when the camp stove blew up, I wasn't ready to film the fantastic blur of flames, running, shouting and rolling in the dirt – and the meter-high wall of fire around the campsite. And I didn't record the pain – physical and emotional – that Bill Steele endured when his injuries forced him to abandon the expedition.

Despite the travails, I was able to shoot 675 meters (about 70 minutes' worth) of 16mm color negative film. That compares with about 45 minutes' worth that I shot on the 1984 expedition, when I dropped the camera and broke two



Jay Arnold loading film in Camp III. (Jim Smith)

lenses! This time I held onto the camera, and considering that my lights weren't water-proofed and my camera was protected only by a neoprene "condom" that I designed, the equipment held up well.

Bill Stone lent me his diving batteries to power my 100-watt and 250-watt movie lights. In most scenes, I tried to use a 250-watt light as the main light, with one of the 100-watt lights as a fill or a back light.

The Eastman Hi-Speed Color Negative film that I used performed exceptionally well in low-light conditions – the "available darkness" that is the norm in cave photography. I was able to shoot at ISO 360 in the cave without forced processing. Typically, I could shoot f-stop eight or better with subject-to-light distances of three to five meters. At about 15 meters I would have to open up all the way to f 1.5, the limit of my 13mm lens, which is comparable to a 26mm lens in the 35mm format. Even at the wide-open aperture, the film gave good color and clarity without too much graininess.

I consider the filming in 1988, as in 1984, a great success. However, the Huautla cave movie is far from complete. More shooting will be required, on-camera interviews must be conducted, and more money must be raised for this most expensive effort. I've told those

who've made investments or contributions that this will be a long-term project, with a completion date no later than summer 1991 – hopefully, much before that time. I'm still seeking investments or donations, by the way.

For what I have accomplished so far, I must thank all the financial backers and the cavers involved, especially the 1988 expedition members, headed by Jim Smith and Bill Steele. And thanks to Bob Runser, Ed Holladay, Keith Goggin, Don Coons, Todd Warren, Mike Futrell, Alan Cobb, Mason Estes, and Lee Perry – the Huautla Marines, as Smith dubbed the expedition crew. These cavers worked their tails off, despite the inevitable tediousness of filming ("like watching grass grow") and the sometimes difficult filming conditions, especially in the maelstrom of wind and water in the Gorge.

I think they enjoyed the filming experience – just don't ask them if they'd like to do it again.

HUAUTLA PROJECT

FILMACION EN EL SISTEMA HUAUTLA

Durante la expedición a Huautla, Oaxaca en 1988, Jay Arnold y compañeros continuaron la filmación en 16 mm sobre la exploración del Sistema Huautla. Arnold anteriormente ya había realizado la filmación en la expedición de la Peña Colorada, conducida por Bill Stone en 1984. Esta vez la filmación en el Sótano de San Agustín incluyó el Gorge, los Dust Devils, los tiros de Nita Cha, Anthodite Hall, y el espectacular pasaje de Tommy's Borehole. El tipo de Película usado fue Eastman Kodak Hi-Speed color negative film, con luces de 100-250 watts.



Nita Ka

Suddenly, a clatter of rock and a cry of pain filled the air. With hearts racing, Ed and Lee regained composure after a mental flash of danger prompted them to take cover. The rocks had never reached them, though the instinct for survival required them to act first and question the situation later. They yelled up to Mason, who was anxiously awaiting a report. Mason swore, then in his horse voice relayed a message that was difficult at best to understand in the resonant shaft.

Jim Smith

The exploration of Nita Ka began near the end of the 1988 Sistema Huautla Expedition, in late February. Only five members of the 18-person expedition remained to continue cave exploration. The crew was "tight." We had been caving hard for almost two months and were at our physical peaks. Don Coons and I had the most caving experience in the group. However, Ed Holladay is second in the United States in trips over 500 meters deep and is the best teammate in the business. Our other two teammates, Lee Perry and Mason Estes, were greener than a cucumber when they started the expedition. Now, after almost half a dozen 500-meter-deep adventures, they had proven by stubborn will that they could endure the hardships of deep caving.

Chased Away From Tarantula Cave

On 25 February, we drove up to San Andrés with intentions of exploring Tarantula Cave. Tarantula Cave had already had one serious push, led by Keith Goggin. Ed, Keith, and the Australian, Stephan Eberhart had explored an estimated 800 meters of passage with two parallel shaft series. One series was very tight, and the other, although less difficult, was also small and miserable. Tarantula Cave looked as if it were going to be difficult to explore, compared to the big-name caves of the area.

Caving suits and equipment were being busily fitted, when a dried-up old man brandishing a machete, filed to look like a sword, appeared from over the hill. He excitedly chattered in the local dialect and was very irritated at our presence. In Spanish, he cursed us like yard dogs and waved his machete with threatening gestures. We didn't need to have command of the language to realize that we weren't welcome, so we left. Our only alternative was to find another cave to explore.

Discovery

Ironically, the next entrance we discovered was owned by one of the friendliest

farmers we had met. Mason instigated the exploration, soloing into the cave, while the rest of us mapped outcrops. He returned to the surface, having free-climbed two marginal climbs of nine and ten meters. The cave was going! The cave was named Fire Cave or Nita Ka, the Mazatec equivalent, because the sink had been set ablaze for cultivation.

Carrying several PMI ropes, Ed, Mason, and Lee entered the cave the next day to resume exploration. They traversed 100 meters of walking passage, through breakdown punctuated by an occasional crawl, which had formed along the strike of the bedding. A climb down led to a climb up and a bellycrawl, which ended at the top of a four-meter shaft. Below the pit, the trio began to descend a dry upper-level canyon that followed the dip. They chimneyed across deep holes in the floor that led to a lower level. Ed set a bolt and rappelled 12 meters to the stream and the beginning of a narrow canyon. The canyon was awkward to traverse, as the many chert ledges snagged on clothing and ropes. With hammers, they removed chert to permit passage. The canyon sloped steeply, with numerous short free-climbs, and ended at the top of another shaft requiring bolting. The shaft actually had two parts, with an eight-meter, sheer plumb followed by a steeply sloping four-meter drop only needing a handline. The canyon abruptly enlarged where it intersected a wet, 30-meter-high dome. A few meters later, the explorers were stopped by a large shaft at an intersection with a huge canyon. They had run out of rope, and they surfaced after caving only six hours.

The exciting previous day's exploration made a return trip on the following day necessary. Don and I derigged Nita Zan from -525 meters to the surface, while Lee, Mason, and Ed entered Nita Ka. We got into Nita Zan early and derigged in four-and-a-half hours. The Ka crew got a late start and had just started rigging the last shaft when we arrived with additional rope. The five of us had over 400 meters of rope in going cave with strong wind. It was time to scoop! We were overwhelmed with the desire to explore new cave, since we had only explored 1.2 kilometers in the last two months because so much time had been spent conducting hydrologic research and movie making in Sótano de San Agustín.

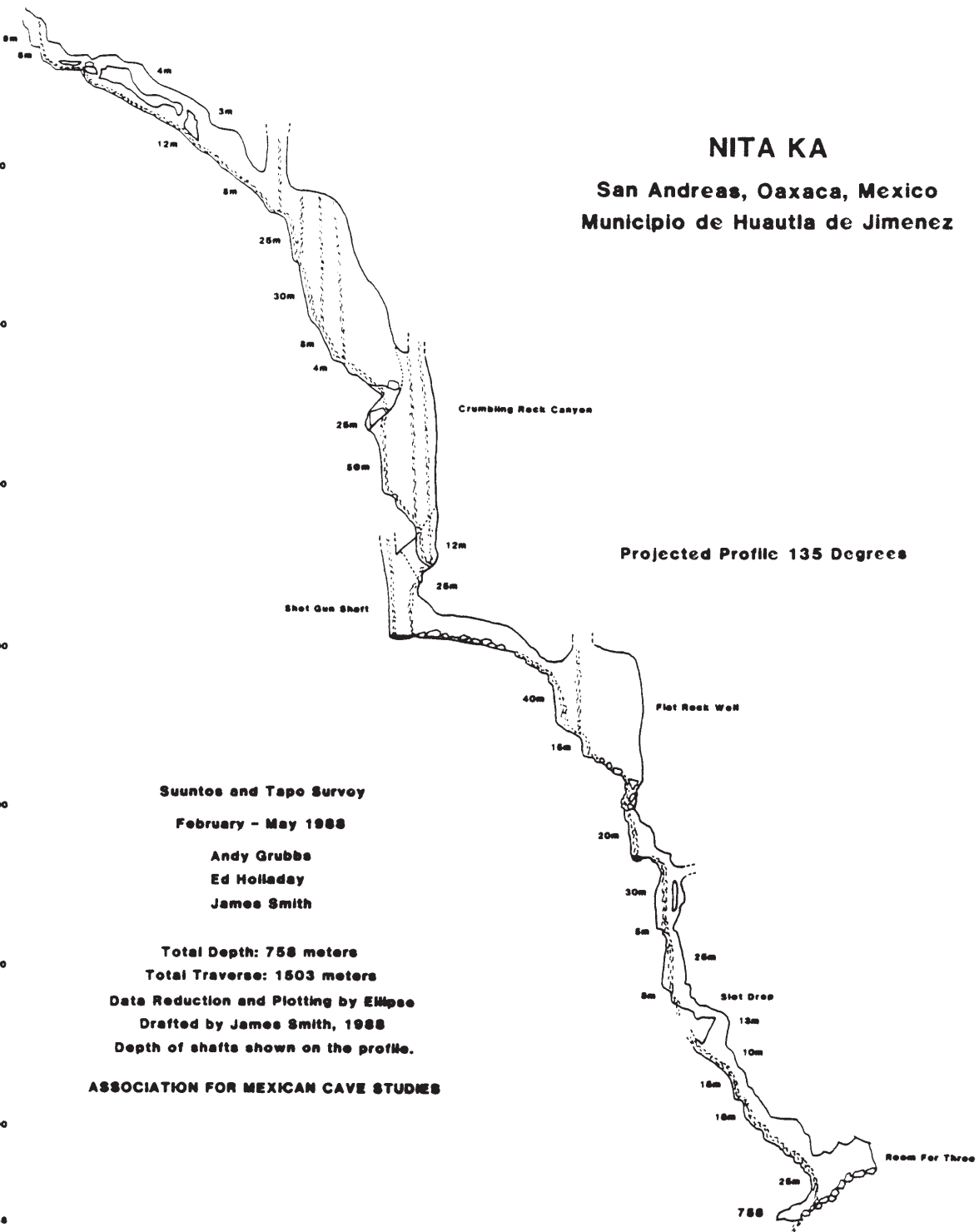
Previous page: Ed Holladay rappelling an eight-meter drop at -650 meters. (Jim Smith)

METERS



NITA KA

San Andreas, Oaxaca, Mexico
Municipio de Huautla de Jimenez



Suunto and Tape Survey
February - May 1988
Andy Grubbe
Ed Holladay
James Smith

Total Depth: 758 meters
Total Traverse: 1503 meters
Data Reduction and Plotting by EMLPee
Drafted by James Smith, 1988
Depth of shafts shown on the profile.

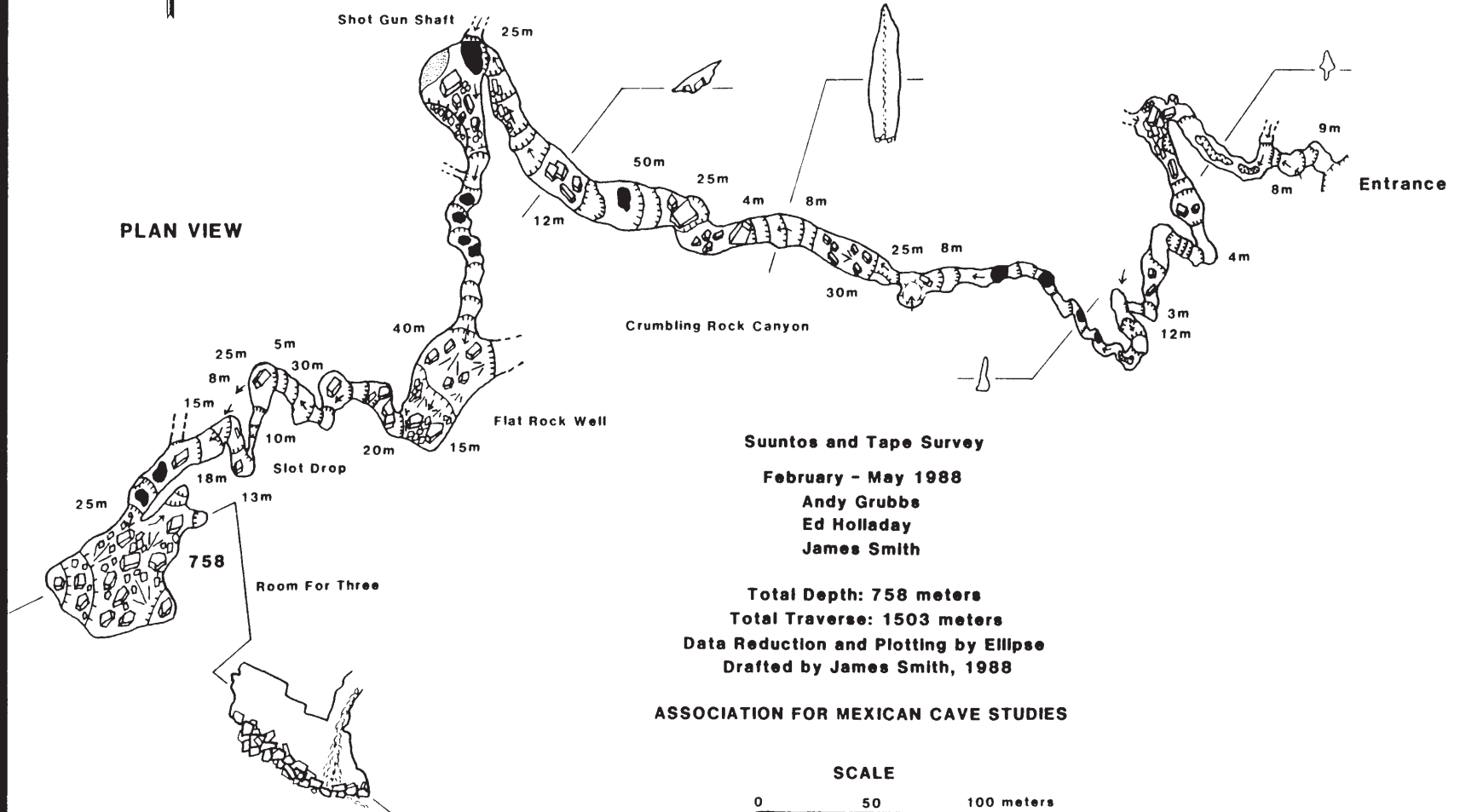
ASSOCIATION FOR MEXICAN CAVE STUDIES

NITA KA

San Andreas, Oaxaca, Mexico
Municipio de Huautla de Jimenez



PLAN VIEW



Suuntos and Tape Survey

February - May 1988

Andy Grubbs
Ed Holladay
James Smith

Total Depth: 758 meters

Total Traverse: 1503 meters

Data Reduction and Plotting by Ellipse

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ASSOCIATION FOR MEXICAN CAVE STUDIES

SCALE



Lee descended the shaft first, screaming in euphoria! He had to tie two short ropes together in order to reach the bottom of the pit. The bottom was only a large ledge atop another void that appeared to be as deep as the previous pit, 25 meters. We began to bunch up on the ledge, creating more targets for missiles dislodged during descent. We were just beginning to realize the crumbly nature of this shaft series. Ed descended the second shaft, 30 meters deep, to the beginning of a five-meter-wide canyon with a 50- or 60-meter high ceiling. The boulder-strewn floor sloped steeply to the next eight-meter drop. I rigged the shaft from a natural tie-off and continued deeper into the cave.

Crumbling Rock Canyon

From unseen heights, small showers soaked us and contributed to the increase in stream volume. We were temporarily stopped by a short drop of four meters, which we rigged through an obscure little solution hole. Ed, followed by the rest of us, continued down Crumbling Rock Canyon to a huge breakdown block chocked between the walls. We sounded for the bottom of the shaft by rock tosses. The lengthy clatter of rock foretold the shaft to be quite deep. Ed set a bolt and dropped 25 meters to a large ledge that was soaked by spray from the main waterfall and the shower of an infeeder.

Without wetsuits, Lee and Mason were getting chilled, and both declined to be the first to descend the next shaft, which required rigging under a waterfall. I volunteered, and rigged a rebelay three meters down to avoid the direct force of the falls. Fifteen meters down, another rebelay was slung from a solution hole to reduce rope abrasion. This was time consuming, and I heard muffled shouts of "hurry up, we're freezing!" Ten meters lower, I set a bolt for the third rebelay and continued down to the lip of another pit. Thirty-five meters down I set another bolt and descended 12 more meters. The offset shaft was about 50 meters in total depth. The stream disappeared through breakdown into a pit. A bolt was drilled, and Mason descended the 12-meter drop.

The canyon continued to slope steeply and

changed into a more rectangular-shaped passage, which ended abruptly at the top of a wet shaft. Unfortunately, the pit could not be rigged free, and the rope hung close enough to scrape the cherty walls, which showered us with mud and chert bombs. We were thankful we were using tough PMI rope. The drop was dubbed the Shot Gun Shaft. It is one of the most worrisome drops in the cave, because you know you are going to get hit every time.

The character of the cave changed from steeply-descending canyon to an almost horizontal borehole passage 20 meters wide by six high. This then changed into a narrow canyon with stair-stepping cascades. Don was in the lead, and those of us behind him were stopped in the middle of a freeclimb. "What the hell is going on?" We heard a reply with a laugh, "Sump! Air sump!". He had been stopped by a deep shaft of great volume. I climbed over the top of the lead explorers and found an obscure natural tie-off. The rock was the flakiest I had seen in the cave thus far and unsuitable for bolting. Ed descended first, dropped to a ledge a few meters down, and disappeared from view. We waited while he set a rebelay. "Off rope." Each of us kicked loose slabs down during descent, so we would not get flat-rocked when we climbed.

The 40-meter pit had dropped into a 30-meter-wide chamber 50 or more meters high. The floor was strewn with loose boulders, steeply sloping to another drop of 15 meters. Don rigged the ledgy shaft with our last 9mm rope and descended. Ed waited at the end of the chamber, organizing his survey crew of Lee and Mason. Meanwhile, Don and I dropped 30 vertical meters through a breakdown-filled canyon to the edge of a 20-meter pit. We estimated we had dropped at least 500 vertical meters below the entrance. Don and I left the survey crew and left the cave after our second 500-meter-deep trip of the day.

Injury!

I awoke the next morning vaguely remembering the surveyors entering the field house in the wee hours of the morning. I asked Ed how long their trip was. He replied it lasted 13 hours, and they only surveyed 25 meters. It turned out Mason had been hit by a rock on the



Ed Holladay surveying in Nita Ka. (Jim Smith)

knee while climbing up 40-meter-deep Flat Rock Well. His injury consisted of a contusion and inflammation. Even though he could barely walk, he had managed to freeclimb unassisted up climbs we later rigged with ropes. The journey to the surface involved climbing 15 shafts up 500 vertical meters. It's hard to keep a good man down, and he was caving a week later. Nita Ka was placed on a back burner until mid-April.

Mid-April

Andy Grubbs arrived from the United States, bursting into the field house one morning and awakening Ed and me. We were glad to see him and to have a third person to cave with. He was just in time. Nita Ka was still going deep. Ed and I had already made one survey trip, the day before. We had surveyed

405 meters, to a depth of 122 meters at the beginning of Crumbling Rock Canyon. Until Andy arrived, Ed and I had been caving without a backup crew. While this was extremely risky, we felt we were in top shape, and willing to accept the risk.

Ed, Andy, and I entered Nita Ka, 18 April, to continue the survey and exploration. Crumbling Rock Canyon, with its successive shafts, is large, so we surveyed with a 50-meter tape. Nita Ka had been stage-derigged in case of flood, and it was necessary to rig while surveying. Surveying was quick, and in 12 hours we reached the beginning of exploration, after setting 46 stations. The survey was temporarily discontinued to begin the push.

Between us, we carried nine push ropes and bolts and slings. We had the feeling that we had not brought enough equipment to finish exploration. We climbed down more than 30 meters through large breakdown boulders, washed clean and rounded from chemical solution and corrosion. A small stream filtered through the chaos and cascaded down an undescended 20-meter shaft. I rigged the shaft and descended. The nature of the cave changed from a vertical breakdown choke into stream canyon, with short, challenging freeclimbs. The next drop, of six meters, led into high canyon passage, which ended at the top of a shaft that "sounded-out" around 40 meters deep. Air flow was encouragingly strong.

Split Shaft

Ed and I each set a bolt to rig the Split Shaft. I descended with the intention of setting a redirection to prevent the rope from hanging in an awkward, narrow crack conducive to rope wear. I had to force myself into the narrower width of the shaft in order to bridge between the walls. This was very strenuous, requiring fast action. I found a small keyhole-shaped crack, tied a knot in the end of a sling and placed it in the slot. A carabiner in the end of the sling was clipped around the rope, for a free hang down the shaft. The shaft was mostly free for 30 meters. There was sufficient PMI rope on the bottom to be snaked down several climbs and a drop of six meters. Above me I heard swear-

ing and blaspheming. On the bottom, Andy cursed me and the rigging because it was hard to pass. I told him it was good practice for the real thing.

Ed rigged the next shaft with a bolt, backed up to the last rope. He descended to a point out of sight and set another bolt for a hanging rebelay. He dropped into a fault chamber floored by huge breakdown blocks. It looked like a "no hay paso," but Ed found a small hole between blocks. Ed set a bolt, and Andy rappelled into a small breakdown chamber. It seemed the air flow had greatly diminished. The cave continued as a narrow tight fissure. At a good stopping point, we surveyed back to our tie-in station. In all, we added 95 more vertical meters and explored Nita Ka to a depth of 620 meters. The day had been productive, with 792 meters of traverse and 496 vertical meters of survey in 18 hours of exploration. We left the cave just before sunrise to find the hillsides alive with working farmers, who paused to curiously watch us lumber up the steep side of the sink.

Bottomed at -758 Meters

The three-man exploration team returned to Nita Ka on 21 April. At the last point of exploration, Ed led the way into the fissure passage. We tried to find a way over the narrows, but failed. Ed returned for a hammer, saying he had found a four-second drop that was possibly inaccessible due to a constriction. Andy and I surveyed towards Ed. He yelled back that he had dug gravel and chocked rocks out

of the floor, creating a passable space. After setting a bolt, he let gravity carry him through the constriction of the Slot Drop. Ed rigged a rebelay halfway down the 13-meter shaft. The so-called four-second shaft was actually three short drops. Next, the corkscrewing shaft series twice dropped five meters, to the edge of a deeper drop. The water that had been lost in the 25-meter pit, now reemerged below the Slot Drop.

Andy rigged and descended the next pit, 15 meters deep, to a sloping ledge. The walls of the canyon series are very beautiful, consisting of massive beds of recrystallized white limestone with orange and black beds, deformed in drag folds truncated against a fault plane. A natural tie-off allowed me to rig and descend an 18-meter drop immersed in spray. The canyon continued to stair-step as free-climbs to the edge of a large black void. I rappelled seven meters to a ledge and retied the PMI rope for a better rig. We were very excited at the discovery of such a large-diameter shaft. We hoped this would lead to an ultimate connection with Sistema Huautla. The freefall 25-meter pit was refreshingly wet and dropped onto breakdown. Unfortunately, our discovery turned out to be a terminal chamber, 40 meters by 50 meters in diameter, named Room For Three. We surveyed up to our junction station, netting 298 meters of traverse and 138 additional vertical meters. Nita Ka had been bottomed at a depth of 758 meters. The total length of our survey traverse was 1503 meters. We derigged to the surface, completing 17 hours of caving.

NITA KA

La exploración de la caverna Nita Ka (Cueva del Fuego en mazateco) en Huautla de Jiménez, Oaxaca, comenzó al final de la expedición a Huautla de 1988 en los últimos días de febrero. El espeleólogo Mason Estes penetró en solitario la caverna, pues sus compañeros visitaban la Cueva de la Tarantula en las cercanías. Nita Ka se caracteriza al principio por una serie de tiros cortos y escaladas en un pasaje de tipo cañon, el cual conduce a un tiro con agua (llamada Shotgun Shaft), donde se encuentra roca quebradiza. Posteriormente la cueva torna en pasajes horizontales, cascadas, escalonadas, y un pasillo de mucha inclinación, conduciendo a un tiro denominado Flat Rock Well, en donde un espeleólogo se lastimó.

En abril, tres espeleólogos retornaron a la caverna, descendiendo más tiros hasta una profundidad de 758 metros, y una longitud de 1503 metros.

Vine Cave and Other Tales from the



Peña Colorada Canyon

Bill Stone

Vine Cave was discovered by Jay Arnold and Mark Tillman during the first few weeks of the 1984 Peña Colorada Expedition to the Huautla resurgence. They had ventured upstream in Peña Colorada Canyon towards Santa Catarina, looking for entrances that might provide a bypass to the multiple sumps then being discovered in Cueva de la Peña Colorada. Approximately three kilometers upstream from basecamp, they saw the ten-meter high, fissure-like entrance. It was a thin,

black slot carved in the east wall of the canyon. Like nearly all caves in the canyon, this one was some 70 meters above the floor, so it was not until two months later that a recon team, equipped with climbing gear, made a return to scout this as-yet-unnamed cave. By this time, Cueva de la Peña Colorada had been derigged following a final, unsuccessful diving attempt on Sump VII, and the notion of a possible bypass by means of one of the canyon wall caves was fueling the exploration of the "holes in the wall."

Above: Rob Parker in the entrance to Gourd Cave, with the wall of Peña Colorada Canyon visible in the distance. The upright slab, left of center, is a tombstone marker.
(Bill Stone)

To facilitate the scouting of the wall caves an advance camp was set four kilometers upstream from base camp in Peña Colorada Canyon. John Evans, Pat Wiedeman, Rob Parker,

and I comprised the recon crew. Our camp was set inside a small shelter cave by the side of the stream. Rob suggested calling this Camp II-A, as we knew from the survey that we were, at this point, 120 meters directly above Camp II in Cueva de la Peña Colorada. How ironic, and taunting, to be camped there and have no easy access between the two.

Several days later, John and Pat found a Mazatec trail leading up to the base of the cliffs on the western wall, towards a hole they had spotted from the arroyo. It required a 20-meter aid climb. They radioed that they needed technical gear, so Rob and I, who were working the east wall that day, hiked over. Rob did the lead using mostly pins and Friends with one bolt on a blank section. The cave did not go, but there was a small dry wall there with a broken pot, so I went up to take photos. Pat and John also came up. It was then that Pat said she thought there was another entrance just to the south.

Gourd Cave

Rob went back on belay and climbed 15 meters up into a larger entrance, eight meters by six meters, with an apparent going passage. He called back "Bill, I think you better grab a light and your camera, and Jumar up here." The Mazatecs had been there, too. A great series of flat paved steps, very similar in construction to those in Altar Cave, led down (see *AMCS Activities Newsletter No. 14*). At the entrance was an upturned marker stone.

We fired a lamp and headed in. The passage was thick with formations, and followed the bedding plane down for about 100 meters to where it pinched shut. It had the same air about it that made Altar Cave spooky – dust, bats, warm, moist air – i.e., it felt like a histoplasmosis cave. Adding to this, was a strange green tint to the stalactites, which were far removed from any entrance light. Although it was small, the cave was a significant find from a purely archaeological standpoint, and we felt it should be surveyed. We named our discovery Gourd Cave, for an old Mazatec drinking gourd we had found hanging from a strand of sisal beneath the entrance.

We took the Mazatec trail back to camp.

Just 300 meters farther we came across a gigantic entrance, 20 by 20 meters. It looked good. Pat, John, and I went in 100 meters to where it abruptly ended. What was it with these things? Why couldn't one of them drop into base level cave? We named this one False Promise Cave and headed back to camp.

Vine Cave

The following day, Rob and I hiked down the canyon to Jay Arnold's "fissure cave in the east wall." Perhaps the first thing that struck me odd about the place was an arroyo leading out to river level. We followed the arroyo up to the wall and found a 30-meter-diameter sink at the base of the cliff. It was full of jungle. At first, I thought there might be a cave down in the sink, but after chopping a wide trail into it, there appeared to be nothing. The more attractive hypothesis was that it was not a sink, but a relict plunge pool at the base of a paleo waterfall from the cave above. We abandoned discussion in favor of getting up the cliff.



Rob Parker leading the first pitch to Gourd Cave.
(Bill Stone)

Rob took the lead, and began climbing up a steep unstable section of cliff. There was just enough dirt clinging to the rock to allow for a menagerie of the foulest plants known to man to populate the route: cactus, thorns, and some horrible vine that had curved barbs all along it. Rob ran the route some 50 meters up through this stuff to a good belay ledge. I ascended to find the rope anchored to a couple of Friends stuck in a crack. Rob said cheerily, "I wouldn't have put you on anything I wouldn't climb on myself!"

The next pitch angled up ten meters in a layback crack. The only problem was that the whole face was covered with this thorny vine. Rob whacked at it with a machete for some time before it fell away with a crash. He then led the layback crack and disappeared over the edge. Shortly, he came back saying, "Bill, I think this one looks pretty good. There's a pool up here, and this passage looks like it has taken water."

I climbed up, fired two lamps, and headed in. After a couple of climbs we came to a pool. Nearby, there was a disgusting pile of vampire guano, and scuds of it had dribbled into the lake and were floating about. It did not look inviting. We then poked into an upper level gallery full of formations, bats, and really gross, guano-ridden pools, some foaming with decay. This led to a pitch that we later rigged using some climbing slings. We followed it 100 meters farther to a dead end.

Having exhausted all other leads, I swam across the deep pool we had first come to. Rob called it the Bat Bath, and watched with amusement from the shore as I shoved crud out of the way. Stalactites touched the surface in numerous places. About 50 meters farther, I swam to a shore with what appeared to be a large gallery leading off. Rob then came over, and we ran for 300 meters through ten- by ten-meter passage, which dipped down the bedding plane to a sump. With the single exception of some spectacular formations along one 100 meter stretch, the passage could easily have been mistaken for some of the stuff between Sumps II and IV in Cueva de la Peña Colorada. The sump had a clean sand floor and numerous surface crayfish.

Footprints!

On the way out, Rob climbed into a large flowstone passage some 30 meters up on the north wall. This continued up a flowstone ramp for 100 meters, and stopped where the flowstone had completely sealed off the passage. Near the end, in a rimstone pool that had been filled with mud, were the unmistakable imprints of bare human feet. "You could have knocked me over with a feather," Rob said when he climbed down. We hastily left for the entrance, elated with the discovery of this new, large cave. It was in the right position to drop in beyond Sump VII, if we could just get past this new sump – Sump V-I.

Of perhaps greater significance was this matter of Mazatec presence in nearly every cliff cave we entered. Altar Cave and Gourd Cave both had elaborate stone terraces and, what appeared to be, marked tombstones. Rob had recently attempted to rappel down the east wall of the canyon below Camarón to swing into a large entrance that appeared to be the continuation of Altar Cave on the opposite side of the canyon. His 120-meter ride deposited him on a terrace some ten meters below the lip; he could not swing in. And in front of him was a tree with notched steps carefully placed so that someone could avoid the technical climb into the entrance. The log had long since rotted, but it was obvious from the smoothed edges that it had been used frequently. And now, footprints in Vine Cave. What could have driven them to reach these entrances, and, in the case of Vine and Altar Caves, go to great efforts to explore the most remote recesses? "Religion, man, religion," Rob speculated one evening at our shelter cave when I brought up the topic.

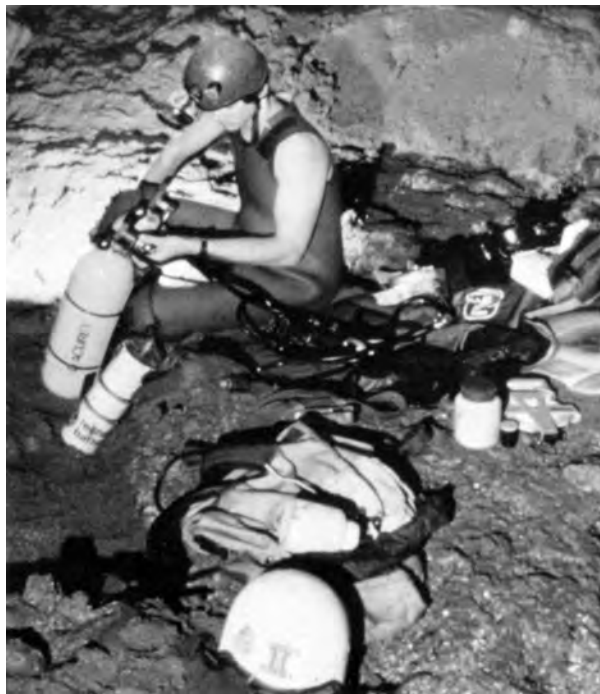
The following day, we returned to Vine Cave to complete the survey to the sump, and prepare the rigging so that diving gear could be tethered up the entrance pitch. Meanwhile, John and Pat had returned from a long-range recon up the canyon. They had passed a fork in the stream, and proceeded a kilometer up the left branch towards Loma Grande. They met numerous Mazatecs tending to their fields, but the discussion was a little labored as neither John nor Pat has a strong command of Spanish. They kept asking "¿donde están cuevas?"

and the locals would answer back, "en la Peña Colorada, al fondo de este cañon. Sí, hay cuevas!" With this bit of enlightening news, they hiked back to camp. It was decided that evening that Vine Cave merited some serious attention, and that it was time to return to base camp and rally the troops.

Diving in Vine Cave

Back at base camp, Rob gave a full briefing to the others. He had matter-of-factly described the sump in Vine Cave, and said that it ought to be dived. No sooner had he said this than Noel Sloan said, "I'll volunteer to..." and Bob Jefferys finished "dive it."

Bob set off early the following morning with a set of double composite tanks. Noel, John Zumrick, and Gary Storrack went to carry gear. That afternoon, Rob, Angel Soto, and I pulled out the final three loads of gear from the two-week-long derig of Cueva de la Peña Colorada. In the arroyo we met Noel coming back from Vine Cave. "Well?" we said. "Do you want the good news or the bad news," he said laughing. We knew the bad



Kitting up for a sump dive in Vine Cave.
(Bill Stone)

news could not be all that bad because he was laughing. "Sump I went 80 meters, and Bob explored another 300 meters of borehole, heading northwest." "And the bad news?" we played along. "He found Sump II."

Bob had been talking around after their return to basecamp, trying to motivate sherpas to put Noel and him back in Vine Cave for a push on Sump II. He was not having much luck convincing the original sherpa team. It was a stiff hike up there, plus a 70-meter climb-up with a load of lead. I ended up agreeing to haul a set of tanks and batteries for Noel. By early afternoon, they had kitted up and were off into the murk of Sump Vine-I.

Around midnight, Noel and Bob walked into camp. Sump II had gone 200 meters through a shallow series of airbells and muddy passage. They had eventually been stopped at a constriction, nearly filled with mud, and a low airspace. Bob said, "I would have had to take the tanks off and push them ahead in a zero-visibility mud passage. And the place stank like a sewer." They had thoroughly checked it, and were convinced, with the exception of a possible dome climb just beyond Sump I, that the cave ended. One could suppose that it might be possible to scale that dome, reach a drainage divide, and drop back down into the mountain, beyond both Sump Vine-II, as well as Sump VII in Cueva de la Peña Colorada, and reach the "main drain" from Sistema Huautla. This possibility was enough to fuel a manic, last attempt before throwing in the towel, and packing up the expedition.

A Change in Plans

Rob and I planned to do the climb beyond Sump I in Vine Cave the following morning, but he awoke with a bad case of diarrhea, and the plan was changed to taking a final poke in the Western Resurgence on the south side of the Santo Domingo Canyon. Pat, John Evans, Bob, and I set off early in the morning with three composite tanks and a full set of kit for solo diving. John had already done a single-tank dive to 60 meters penetration, and reported the spring going well, if indeed a bit cold. The plan was to do a single stage dive beyond John's line to verify whether or not the cave might head back under the river and north.

There was still a nagging doubt as to whether this was part of the Huautla Resurgence.

The first rude surprise was John's discovery of the five lead weights that he had left there for this dive: they had been hacked to pieces with a machete, and were laying on the rocks. The backpack he had stowed behind a rock was also gone. We had been planning on using all of this. The Mazatecs had apparently stumbled onto the gear. Furthermore, they had yanked the dive line out of the cave...as much as they could get anyway. They could not have done more to sabotage the dive. At first, I considered a serious attempt to continue with our plans to be out of the question.

John said that he had seen a hut a kilometer upstream. I set off in search of this house, hoping the owner might have stashed the backpack plate somewhere. A kilometer later, there was still no sign of a house, but I did find another resurgence, similar to the Western Resurgence, but on the north side of the river. The others agreed to haul the gear over there for a poke.

Agua Fría

We did some real "hack" rigging to get a working diving system. Bob rigged a makeshift harness for one tank using a long piece of webbing and the bands I had brought for the stage bottle. Up front we put a tank into a yellow duffle along with a few rocks. It was very awkward.

The spring headed down into what appeared to be a large tunnel. I dropped in, feeling very negatively buoyant with the rocks in the bag. No more than 20 meters in, at eight meters depth, the passage narrowed down to a tight fissure. I could see that it appeared to go on, but I could not fit with the bulky gear. I surfaced, gave Pat the yellow bag and Bob the back mounted tank for conversion to a stage bottle. With this, I was prepared to go in when Bob said, "Ah, I think you better hold up a minute Bill, there's a man here with a gun." A fellow from Loma Grande had ridden up, on horseback, to investigate. He was hunting for deer with a .22 rifle. I explained what we were doing, and he responded with some interesting information. The spring was

named Agua Fría, which, coincidentally, was the name we had been given in Camarón some three years earlier for a large spring at the bottom of the plateau. We went on to find the Peña Colorada and had never followed up on Agua Fría. This particular spring, I later learned, has great importance as a key landmark in Mazatec folklore.

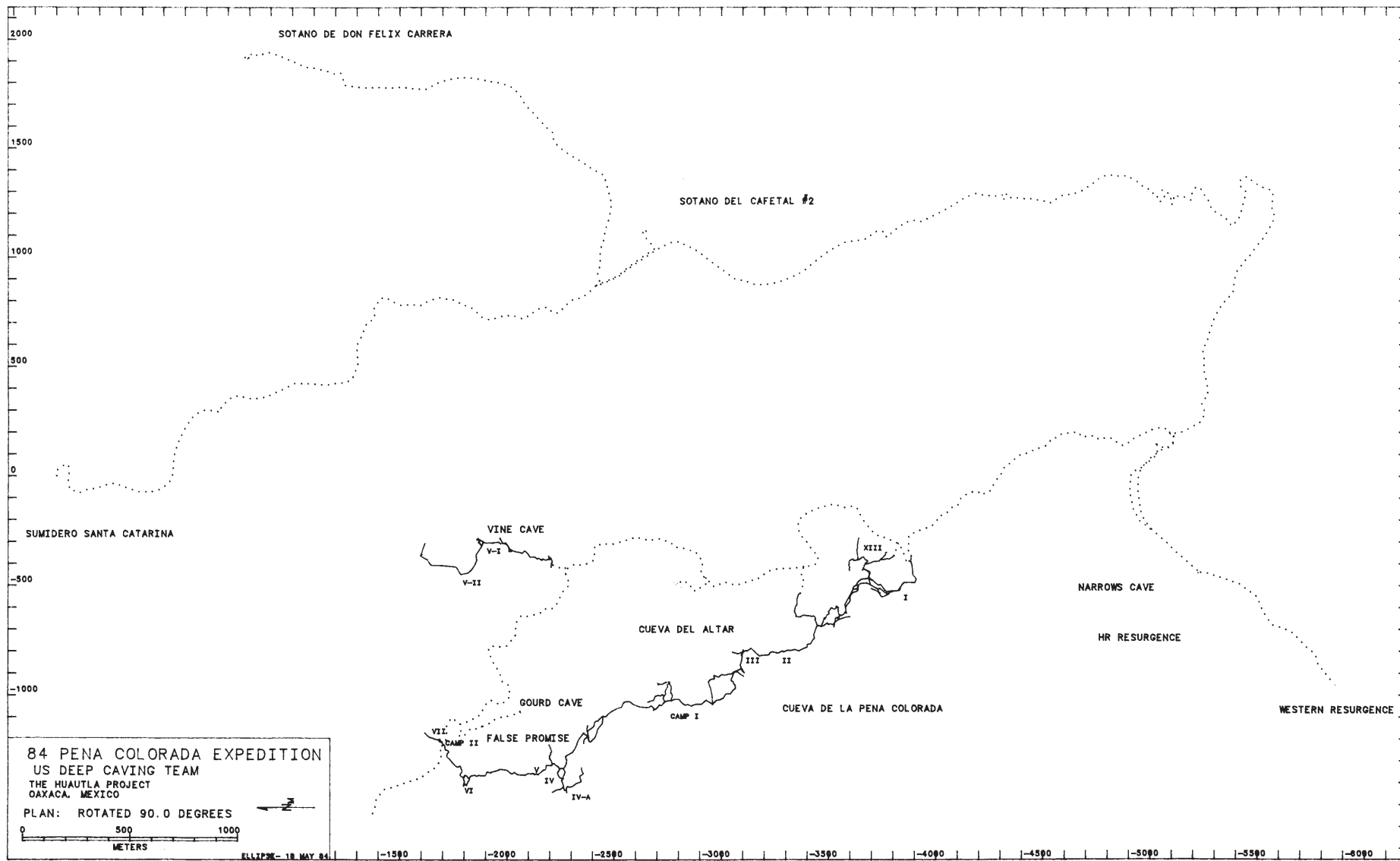
Following this introduction, I put the regulator back in my mouth, returned to the crack, and pushed the tank ahead of me to where my hips stuck. It got smaller ahead, so I gave up, and headed out. There is substantial flow there, probably three cubic meters per second in the heart of the dry season.

Of the three springs on the north side of the Santo Domingo - Agua Fría, HR Resurgence Cave and the Southern Resurgence – two have been dived to tight restrictions. HR Resurgence Cave ends in an upstream sump measuring 0.5 meters high by one meter wide, which is not considered divable. In the spring of 1988, Jim Smith achieved a positive dye trace from Sótano de San Agustín to the Southern Resurgence, near the junction of the Peña Colorada and Santo Domingo canyons.

The Western Resurgence

After the dive in Agua Fría, we returned to the Western Resurgence, and proceeded to jury-rig a set of double tanks to John's Kelty backpack with a flat rock for ballast between the two tanks. I attached this up front to a makeshift chest harness with stage bottles, and I was off. I reeled in some 60 meters before finding the frayed end of John's line. I joined the two lines, and continued down. About 150 meters in, I came to a sharp bend where there appeared to be a large side passage. I put an arrow on the line, and reeled out some 20 meters to an end, then reeled back. I repeated the same maneuver 30 meters farther in, to the left, except that this passage went about 25 meters.

These maze-like diversions were not helping my gas supply. I had used a third of my air by the time I was around 150 meters in. I really felt like going on, and I must have checked the pressure gauge three times. But I stuck to the rules, and surveyed out.



Both John and I felt strongly afterward that this spring was not a part of the Huautla System. Its temperature, around 16 degrees Celsius, was substantially colder than any of the springs on the north side of the river. Furthermore, its flow was a substantial 15 cubic meters per second. The conclusion was that this spring is a primary resurgence for an as-yet-undiscovered major system on the plateau ascending the south flanks of the Río Santo Domingo. Bill Farr and Carol Vesely later discovered Cueva Cheve on this very plateau. Although a dye trace has not yet been done, the Western Resurgence is likely the bottom of Cheve. As such, it definitely merits further diving work.

During our return to base camp, we passed through the distinctive narrows of the Santo Domingo Canyon, where sheer 500-meter walls come within 50 meters of one another with the river covering the gap wall-to-wall. It was here that I noted a large cave entrance some 60 meters up on the north wall. I had never noticed it before. More likely, I had seen it but was looking for springs, not climbing leads. With the amount of climbing we had been doing recently, it perked my interest.

Dome Climbing

Rob was still feeling ill the following day, so Noel and I packed off for Vine Cave with a climbing kit at 9:40 a.m. I did the entrance pitch in shorts, and was up by 11:30 a.m. We made good time to Sump I, and had no difficulty with the dive, although it did seem like a long 100-meter sump. There was a constriction at the beginning, where we had to slither down the sand pile for five meters until it opened up. From there on, it was a big tunnel with limited visibility – five meters maximum, in haze. Bob had done a nice job of pushing it.

On the far side, we de-kitted and stacked our gear on rocks. The dome climb was directly over the sump. The rock was all sound, but overhanging: a good sporting route. The first thing I discovered after I began to lead the climb was the utility of Rob's Friends, the magical spring-loaded cam units he was always raving about (these were new in 1984, they are ubiquitous in climbing now). The

first pitch went fast, mostly due to extensive use of cliff hangers. Next, Noel came up.

The second pitch was mostly flowstone on a 60 to 70 degree angle, and it, too, was fast climbing. I was about 25 meters up, had just placed a Friend, and was standing on a sloping piece of flowstone setting a bolt, when my foot slipped. I fell three or four meters before Noel caught me. It happened so fast I cannot recall having yelled "falling." One second I was pounding the bolt, the next I was four meters lower staring at the wall. But the Friend held. Good thing: the next piece of protection was ten meters lower!

I continued for a 40-meter lead-out, and set a belay. Above this point the flowstone continued steep, but climbable. I did a 25-meter lead-out, and was looking up yet another 25 meters when I decided to bag it. It was not going to bypass Sump II. "This must be Jefferys' fabled 300-meter dome," I said to Noel after downclimbing it. We then did three pull downs, surveying out, and kitted up.

Noel dove first, and after we went under, I never saw him again. The only indication of his passing were these little half-moon tufts of silt percolating down from the roof in periodic columns.

On the other side, we packed our gear for the haul to the entrance. Noel just walked out fully kitted. I decided to try to carry everything, including climbing kit and full dive gear, in one load. I got 100 meters down the passage before falling over. I ditched half of the gear and continued. By the end of the second run, it was 2 a.m., and we felt too punchy to try to rig a pull down rappel and haul all the gear down to the canyon floor in one shot. So we climbed up into an alcove, where I had seen a flat spot, and lay down, hoping to catch some sleep until dawn. I told Noel we would probably not last two hours before getting cold.

At 4:05 a.m. I heard Noel rustling. By this time I had both arms stuffed down my farmer-john wetsuit and was shaking. "Noel, are you cold?" I asked. He started laughing, since he had been patiently trying to lie still for 20 minutes. He said "Well, maybe we could do some..." and I completed it: "pushups." We

Vine Cave

Municipio de Huautla de Jimenez
Oaxaca, Mexico

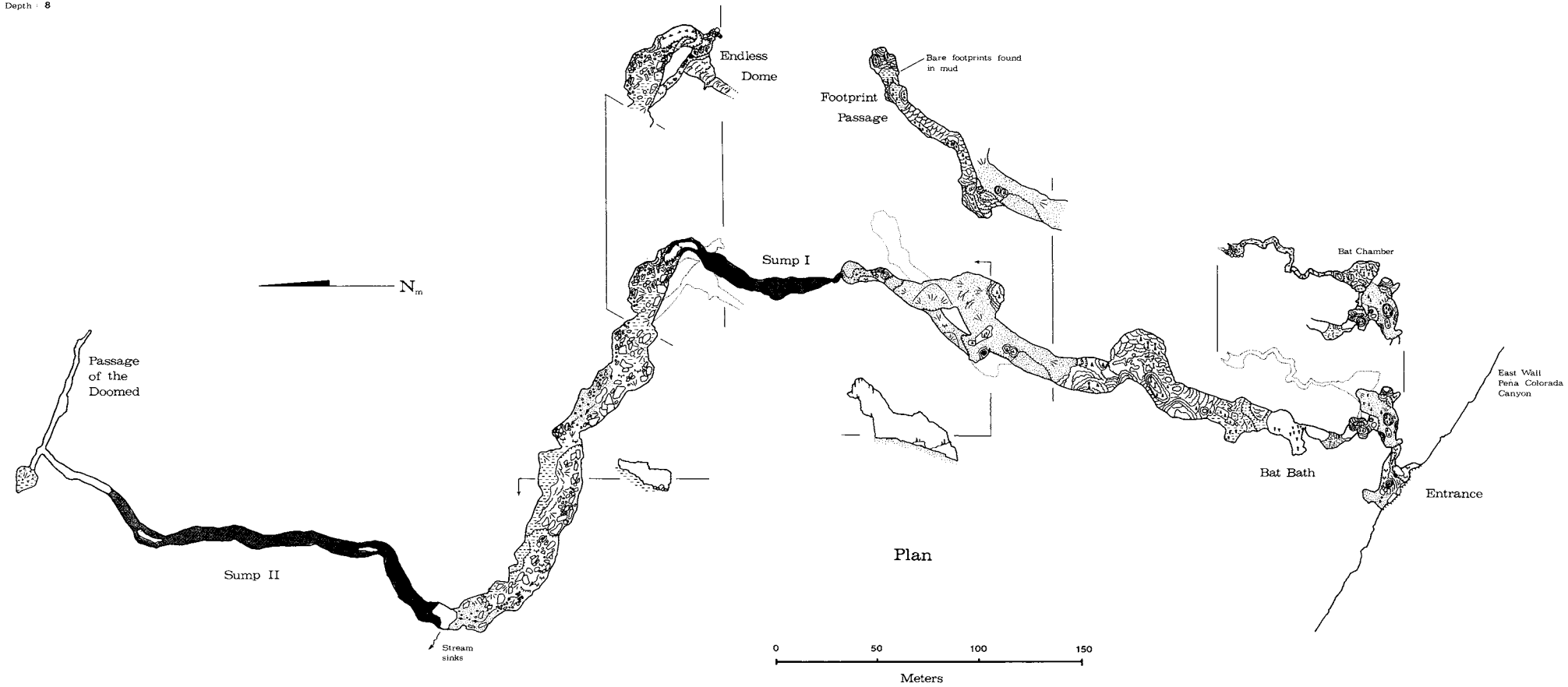
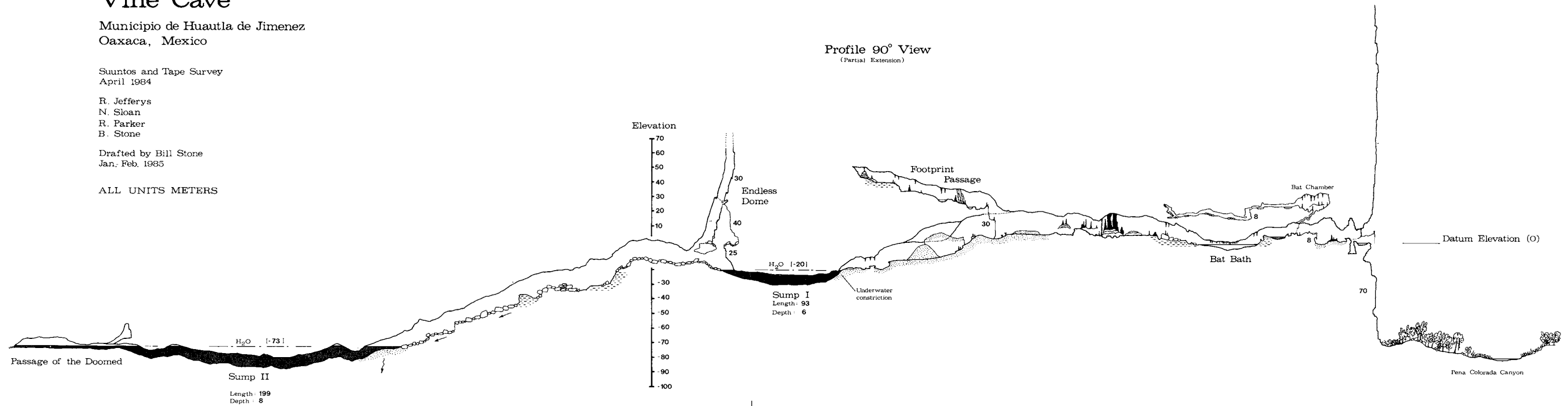
Suuntos and Tape Survey
April 1984

R. Jefferys
N. Sloan
R. Parker
B. Stone

Drafted by Bill Stone
Jan., Feb. 1985

ALL UNITS METERS

Profile 90° View (Partial Extension)





Noel Sloan, with 63 kilograms of hardware, rappelling on the final derig of Vine Cave. (Bill Stone)

got up and did 90 pushups and ran in place until we built up some body heat, then tried to get some more sleep. We woke again at 5:20 a.m. and started setting bolts. The pulldown went well, but it was probably the heaviest load I have ever carried on rope – a 36 kilogram pack below, plus double tanks, and a backpack with 5.5 kilograms of lead.

Narrows Cave

With porters from San Miguel and Camarón scheduled to pack out base camp the following day, time was indeed short. The cave in the Santo Domingo narrows still played on my mind. Rob was recovered, and interested in more climbing. It was not long after returning from the all-nighter in Vine Cave that Rob and I headed down Peña Colorada Canyon to the Santo Domingo. Within two hours after leaving camp, we had climbed two pitches and were 60 meters up the wall with Rob in the lead. One eight-meter stretch

had a 5.10 move, but Rob did it without difficulty.

The cave led some 120 meters to the northwest before pinching down to a small tunnel, impassable without digging out the mud floor. There was a howling gale coming out of this tunnel. Sand dropped vertically traveled a meter horizontally before hitting the floor. We surveyed out, and tied into the overland survey. We named it Narrows Cave.

Future Potential

All of the above happened more than four years ago. Study of the overland map has indicated that Vine Cave is likely the resurgence for a series of small stream sinks below Santa Catarina and Camarón, even though the elevation of Sump Vine-II is quite close to that of Sump VII in Cueva de la Peña Colorada. The marked change in water temperature, from 22 degrees to 17 degrees Celsius, at Sump VII in



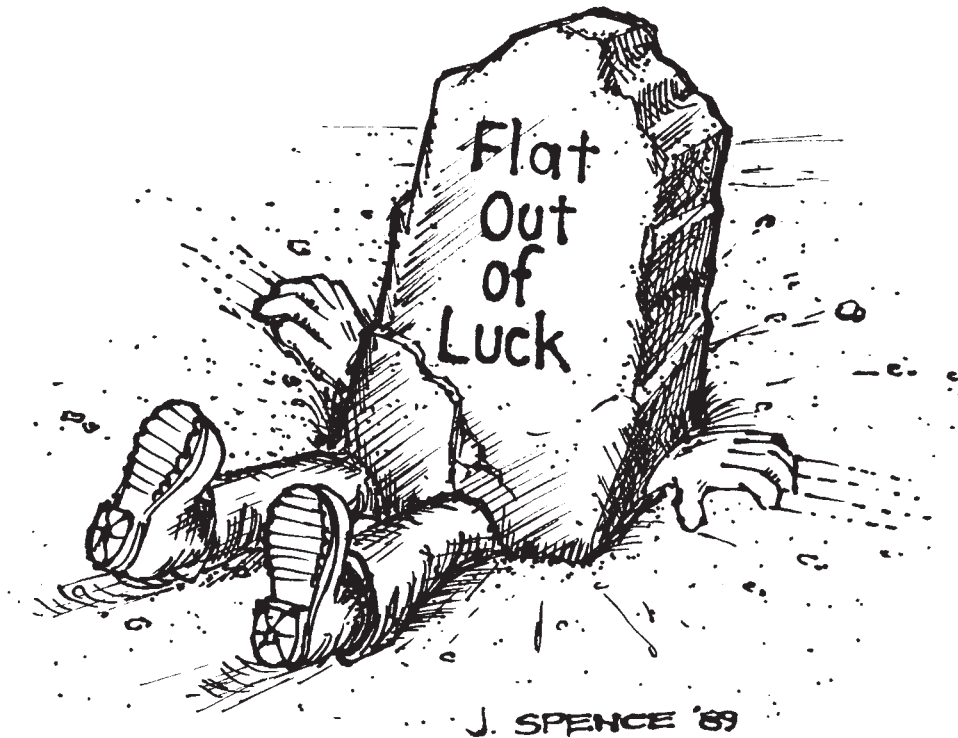
Traversing the Narrows of the Santo Domingo canyon. Narrows Cave is 60 meters directly above the leftmost person. (Bill Stone)

Cueva de la Peña Colorada indicates a connection with the active drainage route from Sistema Huautla. Jim Smith's positive dye trace to the Southern Resurgence indicates that this active drainage route parallels, and underlies, most of the big dry passage in Cueva de la Peña Colorada. Thus, Sump VII still holds the key.

After the Peña Colorada expedition, research was begun on closed-circuit diving apparatus (rebreathers). It has been a lot of work, but if all goes well the San Agustín sump will be passed using this new technology. After that, it will be a tossup as to which route to the core of the Huautla plateau will be best.

PENA COLORADA

Durante la expedición a la Cueva de la Peña Colorada en 1984, varias cuevas en las paredes del cañon fueron localizadas y exploradas, siendo la más significativa, Vine Cave. Con una escalada de 60 metros Rob Parker ganó acceso a la entrada tipo fisura. Un sifón fue encontrado 300 metros después, y Bob Jeffreys buceó dicho, con una longitud de 80 metros. Exploraron así otros 300 metros de pasaje, el cual condujo a otro sifón, buceado posteriormente por Bill Stone y Noel Sloan, topando 200 metros después. Además de Vine Cave, otras cavernas fueron escaladas y topografiadas: Gourd Cave, Altar Cave, False Promise Cave, y Narrows Cave. También, Bill Stone buceó la resurgencia de Agua Fría, localizada en la parte norte del Río Santo Domingo, con una longitud de 150 metros, y exploró dos pasajes secundarios.





Proyecto Papalo: Birth of an Area

William Farr and Carol Vesely



The second half of Saknussem's Well. (Bill Stone)

"I always thought that would be a good area to check..."

By now, it seems we must have heard that line a hundred times. Visible from the Huautla plateau as a high karst area south of the Río Santo Domingo Canyon, the Pápalo area remained unchecked, however, until December 1986, when, acting on a topo map lead given to us by Peter Sprouse, we ventured into the Sierra Juárez in search of new caves.

The Pápalo area is characterized by its high elevation (up to 3200 meters) and relatively uninhabited pine forest. The karst is bounded on the east, west, and south sides by metamorphic rocks that concentrate the surface runoff into streams that sink when they hit the limestone.

Discovery

Our initial target was a large sink that appeared on the map to be two kilometers long by one kilometer wide. After some discussion, we finally decided that the 'valley' we were looking at was indeed the sinkhole, and we descended to the bottom via an abandoned logging road, blocked in several places by fallen trees. Despite having just driven straight from California for over 60 hours, we hardly paused for breakfast before running down the drainage axis of the sink in search of entrances. After passing several cold-air "bug-holes," a couple of which took small streams, our first find worth noting occurred where the drainage axis turns from west to north. Here, an arroyo five meters wide by seven meters deep, dropped into a tall, fissure entrance one-and-a-half meters wide by six meters high. Christening our find Grieta de los Bichos for the cloud of gnats that occupied the first ten meters of cave, Bill checked it out briefly. The cave consisted of a couple of parallel fissure passages dropping rapidly down a series of short climbs.

As we were not yet to the bottom of the main sinkhole, we decided to leave this discovery temporarily, and proceed in search of greater booty. Much to our dismay, only a couple of hundred meters farther, we came across a seeping resurgence area giving birth to a small stream that flowed along the floor of the sink. We began to run through the pine forest alongside the stream, eager to see where it went. Then, just as Carol proclaimed, "Wouldn't it be great to find a really grand Mexican-style entrance," there it was. At our feet the stream dropped down a seven-meter waterfall to flow lazily across a beautiful, grassy-green llano, whereupon it was swallowed by a gaping black hole at the base of a limestone cliff, 80 meters high.

The main entrance to Cueva Cheve is 30 meters wide and six meters high and leads to the top of a large, 30-degree-sloping, breakdown room 70 meters wide by 200 meters long by 30 meters high. A second, tall, narrow entrance lies to the east of, and slightly higher than, the main entrance. The stream sinks into breakdown just inside the main en-



Bill Farr approaching the entrance to Cueva Cheve on the day of the discovery. (Carol Vesely)

trance and reappears in a waterfall at the bottom of the room. From the Entrance Chamber three large passages are visible, two along the south wall and one at the base of the room. Picking our way down the breakdown to the base of the falls, we followed the stream into a seven-meter-wide by 18-meter-high canyon, which continued into darkness, sucking a stiff breeze. Our single flashlight seemed inadequate for exploration beyond this point.

First Survey

The next morning we began with a perimeter survey of the Entrance Chamber. Then, we followed the canyon passage downstream for 80 meters to a second large room, the Basket Room, named for the pieces of woven basket and mat found amongst the breakdown. Nearby, the stream sank again. Although it was possible to follow the water by crawling through the breakdown, we chose to follow the air instead. We scrambled down between car-sized boulders to a continuation of the canyon and the first drop of the cave. A rappel of seven meters led to more canyon passage. By now, we were beginning to notice one of Cheve's primary characteristics: it's cold!

Continuing the survey of Cool Canyon, we encountered a second breakdown area, which required some digging through rotten rock to get through. Beyond, was an unattractive drop of eight meters, followed shortly by another drop of six meters with a small stream trickle going over it. At this point, we decided to return to camp, instead of going for a long trip, as we had the luxury of being so close to the entrance.

The next day, we continued down the third drop, landing in an ankle-deep pool that trickled into a sump along the side of Cool Canyon. Surveying past the Deceptively Deep Pool, we arrived at the next vertical section of cave, the Double Dip. Here, Cool Canyon dropped eight meters to a deep plunge pool, followed immediately by a second drop, of two meters, into another plunge pool, followed immediately by yet another drop, into darkness. As we were accustomed to much warmer caves in Mexico, we had not yet learned to dress warmly enough for surveying in the windy, eight degrees Celsius passages



The Frozen Chicken passage. (Carol Vesely)

of Cheve. While we debated the best rigging of Double Dip, through the icy cold water or along a high traverse, followed by a drop straight down after the second pool, the cold overcame us, and we headed out instead.

By the time we reached the Entrance Chamber we were warm again, so we decided to survey one of the other two side passages off the room. Choosing the highest one, thinking that it might connect to the upper entrance, we began surveying with consecutive 30-meter shots in ten-meter-diameter borehole sucking a gale of icy wind. Alpine caving in the tropics – who would of thought we would find this in Mexico!

The next day, we had to leave the area to meet Peter Sprouse and company at Conrado Castillo. The surveyed length of Cueva Cheve stood at 0.9 kilometers, with a depth of 100 meters. We knew we were going to be back in Mexico for a Purificación underground camp trip in March, and were already planning to return then to find out if Cueva Cheve was going to really "go big time" or not.

March 1987

Once again, due to time constraints, we had only a few days, but our goals for the March trip were to see if the main cave was going to keep going, and to further assess the potential of the area. In addition to work in Cueva Cheve, we began extensive surface work, locating and tagging numerous entrances for fu-

ture exploration. From the beginning, it was obvious that the Pápalo area was worthy of a serious project orientation.

Resuming our explorations downstream in Cheve, we descended the Double Dip Drop via the plunge pools. At the base of this drop Cool Canyon continued horizontally for 50 meters to the sloping, Fissure Drop of 15 meters. Past two more short drops, we came to a T-junction, where Cool Canyon rejoined the main stream passage. Heading upstream, we quickly hit Triple-Whammy Falls, a 12-meter-high triple cascade. The downstream lead went over a series of beautiful rapids and falls to a waterfall drop, the Stop Drop, where we turned around for lack of equipment. On the same trip we also finished surveying the large trunk passage that led from the Entrance Chamber to the upper-level entrance. We named it the Frozen Chicken Loop for the cold wind and chicken bones it contained.

When we finally got around to the middle Entrance Chamber lead, we were in for a real surprise. It contained a parallel stream system! Downstream, we stopped at a six-meter drop due to lack of rope, while upstream we



surveyed about a hundred meters, ending exploration at eight-meter-high Bold Falls. A side passage of Surprise Stream led to a dry, crumbly, mazy area, El Llucu, where we surveyed a couple hundred meters before becoming too disgusted with the loose crud falling off the walls.

By the time we left the area after four days, Cueva Cheve had been surveyed to 1.5 kilometers long and 200 meters deep, with going leads, and strong airflow and water. In addition, we had located and tagged six new entrances, several taking water and air. We decided to return with more people next caving season to continue exploration.

In the entire seven days we had spent in the area thus far, we had not seen a single local. But since we were planning to bring more people on the next trip, we thought it would be best to contact the local authorities. Despite our very limited Spanish, we managed to secure permission for a return trip from the presidente of the nearest large town, Concepción Pápalo, ten kilometers away. We also learned that the cave we had been exploring had no local name, but that the beautiful llano at the entrance is called Llano Cheve. Cheve is an Indian name, but none of the locals seem to agree on its meaning, or if it even has one.

Christmas 1987

In December 1987, we returned to Cheve accompanied by Peter Sprouse, Susie Lasko, Nancy Pistole, Matt Oliphant, and Don Coons. While caravanning through Texas, we encountered a herd of elephants in the middle of nowhere-ville in a supermarket parking lot. We took the event to mean that we were going to find elephant-sized cave, and hence, elephants became the unofficial symbol of our expedition.

After a day of acclimatization, and setting up camp in the llano, we were ready to continue exploration and surveying.

Peter, Don, and Bill headed downstream past the eight-meter Stop Drop, encountering more fun stream passage. After bypassing the next waterfall with a rope traverse followed by

a down-climb, the team encountered an even more impressive waterfall, the Storm Shaft. At the bottom, as they were whipped by wind and spray, they were presented with two choices: either continue following the stream down more cascades, or take a dry side lead that Peter located. Choosing the dry alternative, they rappelled down a 20-meter shaft into a canyon, four meters wide by ten meters high, that appeared to roughly parallel the streamway they had been in. Continuing down a series of two short nuisance drops, the trio came to the finest shaft yet in the cave, the Elephant Shaft. This beautiful, clean-walled shaft dropped 45 meters to a continuing canyon. They could see down another drop to where the passage rejoined the main stream after this pleasant bypass. They ended the survey at the top of the next drop, having passed 300 meters in depth.

Meanwhile, Carol, Matt, and Nancy descended the six-meter drop in Surprise Stream, and followed the water for about 20 meters to a down-climb to a sump. Retreating from this area, the team headed to the Black Elephant Room, which Carol had discovered at the end of the last trip. A perimeter survey of the room located several infeeding passages, a couple with active streams. The main stream, which had sunk in the Basket Room, also reappeared in the Black Elephant Room, where it plunged down a short drop between large boulders.

The next day was spent ridgewalking to the north. Most notable was the discovery of Osto de Puente Natural, an entrance three meters high and wide that led to a room with a deep pit, where rocks rumbled down for ten seconds.

The Christmas Present

The next day, Christmas Eve, Carol, Don, Nancy, and Matt headed into Cheve to continue exploring from the bottom of the Elephant Shaft, while Peter, Susie, and Bill headed downstream from the Black Elephant Room. On their way to the Elephant Shaft, Carol's team decided to check a previously unexplored lead at the top of the Fissure Drop. Don led across a short, exposed, traverse into a huge chamber and a steeply descending pas-

sage they dubbed the Christmas Present. Clambering down over huge breakdown blocks, they came to three short rope drops, and finally rejoined known passage at the base of the dry bypass drop from the Storm Shaft. This new route totally bypassed the wet streamway. It was now possible to descend to the furthest limit of exploration without getting wet above the ankles: a great Christmas Present, indeed.

Starting the survey at the base of the Elephant Shaft, the cavers descended the 15-meter Junction Shaft, where they rejoined the main stream, as expected. Another four-meter drop and a short stream passage brought them to the top of 30-meter Angel's Falls. After rappelling alongside the beautiful falls, where the water is close enough to touch, they landed next to a deep pool. A large infeeder comes in from the east at the base of this drop. They followed the stream down the main passage as it got bigger and bigger. Soon they found themselves reeling out 30-meter shots as they



Descending the Giant's Staircase. (Bill Stone)

descended a large borehole passage 15 meters wide and 20 meters high, the Giant's Staircase. The stream disappeared in breakdown after about 100 meters, and they followed the dry borehole up over the Camel's Hump and down the other side. Again dropping at 30 degrees, they rapidly picked up depth as they climbed down over car- and house-sized boulders. After 500 meters of borehole, the ceiling lowered, and the passage made a 120-degree bend. The passage opened up again at the top of a large drop. Rappelling 50 meters, the cavers landed on a flowstone bridge, from which the stream could be heard below. They dubbed this impressive shaft Saknussem's Well, and estimated it to be at least another 50 meters to the bottom. The cave had now passed 500 meters in depth. Their total survey for the day was 660 meters.

Back in the Black Elephant Room, Peter, Susie, and Bill descended a ten-meter drop through boulders to follow the stream in a 15-meter-wide, ten-meter-high passage. After surveying 350 meters down the Río Cuicateca, they came to Terminator Falls, which they presumed would connect to the top of Triple Whammy Falls. Instead of descending, the trio surveyed a well-decorated ledge, Santa's Shelf. Here, Peter found a small hole blowing air, and proceeded to bash it open. This led to the discovery of Elf Land, a small upstream infeder.

The descent of Mondo Pit in Osto de Puente Natural was the objective of the next trip. Finding our 90-meter rope to be inadequate to reach the bottom, and the lower part of the drop to be much wetter than anticipated, we abandoned the descent. Instead, we surveyed the entrance room and a short upper level directly above the pit.

Returning to Cheve the next day, Carol, Don, and Nancy surveyed their scoop of the Christmas Present. Next, the team ascended the dry drop to the base of the Storm Shaft. From here, they followed the water downstream, surveying down a few short climbs to a sump and up a steeply ascending tube to an overlook of the Junction Shaft. Then they ascended the wet route, derigging the drops and taking photos on the way.

Saknussem's Well

Meanwhile Peter, Susie, Matt, and Bill descended to the flowstone bridge in the middle of Saknussem's Well. Rigging the drop with a 90-meter rope, Bill descended, only to find that the rope had been blown under the waterfall, and had become hopelessly tangled around numerous knobs and pendants. After an hour of untangling rope and then rigging a series of rebelayes to keep the descent out of the water, Bill was surprised to see Matt rappelling down towards him. The noise of the water had drowned out all communication with those at the top of the pit.

Eventually, the rope just reached to a ledge from which it was possible to free-climb down an additional five meters to the bottom of Saknussem's Well. Here, the cave went horizontally, picking up an infeder that doubled the flow of the stream just before a sump that could be bypassed with a tight chimney and high canyon.

The way ahead required swimming. As everyone was cold enough already, the team ended the survey at the infeder, and headed for the surface. Here, they were greeted not by a rising sun, but by clouds and a cold, bone-chilling drizzle. For the next three days it drizzled, hovering just above freezing. Everyone sat around camp watching the water flow into the cave triple, as dry gullies turned into streams. Everyone did manage one trip into Elf Land, where we mapped 150 meters to Santa's Workshop, a well-decorated room with a tight infeder that still goes.

With the first day of sun all we wanted to do was dry out, and besides the water levels were still way up – not optimal conditions to push the bottom of Saknussem's Well. By the next day, everyone except Don and Nancy had colds, putting a damper on enthusiasm. As we were running out of time again, Don, Nancy, and Bill headed in to push the streamway. Peter and Susie's time had run out, so they packed up, leaving Matt and Carol to commiserate on the surface.

Donning wetsuits at the bottom of Saknussem's Well, the three cavers began the chilly survey of the Salmon Ladder. The Salmon

Ladder consists of a series of progressively larger cascades, which eventually require a rope. At the end of the Salmon Ladder the cave descends steeply, as the stream enters the Turbines, where air and water tend to become one. Here, the survey team stopped. Don rigged the next drop and rappelled down to check it out. Radical, but feasible was the report. At one point the force of the water was so strong that Don had trouble clipping onto the rope to ascend.

In an effort to increase the depth of the cave, Don, Carol, Matt, and Nancy searched the karst above the Frozen Chicken Loop. Their efforts were rewarded with the discovery of two higher entrances, both of which connected into the main cave near the Frozen Chicken Entrance, adding 60 meters to the depth.

With only two days remaining and three people suffering from colds, exploration of Cheve was finished for this trip. At over 4.5



The Fuel Injector, the final drop in the Turbines.
(Jim Smith)

kilometers in length and 700 meters in depth the cave was still going, and starting to get serious. We had one goal left: the descent of Mondo Pit in Osto de Puente Natural.

The remaining five of us descended upon Puente armed with a 120-meter rope for Mondo Pit and enough ropes for five additional drops. Bottoming the pit at -100 meters, the group continued down a series of narrow canyons interspersed with short drops of seven to 20 meters. After several hours, Carol and Bill felt quite weak due to their colds, and left early, leaving Don, Nancy, and Matt to continue. They finally ran out of rope after 426 meters of survey. On the way out, Nancy's knee gave way in the middle of a tricky climbing maneuver, causing her to fall backwards three meters into a plunge pool. Despite the pain, she made it out of the cave under her own power, although it was three weeks before she stopped limping.

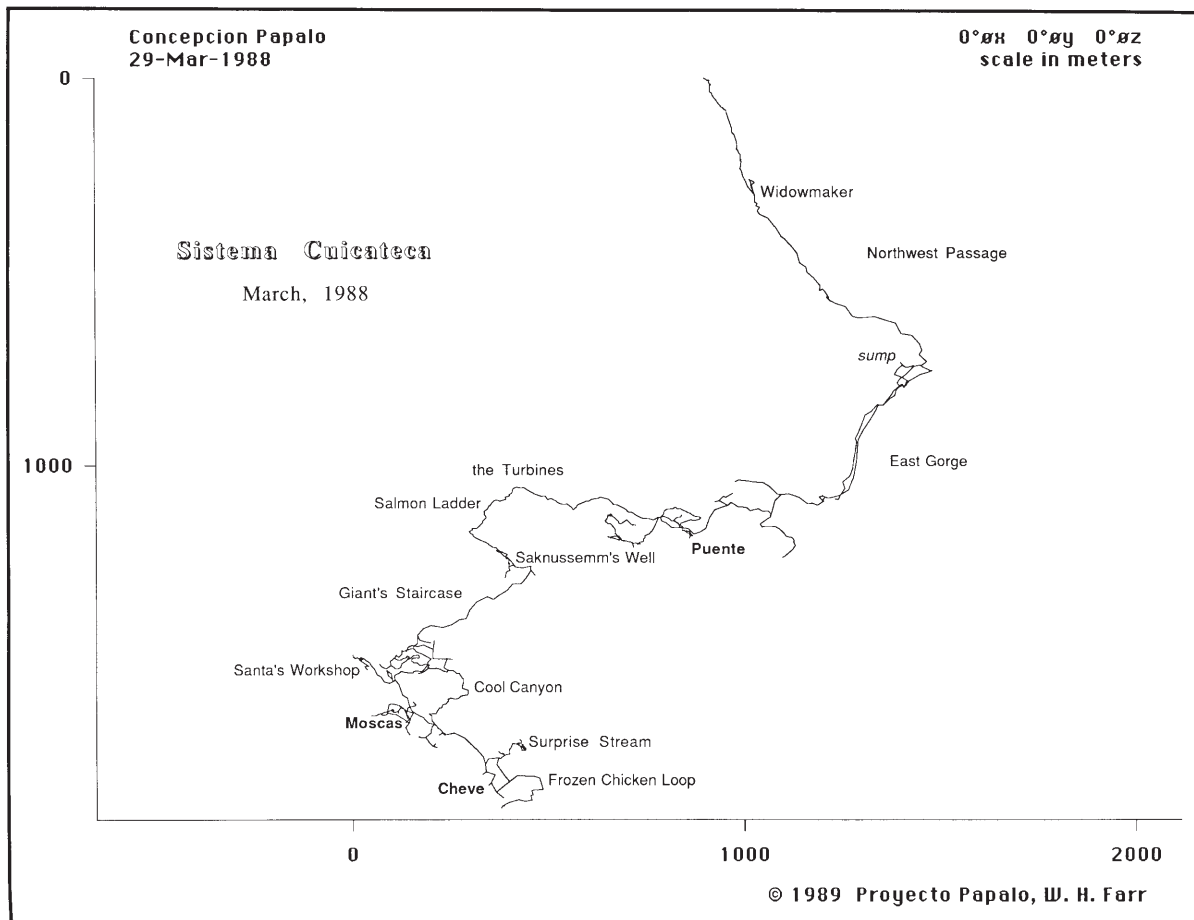
The next day everyone cleaned up the llano and packed out. Dropping Don off at the road to Huautla, the rest of us headed back home, already planning a more extended March return.

Spring, 1988

Word about Cheve was now out, and there was no shortage of people who wanted to help explore the cave. We planned a three-week expedition from the second week in March until the start of April.

Arriving at the llano at our scheduled time with Bill Steele and Mark Minton of Texas, Jeb Blakley, Bob Bennedict, and Steve Zeman of Idaho, and Peter Bosted and Gary Mele of California, we found that Don Coons, Jim Smith, Ed Holladay, Mason Estes, and Lee Perry had arrived from Huautla a few days earlier loaded with ropes and gear. They had done a push trip at the bottom, breaking through the Turbines into gently descending stream passage.

A few days later Karlin and Beth Meyers, and Ernie Garza arrived, having completed their reconnaissance to the Cerro Rabón. Llano Cheve was quite a contrast from the December trip. Then, the green, tree-lined field



had a peaceful, pastoral ambiance. Now, with 17 people and gear everywhere, the place was ablaze with noise and activity.

East Gorge

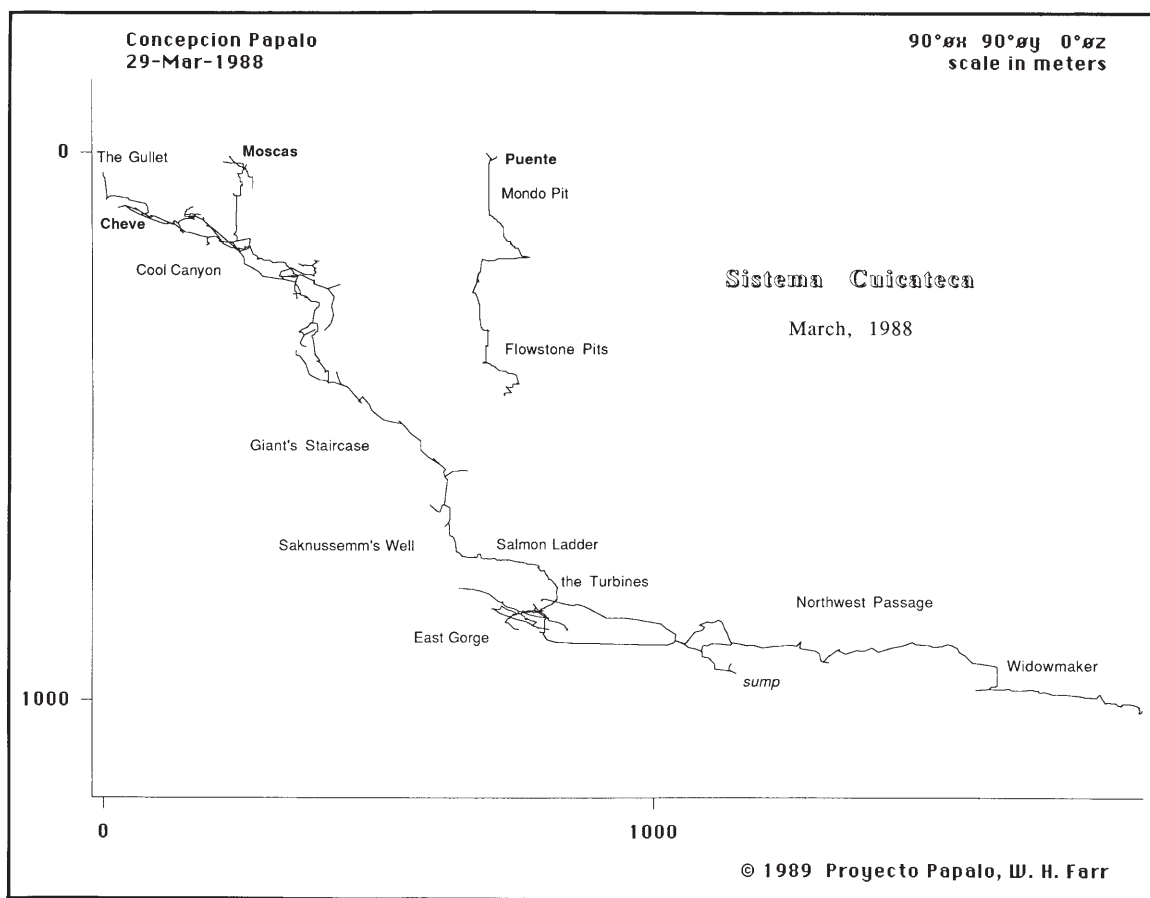
Cheve continued almost horizontally for the next several trips. Water levels were noticeably lower than on the December trip. The main stream was followed, various infeeders were noted, and several sumps were found and bypassed. Finally, a trip by Bill Farr, Mark, Jim, and Bill Steele encountered a distinctive 23-meter free drop into the East Gorge, a borehole in the same black-and-white-banded rock that is characteristic of Huautla. This was followed immediately by a 15-meter drop next to an impressive waterfall. Jim descended this drop and continued following the water down the East Gorge for almost 800 meters.

Returning the next trip with Bob, Jeb, Ed, and Steve, Jim surveyed his scoop, and they continued onwards in the East Gorge. After

going horizontally for almost a kilometer, again the bottom dropped out in a short rope series leading down to a large sump at -958 meters.

Part way through the expedition, we were joined by Bill Stone and Matt Oliphant. As trips were becoming over 24 hours long, the three Bills and Matt decided to try an underground camp in the Giant's Staircase at -400 meters. They soon decided that the camp was too near the surface to make much difference, and the three Bills headed out after four days. Matt, who had never camped underground before, stayed for a total of ten days, the full extent of his time in Mexico.

After a photograph and derig trip to the -958 sump, the three Bills and Matt attempted to find a bypass to the sump. Locating a place to climb up out of the East Gorge, they encountered an upper-level borehole, 15 by 15 meters. But progress in the downstream direction was blocked by a pit back into the



East Gorge. So they surveyed upstream instead, netting several hundred meters of easy passage until they reached another pit.

Northwest Passage

On the next trip, Ed and Jim located another climb-up farther downstream that went to a continuation at the same level as the previous borehole. The two-person team surveyed an incredible 800 meters in the Northwest Passage at over 900 meters depth, and had one loop of several hundred meters that closed to within one meter! They ended their survey at a bolt climb.

The bolt climb at the end of the Northwest Passage seemed certain to bypass the -958 sump. For the final deep push trip of the expedition, Ed and Bill Stone headed into the cave early to get Matt so they could start the bolt climb. Matt led an easy traverse that actually bypassed the anticipated bolt climb. On the other side, the passage broke into large borehole, 15 meters in diameter and filled with ex-

tremely fresh breakdown. The three cavers scooped ahead for about a half hour, then returned to the traverse to wait for the others. After an hour of waiting, Bob, Jeb, Jim, and Steve finally arrived. They had been taking pictures on the way. The whole group explored through the large borehole. Rappelling a 15-meter drop, they found that the



Bill Stone, Matt Oliphant and Bill Farr at the -958 Sump. (Bill Steele & Bill Stone)

borehole continued to another drop, where they could hear water at the bottom. At this point the group broke into two teams. One team headed out, surveying what had just been explored. The others proceeded down the Widowmaker Drop, where Jim set two bolts to redirect the rope away from a large loose rock. They found the stream again; it had now doubled in flow to about two-thirds cubic meters per second. The sump had been bypassed. They followed the water down some small cascades and through two boulder chokes. Exploration finally stopped at a third boulder choke at -1038 meters that has yet to be forced. The group surveyed out and derigged the cave to the top of Saknussem's Well. In total, the two groups surveyed over a kilometer in a trip that lasted 33 hours.

Cueva Moscas

One of the more obscure entrances discovered on the March 1987 trip was that of Cueva Moscas (Fly Cave), located in a small brush-filled sink. The descending muddy crawlway just inside the Moscas entrance had strong airflow, making this miserable-looking hole worth pushing. After ten meters, the cave opened into walking passage, which split into two descending leads. The right-hand passage began as a meandering canyon that went a few hundred meters and down two short pits before becoming too tight. The left lead went to a pit with good airflow. This led to a room followed by a series of five more pits separated by short stretches of horizontal passage and rooms. Moscas was pushed primarily by Carol, Peter, Mark, and Gary with help from Ernie, Bob, and Steve. After four trips and 790 meters, Moscas connected as an infeasible to the Black Elephant Room in Cheve, adding 70 meters to the depth of the cave and creating Sistema Cuicateca.

Llano Español

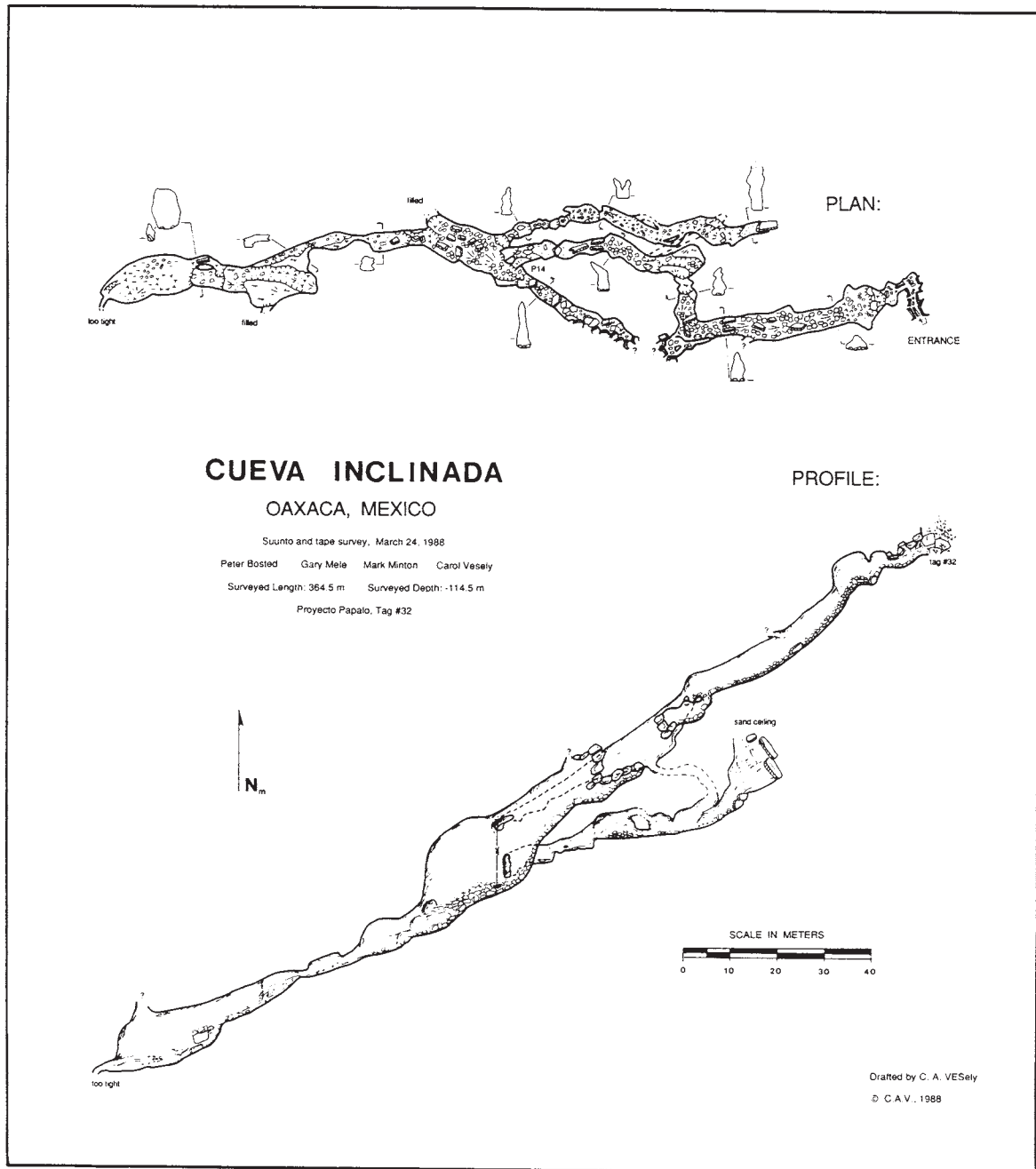
Another objective of the expedition was to begin investigating some of the areas farther from Cheve in the hopes of locating more entrances. After Bill Steele, Mark, and Bill Farr discovered several entrances in nearby Llano Español to the south, Peter, Carol, Gary, and Mark camped there and surveyed the caves. They began with Cueva Inclinada, located next



Mark Minton rigging the drop in Cueva Inclinada. (Drawing by Linda Heslop based on a photograph by Peter Bosted)

to a streambed and issuing a strong breeze. The entrance was in a breakdown pile, but soon opened into a sloping walking passage, which followed the area's 30 degree dip. The canyon passage became progressively larger and eventually led to an 18-meter pit. At the bottom, the passage continued descending, with cobble and sand fill lining the walls. In some places this fill formed significant sections of ceiling more than eight meters overhead. Eventually, the cave ended where the stream channel became completely filled with sediment in a large terminal chamber. The air seemed to disappear into a dome. Cueva Inclinada is 365 meters long and 114.5 meters deep.

The next day the group spent several hours in vain trying to find a way through blowing breakdown in a promising area on the other side of Llano Español. Frustrated, they headed for the last known entrance in the area, Cueva Tutilomo, named for the beautiful orange flowers growing near the arroyo entrance. Tutilomo is formed along a steeply dipping fault. The cave had good airflow but one rope drop and numerous climb-downs eventually brought Mark, Peter, and Carol to the bottom after only 140 meters.



Puente Natural

Throughout the expedition four trips were made to Osto de Puente Natural. On 16 March, Don, Steve, Jeb, and Bob pushed down a series of tight, awkward canyons and short drops to the base of the narrow, drizzly, 90-meter Fissure Drop. The next day Ed and Karlin hauled in massive amounts of rope and surveyed down the second of two Flowstone Drops, each about 30 meters deep, and into the

descending canyon passage beyond. Unfortunately, some confusion about the end-of-survey station resulted in a hanging survey. The following day, Carol, Peter, and Gary surveyed the first Flowstone Drop, thereby tying in the hanging survey. They continued their survey down a dry 13-meter pit that bypassed a wet drop. After a five-meter pit and some small crawlways they called it quits. Their survey left the cave length just 40 meters shy of a kilometer long. A final push



Susie Lasko rappelling in Cueva Cheve. (Drawing by Linda Heslop based on a photograph by Peter Sprouse)

and derig trip by Mark and Bill Farr nudged Puente to just over a kilometer long and 442 meters deep. A surface survey places the cave directly over known parts of Cheve, so it is probably only a matter of rope and effort before it ties in to the system.

Continuing surface work has netted over 30 tagged entrances. A couple of other small caves were mapped, but much work remains in the karst to the north of Llano Cheve. Currently, Sistema Cuicateca stands at 1038 meters deep and 9.2 kilometers long. With continued effort, there is a good chance that the cave will develop into a system to rival Huautla to the north. To this end, we have established Proyecto Pápalo to study the speleology, geology, hydrology, and biology of the area.

PROYECTO PAPALO

En diciembre de 1986, Bill Farr y Carol Vesely comenzaron la exploración sistemática de la área llamada Pápalo, en la Sierra Juárez de Oaxaca. Las primeras dos exploraciones en Cueva Cheve llevaron a una profundidad de 200 metros y una longitud de 1500 metros. En diciembre de 1987, un grupo de siete espeleólogos continuaron la exploración hasta -720 metros de profundidad y 4500 metros de longitud. Al mismo tiempo se empezó la exploración de la cueva llamada Osto de Puente Natural, con un tiro cerca de la entrada de 100 metros. En marzo de 1988 un grupo más numeroso exploró en Cueva Cheve las mojadas Turbines y el East Gorge. Una conexión con una entrada más alta, Cueva de las Moscas, resultó en la formación del Sistema Cuicateca, con 1038 metros de profundidad y 9200 metros de longitud. Osto de Puente Natural se exploró hasta -442 metros, y se espera conectar al Sistema Cuicateca.



OCOTEMPA

Marion O. Smith

During late winter and early spring of 1985, 16 Belgian cavers had a highly successful expedition to the Sierra Zongolica, in Puebla, Mexico. Among their many discoveries were a 19-kilometer-long horizontal stream cave, Coyolatl; a 700-meter-deep multi-drop cave, Atzotempa; and an unusually deep pit, Pozo Verde or Sótano de Ocotempa, estimated to be 380 meters deep.

The Belgians reported their explorations in *Speleoflash No. 148*, and Paul Courbon included Pozo Verde in his new edition of *Atlas des Grandes Cavités Mondiales* as the world's fourth deepest pit and the deepest in the Western Hemisphere. Terry Raines saw these publications, and immediately became interested in touring this super pit. He mentioned his plans to me after our Thanksgiving trip to Cueva del Tecolote.

The entrance to Pozo Verde. (Marc Tremblay)

The Super Pit

Within the next few weeks, both Terry and I had invited others, and 29 December, 16 of us met at the plaza in Chalpulco, just north of Tehuacán: Aspen Adams, Terry and Susie Raines, Don Broussard, Martha Meacham (Texas), Nancy Cantin, Laurent Ouellett, Marc Tremblay (Quebec), Dave Black, Holly Cook, Glen Lemasters, Greg McNamara, Tina Shirk, John Danovich (Indiana), Alan Cressler (Georgia) and me. By the next morning we had driven to the end of the mountain road at Alcomunga, 75 kilometers from Tehuacán. By the following afternoon, we were at Ocotempa village, some ten kilometers by trail farther east, on the foggy side of the mountain in the domain of Nahuatl Indians.

On 1 January 1987, the easternmost of Pozo Verde's two ten-meter-diameter openings was rigged with two ropes. Alan made the first descent and experienced a bad snarl in the offset, semi-ledge crack, some 100 to 130 meters below. I rappelled next and joined him, not at the bottom, but at an 18-meter-wide, 30-meter-long intermediate level 221 meters below the surface. We were surprised to find that the so-called 380-meter pit was in fact two drops.

We finished untangling the rope, rigged the second pit, of 82 meters, and descended. Alan was again first down and disappeared into the borehole at the bottom. When I arrived, he asked if I wanted to "scoop booty" through a crawl. He said it sounded as though there was a river beyond. Alan led through the two-meter crawl, but we found no river, in fact, no water at all. What he had heard was air moving inward very strongly. After only ten meters, we reached a virgin six-meter-high, offset conglomerate climb, which I managed to scale. Farther on, I reached a second climb, of five meters, which the air zoomed up. After my feeble attempt to get up, Alan tried, but he was also unsuccessful.

After we toured all the passages the Belgians had explored, including the up-dipping giant hallway, we prusiked back to the base of the entrance pit. The Indiana cavers were experiencing trouble getting their rope down. It was balled up in the crack. Don descended the

first rope and freed the second one. After that, everyone except Aspen and Martha yo-yoed the pit and the second drop. Terry, using an electronic distance meter, surveyed down the two pits. Then he, Susie, and Don mapped all the known cave passage. At the conclusion of their cartography effort, they investigated Alan's Wind Crawl. Terry, determined to follow the air, easily got up the second climb, and ten meters farther found the very breezy top of a virgin five-second pit!

The next day, as Pozo Verde was being de-rigged, Terry and I were already pondering when we could return.

The Return Trip

On 1 February 1987, a small crew consisting of Terry and Susie Raines and John Gilliland from Texas, Mauricio Tapie-Vizuet from Mexico City, and I assembled in a more sunny Ocotempa. We were puzzled by the absence of Dave Doolin, also from Texas and Alan Cressler, who several days earlier had entered Mexico by bus to meet us.

The next day, we rigged Pozo Verde, and all five of us descended. I was first down and found the 460-meter rope in a terrible mess in the crack. Even with help from Susie and John, it still took me over two hours to unsnarl it. At one spot the rope was frayed to the core, and I cut it, which was not our original plan, leaving about 35 meters on the floor of the entrance drop.

Terry and Susie did some resurveying, and Mauricio took a few photos. I rigged the second pit, rappelled it, and climbed to the top of the virgin third drop, Wind Pit. In time, Terry, Susie, and Mauricio surveyed to that point.

Wind Pit

At last, I started to descend Wind Pit, but three meters down, I noticed a loose meter-high limestone pinnacle. With Terry's help, the rope was pulled up, and the spar was easily dislodged, no doubt saving someone from death or injury. The rope was lowered again, and I rappelled about 30 meters to a narrow ledge with a large column-like boulder. The rope was retied, and I descended another 35 or

40 meters to a narrow, sloping ledge, some five meters from the end of the rope. My call for more rope was relayed to John, who cut the tail of the rope at the second pit before he left for the surface. Slowly, the surveyors came down. Susie delivered the rope, and we tied it to a natural belay, and backed it up to the rope above. I finally completed the rappel to reach a level, cobble-strewn floor. Altogether, Wind Pit measured about 94 meters.

Beyond, about a meter-and-a-half off the floor, there was a meter-wide pass to a fourth pit, which seemed quite deep. The rocks we threw rattled nine to 13 seconds! We cut the tail off the rope used in Wind Pit, and fully aware that it would not reach, I descended about 38 meters. Since we had no more rope with us, we left, and by 11:20 p.m., we were all back on the surface.



The bottom of the second pit. (Dave Black)

Nearby Pits

The next day we did not enter Pozo Verde. During the afternoon, John and Susie went hiking, and Mauricio and I were guided by Sr. Ruben Hernández Martínez of Ocotempa to check some pits on his property that the Belgians had not entered. We walked downhill on the main trail to a field on our left, where the trail went uphill again. At the edge of the field were numerous very sharp karst outcrops. We were shown several openings, which yielded two pits. The first, Sótano de Ruben, had a double entrance. We descended the higher, 30-meter-deep opening, the floor of which sloped past the bottom of the lower entrance to a three-meter pit. We shoved in a rotten log, and Mauricio managed to slip down and walk five meters to a drop of about 15 meters, for which we had no rope.

The second pit, Sótano de Hernández Martínez, was near the base of the karst outcrop, under an overhang in a three-meter-deep, steep-walled sink. It was at least 25 meters deep, offset, narrow, and definitely not nice. Mauricio was the first down, and about two meters from the end of the rope, he threw rocks horizontally and heard them go deeper.

Back to Pozo Verde

On 4 February, I entered Pozo Verde first, tethering a 168-meter rope. At the -221 meter level, I paused to chop off the 38-meter tail of the entrance rope before continuing to the fourth pit. Soon, everyone except John joined me. The routine was the same as before. I was the push-rigger, and Terry, Susie, and Mauricio were the mappers. We rigged the long rope to a bomb-proof tie-off, and I rappelled about 84 meters to a semi-ledge with a large pinnacle, around which I rebelayed the rope. It was another 40 meters to the floor, for a total of 125 meters. Terry dubbed it the Eighth Day of Oztotl Pit. The bottom was about eight meters wide, with attractive marble walls.

Fifteen or 20 horizontal meters farther, there was another pit, which I rigged by tying the tail of the 168-meter rope around a nubbin of a large boulder. This pit measured 25 meters. After another 24 meters of passage containing large boulders, I reached two holes

leading into a sixth pit. The mappers followed, and Terry stayed high on the large, narrow slabs. He located a suspect rig point that placed the rope down the side of the same tilted slab he was standing on. I descended this 33-meter drop. The rope barely reached. On the bottom, I slid down the smooth, sloping flowstone floor, and after five horizontal meters, climbed back to the level of the end of the rope, and located a six-meter pit. Terry descended and suggested that the pit be rigged with a longer rope, which turned out to be a very good idea. Susie and Mauricio did the rerigging and were soon down. Meanwhile, I looped the tail of the longer rope around a boulder, and descended an offset, curving, canyon drop with parts of about six, two, and three meters. After waiting for the others, I descended the next pit, of eight meters, still using the tail of the rope from the 33-meter pit, and, 11 meters farther horizontally, found yet another pit, below some jammed boulders.

Rockfall times indicated that we might not have enough rope. I tied together our last two ropes and put them into the chasm. With Terry and Mauricio holding the rope in place on top of a boulder, I squeezed through a small hole and dropped 30 meters to a small ledge, some five meters above the knot. Terry came down to the ledge, and held the upper end of the tape, while I rappelled past the knot to the bottom, about another 35 meters to a breakdown chamber. The rope just reached.

I climbed down two meters and followed a meter-wide, almost dry stream passage ten meters to a pit, which I estimated at eight or nine meters. But, out of rope, we would not descend it this expedition. We had reached a surveyed depth of 657 meters, at a point that was only 60 to 90 meters offset from directly beneath the entrance.

We derigged as we went. In time, three ropes totalling nearly 300 meters were "snaked" across the floor and tied to the entrance rope. Terry brought up the rear and our fine reconnaissance ended, with trip times ranging from 15 to 17 hours.

About noon on the fifth, all five of us returned to Pozo Verde. Mauricio rappelled

about half way down the entrance, changed over to take some video movies, then climbed out. Following that, we derigged the pit.

The next day, we left Ocotempa. In Tehuacán Terry called Peter Sprouse in Austin and learned that Alan Cressler and Dave Doolin had been hassled in Mexico City and lost all their gear. At about 12:30 a.m., 30 January, Alan and Dave, while riding in a Mexico City taxi from one bus station to another, had been pulled over by badge-carrying "detectives." They were taken from the taxi, driven to a secluded area, and robbed of everything except the clothes on their backs and \$40, which Dave "stole" back when they weren't looking.

Spring, 1987

Within a few weeks Terry and I were already planning a spring trip.

In the early afternoon of 4 May, Terry and Susie Raines and Brian Burton from Texas, Greg McNamara from Indiana, Dave Doolin from Tennessee, Ray Gregory from Georgia, Paul Smith from Florida, Marc Tremblay from Quebec, and I congregated in Ocotempa. The teacher did not want us to use the old school-house grounds as we had in the past, so we camped next to the trail just above Pozo Verde.

Later that afternoon, we rigged the entrance pit, and at 6:15 p.m., I began my rappel, hauling a duffle holding 200 meters of rope. Without much trouble, I untangled the usual rope spaghetti. I cut the new entrance rope and rigged the second pit. Meanwhile, Ray descended the entrance pit with another duffle of ropes. We tied the two duffles to the rope in the second pit and lowered them down. Then, I hauled the 300 meters of rope to a place near Wind Pit, and rigged the two climbs. I checked the lip of Wind Pit for bolts or other signs that a descent had been made since February. It was clean. I was concerned that "our" lead had been discovered, and we had gotten scooped. Local residents had told Terry that perhaps as many as six Belgian cavers spent three days at Pozo Verde only a couple of weeks earlier. Apparently, their purpose was to remap the cave, since I found fresh topofil thread in many places at the bottom of the entrance pits.

To the Infinity Room

After a light rain early the next morning, Marc, Greg, Paul, and I went on a rig and push trip. Everything went fairly smoothly until we reached the 33-meter sixth pit. There we hesitated. I did not like the limited tie-off options. Finally, a cemented, chocked rock behind the huge slab was used as a back-up, and Marc set a bolt on the front of the slab. Below, Marc placed a second bolt at the top of the eight-meter drop just above Split Pit.

The virgin 15-meter pit was at last descended. The only way on was through a narrow, stair-stepping, six-meter climb to a three-meter pit. We used one rope for both pits and climb. I was first down, and found a ten- or 11-meter pit past a narrow canyon. Marc installed two bolts at the new pit. He descended first and became the "point," or person in front. Just beyond the ten-meter pit was a four- or five-meter drop and a three-meter climb, followed by a narrow passage, less than a meter wide. A three-meter sloping pit was at the far side of this passage, past a chocked boulder that was awkward to get over. Before reaching the pit, Paul turned around and headed out.

After the three-meter sloping pit the passage improved, and, less than 30 meters away, Marc found about a 35-meter pit into a passage 15 meters wide. Greg installed a bolt, and Marc descended the impressive new drop. After Greg and I rappelled, all three of us walked as a unit along 60 to 90 meters of borehole. A short climb led to a ten-meter pit with a deeper, offset drop. We were ready to turn around, and made no attempt to descend.

A few meters back up the borehole, we explored a large alcove, later named the Infinity Room by Terry. Greg led a climb up a crack, and we crossed over breakdown into a large side chamber, which had a ten-meter pit at one end and water coming in from above. (This chamber was never adequately explored or mapped.) After this, we split for the land of moonlight. Trip times were 17 to 20 hours.

On 6 May, Terry, Susie, Brian, Dave, and Ray set up a camp in the large chamber below Pozo Verde's second pit. Then they headed

deep to map and push. At Wind Pit, Ray, nervous about going deep, decided to return to the surface.

The team mapped much of what had been found on the fifth. They rigged the virgin pit, but ended the survey at the bottom of the first, ten-meter phase. Dave alone descended farther drops of 20 and 30 meters. At the bottom, he found an active stream passage, 15 to 30 meters high and two to five meters wide. He explored some 120 to 150 meters, negotiating a series of climb-downs totaling about 30 meters, until he was stopped by a wet 15- to 20-meter sloping pit. Everyone was back to the cave camp by 4:40 a.m., after about 14 to 16 hours.

High Water

On the seventh, it was still overcast on the surface. Slowly, Greg, Marc, Paul, and I packed our camp duffs and descended to the cave camp. We took down two more ropes.

Once we all were at the cave camp, we pondered our next move. Marc was not sure we should go deep that day, but I voted we should



go. So, we compromised, rested a couple hours, and at 6 p.m., Marc, Greg, Paul, and I finally left. Near the 35-meter pit into the Junction, Marc took some photos. Then we descended the three-phase pit and traversed the stream passage to the pit where Dave had stopped.

Unknown to us then, the water was up. It had started raining about an hour after we began our trip. Not knowing how much water Dave had seen, we assumed everything to be the same as the day before. The flow cascaded into the virgin pit, augmented just past the lip by a fairly heavy waterfall from a dome. Thus, the drop was quite wet, and Greg and Paul elected to stop. About 50 meters of our 110-meter rope was let out. Dressed in a hooded rainsuit with polypro underneath, I descended the offset, jagged, sloping pit, much of which was freeclimbable. It was perhaps 20 meters deep.

The passage at the bottom was two to four meters wide and often six to 15 meters high. Marc joined me, and we explored maybe 120 meters, losing at least six more meters in step-downs and climbs. The rock, marbled with white streaks, seemed as beautiful as in the Huautla caves. Marc set two bolts, and we descended another pit, again getting drenched.

Our rope in this pit was about 20 meters in length, and at the bottom we found another wet pit of about the same depth. We had only a ten-meter rope left, so we couldn't do the new pit. Luckily, nearby there was a parallel, dry down-climb. This led to a couple of 12-meter drops into the same passage, below where the main water fell. Off to the side was a window, beyond which was a muddy, spiraling, steeply sloping route. Using our rope as a handline, we reached the wet passage below. In front of us, below the waterfall pit, was an eight-meter series of short climbs. We returned to our handline, cut it, and attempted the wet climbs. I did one climb, then tied the rope to a solution pocket, and went another three horizontal and three vertical meters. At that point I was in a heavy waterfall, and could not see if the rope reached. Consequently, I wimped and retreated. Marc also declined to go any farther. This was the lowest point reached on the May expedition, which I esti-

mated at about -873 meters. The passage we were in certainly appeared to continue, but we could not see clearly because of the waterfall.

Retreat

Marc and I derigged the short ropes and returned to Greg and Paul, after an absence of three hours. While they waited, Greg had explored a very steep upstream route and stopped at breakdown after 100 meters.

While Greg and Paul derigged the wet pit, Marc and I continued to the top of the three-phase pit. There, we decided all ropes should be pulled and stashed in the Infinity Room.

At the Junction, Greg first noticed that there were waterfalls where none were before, and that the pool's depth had increased. Not far along in the narrow passage, we found water a half-meter deep. This prompted me to decide to pull all ropes to the tops of individual pits as far as the base of the Eighth Day of Oztotl Pit. I did not think the group was sufficiently prepared for a wet cave, and, if another deep trip was delayed, Greg and I would certainly miss our plane flights. Hours later, about 9:45 a.m., I crawled back to cave camp.

After a three-hour snooze, I awoke and learned that Mauricio Tapie-Vizuet had just arrived in the cave camp with full gear. Ray was also back down. My unilateral decision to cease exploration did not receive much criticism. Naturally, Terry was disappointed not to do another survey trip. During the afternoon, Dave and Ray pulled up my rope in the Eighth Day of Oztotl Pit, derigged Wind Pit, and brought the ropes to camp. Terry, Susie, and Marc did some resurveying and photography.

During the night, it rained fairly heavily again, and the next morning Terry announced that he would not have gone deep that day, satisfying me that I had made the correct decision. During the day, the rest of us cleaned up camp and ascended to the surface. My climbs were just about the worst in my experience. My gear was very heavy, and the pit was quite wet.

On 10 May, numerous men and burros carried most of our gear back to Alcomunga. By the thirteenth, we were back in Austin.



Ed Holladay snaking the rope. (Jim Smith)

The Big Push

Since we still had not bottomed Pozo Verde yet, another expedition had to be organized. Our progress was an open book to the world. Terry presented a slide show at the Michigan NSS convention, wrote an article for the *AMCS Activities Newsletter*, and corresponded with Belgian cavers. Bill Stone published a synopsis of our activities in Britain's *Descent* magazine, and both Marc and Greg had written reports for their local newsletters. For a time, it looked like we would have a grossly oversized group. But largely because of that very possibility and confusion about the departure date (I was telling people February 1988, and Terry, December 1987), we ended up with a manageable team.

On 22 December 1987, Terry Raines, Mark Minton, and Nancy Weaver from Texas, Peter Quick from Michigan, Louise Hose from Louisiana, John Ganter from Pennsylvania, John Schweyen from New Jersey, Jim Smith and Bob Runser from Tennessee, Dick Graham from North Carolina, and Gerald Moni, Ed Holladay, and I from Tennessee reached Ocotempa village where Serge Delaby, Michel Dupris and François Saussus of

Belgium were already camped.

Later that afternoon, Ed, Mark, Nancy, Gerald, Peter, John S., and I rigged the entrance to Pozo Verde. The tactic was similar to that used in May. I descended first, with 120 meters of rope in a duffle, and cleared the usual mess from the crack. Dick followed, tethering more ropes. We descended the second pit, cut the rope, and dragged it through Wind Crawl. The two climbs were rigged, and after lowering the rope to the -33-meter ledge at Wind Pit, we left for our tents. It had been raining most of the time we were in the cave, creating a substantial waterfall in the second pit, and we got thoroughly soaked.

The next day, the plan was to again set up camp at the bottom of the second pit, and try to rig deep into virgin cave. We bunched up near the climbs in the Wind Passage because Jim decided to place a bolt at Wind Pit. Dick, Mark, and Nancy returned to the cave camp. It worked out that the riggers were Jim and Ed. At Split Pit, to avoid the tight crack, Jim pounded in a bolt. At the next pit, Ed placed a third bolt. From there, we routinely traversed the route to the Junction, rigging even the short climbs.

At the base of Marc's Pit, Bob decided to head out, and at the main rope stash in the Infinity Room, Peter Quick did likewise. Jim, Ed, and I grabbed more rope and pushed down to where Marc Tremblay and I had stopped in May. Despite the recent rain, there was considerably less water than then. As fate would have it, in May I had stopped literally only a meter above the bottom of a three-meter free-climb, and ten meters from a 17-meter pit.

The Bottom

Jim was the first to scale the climb and descend the still very wet pit. The bottom was basically a 100-meter-long room. We lost ten to 12 meters of elevation by climbing down breakdown, but soon we reached massive, hard-mud slopes, which extended 15 to 30 meters to the right. On the left side, Ed scrambled down to where the stream disappeared into rocks. Past this, Jim led to a more narrow portion of the room, up and down huge mud-coated boulders, and finally rigged a 12-meter-

long, 30 degree mud-slope rappel. Almost immediately, there was a sump pool, with no way forward. We had apparently bottomed the cave. Shades of Ghar Parau! We climbed the mud slope rope, and searched the wide uphill areas, but found no obvious lead.

Many hours later, at 4 a.m., I was the last of the bottoming trio to return to camp.

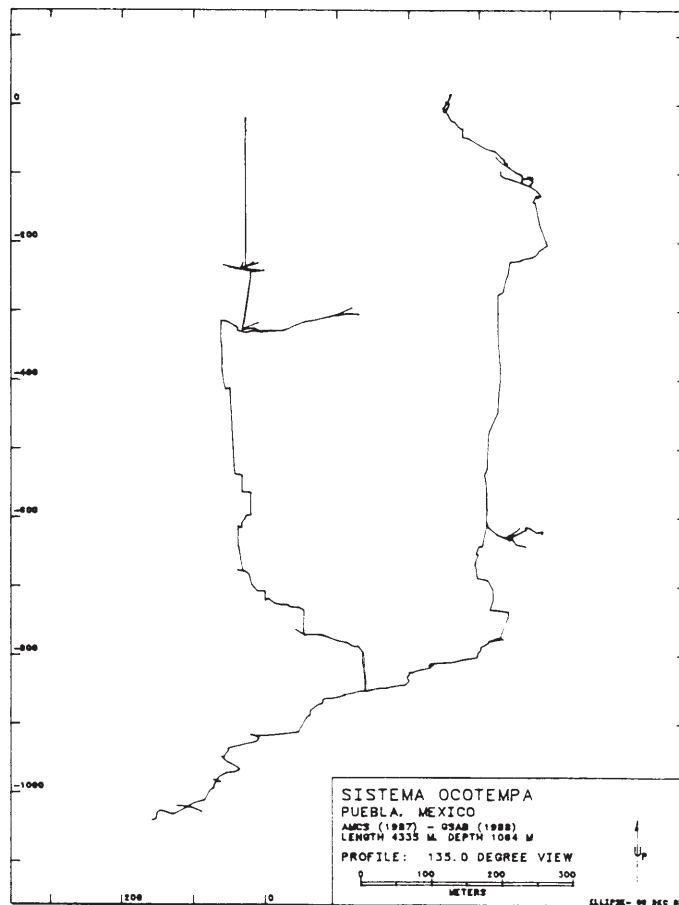
Christmas Eve

By late morning of 24 December, there was a lot of commotion, as everyone on the surface came into the cave. All the Americans planned to camp, while the Belgians did not. Mark, Gerald, and Dick went to the bottom and surveyed out, while Terry and Louise went to the three-phase pit and surveyed in, connecting their surveys in the passage above the ten-meter wet pit. The survey showed that my May estimate of -873 meters was low. It was, in fact, -950 or more meters. Serge, Michel, and François also went to the bottom and tried very hard, without success, to find a going lead.

By about 5 a.m. Christmas, everyone except Gerald had returned from the depths below camp. The hardy Belgians continued to the surface. Those, such as Terry, who did not know Gerald, thought that a rescue situation might be developing. But those of us who did know him merely said that he was coming, slowly but surely. The new day's deep trip was just beginning when Gerald at last returned to camp, amid cheers and applause.

Ed, Jim, John G., and Bob headed deep. I waited before following them. Don Broussard and Martha Meacham, who had arrived the day before, came into the cave. The entrance pit was Martha's first pit!

At 12:10 p.m., I headed in alone and, about two hours later, met Ed and Jim about half way between the wet 20-meter and ten-meter pits. They had been to the base of the 17-meter wet pit and had attempted some photographs. John G. and Bob went to the very bottom, and on their way out derigged all drops to the bottom of the three-phase pit, and hauled those ropes, and more, back to camp.



Jim, Ed, and I climbed back to the base of the three-phase pit, pausing en route for more pictures. We then surveyed upstream in the steep, updip passage Greg McNamara had first explored in May. We mapped about 400 meters, half of which was virgin, gained nearly 60 meters in elevation, and stopped at a 30- to 45-meter wet dome.

When we returned to the base of the three-phase pit, Bob and John G. were long gone, and we continued the derigging. Eventually, we derigged everything to the bottom of the Eighth Day of Oztotl Pit.

Derigging

On 26 May, Mark, Dick, Terry, John S., and Louise finished derigging below camp.

Later, Mark placed a rebelay bolt to prevent further abrasion of the rope. After this, Gerald, Dick, John S., and Terry climbed to the surface with their camp duffles.

Well, actually, three of them did. Gerald experienced some as-yet-unexplained problem with hauling his duff, even though he was now using a complete Gibbs rig. When he was about 15 meters off the floor in the second pit, we heard him call "help" and for Dick to hurry. Before Dick got to the rope, Gerald managed to tie a loop in the main line, where he left his duff hanging, and climbed up. Dick, of course, had to climb around the duff, and, when he got up, both he and Gerald hauled it up. Then, Gerald dragged it close to the entrance rope and abandoned it. Sometime later, at camp in Ocotempa, he talked Serge into descending the 221 meter entrance pit to haul out his duff. Serge apparently was quite willing to help, provided he could try out Gerald's Gibbs rig. From the time he started to rappel, Serge was back at camp with Gerald's duff in under an hour!

On 27 May, the remainder of us underground cleaned up camp and climbed to the surface. Then, by a major group effort, we

pulled the mountain of tied-end-to-end ropes out of the entrance and overland to the trail-side Pine Tree Camp. By dark, we had completed this laborious task, and Pozo Verde was history.

The result of our four trips to Pozo Verde within a year was to make it, temporarily at least, the second deepest known-cave in the Western Hemisphere. Depending on where Terry decides the pit actually begins, the depth will be approximately 1,017 meters or 1,041 meters. The first figure is from our rig point, and the other is from the breakover or drip line in the ravine above the opening we did not rig. Jim Smith says Pozo Verde is the "easiest thousand-meter deep cave in the world," and compared with the Li Nita and Nita Nanta routes in the Huautla system, less than a 150 kilometers away, I will have to agree.

Editor's Note: A return trip by the Belgians resulted in the connection of a higher entrance. Ocotempa is currently 1063 meters deep.

SOTANO DE OCOTEMPA

En 1985, espeleólogos belgas exploraban el Sótano de Ocotempa en el área de Zongolica, cuyo tiro de entrada "Pozo Verde" midió 380 metros. En enero de 1987, un grupo norteamericano dirigido por Terry Raines y Marion Smith llegó a visitar el sótano. Descubrieron que el Pozo Verde actualmente compuso dos tiros, y encontraron una gatera al final la cual condujo hacia nuevas galerías. Posteriormente en otra expedición se descendió el Tiro de Viento (94 metros), descubriendo otro tiro, sin embargo no tuvieron más cable para descender. En el 4 de mayo se descendió hasta una profundidad de -763 metros, también explorando quizá otros 100 metros más de profundidad antes que la lluvia ordenará el final de la exploración. En la Navidad de 1987, los espeleólogos otra vez se congregaron, llegando al final de la caverna, después de haber descendido el último tiro de 17 metros. La parte final del Sótano de Ocotempa comprende un salón lleno de lodo sin manera de continuar. El resultado en cuatro visitas estableció temporalmente la segunda caverna más profunda del hemisferio occidental, con una profundidad total de -1041 metros.

TO TURN OFF THE NIGHT

by Dale Pate

Woke up this morning down in Camp 1,
Darkness surrounded me with no place to run.
It's these places we go to, the things we see,
It's the darkness of these caves that call to me.
It's a different world than the one above
A different world that you'll come to love.
Spend some time and visit this realm.
To some, caves shine brighter than the brightest of gems.

There are places on this earth where no one's ever been,
And there's caves on this earth and some may never end.
And you get to be among the few
And maybe even the first
To turn off the night
Turn off the night.

Where you are the first to turn off the night,
Seeing a new world by its first light.
The darkness of these caves, they hold such sweet sights.

Some people ask me why is it so,
Why choose the caves as places to go?
What calls you from deep in this earth?
What do you think all these caves are worth?
What makes you long for the passage ways?
What makes you want to leave the light of day?
Why does this darkness beckon to you?
Why is it this that you want to do?

Well, think of all the hidden rooms where no one's ever been,
And think of all the passage ways, some may never end.
And you get to be among the few
And maybe even the first
To turn off the night
Turn off the night.

Where you are the first to turn off the night,
Seeing a new world by its first light.
The darkness of these caves, they hold such sweet sights.

PROYECTO
ESPELEOLÓGICO
PURIFICACIÓN

Dale Pate and Allan Cobb in the Black Gyp
Joint of Arrakis. (Dave Bunnell)



SISTEMA PURIFICACION

CAMP 1, 1988

Dale Pate and Peter Sprouse

After the successful expeditions in 1986 and 1987 to remote camps deep inside Sistema Purificación, cavers of the Proyecto Espeleológico Purificación decided, in 1988, to turn their attentions back to the Camp 1 area near the Infiernillo entrance. Camp 1, located about 600 meters from the huge entrance, was used extensively in the late 1970's, but hadn't been the base for PEP surveys since late 1982. At the start of the expedition, the

length of Sistema Purificación stood at 67,599 meters.

On 12 March, everyone packed up their camp duffles at the roadhead. Participants were Jerry Atkinson, Dave Bunnell, Allan Cobb, John Fogerty, Jeff Horowitz, Susie Lasko, Dale Pate, Scott Scheibner, Peter Sprouse, and Cyndie Walck. The following day, 13 March, was spent hiking to the entrance, making the

30-meter ascent up into the cave, shouldering our duffles to the Camp 1 site, and setting up camp.

Surveying in the Confusion Tubes

For the first day's survey, 14 March, it was decided to concentrate all three survey teams in the eastern Confusion Tubes area. It was in this area that the original route through the maze had been mapped in 1977. Peter, John, and Susie climbed above the Original Tube to a section known as Rubik's Tubes, a complex area with many junctions. They mapped a route north that tied into the Help Room near Lakeland. Returning to the Rubik's Tubes, they happened upon a tube that seemed to be going somewhere. This was the Granola Tube, which they followed for about 200 meters before it ultimately connected in near the Seven Way Junction near the northern limit of the Tubes.

Dale, Cyndie, Scott, and Dave mapped a parallel tube south from the Seven Way Junction that had multiple connections into the Original Tube. They then took an upward trending tube from the Seven Way Junction, and broke out into a horizontal passage that left white dust covering everyone after they traversed through it. This was aptly named the Ghost Tube. This led to several other leads, which were left for another day. The team then headed back to the Seven Way Junction and continued south, deeper into the Tubes, to a tube that had a beautiful, scoured, elliptical cross section, heading downward with good airflow. This passage, the Classic Joint, was also surveyed into, and it continues. Jerry, Jeff, and Allan got into a high lead heading south off the 17-hour Tube, which they named Up The Tubes. This tied into Lakeland via a pit, then trended west, and was still going when they quit. Between the three teams, 609 meters of new survey was added the first day.

On 15 March, Dale's team returned to the eastern Confusion Tubes to shoot video and map more tubes. The Gun Barrel Tube and the Son Of A Gun Tube were surveyed off the Ghost Tube to where they connected into the Granola Tube and the Rubik's Tubes area. The other two teams headed through the west-

ern Confusion Tubes, replacing the permanent ladder with a rope at the up-climb into Ithilien. At the top of this climb, Jerry's team began mapping an alternate route through the Ithilien canyons that tied into the original route in several places. Peter's team pushed on through Ithilien to the larger passages of the Hellenic Borehole, where they sniffed around for leads. First, they mapped two short loops that tied to nearby Fissureland, then they noticed a high lead that led into a new area. At a T-junction they mapped left in the Long John Borehole for 50 meters to a pinch. The right lead went better, through a slanted fracture that they named the Tilted Planet, finally stopping at an unclimbable dome. Hello Well, as they named it, was large and took good air, but had sheer walls of rotten rock. In total, 607 meters of passage was mapped that day.

Windwater and the Jersey Turnpike

The following day, 16 March, Jerry, Jeff, and Allan donned partial wetsuits to push a lead that had been hanging for 11 years: Frustration Lake. During the original survey through Lakeland, Jeff had been frustrated in his attempt to cross this lake and stay dry, and the survey had taken another route south in the quest for the Brinco connection. The trio found that the lake went with good airflow. They stopped, due to cold, at another lake 150 meters farther along, which they named Desperation Lake. This deep lake passage was named Windwater.

The other two teams set off for the far parts of the Jersey Turnpike, a long passage which parallels the main Infiernillo passages, offset to the east. At Turkey Lake, a 130-meter swim, the seven cavers put on wetsuits, taking them off again on the far side for dry surveying. Dale, Cyndie, Scott, and Dave picked up a right-hand lead at Lake Superior that Dale had noticed on a 1982 trip. It doubled back to the north paralleling the way they had come, as a nice walking passage, which at first had death coral (we had to find at least a little this year) covering the floor. Soon the death coral gave way to shiny black, scoured limestone. This parallel passage was named Looney Tunes. At one point, a small trench filled with brilliant white calcite crystals cut across the passage. Along the route several smaller passages head-



Peter Sprouse in Purificación. (Linda Heslop)

ed downward and to the east off Looney Tunes, presumably tying into the main Jersey Turnpike passage.

During a break in the survey Dave opened his waterproof box to change carbide and ¡BOOM!, the box ignited from a spent carbide bag that held residual carbon dioxide. Dave instinctively tossed the box away, losing his flash gear and flash cubes down a small hole, and Cyndie, who had been lying down under a low ledge and had taken her helmet off, bolted upright, bashing her head on the ledge. There was a minor delay as everyone recovered. Looney Tunes, ran for 290 meters before turning east and downward through a mazy area and after 20 meters tied into the Jersey Turnpike. Good leads still heading north were left in this small maze.

Meanwhile, Peter, Susie, and John continued on to the southern limit of exploration. Here, Peter Keys had done a steep climb to report that the passage continued upward. They mapped up a series of climbs, including one where they piled up rocks to do a step-up. Above that, they followed a bed-dip zigzag up to a small tube that broke into a two-part chamber. A number of tubes were checked leading from this room, but all were quite small or seemed to rejoin. The best lead appeared to be a high one in the ceiling, which required another rockpile to get into. The three of them got on the meter-high cairn, and Peter and Susie hoisted John up into the lead. After a time, he came back to report that he had reached another climb-up. Between the three teams 674 meters was added to the map that day.

A Day Of Rest

After long trips the day before, on 17 March, no one got an early start on anything ambitious. While most of the crew went for a photo trip through the main passage to the Balcony, Peter, Dale, and Susie went up to the initial part of the eastern Confusion Tubes, and mapped a number of loops at the beginning of the Original Tube. Without straying far from their starting station, they mapped 105 meters of tubes before returning to camp. Back in camp, in celebration of St. Patrick's Day, Peter and Susie treated everyone to bright green margaritas, while Dale provided a cheesecake, which provoked a feeding frenzy.

Return to Desperation Lake

Jerry, Jeff, Cyndie, and Scott left the cave the next day, since they had less time available than the rest of us. Before leaving the area, they had a chance to visit the springs lower in Infiernillo Canyon that are the likely outlet for the known streams in the cave.

For those left underground, the most exciting lead was to continue exploration at Desperation Lake. After slipping into cold, wet wetsuits Dale, Susie, John, and Allan found that the way continued for 140 meters as a major passage. Across Desperation Lake, they climbed up out of the water into an area with several smaller leads feeding into the passage from the west. Following the main passage, a

huge upside down mushroom was found hanging from the ceiling in the Hanging Mushroom Room. Beyond this, a wading pool was followed for 70 meters to where the large passage defused into several smaller ones. In all, three separate connections were made in this area by following these small tubes up to where they came out of holes in the floor of the Jersey Turnpike. Two of the connections were surveyed. Returning to the leads emptying into the passage from the west near the Hanging Mushroom Room, the most prominent lead, the Lava Tube, was pushed for 35 meters to a very recognizable place, the bottom of the initial climb up into the Jersey Turnpike. None of us had ever noticed the gaping hole at the base of this climb-up. Jeff swears that it wasn't there before. This team surveyed 284 meters that day.



The Original Tube. (Peter Sprouse)

Arrakis: An Exciting New Discovery

Peter and Dave were both suffering from minor injuries, and elected to do some mop-up survey off the East Loop not far from camp. At the Bicycle Run, they followed a nice flowstone-floored passage, The Puncture Passage, to where it tied into Tube 28 completing another nice loop. Moving to the D-Survey, they did two small loops off the main passage, then noticed an interesting lead in the ceiling. Peter led the climb, and found going passage at the top. As they mapped into it, they realized that they had found a major new section of cave. It was a large, dusty passage that climbed steadily up to the east, out of the known boundaries of the system. After several hundred meters they hit a T-junction and surveyed left. This passage zigzagged along the strike and dip, in the style of the other "dwanalands" in the system. This term came from the Godwanaland area in the Oyamel section of the cave system, where the route alternates between horizontal trends along the strike, and, at right angles, sloping passages following the dip. Later, similar parts of the cave such as Yawndwanaland and Dawn-dwanaland carried on the nomenclature. This new area received the name Chacdwanaland, due to its chalky nature.

Eventually, the route leveled out and turned south, and they quit mapping at a junction, having set an amazing 100 stations in 561 meters of survey. All that by two injured cavers on an "off" day! The two teams' survey pushed Sistema Purificación past the 70-kilometer mark on this day.

The following day, 19 March, both teams climbed up to this new area, now named Arrakis, after the desert planet from the science fiction novel *Dune* written by Frank Herbert. Dale, Allan, and Dave first took the right-hand lead at the T-junction. This passage bore due south in a straight line for 200 meters, finally becoming too narrow to continue, although there was good airflow. Towards the end of this passage the walls had a heavy encrustation of gypsum. The passage was named the Black Gyp Joint, for the fine, black, hair-like formations found along the way. Also in areas along the passage were piles of gray dust, where it appeared that the limestone walls had just



Dale Pate sketching in Purificación.
(Drawing by Linda Heslop based on a
photograph by Dave Bunnell)

turned to powder and crumbled into piles. Returning to the T-junction, they tried a small lead that went straight ahead and up. This small tube, the Pflögger Tube, twisted upward and connected into a reasonable walking passage, named the Mummy Tube. To the left was a balcony that looked out over the original passage near the T-junction. There were also several leads, one of which led to a high dome, and also tied into the original passage below the T-junction. To the right, the passage continued as the Mummy Tube, through

the Totally Tubular Room where there were numerous other leads. The Mummy Tube continued for 40 meters on a downward trend. At the bottom of this trend, the character of the walls and floor changed from dry, powdery rock to a hard, grey limestone. A surprising find was a pool of water with lots of small crystals lining the bottom. The pool, named the Oasis, was waded across with bare feet. Beyond this, the passage narrowed to a crawlway and eventually ended when it turned into several small unenterable holes with good airflow.

Near the end, a mummified bat was found, thus the name. Several leads were pushed off the Mummy Tube, including one, The Pfluger Tube, which looped into Peter and Dave's survey of the day before at an area known as Pflugerville.

The second team of Peter, Susie, and John went to the end of the previous day's survey and mapped to the left. Soon they hit another junction, where John explored a promising canyon to the right. But the group elected to carry the survey to the left, through some crawls to yet another junction, Sawdust Junction. They mapped to the right, which was an ample passage that zig-zagged downward to the north. This passage, the Snorehole, led to a climb-down, which John checked, and reported seeing another muddy crawl that led two ways. Backtracking up the Snorehole, they picked up another passage that continued on the south trend, the Sword Throat Passage. This went well for a while, then it

seemed to hit a structural problem, pinching out in a flowstone maze where the air rushed into a crack too small to get through. One side lead off of the Sword Throat Passage revealed a large chamber with nice totems, but it, too, pinched. In all, our two teams added 1,093 meters to Arrakis that day.

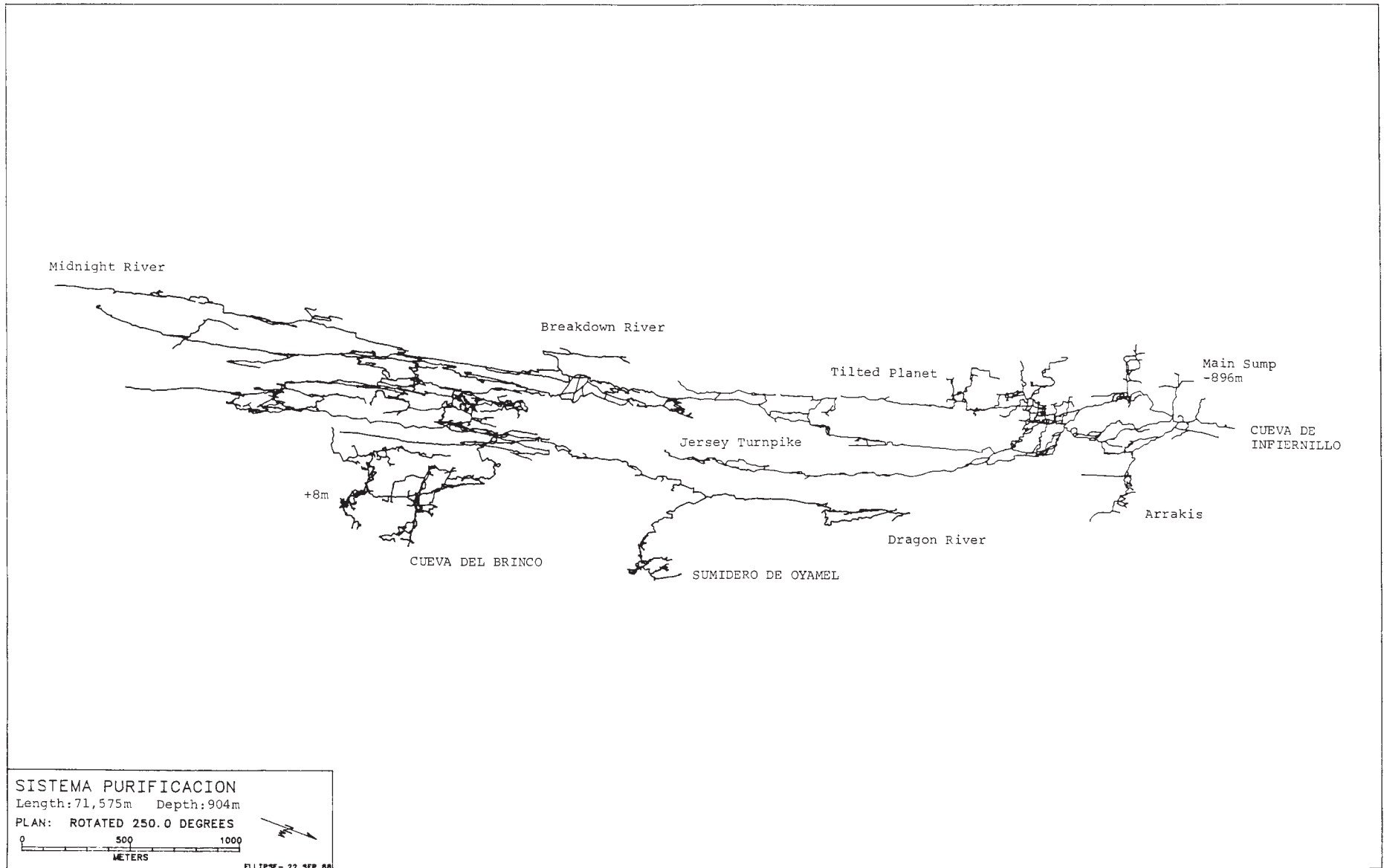
A New Depth

For the last available survey day, 20 March, projects close at hand were selected. Susie and Peter pulled on wetsuits to survey the enigmatic Main Sump below camp, which had never been measured. With lots of encouragement from the shore crew, they swam the 40 meters to the back wall of the lake and dropped the tape for nine meters to the bottom. This additional nine meters makes the total depth of Sistema Purificación 904 meters. Afterwards, Dale, John, and Susie went to the Twin Hole Tubes near the entrance, but had trouble locating the end of the old survey. They quit after



The Balcony Borehole.

(Dave Bunnell)





Lakeland. (Peter Sprouse)

realizing that they were inadvertently resurveying. Nonetheless, the eight-day camp had added 3976 meters of new survey to the cave, giving Sistema Purificación a length of 71,575 meters.

Surface Exploration

The team packed up and left the cave on 21 March, retiring to the project fieldhouse near the Cueva del Brinco entrance. A short photo trip was made into Brinco that afternoon. The next day was spent looking for higher entrances to the south near Ejido Cuautemoc, Nuevo León. A number of pits were located, including Sótano de El Techito, a 55-meter drop which Susie and Allan mapped. John and Susie checked the next one, two small holes that opened into an 80-meter shaft. At the bottom, they encountered another drop, but couldn't raise contact with those on the surface to ask for more rope. Finally, they climbed out and discovered why. Everyone else was off on a karst pinnacle shooting a video of Dale and Peter performing caving songs. Later, Susie and Allan went back down Sótano del Café Molido, and descended the second drop 27 meters to the end. With that, the caving ended on another fine PEP trip.

PURIFICACION 1988

La expedición 1988 del Proyecto Espeleológico Purificación al Sistema Purificación, Tamaulipas, consistió de 10 espeleólogos, los cuales acamparon a 600 metros de la entrada llamada "Infiernillo". Los primeros días topografiaron 1200 metros en la sección denominada los "Confusion Tubes". El tercer día se topografiaron 150 metros de la laguna "Frustration" a la laguna "Desperation", mientras tanto otros dos grupos exploraron diferentes pasajes del "Jersey Turnpike". Posteriormente, se retornó a la laguna "Desperation" con resultado de obtuvo tres conexiones con el "Jersey Turnpike".

Probablemente el descubrimiento mas emocionante fue el del pasaje llamado Arrakis, al cual una escalada condujo al este. Se topografiaron 1500 metros y quedando otros pasajes secundarios sin explorar en suma. Los resultados en 8 días de exploración añadieron 3976 metros topografiados, y así sumandose en total 71.575 metros en longitud, la caverna más larga de México. Además varios sótanos fueron encontrados en la parte sur de la misma sierra.

CUEVA DEL TECOLOTE

1987 Expedition

Patricia Kambesis, Peter Sprouse and Carol Vesely



The arroyo draining the tiny village of Los San Pedro abruptly terminates at an imposing limestone bluff that holds the entrance to Cueva del Tecolote. Situated in a wide valley near the eastern edge of the Sierra Madre Oriental, Tecolote has proven to be one of the most impressive caves in the Purificación area.

Locals have installed two lengths of tractor tread in the vertical entrance in order to access the cave for water during the dry periods. The tread also serves as in-situ vertigear, permitting an unconventional descent or ascent. A short stretch of relatively dry bi-level passage quickly leads to the first in a series of three cable-ladder climbs and nine wet rope drops. These are separated by canal swims, short crawls, some canyon straddling, and lots of climbing. In the Undressing Room at the base of the Ides of March drop, the dual nature of the cave becomes apparent. The wet and vertical stream canyons change to dry, wide, mud-floored corridors that eventually open into boreholes in the far reaches of the system.

This large and sprawling cave, already surveyed to a length of 11,084 meters and a depth of -231 meters, was the object of a week-long exploration and surveying trip by Proyecto Espeleológico Purificación cavers over the 1987 Thanksgiving holidays. Project participants were Doug Allen, David Dodge, Paul Fambro, Bill Farr, John Fogarty, Terry Gregston, Erika Heinen, Patty Kambesis, Dale Pate, Peter Quick, Mary Sakry, Scott Scheibner, Peter Sprouse, Carol Vesely, Cyndie Walck, and Jack White. The crew settled in at the surface camp on the evening of 21 November, and prepared gear for a push on the following day.

Leads Off The Fantasia Borehole

Eleven cavers entered the system for the first trip, their objective: to rig the cave and map leads off the Fantasia Borehole. As is

Previous page: John Fogarty waits his turn while Pat Kambesis rappels the first drop. (Drawing by Linda Heslop based on photograph by Carol Vesely)

usually the case with many people moving at different speeds, the group became quite strung out in the upper section of the cave. However, once in the Undressing Room, they were able to regroup, as everyone stopped to change from wetsuits to dry clothes. Leaving the walls and ledges draped with wet neoprene, the survey teams took off for their respective destinations. Jack lagged behind the rest, with the intention of setting up a solo camp for the week in the Ides of March.

There are a couple of kilometers of cave to traverse before reaching the Fantasia Borehole. From the Undressing Room, a breakdown-floored passage with intermittent pools leads to Anxiety Canyon – a short stretch of smooth-walled canyon passage requiring a wide chimney over water. Just beyond is the last rope drop, at the Salón Del Puente, named after the natural bridge that spans the room. The route continues up and over a hand-line-rigged, flowstone slope that opens into the dusky corridor of the Dark Ages. This trend eventually intersects the base of a large breakdown room, Anotherhall. On the other side of the breakdown, a low, wide sandy crawl, Russian Dancer Borehole, leads to the flowstone-floored Rimstone Gallery. A short ladder descent at the far end of this room leads to the Fantasia Borehole. It's an awesome hike over the broadly sloping mud mounds in these spacious confines, 40 meters wide by 20 meters high.

Patty, Cyndie, and Scott tackled the first lead in the Fantasia Borehole. This passage trends to the northwest and is located just beyond the Fantasia Abyss. They mapped a sinuous descent into a small maze and up some short breakdown slopes to a junction. The left side terminated in a small room. The right side continued as a small-scale, mud-floored maze. This spiraled down through sharp breccia blades, earning the name Knives and Forks for the low sharp ledges and many junctions. The survey ended after 110 meters, when this passage pinched.

Carol, Bill, and Peter Quick started surveying in the second left-hand lead off of the Fantasia Borehole, the Mickey Mouse Maze. They carried a rope for a small pit-lead that had been seen near the beginning of the maze on the



Fantasia Borehole. (Peter Sprouse)

last trip. Descending the muddy, sloping pit, they continued the survey down a short, twisty crawl that opened into a wet walking passage. They were able to avoid the water by taking a meander loop that led to a T-junction. Starting with the upstream route, they surveyed over a five-meter-high flowstone mound, through a tight squeeze, and into the Just-Say-No Room. Every lead out of this room was even tighter and more slimey than the route in, so the team just said "no" to surveying any of them. Returning to the T-junction, they went downstream and discovered Bullwinkle's Borehole, a large, mazy trunk passage speculated to connect to the top of the muddy drop. They headed back with 642 meters of survey.

Peter Sprouse, John, and Dave continued on to Kennedy's Canyon – the farthest known-cave extent past the Fantasia Borehole

The date of 22 November inspired the name for this section of cave, which begins as a sinuous canyon in sharp breccia. The twisty route led around numerous holes in the floor and eventually to a T-junction. Exploration to the right terminated at a drop into deep water; the left opened into a spacious maze, with many ways to go. With many leads to choose from, the three mapped a passage that soon led to a long deep lake – definitely a wetsuit prospect. After 115 meters of survey, the group began the long trip out, unable to do much more due to the long commute. Survey trips to the far reaches of Tecolote average in excess of 24 hours.

Yucky Poodle

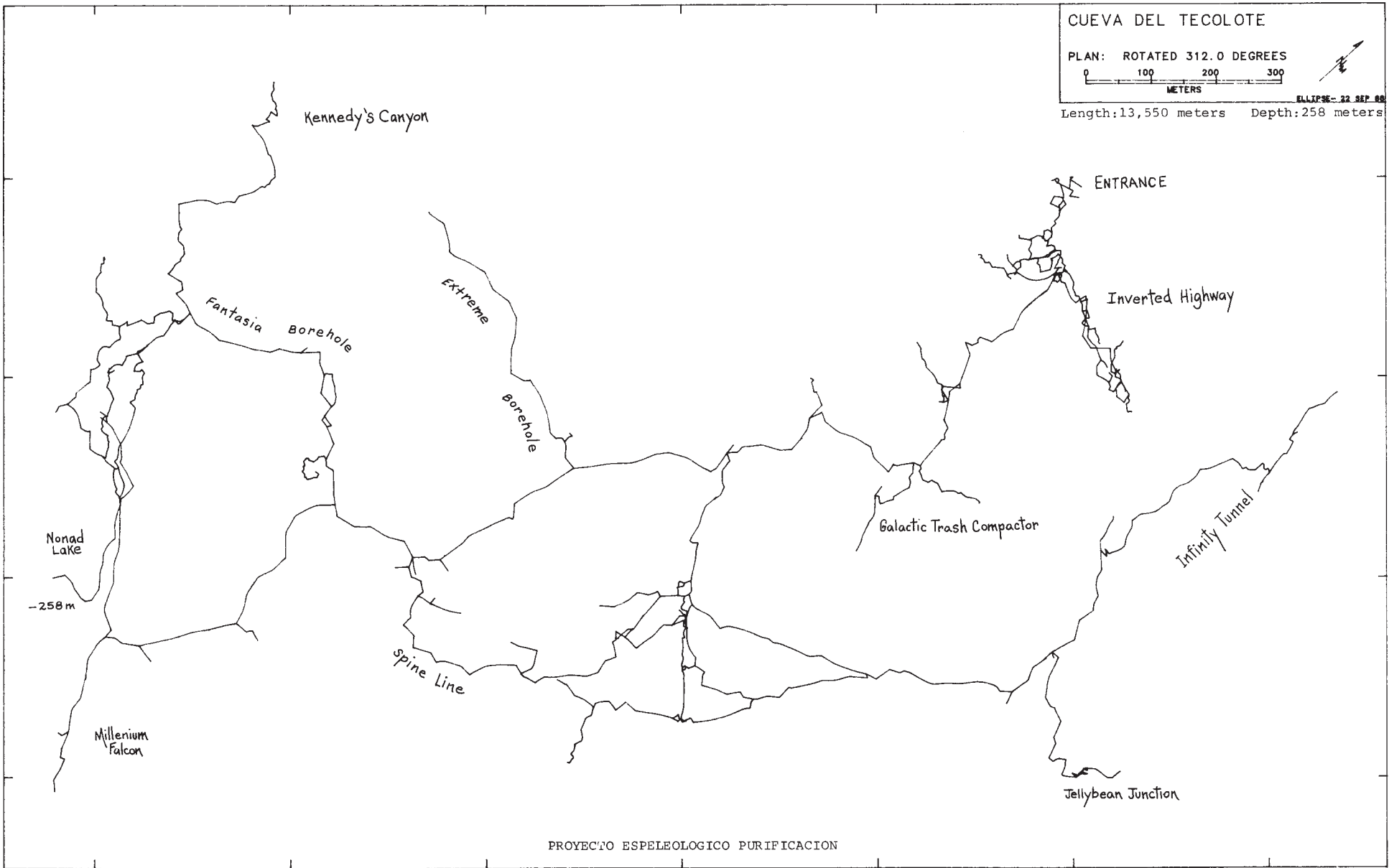
Two days later, two survey teams entered Tecolote. Peter, Peter, and Bill headed back to the distant parts of the cave, picking up Jack along the way at his camp. Jack, it seems, had relished underground living during the ten-day camp in Sistema Purificación the previous March, and wanted to try a solo camp. But by staying underground he ended up on a different schedule than the others, who would do long cave trips, then rest for a day on the surface. So, when the team met Jack at his camp in the Ides of March, he had been alone for 36 hours, and had just returned from an 11-hour, solo photo trip.

The four of them returned to the Mickey Mouse Maze area. But instead of descending the muddy pit, they traversed past it into a labyrinth of passages that Marion Smith had partially explored in 1986. Picking their way through the maze, they eventually reached larger passage – the Yucky Poodle Trunk. Breakdown nearly filled the passage at one point, but they were able to drop their tape through a constriction, the Eye of the Needle, and continue on to reach a T-intersection.

The team surveyed 100 meters of large passage off of the right arm of the T and tied into the end of the previous survey; they had found Bullwinkle's Borehole from the other end. The left arm of the T led to an even larger borehole, which dropped down a steep slope into a mud funnel, with the main passage continuing overhead. Popping through the bottom of the funnel, they found two leads. To

CUEVA DEL TECOLOTE
PLAN: ROTATED 312.0 DEGREES
0 100 200 300
METERS
ELLIPSE-22 SEP 89

Length: 13,550 meters Depth: 258 meters



PROYECTO ESPELEOLOGICO PURIFICACION

the left was a sloping bellycrawl with blowing air to a low lake. To the right, they crossed a crotch-deep body of water, dubbed Nonad Lake. Beyond, the passage climbed up wet breakdown to another, deeper lake. Jack waded out into the water, clinging along the wall for a while, to report that there was no end in sight to the canal. The group turned around in this going passage with a survey total of 699 meters. In addition, they added 27 meters to the overall depth.

Upper Cave Clean-up Survey

On the same day as the Yucky Poodle trip, Carol, Erika, John, and Patty did a short photo trip followed by some clean-up survey in the upper section of the cave. Their first lead was at the base of the Spiral Climb. The beginning of this passage is well traveled by cavers who miss the climb on the way out. The survey proceeded through a bellycrawl to a nicely decorated dome. They popped through a small ceiling hole into a very short stretch of



Erika Heinen in a passage above Flowstone Falls. (Carol Vesely)

stream passage. One end continued low and muddy. The other, which took air, was blocked by flowstone. Passage was evident beyond the plug, but it would require chemical magic to make it accessible.

Their second lead was located beyond a climb on the right wall, five meters above the lip of the Flowstone Drop. John negotiated the climb, and rigged the rope for the rest. A short stretch of vadosly modified passage led to the Bat Room. The destination was an obscure little mud crawlway that Erika had seen on a previous trip. The foursome mapped ten stations in this tight twisty passage, which got even tighter and muddier, with no air. At the end of the trip, their survey total was 116 meters.

On To Infinity

The last survey day in Tecolote was 26 November. Three highly motivated teams headed in, their destinations: the Serious and Fantasia Boreholes.

Peter Sprouse and Bill zoomed out to the end of the Serious Borehole, where a blowing cobble choke had stopped previous exploration. Bill sniffed out a route, and the two moved a few rocks, enabling them to drop into a major north-trending passage reminiscent of some of the boreholes in Infiernillo. They began stretching the tape for regular 20-meter shots over the mud-covered floor of the Infinity Tunnel. Part way through the survey Peter paused to collect a troglobitic spider. Of the many cave-adapted spiders in the area, this was the first completely eyeless species. During their survey, they passed several side leads, finally stopping after 603 meters at a shallow lake with good airflow.

The Mazes Revisited

Cyndie, Jack, and Patty chose to survey in the Mickey Mouse Maze, while Carol, Scott, and John planned to continue pushing and mapping in Kennedy Canyon. Unfortunately, the "turistas" caught up with John by the time he reached Anotherhall. Scott volunteered to leave with him. The remaining four cavers consolidated into one survey team, and decided to go for the Maze.

Returning to the Bullwinkle Borehole section of the Mickey Mouse Maze, the team hoped to continue the survey. However, they discovered that everything in the immediate vicinity either ended or had already been mapped. They surveyed a short loop off the Yucky Poodle Borehole and pushed some side leads in search of something else that went. Finally, Jack found a small, tight, canyon passage with good air, the Yucky Puppy Subway. But before resuming the survey, Jack suggested that they indulge in a "power nap" – a short intense sleep that supposedly rejuvenates. Cyndie, Carol, and Patty awoke refreshed. Jack, appalled to learn that women snore on occasion, was unable to reap the benefits of his nap due to this disturbing fact.

The team mapped a convoluted route through narrow, mostly stooping-height passage. A steeply inclined chute was ascended into the breakdown floor of a breezy, bone-yard corridor. The entrance hole was so obscure that it had to be flagged. At this point Jack and Cyndie had had enough, but Carol and Patty didn't want to turn around in going passage. They reached an amenable compromise. Cyndie and Jack would head for Jack's underground camp and wait there. Carol and Patty would continue the survey, but not before having another power nap.

The good air movement in this passage was encouraging, even for a maze. A thin layer of mud on the floor, indicative of back-flooding, made the footing interesting. Several multi-passage junctions made it confusing. And as the survey progressed the passage got bigger. All this caused mixed feelings for the surveyors. On the one hand, they were thrilled with the big going passage. At the same time, they were clueless as to where they were in relation to the rest of the cave. The notes indicated that they might have doubled back towards the beginning of the Mickey Mouse Maze, or could they be in some obscure, remote area more than six hours from the entrance?

Then to their disappointment, and relief, they found footprints with a clearly numbered survey station nearby. But when they looked up the station in the book, the passage did not match the sketch, and compass readings were 90 degrees off. The theme music from the



Cyndie Walck rappels the Salón Del Puente drop.
(Drawing by Linda Heslop,
based on a photograph by Carol Vesely)

Twilight Zone played through their minds. Later, it was determined that there had been a mix-up in labeling the end-of-survey station on a previous trip.

Not knowing where the connection station was in relation to the rest of the cave, they resigned themselves to retracing their tight, windy route – not an inviting prospect. But before they left, Carol wanted to explore around just one more corner. To her pleasant surprise, she came to the muddy pit lead that she had mapped earlier in the week. The Fantasia Borehole was just around the bend, and in a few minutes they were tromping down big passage heading for home. A quick tally of the notes revealed 395 meters surveyed. After checking one more lead, they headed out, derring the Rimstone Gallery and Salón Del Puente drops on route. Upon reaching Jack's camp, they were informed that Cyndie had left hours before with Peter and Bill. Carol and Patty proceeded to the Undressing Room, dropped off the ropes and cable ladder, and



Bill Farr in Bullwinkle's Borehole. (Peter Sprouse)

experienced the inevitable warm skin, cold neoprene blues.

A chilling breeze whipped through the upper stream passages, and the canal swims seemed colder than usual – a cold front must have hit. They passed the first of the derigging team headed into the cave and Peter Quick related that instead of sunshine they could expect overcast skies and drizzle. But Thanksgiving dinner was being cooked as they spoke. "Yeah, you know those two cute baby goats in camp the other day..." That night everyone enjoyed a cabrito feast and a mandolin and guitar serenade compliments of Peter Sprouse and Dale.

The mapping endeavors of the week added 2466 meters to the surveyed length, bringing the overall total to 13,550 meters, and added 27 meters to the depth, making it 258 meters. The speculated resurgence is still quite a distance away, and many of the passages surveyed had evidence of backflooding: the main drain has yet to be found. Because the remaining leads are from four to six hours from the entrance, and trips have been over 24 hours long, underground camps will be necessary for major pushes in the future.

New Caves

During the explorations in Cueva del Tecolote, Dale Pate, Paul Fambro, and other members of the crew were exploring a new cave to the south of Tecolote. Sótano de Trejo has a 15-meter entrance drop with going passage at the bottom. A number of different passages, with several streamways, were explored and by the end of the week 756 meters had been mapped to a depth of 78 meters.

Joining in the Sótano de Trejo explorations were Charles Fromen and George Sanders, who earlier in the week had been locating entrances in the Arroyo Trejo, some 18 kilometers south of Tecolote. They succeeded in reaching their main objective, Cueva de la Encantada. Just inside the entrance is a sump lake that has significant flow during floods, judging by the large stream cobbles. Much more remains to be done in the area.

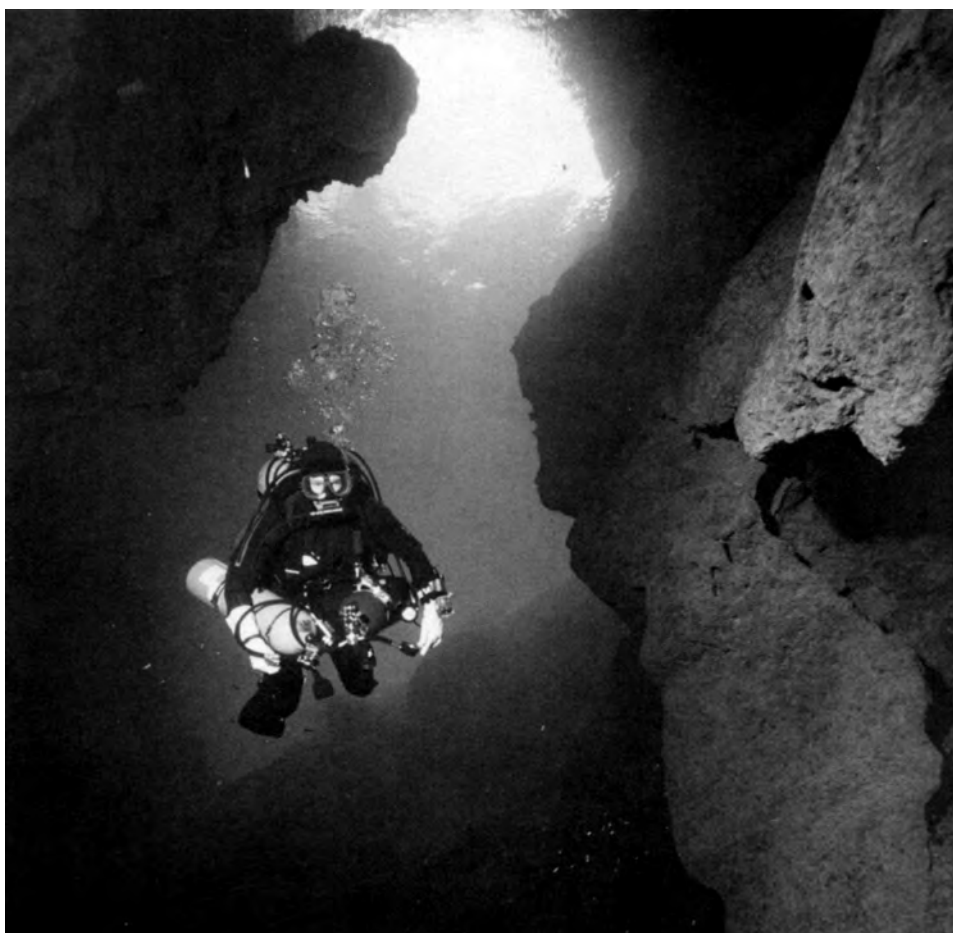
TECOLOTE 1987

En noviembre de 1987, espeleólogos del Proyecto Espeleológico Purificación condujeron la sexta topografía en la Cueva del Tecolote, Tamaulipas. Tecolote es una caverna compleja, con pasajes de bastante tamaño, con longitud anteriormente de 11.084 metros y profundidad de 231 metros. Varios pasajes fueron explorados a partir del Fantasia Borehole, y uno de los cuales condujo al complejo Mickey Mouse, en donde pasajes secundarios quedaron sin explorar. El total de pasaje topografiado fue de 2466 metros, sumando 13.550 metros en total y aumentando la profundidad a -258 metros. Al mismo tiempo exploraban otra cueva llamada Sótano de Trejo, hasta una longitud de 756 metros y una profundidad de 78 metros.

WORLD DEPTH RECORD BROKEN IN MEXICO

Sheck Exley

I paused at the lip of what could be the world's deepest pit. Aiming the beam of my lamp downward, I saw the slender white thread of my rope plummeting past jagged gray walls before disappearing in the darkness. I dropped a small rock down the pit, and it disappeared without a sound. Geologic evidence suggested that it could be more than 600 meters deep. Maybe this time the geologists were right, for the pit had been descended to a depth of 183 meters without seeing bottom, and Golondrinas was less than 30 kilometers south, in the same mountain range. I felt a surge of adrenaline as I leaned out farther and began my descent without being attached to the rope.... After all, the rope was only 1.6 mm in diameter! --- The pit at Mante is completely filled with water.



Sheck Exley beginning his dive in Nacimiento del Río Mante. (Ned DeLoach)

The fact that the pit is underwater means that I can ascend and descend effortlessly, without a rope, rack, or ascenders. It means that I cannot be injured in an uncontrolled fall, and I don't have to wear a helmet to protect my head. Since I am nearly weightless, I can also carry five large, heavy lights, each of which is considerably brighter than the most powerful lamps used in air-filled caves. Also, I need not worry about bad air in the pit, since I carry my own breathing supply. Despite these benefits, however, successfully bottoming an underwater pit is much more hazardous than yo-yoing an air-filled chasm. As a matter of fact, most of America's top cave divers consider reaching the bottom of Mante's Macho Pit impossible.

For one thing, there is the ferocious flow of water, which prevents serious dives at Mante for most of the year. Even though it was the height of the drought, I felt like I was trying to swim up Niagara Falls, or more appropriately, Angel Falls, as I worked my way downward by tugging on the rocks and bracing my legs against the walls of the narrow pit. I was racing against time. To avoid running out of breathing gas or getting the bends, I would have to start back up after only 24 minutes. On the other hand, I couldn't go so fast that I would become winded. If so, I could also run out of breathing gas by elevating my breathing rate, or simply black out and drown from any of a number of problems, such as carbon-dioxide buildup. It was a delicate balance, which kept most of my mind fully occupied, despite months of training and a quarter-century of experience. After all, no one had ever before attempted to dive below 201 meters without a submarine, even in controlled conditions in open water, much less in a cave.

History of Record Dives

Record cave dives are not new to Mante. On our first expedition in 1979, Paul DeLoach and I reached a depth of 100.6 meters in Macho Pit, the second deepest cave dive in the world to that date. (The deepest dive at the time was my 1978 descent of Boiling Hole, Andros, Bahamas, a scant three meters deeper at 103.7 meters.) Then, in April of 1987, I soloed to a depth of 158.5 meters, set-



Nacimiento del Río Mante entrance.
(Peter Sprouse)

ting a new American record by 48.8 meters. The dive was second only to German diver Jochen Hasenmayer's 1983 descent in France to 200 meters. Two months later, I returned to Mante with Mary Ellen Eckhoff, the world's premier woman cave diver for the past decade. Mary Ellen hit 122 meters, breaking her own seven-year-old world mark for women, and becoming only the second American of either sex to attain that depth. Two days later, I reached 201.2 meters, "officially" a world record by 1.2 meters. But I felt like I was cheating my good friend Jochen; below 190 meters it is impossible to gauge depth more accurately than to the nearest three meters.

I focused part of my attention on my 16 decompression tanks, which were tied off at various depths. Each contained a different mixture of oxygen, helium and nitrogen, carefully calculated to enable me to avoid the bends, hypothermia, and oxygen toxicity, a major cause of fatal accidents in the few previous attempts to use helium in underwater caves. As I reached the last one, at 100 meters I relaxed a little. Sergio Zambrano and Angel Soto, Mexico's two best cave divers, had done their usual excellent job of placing each tank precisely where it was needed. Without their help, and Ned DeLoach's assistance, I couldn't have even gotten this far.

I exchanged the tank I had breathed from the surface for another one at 100 meters,

then continued down. Macho Pit expanded to a width sufficient to diminish the speed of the up-rushing torrent. Because of the heavy tanks I was wearing, I could now make a controlled fall down the pit without clawing the walls. At 158 meters, I clipped a depth gauge and spare watch to the guideline, then switched to my main tanks before continuing my descent.

Three minutes later, I reached the end of the previously-installed guideline at 201.2 meters and tied on the end of my new line. Now our \$20,000 expedition was a success: with every meter of descent, a new world record was set. I played the 40-watt beam of my primary light back and forth over the pit as I sank ever deeper, enjoying the awesome grandeur of the plunging chasm. It seemed as if it would go on forever. Maybe Jules Verne was right, except Arne Saknussemm was not a cave diver....

Equipment Problems

At around 210 meters, I noticed that the northwest wall of the pit had begun a steep slope, heralding a possible end to the pit. But now, I had cause for serious concern. One of my many systematic equipment-status checks revealed that my tank-contents gauge had not changed since my previous reading. The tremendous pressure had bent the thick lens inward, trapping the needle. Fortunately, I was able to free it by banging the metal housing on a tank.

A short distance farther, I decided that I had gone far enough, so I headed for a rock projection six meters below me where I would be able to tie off my line. Suddenly, a deafening roar and enormous concussion shook the cave, and might have dazed me, if I had not been wearing a thick wool hat and rubber hood on my head. A few quick checks showed that the battery pack of my primary light had been shattered by the nearly 100,000 pounds of force it was subjected to at that depth. Since my lamp was still burning, the problem was not serious, except for the slight loss of buoyancy due to flooding of the battery case.

I continued down, quickly tied off on the projection, left a marker for posterity, and checked my elapsed time: 24 minutes since beginning my descent. Then I had a quick look

around. There was no doubt about it. The northwest wall was now definitely a floor, sloping in and down at an angle of about 45 degrees. Macho Pit was finally bottomed! As I started back up, thoughts rushed through my mind: sadness that the world's deepest free-hanging pit would not be underwater, a sense of triumph at having set a new depth record and reached the bottom, and not a little bit of anxiety over the ten-hour ordeal of decompression stops awaiting me on ascent.

52 Decompression Stops

At 213 meters, I discovered a new cause for alarm. My primary breathing regulator, specially designed for extreme depth, started shutting off. Fortunately, the problem was a malfunction and not a lack of breathing gas. I was able to switch to another regulator, and continue my ascent. The first of 52 lengthy



Sheck Exley cooling off in sump pool before the dive. (Ned DeLoach)

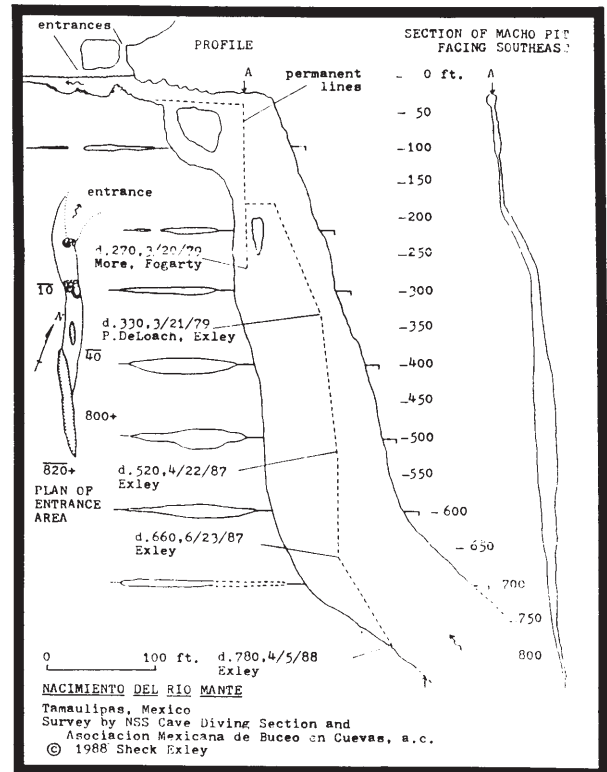
decompression stops to avoid the bends was at 158 meters. It felt a little scary stopping to do post-dive decompression at a depth 36.6 meters *below* the maximum dive depth ever attained by another American cave diver.

A few hours later, at a depth of 37 meters I checked the remaining measured line on my reel, and saw that I had laid 43 meters of guideline on the dive. The slope of the new line below 201 meters feet was 10 degrees to 30 degrees from vertical, so the depth of my dive was between 237 and 243 meters.

The free-hanging portion of Macho Pit extends from six meters to a steep slope at approximately 220 meters, for a total depth of 213 meters. Since the cave extends nine meters above the water surface, the total explored depth of the cave is 247 to 252 meters, and I could see that it extended at least six meters deeper.

Acknowledgements

Thanks to Arwyn Carr of Spring Systems Dive Resort, Dale Sweet of Scuba Etcetera, and Paul DeLoach for donating supplies and equipment. Also thanks to Paul Heinerth, Bill Hamilton, Bill Stone, John Troutner, Lamar English, and especially my support divers, Sergio Zambrano, Angel Soto, Ned DeLoach, and Mary Ellen Eckhoff. And a special thanks to Jesús Escabedo Gonzáles and his family, owners of the spring, who allowed us access and helped with the dive.



NACIMIENTO DEL RIO MANTE

En junio 1988, Sheck Exley estableció otro record mundial en profundidad de buceo al descender 238-242 metros en el Tiro Macho del Nacimiento del Río Mante, Tamaulipas. El primer espeleobuceo en Mante fue alcanzado a una profundidad de 100 metros en 1979. En 1987, Mary Ellen Eckhoff exploró hasta -122 metros, y dos días después Exley descendió hasta 201 metros, batiendo el record mundial anterior realizado por el alemán Jochen Hasenmayer de 200 metros.

Luchando con la corriente, Exley utilizó las paredes para así descender más fácilmente. A -213 metros, Exley notó que la pared noroeste alcanzó 90 grados de pendiente, pero luego cambió a 45 grados. Repentinamente su luz primaria explotó debido a la presión de aproximadamente 100,000 libras. Hubo otros problemas también con su regulador especialmente diseñado para dichas profundidades, y una aguja atorada en el medidor del tanque. El proceso de descompresión tuvo 52 paradas en 10 horas, requirió 16 tanques con una mezcla de gases. Los buzos Sergio Zambrano, Angel Soto, y Ned DeLoach ayudaron en este record de espeleobuceo.

Cenote Sac Actún



The White Cave

Jim Coke

Johanna de Groot diving through Cenote Sac Actún using sidemounting. (Jim Coke)

Descending through crystal clear fresh water, we are greeted by the intact remains of an alligator (lagarto in Mayan). Are we actually ready to explore the cavern zone of this new cenote, or cautiously search for Lagarto's living cousins? The cave zone beckons, as our trained dive team chooses fight, not flight. Once in the cave zone, I wonder how long alligators can hold their breath. It seemed only minutes before all of our exploratory reels were empty, leaving 250 meters of continuous guideline leading the way out of this remarkably decorated and complex cave. The amount of air left in our tanks indicated that it was time to return to the cavern and exit. Elected as the surveyor on this trip, I remained at the rear of the team, surveying passage and leaving markers on the permanent line where side

tunnels looked promising. It was only through my perverse sense of humor that I imagined seeing a silent underwater coin toss between Johanna de Groot and Steve DeCarlo. Who's to be the first into the cavern *¿Aguilas o Soles?*

This was our introduction to an underwater cave that continues to surprise us in its varied colors and complexities. Nine months of intense study has revealed a different type of cave formation and environment not generally found in this area of Quintana Roo, Mexico. Sac Actún (White Cave) is in part a product of heavy stream erosion and changing water-table levels as evidenced by its grand speleothems and vadose nature. The speleogenesis is so unusual that underwater caves found a short distance away, Carwash and Temple of Doom

cenotes, have entirely different characteristics, suggesting that stream erosion had less of an active role in their formation.

Geographical circumstances seem to have contributed to this vadous speleogenesis. Rough land surveys place Sac in the middle of a large limestone pressure ridge six kilometers from the ocean. Much of the cave passage is fault and joint controlled; this being determined by the general geologic position of the uplift. Smaller cenotes are located on the breakdown edges of this ridge. Although they are not extensive and have not been connected with the main system to date, they do contain strike and fault orientations similar to the main cave. These characteristics, coupled with a stronger than normal water flow, lead us to believe that we are in the center of a major drainage pattern. Further investigation of the cenote's siphon side will likely produce more cave and perhaps more evidence to support our theories.

Many animals find the area ideal for their water needs, as there are numerous cenotes connected in the system. Deer, monkeys, and flocks of birds are common sights. Tracks of nocturnal animals mark the smooth mud surfaces close to the water's edge. Cave-adapted blind fish, isopods, and crustacea are seen in all sections of the cave, thriving in the oxygen-rich water. Sac Actún is indeed a river: an underground river of life for many diverse creatures.

Two New Techniques

Our initial dive into Cenote Sac Actún was made possible by two new exploratory techniques we currently have at our disposal. The first is a Cessna 172, used in spotting cenotes from the air. Slow air speeds combined with the early morning sun produce a strong 'water wink', or sun reflection, on the cenote pools. We limit our search to the more inland areas, where those cenotes found should have large cave systems. For now, we are ignoring the cenotes situated closer to the ocean, as their caves tend to be smaller and not as enticing.

The second exploratory technique allows us more versatility and mobility when attempting longer jungle treks to virgin sites. The

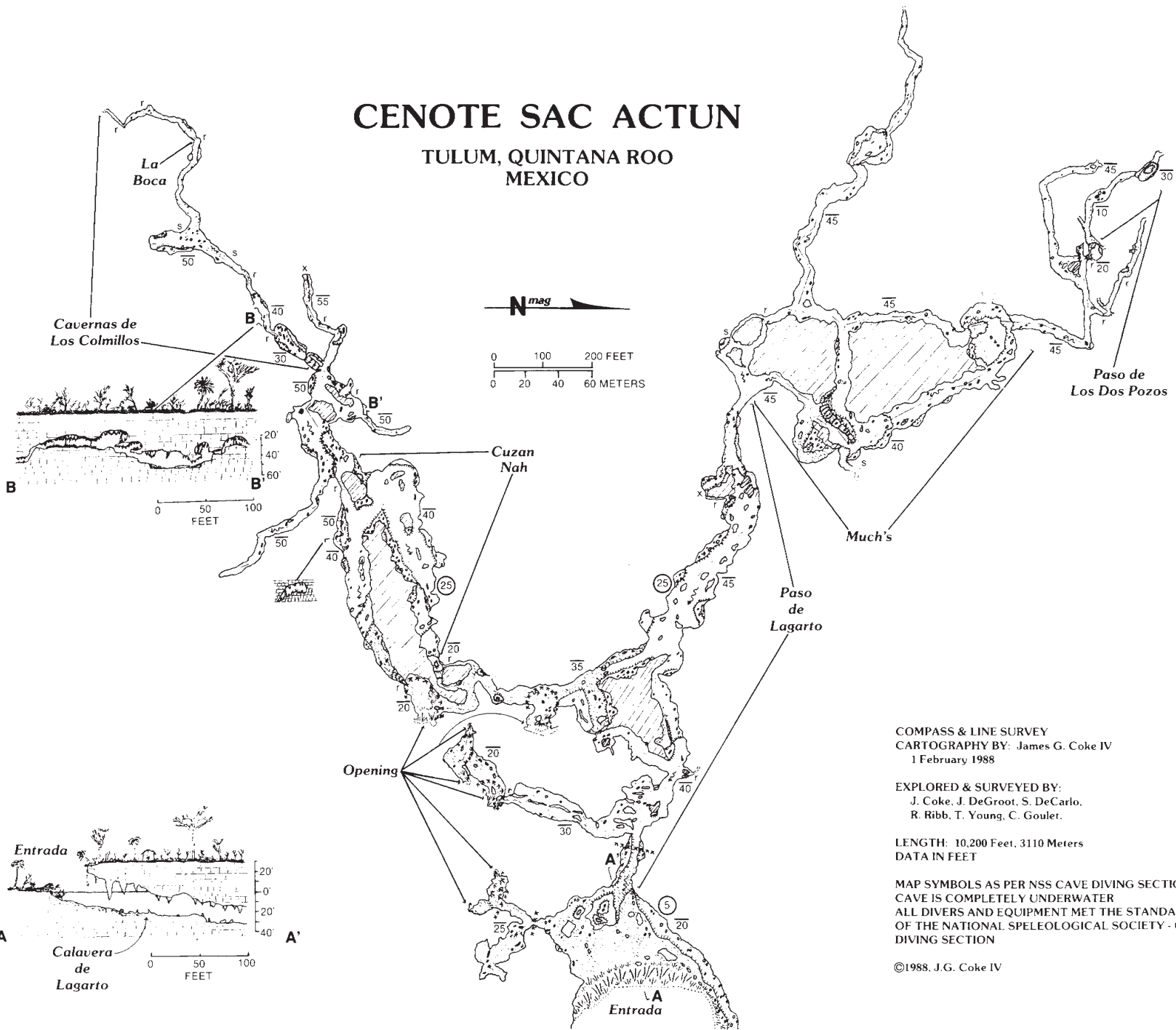
weight of a full cave-diving kit approaches 65 kilograms, far too heavy to manage under less than ideal conditions. Broken bones and heat exhaustion, although uncommon, are very real possibilities. Horses and porters are also out of the question unless an already explored system warrants them. Therefore, we've elected to use a common equipment configuration designed by cavers diving sumps, i.e., sidemounting. Equipment weight is drastically reduced to 18 kilograms and everything is easily stowed in a small backpack. Using this method creates an alpine-style approach, making long-range cave exploration possible.

Incorporating the sidemount kit, divers were able to extend upstream exploration to a surveyed length of 900 meters. Average water depths are shallow, eleven meters, allowing more time in the cave due to less air consumption. As cave divers save two thirds of their beginning air supply for the return trip, much of the cave complex close to the cavern entrance was quickly explored. Seeing that more cave lay beyond our single-tank limits, we hesitantly discussed the subject of diving with double tanks. Time and transportation were the key problems. Fortunately, the last virgin lead explored with sidemounts resulted in a new cenote! Surfacing in this offset sink, we discovered that the entrance was only 80 meters from the road. Full cave-diving kit was now feasible, as soon as a path could be cleared through the jungle. The real possibility of extending Sac was now at hand.

Now longer dives could be made, and Sac Actún was most accommodating for us. Depth remained shallow in most parts, as we surveyed through phreatic tunnels and large domed chambers. White silt dunes, formed by the current, lay along the left and right walls of the passage, while cave pearls and rimstone dams occupied the centers of these conduits. The large chambers found at the end of these tunnels resulted in slight disorientation. Which way should we go to find the most passage? Time and air were running out, we needed to make a decision! With these thoughts in mind, we intentionally disturbed a small amount of silt, which would indicate the direction of water flow. Strong water flow meant more cave beyond; precious air was saved for true passage rather than fruitless searching.

CENOTE SAC ACTUN

TULUM, QUINTANA ROO
MEXICO



COMPASS & LINE SURVEY
 CARTOGRAPHY BY: James G. Coke IV
 1 February 1988

EXPLORED & SURVEYED BY:
 J. Coke, J. DeGroot, S. DeCarlo,
 R. Ribb, T. Young, C. Goulet.

LENGTH: 10,200 Feet, 3110 Meters
 DATA IN FEET

MAP SYMBOLS AS PER NSS CAVE DIVING SECTION
 CAVE IS COMPLETELY UNDERWATER
 ALL DIVERS AND EQUIPMENT MET THE STANDARDS
 OF THE NATIONAL SPELEOLOGICAL SOCIETY - CAVE
 DIVING SECTION

©1988, J.G. Coke IV

As the line plot expanded on paper, general trends in the upstream sections were noted. Current and compass direction, combined, made reliable indicators of passage ahead. Exploratory dives were now lasting one-and-a-half hours, with straight-line penetrations of 800 meters. Also six new windows into the cave had been discovered, connecting a total of eight cenotes. It was at this point in time that the accompanying map was drafted.

Recent Explorations

One week after the survey was finished, two long staged penetrations were planned, expected to last at least two-and-a-half hours each. Poking beyond Much's Maze (Spider's Maze in Mayan), the dive team found a small joint-controlled tunnel that led into two huge dome rooms, resulting again in a frantic search for more cave. A primary-light failure caused a premature end to this dive, yet not before a rapid solo effort uncovered going passage.

The second dive was planned using the usual two cylinders of air, plus a spare primary light. One hour of swimming took us to the end of the line, and a major breakthrough in exploration. Heading through borehole, we were abruptly halted in a breakdown dome filled with white silt. Having already emptied one exploration reel of 145 meters and barely begun the second, we forced a low bedding-plane passage in the direction of a weak current. A large chamber with black silt welcomed us with a hint of natural daylight! The new cenote, Bosh Chen (Black Well in Mayan), was another offset sink, located near the

main road. Land distance from Bosh Chen to Sac Actún is 500 meters. Using a machete and ladder, we gained access to the entrance, thereby avoiding a 1150 meter swim. Surely there was more to find. In fact, by including this new cenote, the Sac complex contains more than four kilometers of surveyed underwater cave on the spring side alone.

The Downstream Section

As for the downstream section, currently more than 150 meters of underwater passage has been surveyed, ending in an air-filled chamber with a sump a few meters away. It is accessible only through the main cenote containing the alligator skeleton. We may be fairly slow in exploring this section, however. There are a few unconfirmed rumors about the origin of certain tracks found in the mud near the siphon entrance.



Lagarto - alligator bones. (Jim Coke)

CENOTE SAC ACTUN

El Cenote Sac Actún es una cueva sumergida por las aguas, localizado en el estado de Quintana Roo, cuya espeleogenesis quizá sea única en el área, túneles espaciosa de poca altura con formaciones formidables. Perlas y gours nos sugieren un desarrollo vadoso. La corriente fuerte, junto con las fallas, indica que quizá Sac Actún sea un drenaje principal. El cenote fue encontrado con avioneta. Espeleobuzos exploraron y topografiaron 3962 metros aguas arriba. En adición, se topografiaron 152 metros corriente abajo, encontrando pasaje seco, seguido por un sifón. Hasta la fecha se han encontrado ocho diferentes entradas de tipo cenote.

The Connection Dive Between Sistema Huautla and Nita Nanta

Jim Smith



I shook my wetsuit, hoping to dislodge any scorpions that might be clinging to the inside. The little devils are "fishing scorpions" and quite amphibious. They have been observed walking on the bottom of pools and clinging to the undersides of muddy ceilings. The potency of their poison has yet to be determined and I didn't want to be the first. My diving suit had been hanging in the Scorpion Sump chamber between dives. Now it was time to suit up and glide into the inky blackness of an airless world.

The 1987 Sistema Huautla Expedition had one goal: dive...dive...dive! Dive for a connection between Sistema Huautla and Nita Nanta, in hopes of having the second-deepest cave in the world. A connection would yield a 1370-meter-deep cave. Diving was our last resort, since we had spent weeks in 1985 trying to probe the breakdown at Loggerhead Hall in Sótano de San Agustín for the illusive connection to Nita Nanta. That effort was not without reward, however, since we did discover a connection to La Grieta, which reinforced the effectiveness of our survey as an exploration tool.

As usual, there was some dissent over how to achieve the goals of the expedition. Some ardently felt diving required too much

expenditure of energy for the chance of not connecting. Those individuals wanted to continue to work in the breakdown maze at the Quadruple Connection site. Fortunately, there were those willing to give diving a chance and bear the burden as sherpas. These cavers would be the real heros, if diving was successful.

A tremendous amount of preparation was required to set up the sump dive. The expedition focused its energy on hauling into Sótano de San Agustín more than 26 PMI ropes totaling 600 meters in length. The rigging took two trips.

A team was sent to the beginning of Kinepak Canyon to pyrotechnically enlarge a crawl

originally enlarged by Bill Stone and Hal Lloyd in 1979. This chore was necessary because the tight crawl would otherwise require unpacking duffle bags. Following the passage enlargement, we could establish Camp IV in a sandy area before the climb up into Loggerhead Hall. For hauling the heavy equipment to Camp IV, five ropes were rigged to protect otherwise easy freeclimbs. Sherpas would then have to haul in two loads of diving and camp equipment, each weighing up to 25 kilograms. Once this was accomplished, dive exploration could begin.

On 25 March, Don Broussard, Ed Holladay, Bill Steele, Alan Cressler, Paul Wojtkowski, Hal Lloyd, Doug Powell, and I entered Sótano de San Agustín prepared to camp underground for eight days. The cave had been rigged and all the equipment hauled down to Kinepak Canyon. Three trips were made back and forth along the 1.5-kilometer length of Kinepak Canyon ferrying the remainder of the equipment to Camp IV. The last of the team dragged into camp 17 hours after entering the cave.

The Big Day

When I awoke, the silence of the cave seemed deafening. I began to think about the task that lay ahead of us, and psychologically prepare myself to lay my life on the line, no pun intended. I was to be the exploration diver. I had over 50 dives logged in some awful conditions, through body-tight sumps and zero-visibility. Nevertheless, I considered myself a novice in the diving community. Before every dive, I always feel apprehension and foreboding about whether I am mentally prepared, and whether there might be some hidden flaw in my equipment that might cause it to fail in the worst situation. I suppose I would be considered suicidal if I didn't worry about it. At any rate, I had survived dives of the past, and this one was no different. But it couldn't be taken for granted.

After a hearty meal, the group prepared to haul dive equipment to the sump. It was 26 March, a day of success or failure. Three scuba diving tanks: two 100 cubic-foot Acurex tanks and a 14 cubic-foot aluminum pony

tank were packed in foam rubber and soft packs for the journey to the sump. In one duffel bag there were three first stages (two Sherwood Magnums and one U.S. Diver) and regulators with high pressure gauges. Additional gear included: one farmerjohn wetsuit, 12 kilograms of lead, one backpack, a set of Rocket fins, a line reel with 300 meters of line, buoyancy compensator, mask, assorted essentials and five dive lights. The weight and bulk of the equipment required six sherpas.

Equipment was passed up and through a breakdown squeeze leading into Loggerhead Hall. At the other end of the chamber, a climb-down led to a ten-meter-long belly-crawl. This whole section of the cave was a biologist's dream come true, for it is the habitat of *Alacran tartarus*, the aquatic cave scorpion for which the sump was named. It gave me the creeps, and each of us kept our eyes peeled for the little hunters.

Scorpion Sump was reached after more than an hour of tugging on snagged duffles. The perch on the edge of the sump was only large enough for me to stand, requiring the others to lay in the crawl or sit in cramped quarters. It took me two hours to untape valves, assemble the scuba equipment, and suit up. The moment of reckoning was at hand, and after a leak and light check was performed, I was ready. I felt confident and at ease, the way you're supposed to feel before committing everything.

The water was enticingly clear and deep. I submerged, and tied off the dive line. I directed my light around the circumference of the submerged passage, sighting at least two obvious directions to follow. The compass pointed north – the direction to Nita Nanta. The depth gauge read 9 feet (2.7 meters) and I hung suspended in the clear water a meter above the bottom of the channel. The beam from the powerful Faralon light indicated there was an airbell ten meters ahead. I kicked a few powerful thrusts, and my course followed the gravel-bottomed channel until I broke the surface of the water. I caught a glance of a scorpion scurrying across the bottom of the channel, away from my approach.

Connection Made

I crawled out of the sump and dropped the regulator from my mouth. I didn't recognize where I was so I took off my fins and continued to reel out the line until I could reach a tie-off. I was hoping to find another sump. Then I realized I was in Nanta! The connection was made. I recognized instantly a climb-up into breakdown, and a narrow side passage. I had not been in this section since 1983. I surveyed back through the sump and surfaced with thumbs up.

The next day I took everyone but Paul through the sump to survey the remaining 150 meters of traverse to link the two surveys. The goal of seven years of hard work had finally been realized with a few thrusts from a set of fins. Tank hauling had paid off, as it did in 1980 when the Li Nita-Sótano de San Agustín connection was made by Bill Stone and his crew of sherpas. The field-calculated depth was 1370 meters. The length of Sistema Huautla was increased to 52.1 kilometers by this dive and other explorations occurring later in the expedition. The depth of Sistema Huautla was later revised to 1353 meters, when two other connections revealed an earlier survey error.



A scorpion in Scorpion Sump. (Jim Smith)

HUAUTLA  PROJECT

CONEXION EN HUAUTLA

El 26 de marzo de 1987, Jim Smith buceó 10 metros del sifón "Scorpion" y conectó así Nita Nanta con Sistema Huautla. Dicha conexión añadió más longitud y profundidad al sistema, hasta 52.1 kilómetros y -1353 metros. A pesar a la corta distancia en el sifón, las preparaciones tomaron bastante tiempo y trabajo. El grupo colocó las cuerdas necesarias que conducen al Campamento IV, para así descender el equipo necesario. Esta conexión dió termino a varios años de exploración y esfuerzo utilizados para conectar Nita Nanta con Sistema Huautla.

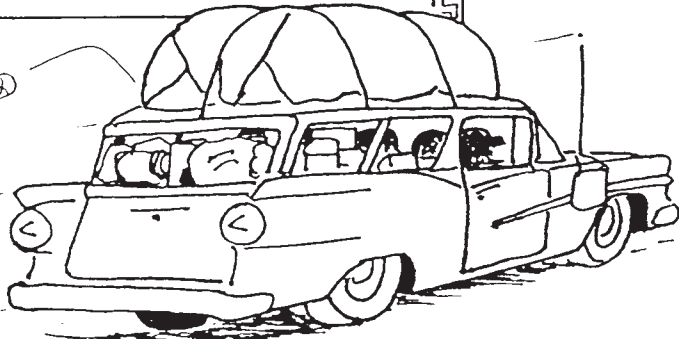
A BRIEF LOOK AT

THE RISE AND FALL

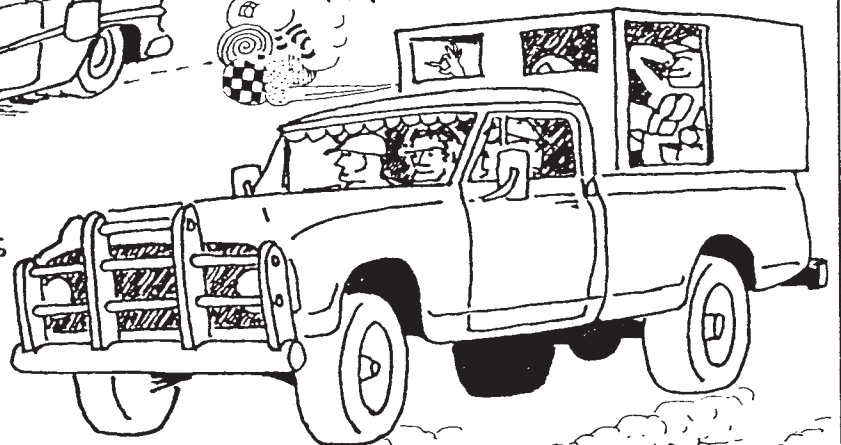
OF CAVING TRANSPORTATION
USED BY AMCS TYPES.

IN THE 50'S AND EARLY 60'S JUST ANYONE'S FAMILY WAGON WAS APPROPRIATED FOR THE DRIVE SOUTH. REASONABLE COMFORT. NOT SUITED TO LOCAL MEXICAN ROADS.

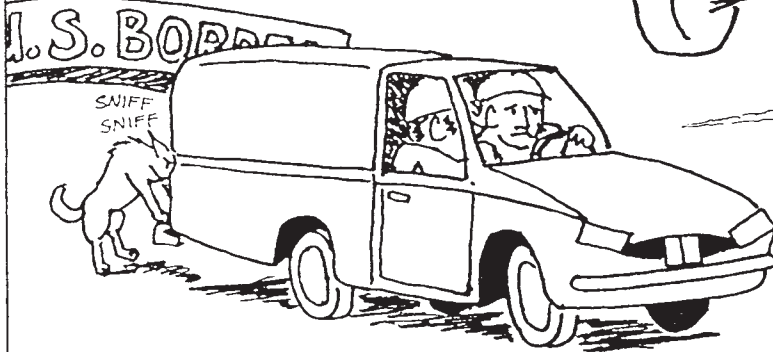
FROM THE LATE 60'S AND WELL INTO THE 70'S MODIFIED 2ND HAND HEAVY-DUTY PICK-UPS WITH CUSTOM ACCOMODATIONS WERE THE



STANDARD. ALL COMFORTS
KNOW TO CAVERS. WELL
SUITED TO LOCAL MEXICAN
CONDITIONS.



THE 80'S HAVE BROUGHT NEW MINIS TO PROMINENCE. NO COMFORT. GREAT FUEL ECONOMY. LOCAL CONDITIONS? NO PROBLEM...



AND WHAT OF THE FUTURE? AS SOON AS PEMEX TOPS 50¢ (U.S.) PER LITER AND IMPORTED MOUNTAIN BIKES REACH RESPECTABILITY AT \$15,000. (U.S.), CAVERS WILL BE PEDALING THEIR WAY SOUTH.

DEC'88 N.S.S.14671L



Proyecto Cerro Rabón

Karlin
Meyers

The Fissure, Nita Diplodocus.
(Ernesto Garza and Urs Widmer)

In March 1988, Ernesto Garza, Beth Meyers, and I set off from Phoenix to meet Blane Colton, Jeb Steward, and Laszlo Kubinyi in Mexico City. For most of us, the spring ushers in the Mexican caving season, the time to head south. In Mexico City we hoped to gain the official permission that is required to enter the high plateau area just east of Huautla. Permission was granted with an official letter in only one day, due to excellent public relations work during the previous three years. Our

next stop was beyond Huautla at a small town called Tenango, otherwise known as 'the end of the road.' From here, one must hike 13 rugged kilometers up into the high jungle karst to enter the misty realm of the Cerro Rabón.

Setting

The Cerro Rabón, meaning bob-tailed mountain, is named after the large massif that marks the eastern extent of the greater Huautla plateau.

Due to its inaccessibility, the plateau was visited by only a few outsiders prior to 1985. All cavers visiting the area opted for the more accessible and well known Sistema Huautla caves to the north. The karst topography of the Cerro Rabón, well pronounced on the maps, was first seen by cavers during an airplane reconnaissance flight in 1978. The huge karst features equalled those in the Huautla area and, unlike most areas to the west, were thickly carpeted with tropical rain forest.

From a geological standpoint, the Cerro Rabón is the leading block of the overthrust dark Cretaceous limestones that make up the greater Huautla plateau. Since tectonic forces originated from the west, folding and faulting is more extensive around Huautla and less so to the southeast, near the Cerro Rabón. Massive, nearly horizontal beds terminate in escarpments that tower almost 1800 meters above the town of Jalapa de Díaz to the east, and the Río Santo Domingo, which drains in from the west.

The Rabón plateau is approximately 200 square kilometers, of which approximately two thirds is still pristine unprotected rain forest. The western extension of the plateau rises to over 2100 meters in elevation above San Juan Coatzacoapan. Scattered habitations on the plateau extend southeast from Tenango to the Presa Miguel Alemán.

First Reconnaissance

In February 1985, Ernesto Garza from California, Blane Colton and Laszlo Kubinyi from Colorado, and myself from New York were the first foreigners to visit these highlands since 1969. Our goal was purely reconnaissance, since our maps, photos, and information regarding trails and terrain were very inadequate. There are no roads onto the plateau, so we first decided on a steep, but direct, route from Jalapa de Díaz. A trail ascends the escarpment, traverses the plateau westward, and passes through the village of San Martín, before descending to Tenango. South of this trail is uninhabited and unexplored.

We had prepared ourselves for five days on top of the mountain. After six days in the rain and fog, we ended our disoriented explor-

ation. We returned with green toothbrushes and the locations of a few cave entrances in the San Martín area. We also learned that to continue exploration we would need permission from the presidente of Tenango.

The trail up from Tenango was to later prove more expedient and less rigorous. We had, however, quickly gained a few friends in San Martín, and got a good idea of what it would take to mount a caving trip into the area. South of the trail, the virgin rain forest receives approximately 160 centimeters of rain a year. This and the very rugged karst makes for difficult camping – at least comfortably. Water is a very precious commodity to the locals, since all rainfall sinks immediately with few or no surface catchments. Hence, all water requirements must essentially be satisfied by collecting rainwater. This could prove difficult with a large group. Temperatures were often above 24 degrees Celsius during a rare sunny day, and fell as low as six degrees Celsius during stormy nights. We attempted an approach from Tenango, but were refused permission due to a state archaeological directive. However, the tremendous natural beauty and cave potential merited a return trip the following year.

Second Recon Trip

In the winter of 1985, we received some preliminary topographic maps from Bill Stone, and, with only the question of official permission yet unresolved, Ernesto, Blane, and I set off again in January 1986. We headed directly to Oaxaca City in search of permission to enter what was an "archaeologically sensitive area." After a frustrating week of red tape, the state offices produced no results, so we banked our luck on the local presidente in Tenango. After making a valuable friend in Tenango, we succeeded in obtaining permission. With less than two weeks of our time left, we would again be restricted to a recon trip. Our goal was to penetrate the high karst south of San Martín and locate entrances.

We ascended the worn, cobbled trail 13 kilometers to San Martín. Gaining nearly 1000 meters in elevation, we entered the cloud enshrouded jungle again. We selected a small camp spot with a water seep outside of the vil-

lage, in order to eliminate many of the curious onlookers. With the assistance of a local guide, we made trips to many of the large sinks visible on the air photos. Many were blind, but hosted a thick variety of tropical flora. Within two days we were standing on the edge of the largest pit, Ojo de las Mazatecas, which we estimated to be about 260 meters deep. Time permitting, we could have climbed down one of the slightly inclined walls, but that would have to wait. We located several more deep pits and entrances before our supplies were exhausted. We, again, gained more respect for this tropical wilderness. A total of 12 days had now been spent in recon exploration, and we now felt a large caving trip was merited.

Return Expedition

By February 1987, Ernesto and I organized a group of 13 people to spend three weeks on top of the plateau. The members of this expedition were Ernesto Garza, Judith Ogden, Don Coons, Sheri Engler, Linda Gough and myself, and seven Swiss cavers: Urs Widmer, Jasmine Ustentag, Ursi Sommer, Philippe Roullier, Peter Keller, Pierre-Yves Jennin, and Christine Loosli.

We had figured local permission would not be a problem, so we all met in Tehuacán and shuttled up into the mountains using local buses and Ernesto's Ford van. Our international cargo included approximately 1000 meters of rope and 20 kilograms of Swiss chocolate! Much to our satisfaction, the Huautla road was greatly improved, and to our even greater surprise, so was the grim 19 kilometers from Huautla to Tenango, which is still a two-and-a-half-hour drive. Unfortunately, the newly-elected presidente of Tenango denied us permission and a trip to Mexico City was required.

While the rest of the crew anxiously waited in Tenango, Peter, Ernesto, and I took a bus to Mexico D.F. After a few phone calls and a letter of introduction from the university, we managed to secure permission from the national archaeological department (I.N.A.H.). With this official paper in hand, we sped back to Tenango, losing only two-and-a-half days. Our official paper was accepted by the presidente, and we celebrated with a bottle of champagne

that someone had mysteriously brought with them.

Since the Cerro Rabón plateau is far from flat, an advance group of Don, Sheri, Philippe, and I set off immediately to establish a camp in the vicinity of San Martín. The balance of the group would set out the next morning with porters and burros and some 350 kilograms of gear. We located our base camp on the deforested side of a very large doline only 300 meters from the village, and immediately began to build a large frame over which we stretched tarps. Our new tarp home was then christened with six days of rain! Our water problem was solved.

Undaunted by the rains and the large quantities of mud that blossomed, we started exploration. Our first targets were entrances we had located the previous year, nearly all in the immediate area of San Martín. Nita Naxo (Flower Pit) is a large, 105-meter pit with cave swallows nesting at the rim. The entrance, lined with ferns, orchids, and vines, opens to a very large chamber, but collapse debris has plugged all possible leads. Nita Nindi (Window Cave), located only a stone's throw from Naxo, is a dry, horizontal 95-meter cave with a significant burial site inside. Several other local pits were dropped, but turned out also to be blind.

We turned our attention south to the areas above San Martín. Prepared with rigging equipment this year, we pushed Sótano San

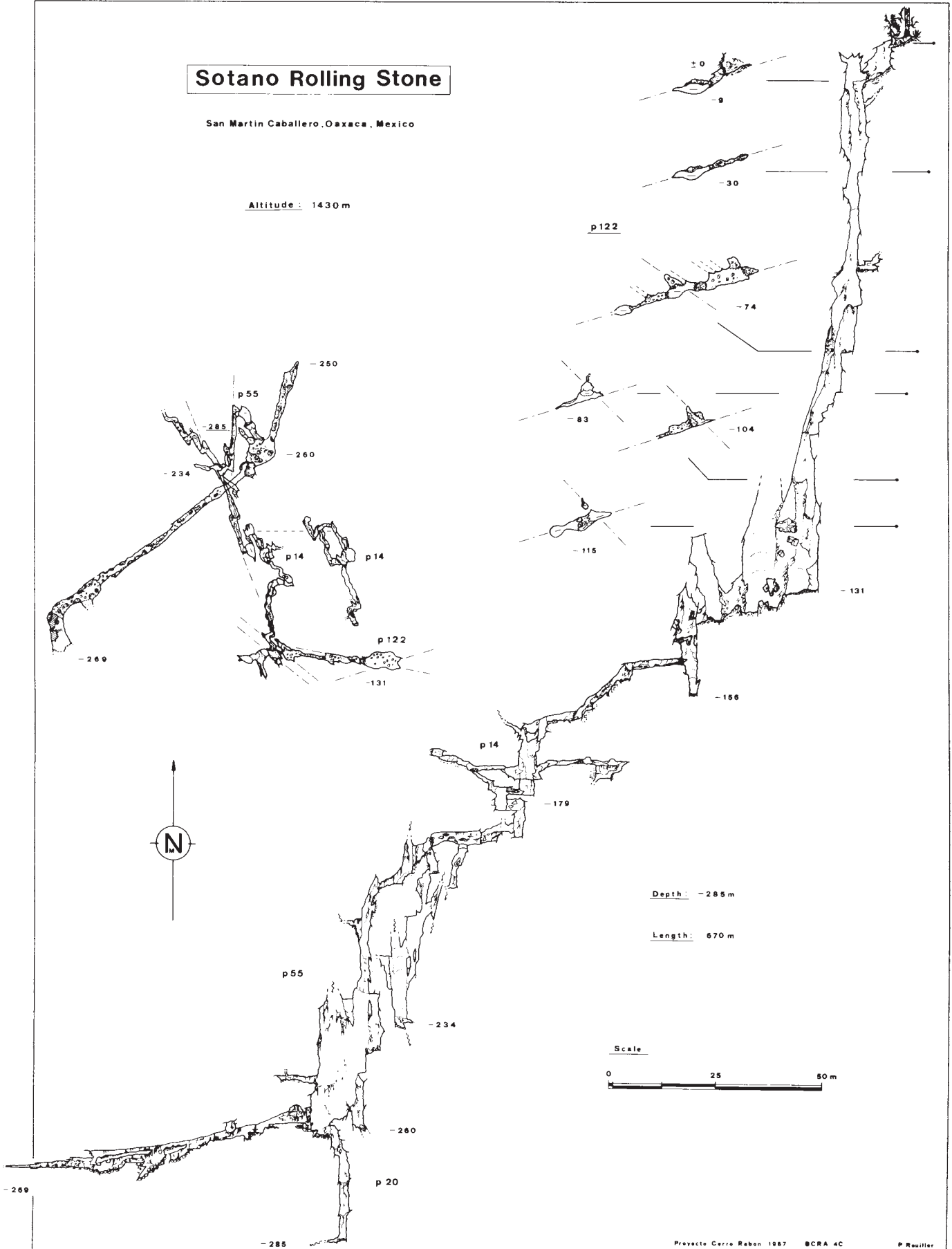


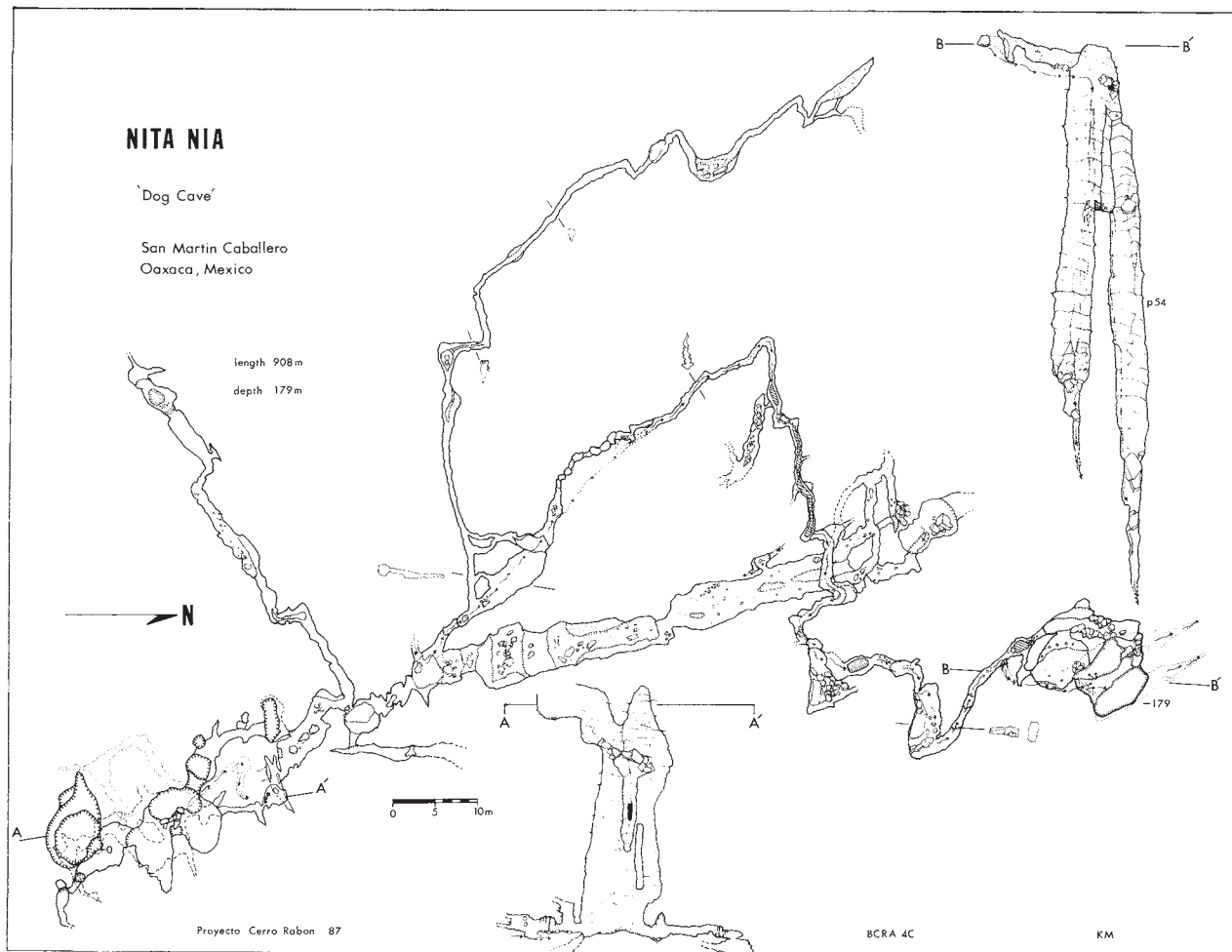
Mess Hall in Base Camp. (Karlin Meyers)

Sotano Rolling Stone

San Martin Caballero, Oaxaca, Mexico

Altitude: 1430 m





Martín past the 40-meter entrance drop. This entrance was shown to us by the locals when we first arrived in 1985. Upon learning we were interested in caves, they swept us off in hopes that we might be able to help them extract water from the depths. Unfortunately, we were not able to help them. This year, we noticed a skull near the entrance and wondered briefly about our fate, but decided any fears were unwarranted.

In sharp, fluted alpine style, the sótano plunges down numerous drops until ending in a tight pinch at -245 meters. There was a large amount of water dripping in everywhere, so our PVC suits proved very useful. Due to the poor rock, the technique of rebelaying became essential. For many American cavers, this required a re-evaluation of vertical technique.

Sótano Rolling Stone

Our local guide then quickly led us less than 100 meters to the northwest along the same hillside to another sótano. This became known as Sótano Rolling Stone because the 131-meter entrance shaft was lined with loose rock. Again, rebelaying and a whistle system were required for safe descent. The initial descending party was thwarted by what seemed a plugged shaft, but after a short dig by Don and me, more tight cave was found. A tube-shaped passage led to several more drops. A subsequent trip by Philippe, Pierre-Yves and Ursi added another 100 meters of depth in tight, broken shafts that pinched at -285 meters. Both of these two sótanos seem to have formed in a highly fractured section of rock, and development appears to be largely controlled by a set of joints of north-south and

northeast-southwest orientation. Total extent of each cave was nearly 700 meters.

Much of the local karst is a complex array of pits and fissures, making systematic exploration difficult, yet spectacular. Urs and Peter found a section just uphill from Sótano San Martín that is called Los Anselmos. This fissure system has several pits, one of which is 100 meters deep, but they all turned out to be blind.

Pierre-Yves and Philippe explored another similar area higher yet on the mountain. This concentration of deep pits is called Sótanos de las Tierras Perdidas. They mapped 750 meters of mostly vertical passage, the deepest cave being 210 meters deep with a 95-meter cylindrical entrance shaft. Unfortunately, these pits also failed to yield an entrance to a system.

Nita Nia

Another promising sótano, which was named Nita Nia or Dog Cave, was located in the same region. A 35-meter entrance pitch opens to a large junction room with many side passages. The rock in this section is very poor and sharp; we called it broken bottle rock. Most side leads became either too tight or led to nearby sinks. However, one continued as a small, dry, fossil stream passage. A near mishap occurred when a ledge gave way during a traverse. Fortunately, no one was injured, but it reinforced our caution in the broken-bottle layers.

A parallel pit bringing in a small stream was then reached. At the bottom of this 15-meter pitch, the cave enters hard black limestone and takes on the characteristics of a small, tight, stream cave. A tight passage, possibly an overflow, takes off from here for 150 meters, and finally becomes too tight, but still has very good air flow. The right-hand passage follows a very tight, old stream passage that then breaks into the active stream again in walking passage. After 230 meters and several tight spots, the stream enters a large shaft. Heavy rains above made for very wet and thundering conditions for exploring the shaft. However, a rope was rigged from a belay loft, and the 20-meter drop ended on a

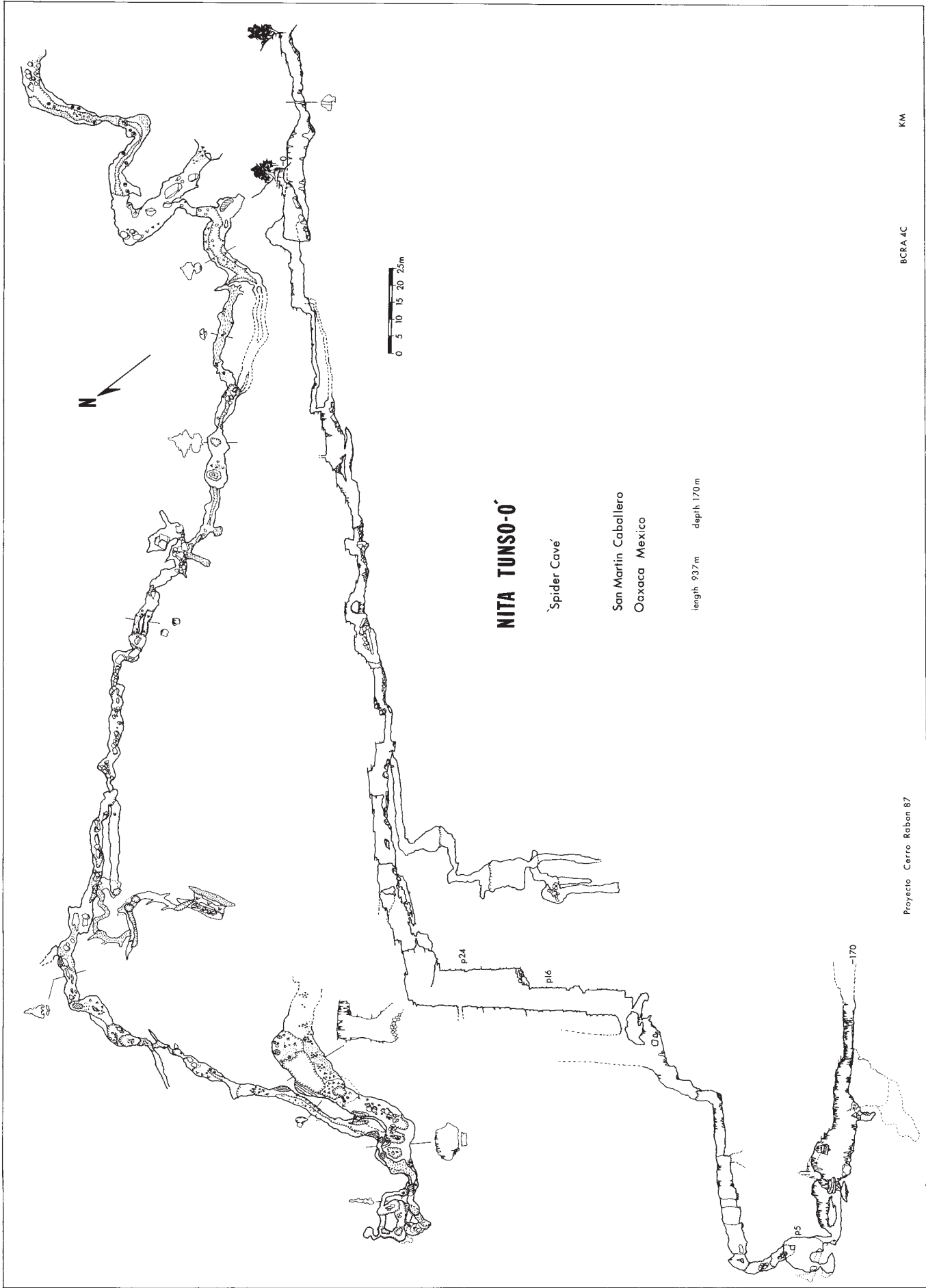


Jasmine Ustentag admiring the formations in Spider Cave. (Ernesto Garza)

thin rib that divided the pit and the waterfall. One side entailed another 20-meter pitch and ten meters of down climbing to a very tight pinch that took a fair amount of water. The other side was similar, but it was nearly 40 meters deep from the rib. It was annoying to see all this water enter a fine shaft and leave through impassible fissures at the bottom. Nita Nia was bottomed at 179 meters, and has a total length of 908 meters.

The High Country

On our sixth day, the rain stopped, and a group headed up into the high country, our term for the higher elevation rain forest south of San Martín, which is completely unexplored, even by the locals. Sótano Cerro Vista, a large, open pit located the previous year, was descended on 8mm recon rope to the bottom at 60 meters. A short passage near the bottom failed to lead to any more cave.



NITA TUNSO-O'

'Spider Cave'

San Martin Caballero
Oaxaca Mexico

length 937m depth 170m

The view from Cerro Vista above the sótano includes the beautiful vast, virgin forest that still remains, as well as the many enclosed sink valleys. From this vista, we realized the future of this area should include a national park, and decided to add that to our expedition goals. The huge gaping sink known as Ojo de las Mazatecas was also visible. This sink was bottomed the following day by a party of seven, using roots and branches to down climb one of its nonvertical walls. The famous pit with its estimated 250-meter headwalls turned out to be blind. Unlike most large collapse sinks, the doline tapered to a very small twilight forested area on the bottom, its sides clearly joint controlled.

Spider Cave

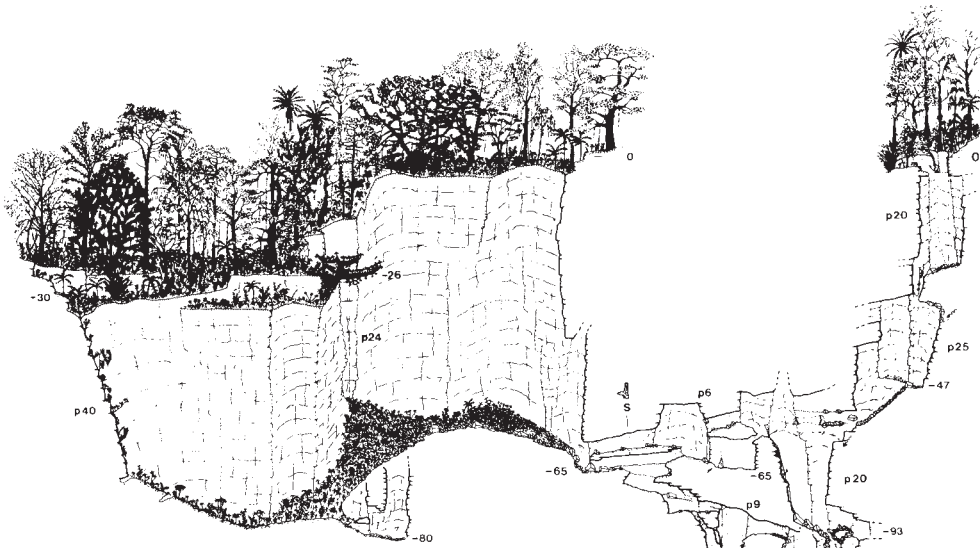
To the north of base camp and San Martín, another entrance was shown to us at 1260 meters elevation. This cave became Spider Cave, or Nita Tunso-o, due to the tarantulas found inside. This dry, fossil horizontal

passage passes 115 meters through the hillside, and was thought to be finished until Peter found a side lead that, after some crawling, opened to a large fossil stream passage, frequently decorated with lots of popcorn.

The main passage leads to a 51-meter shaft series that narrows to a tight squeeze, but then opens to a sloping, decorated passage. A series of drops, mostly climbable, but including a ten-meter ladder drop and a ten-meter rope drop, was encountered. This leads to a small complex chamber that seems to end, but a tight, dry stream passage leaves from one corner. After 15 meters, it opens up into large well-decorated borehole. This photogenic section meanders for approximately 250 meters, passing a large canyon, and then suddenly ends in a large collapse. Passage dimensions at this point are nearly 15 by 15 meters. Soon a bypass was found through a tight, dry stream passage with good airflow. The survey ended at this point. Spider Cave, while nearly 200 meters deep, is mostly a horizontal cave and measures 937 meters long.



Peter Keller sketching in Spider Cave. (Urs Widmer)

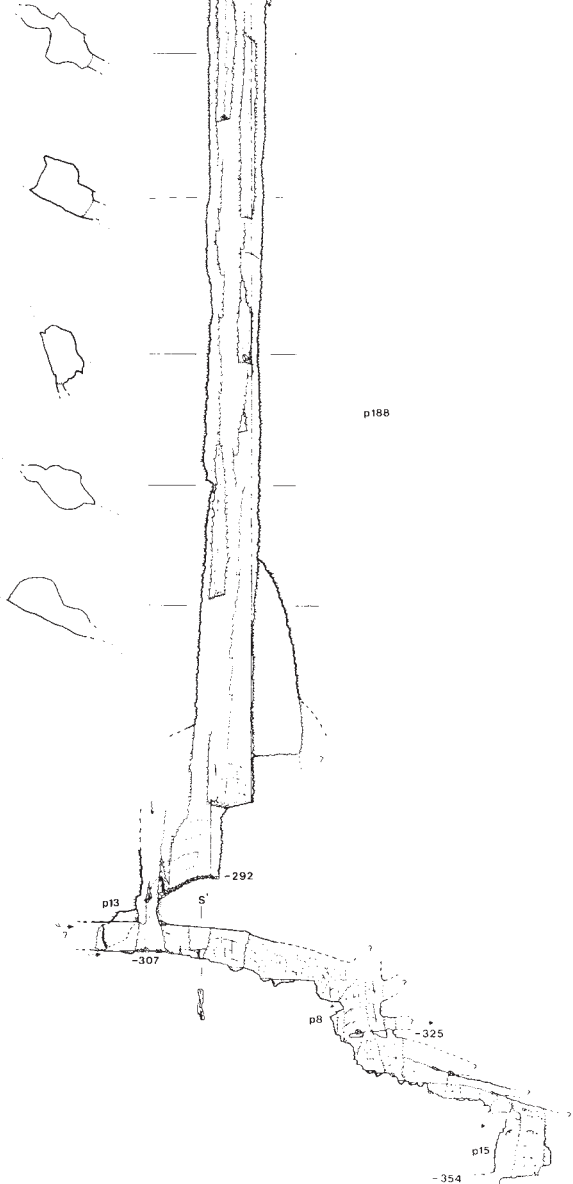
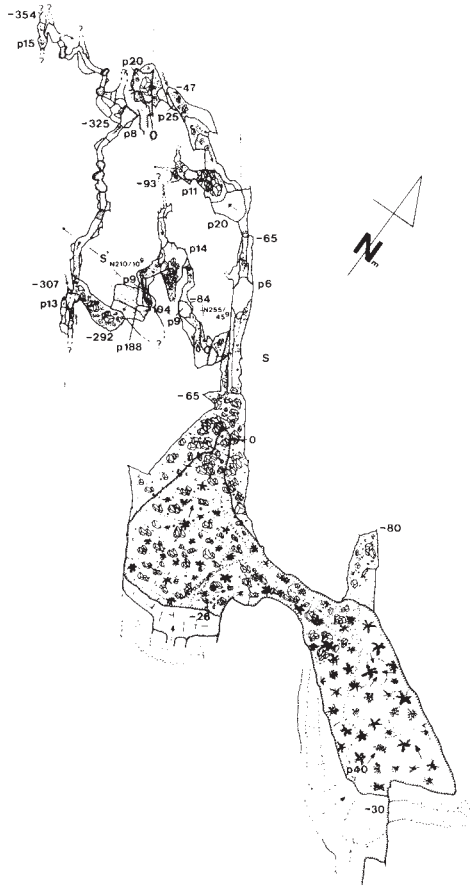


Kijahi Shunthua

SAN MARTIN CABALLERO, OAXACA, MEXICO

Longitud: 950 m

Desnivelacion: 354 m



With very little time left on the 1987 trip, we chopped a trail into a new area to the south. At an elevation of over 1600 meters, a large enclosed sink valley was penetrated. Nita Oztotl, or Oztotl's Window, was located at the southern end. This very impressive open-air pit proved to be difficult to rig with the 8mm recon rope, due to the poor rock at the rim. After three-and-a-half hours of rigging, Peter and Ursi succeeded in reaching the bottom of the 120-meter shaft. The last 60 meters are especially exciting, as one rappels past the roof of a large room that opens 100 meters off the side of the shaft. From the surface, this gives the impression of a huge black window to the underworld. Unfortunately, the pit bottomed at 143 meters. A parallel shaft of smaller dimensions was then descended to a depth of 100 meters, with nearly 60 meters of horizontal development to a collapse.

Forgotten Door

With three days left, another push into this new sink valley was made. Within hours, Philippe, Pierre-Yves, and Judy found a large double sink, and quickly descended the 40-meter entrance pitch. A lush growth of twilight forest carpeted the bottom. The second doline was entered through a wide cleft in one of the walls. This led down under a headwall to a breakdown pile. While penetrating the breakdown, they encountered strong wind and then a smooth, dry stream passage that plunged down small drops. Immediately after entering the cave, one notices the difference in the limestone. Unlike the other Cerro Rabón caves, this rock is very hard, black, well-consolidated limestone. Through a hole in the entrance gallery, a series of pitches leads up to another entrance doline about 100 meters northwest. This would explain the circulating winds, except that when continuing down from the entrance passage, one feels the air blowing up from the depths. This was a very exciting find. Perhaps we had at last found an entrance that would lead deep into the plateau.

After descending a few short drops, Pierre-Yves encountered a rift that appeared to have a pitch near the bottom. After several rock drops and several surprised double takes, he realized it was a full seven seconds before

the rocks hit bottom! The enthusiastic three ran back to camp making it in a record two-and-three-quarters hours. After dividing up the remaining work to be done, it was decided that Philippe, Pierre-Yves, and Peter would make a one-day trip into the new sótano, the Forgotten Door, or Kijahi Shunthua in Mazatec.

The next pitch in Shunthua is a spectacular 188 meters. Another 15-meter pitch drops into a passage with a small stream. Several plunge pools were downclimbed to an eight-meter drop. At this point there are several other leads, but the team followed the obvious route down another series of plunge pools to a 15-meter drop. This was rigged and descended, but it was followed by yet another drop. The team had reached -354 meters, and at this point they were out of tackle. They left the cave and returned to camp early the next morning, before daybreak. We were all very excited about the new lead, but it would have to wait for another trip.

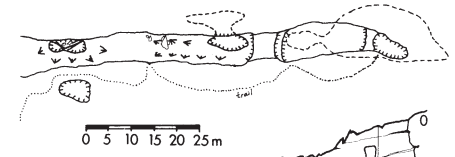
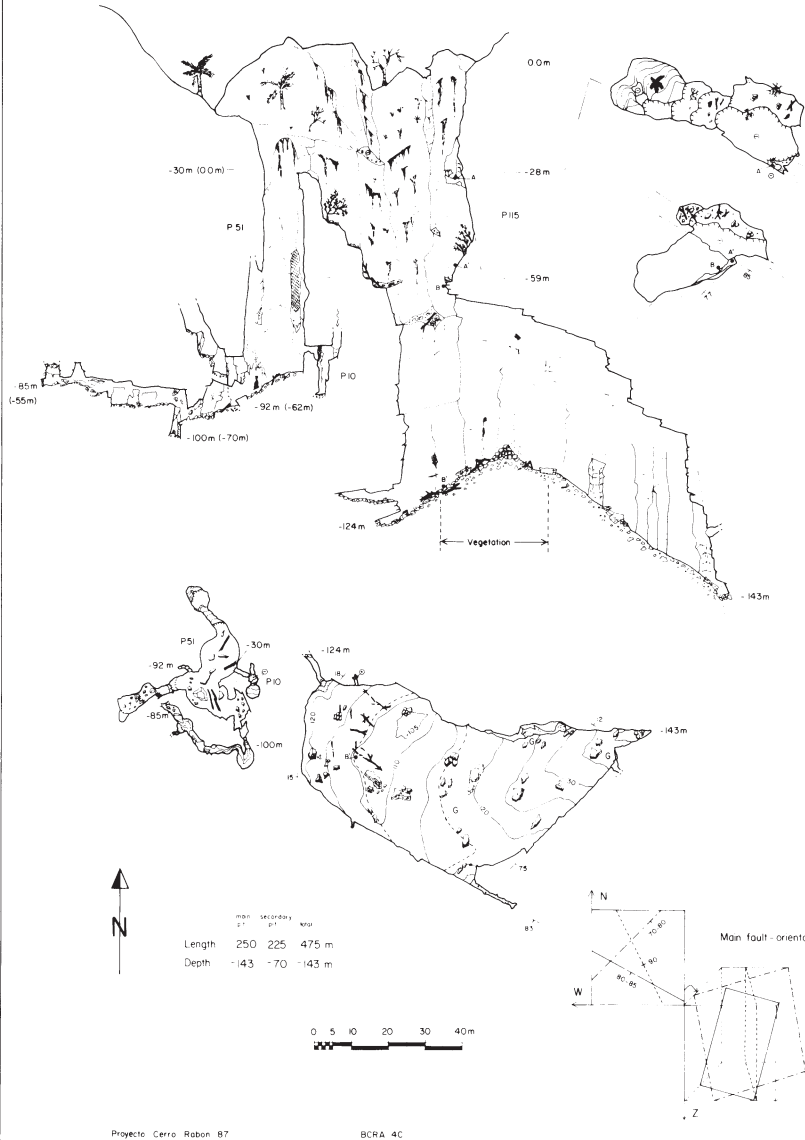
Nita Diplodocus

Meanwhile, another team of cavers, headed by Ernesto Garza, made their way southeast and up the mountain from San Martín to a large surface rift that became known as The Fissure, or Nita Diplodocus. This spectacular cleft has two deep pits in its upper section. Don Coons descended the downhill pit, which measured 105 meters and ended there. The second pit was rigged, and Don descended, passing the knot, to the end of his 105 meter rope, but the bottom was nowhere to be seen. Lack of time again forced the team to wait for another year.

The 1987 trip, over a three week period, produced an inventory of 34 caves of ten to nearly 1000 meters in length and up to 354 meters in depth. In total, 7.6 kilometers were surveyed. Although exploration is still in its infancy, a large number of deep shafts have already been discovered and, hopefully, at least one is the entrance to a major system. The tremendous drainage area, and the presence of a resurgence as large as that of Sistema Huautla leads us to believe that a large cave system does exist. The region seems to be different from the neighboring Huautla plateau from a geological standpoint, in that the structure of

Nijha OTZTO¹tel

San Martin Caballero, Oaxaca, Mexico

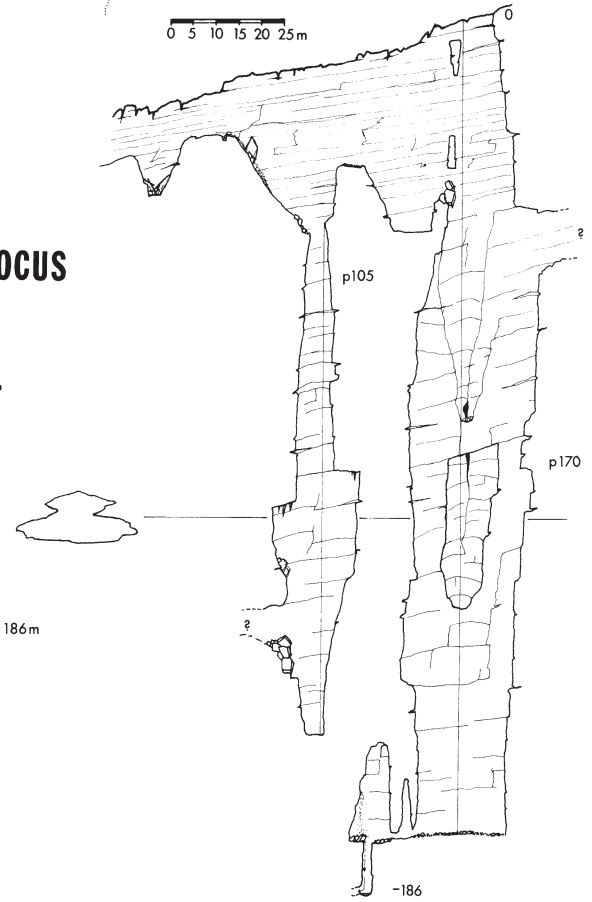


NITA DIPLODOCUS

The Fissure

San Martin Caballero
Oaxaca, Mexico

length 400m depth 186m



Proyecto Cerro Rabon 87

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the Cerro Rabón plateau is less deformed, and the karst appears to be more of an alpine style. In the future, if a system is discovered, it will be especially interesting to compare it to the neighboring Huautla area.

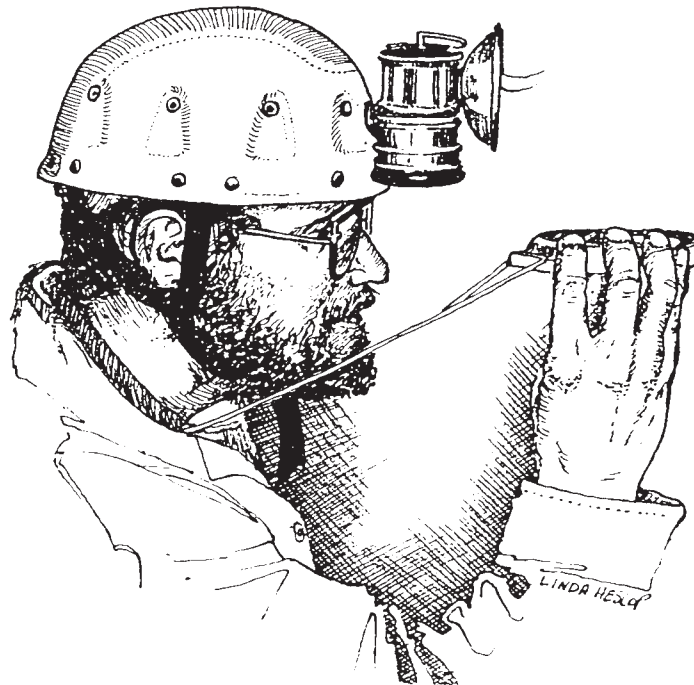
A Brief Return

A six person team returned briefly to the plateau in March 1988. During the week-long stay, the upper pit in Nita Diplodocus was

dropped. It turned out to be a fine 170-meter free rappel ending abruptly in fill. Several treks were made up into the jungle, re-establishing trails and visiting new sinks. Large sections of the forest had been cut down during our absence, and we were quite upset over this "progress". Once again, we vowed to do what we could to see this beautiful wilderness protected from devastation. A longer return trip is planned for March 1989.

CERRO RABON

El Cerro Rabón es el nombre dado a una meseta de aproximadamente 200 km², la cual se localiza al sureste del macizo calcáreo de Huautla, Oaxaca. Allí se encuentran inmensas lajas calizas casi horizontales que terminan escarpadas a 1800 metros arriba del río Santo Domingo. En febrero de 1985 y al finales del mismo año, un grupo pequeño de espeleólogos hicieron exploraciones en esta remota zona. En febrero de 1987 Ernesto Garza y Karlin Meyers condujieron exploraciones con espeleólogos de los Estados Unidos y Suiza con duración de tres semanas. Encontraron bastantes sótanos, todos acababan al fondo del tiro vertical. La mayoría de estos se encontraron en las cercanías del pueblo de San Martín.



Mexpé 88: From the Pits to Plenty!



The Quebec Expedition to Sierra Negra

Marc Tremblay

In January 1988, the dream of a serious expedition for reconnaissance was realized. The Sierra Negra, a "new" karst area 20 kilometers north of Huautla, had shown itself to be the real thing. In less than three weeks, a team of 14 cavers from the Société Québécoise de Spéléologie (SQS) explored a number of entrances that led to a set of spectacular discoveries. It reached the point where even the least optimistic members of the team were speaking of work to last for decades.

Above: Before plunging into the void of Sótano de los Planos. (Marc Tremblay)

The Quebeçois in Mexico: Some History

Mexpé (MEXique EXPÉdition), a Quebeçois speleological expedition into a zone of virgin Mexican karst, met few major obstacles because of the preliminary work that had been done. For about five years there have been a number of Quebeçois visits to Mexican territory. At first, these were in response to an invitation by cavers from Ontario. This led to some unfruitful attempts to locate some potentially interesting areas, followed by our first contact with the AMCS. In 1984 and 1986, some Quebeçois participated in two work camps or-

ganized by Peter Sprouse and Terry Raines, in Tlamaya and Ocotempa, respectively.

Following consultations with Terry Raines and Mauricio Tapie Vizuet during my first visit to Ocotempa, the prospects of a Quebecois expedition became a reality. A close study of the map of the Sierra Zongolica area, and an analysis of various earlier expeditions gave us hopes of realizing the immense potential in the Sierra Negra. Then the process began that would bring the SQS by leaps and bounds into the heart of speleological exploration.

Preparations

In September 1987, a team was formed, and enthusiastic preparations were begun. From food to equipment, all was designed to be transported by airplane, bus, and mule. Speculations were running high about the potential of the Sierra Negra. The immense depressions indicated on the topographic map were probably karst features, but how would we find the entrances? For better or worse, MEXPE 88 was in gear.

There were 12 Quebecois cavers on the team: Jean-Pierre Boivin, Michel Cadieux, Natalie Chapedelaine, Marc Foisy, Roger Gagnon, Claude Godcharles, Michel Labrie, Francine Langevin, Jean-Benoît Nadeau, Pascal Samson, Marc Tremblay and Luc Trépenier, and two Ontario cavers, Jane Mulkewich and Steve Worthington. Louise Hose and Terry Raines from the United States. and Mauricio and Pablo Tapie Vizuet of Mexico joined the expedition for a time.

Getting There by Trial and Error: Horrors

The Sierra Negra is a mountainous plateau cut at the northwest and southeast by the Coyolapa and Petlapa Rivers, respectively. Situated about 60 kilometers south of Cordoba, it is accessible by mule trails originating at Tlacótepec de Díaz, Puebla or Chilchotla, Oaxaca. The topographic map suggested a route that hypothetically joins Santa María Chilchotla to Buenavista, crossing the Petlapa valley. Most of the team arrived by air without problems. Jean-Pierre and I rented a VW combi-van for 40 days, and we left Mexico

City with 500 kilograms of equipment. The itinerary was deceptively simple: touch base in the town of Huautla to get to Chilchotla, ask for information, continue towards Buenavista with the van, and search for caves.

At Chilchotla, we were told by the presidente that there isn't a road to Buenavista. A messenger was sent to find mules to use; there were none in Chilchotla. He came back two days later without any real answer. Michel Cadieux, Michel Labrie, Claude and Jean-Benoît left to negotiate directly in Buenavista. It took eight long hours to get there: the Petlapa valley snakes 1000 meters below Buenavista and Chilchotla. They came back three days later with discouraging news. We didn't have official authorization, so we couldn't go. The vil-



The Quebecois team. Left to right: Jean-Benoit Nadeau, Marc Foisy, Claude Godcharles, Michel Labrie, Francine Langevin, Marc Tremblay, Pascal Samson, Jane Mulkewich, Natalie Chapdelaine, Steve Worthington & Jean-Pierre Boivin. (Terry Raines)

lage of Buenavista is under the jurisdiction of the municipality of San Sebastian Tlacótepec, so the presidente of Chilchotla couldn't help us. In fact, when you cross the Petlapa to the north, you are back in the state of Puebla. Moreover, you cross ethnographic lines, as well. The inhabitants of the Sierra Negra are of Nahuatl descent, while the Chilchotla are Mazatecs. We had not anticipated the complexity of the bureaucratic problems.

To get back to Tlacótepec we had to retrace our steps and detour around the massive Sierra Zongolica to the north, go through Orizaba and Córdoba, and then go back south until reaching Tezonapa. From there, we had to follow very difficult logging roads to Tlacótepec de Díaz, the administrative seat of the region. Our arrival did not pass without notice, and we hurried to contact the local authorities. To our horror, the municipal secretary and the presidente refused to allow us to work without official permission of the government of the State of Puebla. We were dumbstruck.

While the rest of the team spent their time waiting, Claude and I returned to Puebla (¡otra vez!) to try what seemed to me to be impossible. At the General Offices for the State of Puebla, we were introduced to the sub-director. A bit nervous, we presented the goals of our expedition: to study the Sierra Negra. Finally, after more than two weeks of trials and errors, authorization was granted.

Finally, The Plateau!

To reach the plateau of the Sierra Negra we needed a dozen mules to pack in the voluminous and heavy equipment. The long, tortuous clay footpaths led up to La Cumbre, 1000 meters higher – a small hamlet that became our base camp. It was with fear and excitement that we finally reached the object of our dreams!

Our reception by the Nahuatl on the plateau was a mixture of tension, wariness, suspicion, and nerves. Certainly, the rudiments of the Nahuatl language that we possessed had a positive effect on their attitudes. Our procedure is always to learn as much of the local dialect as possible, above and beyond

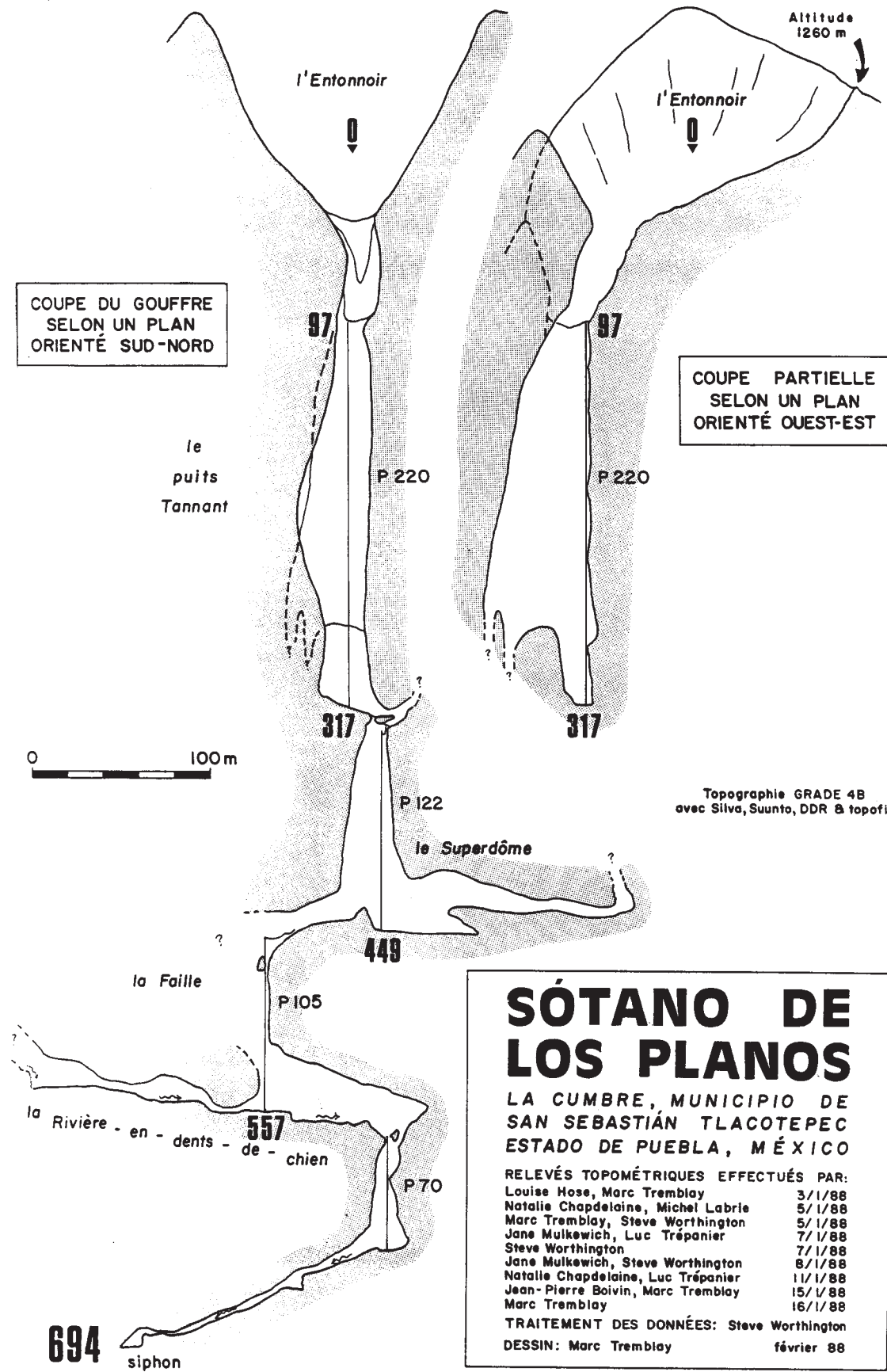
Spanish. We hoped to be able to conduct fluent basic dialogues in Nahuatl with the locals, even though Spanish would remain the official language for communication. We could not emphasize enough the mutual respect that we desired to be the norm between the two parties. The first day we arrived at La Cumbre, locals pointed out caves to us at all four points of the compass. And big ones! On our way to the first entrance, we had no doubt of the formidable potential hidden in the bowels of the Sierra Negra.

Sótano de los Planos

One of the caves we found deserves the name "monster." Sótano de los Planos, as we named it later, was known to the local popula-



The River-of-Dog-Teeth is developed along a fault dipping 60 degrees. (Marc Tremblay)



COUPE DU GOUFFRE
SELON UN PLAN
ORIENTÉ SUD-NORD

COUPE PARTIELLE
SELON UN PLAN
ORIENTÉ OUEST-EST

0 100m

Topographie GRADE 48
avec Silva, Suunto, DDR & topofil

SÓTANO DE LOS PLANOS
 LA CUMBRE, MUNICIPIO DE SAN SEBASTIÁN TLACOTEPEC ESTADO DE PUEBLA, MÉXICO

RELEVÉS TOPOMÉTRIQUES EFFECTUÉS PAR:

Louise Hoss, Marc Tremblay	3/1/88
Natalie Chapdelaine, Michel Labrie	5/1/88
Marc Tremblay, Steve Worthington	5/1/88
Jane Mulkewich, Luc Trépanier	7/1/88
Steve Worthington	7/1/88
Jane Mulkewich, Steve Worthington	8/1/88
Natalie Chapdelaine, Luc Trépanier	11/1/88
Jean-Pierre Boivin, Marc Tremblay	15/1/88
Marc Tremblay	16/1/88

TRAITEMENT DES DONNÉES: Steve Worthington
 DESSIN: Marc Tremblay février 88

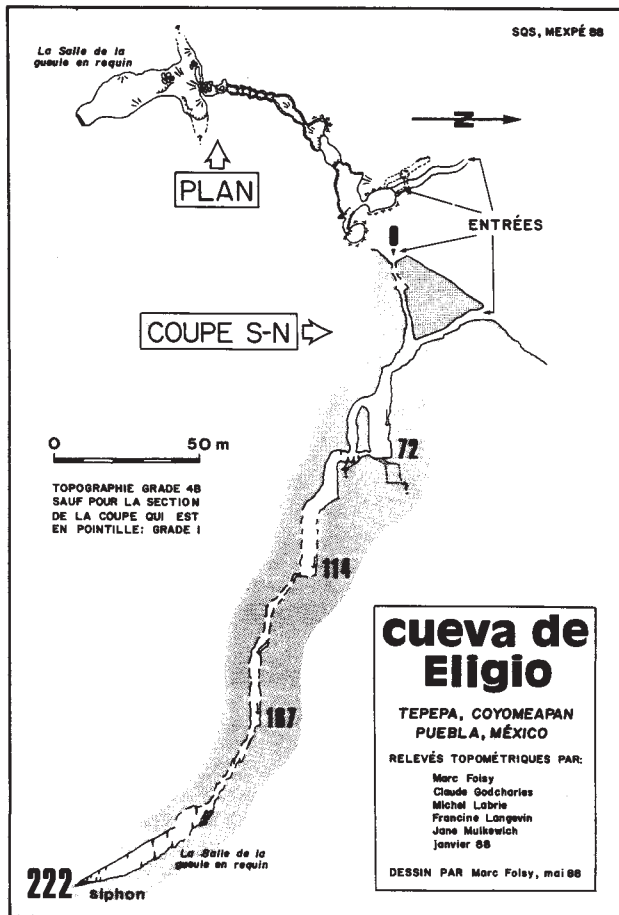
tion, but apparently not considered important. Despite their imposing appearances, these sótanos seemed to be viewed only with indifference by the Nahuatl, just like ordinary rocks. Were they hiding their real feelings?

The entrance, a vast funnel covered with green and resounding with the sound of flowing water, drew us towards its center. Jane, Terry, Louise, and I were the first cavers to descend to the edge of the abyss. A little over an hour and many machete strokes later, we reached a point where rope was necessary. I rigged in, and descended, always surrounded by the encroaching green. Finally, the incline forced me to place a couple of rebelayes, and I saw a free drop beneath me. Throwing a stone brought confusing echoes after eight seconds. Tannant Pit turned out to be 220 vertical meters, the first of four to a total depth of 694 meters, ending in a siphon.

Sótano de los Planos is developed along a minor normal fault. You can see evidence of this fault in the cave at the level of the River-of-Dog-Teeth (Rivière-en-dents-de-chien), where there is spectacular limestone breccia. We decided to establish a base camp at -450 meters, in a vast, dry room, in anticipation of a continuation. By camping in the cave we avoided the 122- and 220-meter pits, as well as the strenuous climb out of the doline, and the muddy return hike to camp in the rain. Unfortunately, the siphon terminated our hopes. Interestingly, if you rigged the rope higher and vertical, and if the little ledge at -317 meters did not exist, you would have an absolutely free vertical drop of 420 meters. Even in the big room, the feeble light of day penetrated, diffused by a group of parallel projections originating from Tannant Pit.

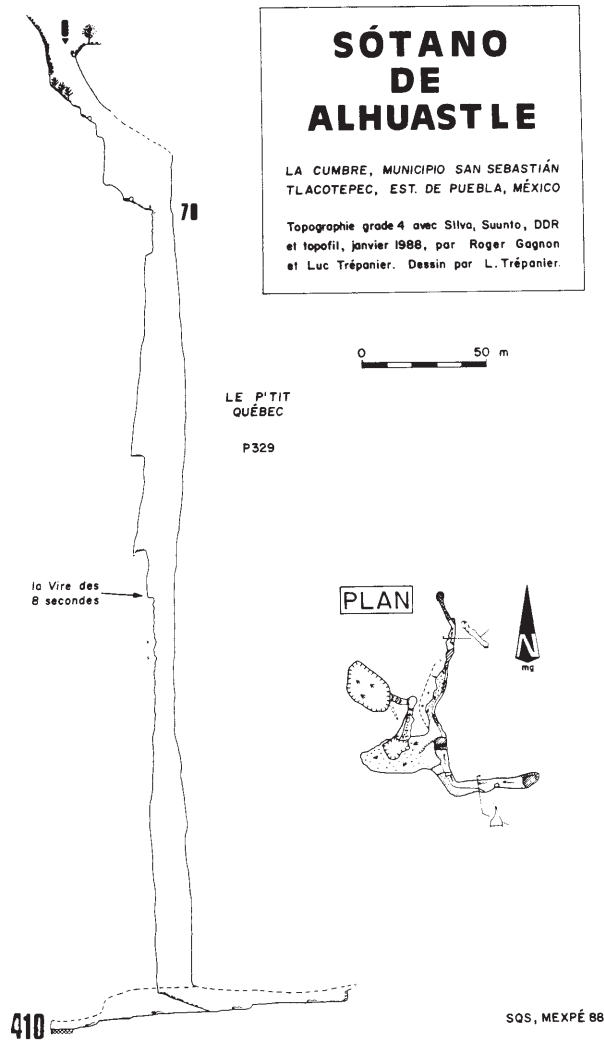
Tepepa, to the West

To the southwest of La Cumbre, an alignment of promising dolines was the objective of a small team composed of Steve, Claude, and Michel Labrie. On the morning of our second day in the Sierra, they inspected a number of blind caves along the route connecting Tepepa to La Cumbre. At Tepepa, they encountered Eligio Guergue, a very kind man. Eligio showed them a dozen pits of various depths, several of which were blowing



perceptible air. After taking several photos of Eligio's family, they promised to return the next day with ropes. It was afternoon of the following day by the time they finally headed towards the first doline represented on the map. After typical descents accompanied by machete cuts, the first two dolines produced three promising caves. One of them, Alhuastle Ehecoklh, the cave that breathes, became the target of further explorations.

Early the third day, two buoyant teams headed towards Tepepa. Steve, Natalie, and Jean-Pierre chose Alhuastle as their goal. At the same time, Claude, Michel, Francine, and I went to meet Eligio. At Tepepa, Eligio and his clan came to meet us, proud of their morning's discovery, a magnificent blowing cave, which we baptized La Cueva de Eligio. Claude



cleared a path to the pit. Then, with the last cut of the machete, he suddenly cried, "Wow, it blows!" The last cut leaf was carried away by the cave's wind. I rigged the rope and thrust myself into the narrow opening. A dirt-floored passage at a steep 70 degree angle took me 30 meters deeper to an inclined gallery. Claude rigged the second 30-meter pit and landed in a little room populated with amblypygids. The continuation, a little decorated room, led to three pits. I rigged the largest, and descended 20 meters. Ten meters lower, Claude and I scaled a pile of pancakes and mushrooms of beige calcite. Then, we returned, mapping as we went, scaling the first pit. Horrors! I dropped the topofil, and it smashed 20 meters below. That ended mapping for the day.

At the exit, the 20 locals who had escorted us were still there. We took them into the cave by a horizontal entrance between the first and second pits – they loved it.

The next day, Francine and Jane returned to La Cueva de Eligio with rope. They rigged a 25-meter pit, and after a series of climbs and chimneys, arrived at the top of a pit that appeared to continue, but they retraced their steps to survey.

After this, Claude, Jean-Pierre, and Marc Foisy went to the cave with the intent of retrieving the rope for Sótano de los Planos. After having rapidly passed the pit, a narrow passage and a canyon, they did a short rappel and rigged a wet pit. After a half-hour of moving downward, they found an immense amphitheater and a siphon at -222 meters.

Alhuastle Ehecoklh

Meanwhile, another team consisting of Natalie, Jean-Pierre, and Steve explored Alhuastle. Two large pits and some easy climbs were passed, permitting them to rejoin a small stream. The passage narrowed rapidly, and a crawl in a low, narrow canyon took them to the top of a toboggan run with a steep slope of 60 degrees. A narrow place at the top of a pit stopped the team. Jean-Pierre went to explore a possible shortcut, while Steve and Natalie started mapping. After a small climb-up, Jean-Pierre found the air again, and a 50-meter pit. He rigged it and descended. After a few climb-downs, he stopped at the top of a second 50-meter pit at -200 meters. The next day, Claude and Marc returned to derig, since we lacked rope at Sótano de Los Planos.

The Environs of La Cumbre

From the beginning, the caves of La Cumbre seemed different from those of the two other areas. The geologic context there favored caves that developed sub-horizontally. Layers of shale are visible in many places underground, and control the structural evolution of the passages. La Cueva de los Niños has 880 meters of spacious conduits, rooms with unstable ceilings, and fine speleothems. Other caves of smaller dimension are very similar, but few of them have serious depth potential.

Mexpé 88, Phase 2

Having completed the reconnaissance and first explorations of the Sierra Negra, we are already thinking of returning. A more significant expedition is planned for 14 December 1988; 23 participants are preparing for it. We have multiple objectives, and doubtless several sectors will be investigated in parallel. The exploration of known caves will continue, and a large-scale map of the surface will be made. Underground mapping and photography will be systematized, and there may be a video made of the expedition.

GEOLOGY

The area under exploration is situated about 60 kilometers south of Córdoba in the extreme southeast part of the state of Puebla, extending

to the states of Veracruz and Oaxaca. The sector which we propose to study looks like a deformed polygon, the limits of which are temporarily defined as follows: on the northwest, by the line joining the summits of Xicintepetl, Tlacótepec de Díaz, and Villa del Río; on the southeast, by the Río Petlapa; to the west and east by the north-south lines passing respectively through the summit of Xicintepetl and Villa del Río.

The geology is very complex on a regional scale. The Sierra Negra is part of the vast Sierra Madre del Sur.

Stratigraphy

A thick sequence of limestone constitutes the major part of the Sierra Negra. The oldest unit (Upper Jurassic) is composed of shale



A passage with floor development controlled by layer of shale, Cueva de los Niños.
(Marc Tremblay)

and grey-green sandstone, interwoven with limestone. It is found beneath the overthrust Upper Cretaceous limestone. It forms a narrow band to the northwest of our zone. The major limestones of the Sierra Negra belong to the Lower Cretaceous, and are of variable sedimentary origin, associated with a reef platform environment. At the base of the sequence, the Miahuatepec Formation of Aptien age is characterized by a very folded and weak gray limestone, with fractures filled with calcite. Above is the Morelos Formation (Albien-Cenomanian age), a massive fossiliferous gray limestone. The two overlying formations are also Albien-Cenomanian. The Orizaba Formation is a massive dolomitic limestone with rudists and fragments of bryozoans. Finally, the deep grey, deformed Upper Tamaulipas Limestone rests on the top of the sequence, and represents a deepening of the depositional basin, announcing the end of the limestone sequence.

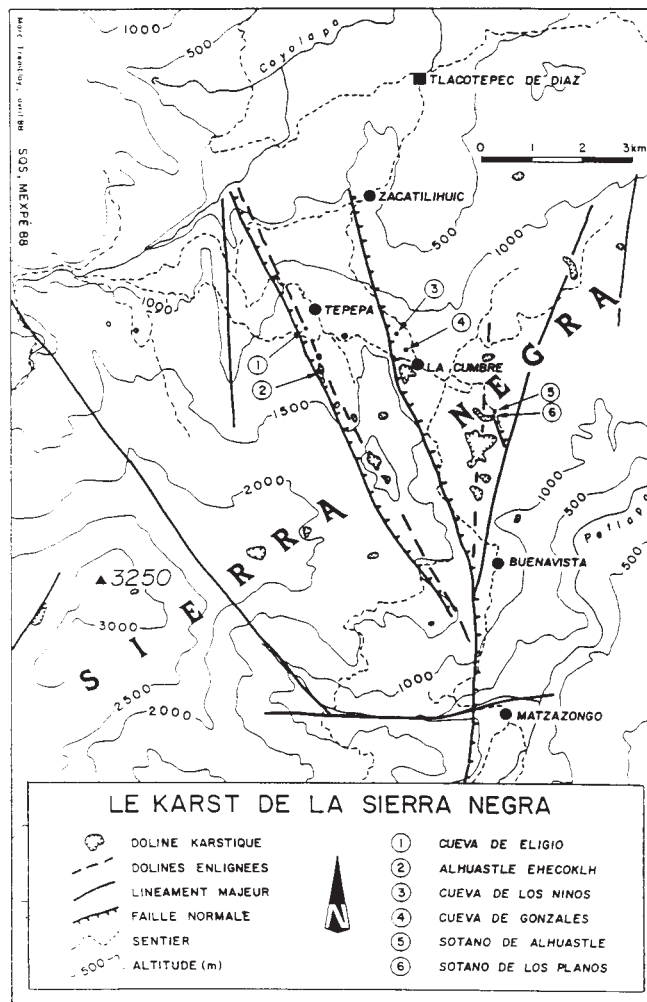
The whole mass of Lower Cretaceous limestone is thrust over the yellow clay of the Upper Cretaceous. The clay outcrops in the valley and the eastern section of the Sierra Negra. Finally, at the northeast corner of the region, and underlying the Río Petlapa, is an outcrop of Paleocene yellow flysch deposits.

Structure and Tectonics

The province of the Sierra Madre del Sur constitutes a region of high structural complexity, in which one finds many superimposed tectonic domains. A phase of compression, starting at the end of the Mesozoic and continuing into the Tertiary, is responsible for numerous faults and displacements. A second phase of tension, in the Quaternary, resulted in normal faults associated with an ensemble of horsts and grabens. These two phases have imprinted on the structure a general orientation of 150 to 330 degrees, that is particularly visible towards the east, where the folds have a clear relation to the morphology of the terrain. In contrast, the folds are less evident in the sierra, because the karst processes have modified the relief enormously.

Karstification

The local relief is obviously the result of



development of a cone karst, where dolines are omnipresent. Even The Funnel, the large doline at the entrance of Sótano de los Planos, is small in comparison with certain monster depressions.

The topographic map clearly shows at least two important alignments of dolines that could correspond to two independent cave systems. Superimposing the alignments and the lineaments on the map allows us to postulate two probable locations for major resurgences, coming from one, or both, of two hypothetical subterranean systems. One hypothesized resurgence is on the Río Coyolapa at an altitude of about 200 meters, where the surface profile shows the gradient decreasing abruptly. Oriented exactly on the axis of the Tepepa dolines, the powerful resurgence of Coyolatl seems to point to the same spot.

Mapping the caves confirmed the structural control exerted by geological fractures, folds and impermeable formations. Certain caves, (e.g. Sótano de los Planos), show development controlled by a fault zone. The entire length of the River-of-Dog-Teeth shows magnificent breccia, accompanied by limestone blocks covered with calcite crystals as long as ten centimeters.

Finally, none of the caves would exist at all if their favorable structure had not been assisted by two essential agents, the verdant vegetative cover, which produces the carbon dioxide necessary for solution, and the abundant rain, so abundant that it made us cry: "Let's go . . . it's raining; the karst is forming."

The Age of the Karst

The Sierra Negra is the expected erosional result of deep incisions at the edges of a mountainous massif by two parallel valleys, developed along major fracture systems. The southeast flank is particularly steep and cut by the sinking of the Río Petlapa. To the northeast, the slopes are more gradual, attesting to the influence of a greater quantity of rocks, or maybe by the fact that the valley of the Coyolapa is older than its neighbor to the south. The development of the karst in the Sierra Negra depends on the evolution of a base level associated with the bottom of one or both valleys. We need to evaluate the relative ages of the valleys in order to provide a better concept of the evolution of the karst, and also to better orient our work.

SIERRA NEGRA

La Sierra Negra est une zone karstifiée localisée au Mexique dans l'état de Puebla, près de sa jonction avec les états de Veracruz et Oaxaca. Les phénomènes karstiques majeurs se concentrent sur un plateau dont l'altitude varie entre 1,200 et 1,500 m. Ils se développent dans des calcaires plissés et faillés du Crétacé inférieur. En décembre 1987 et janvier 1988, une équipe de 14 spéléologues de la Société québécoise de spéléologie a effectué une première expédition de reconnaissance. Au cours de trois semaines de recherches sur le terrain, ils ont repéré des dizaines d'entrées potentielles et exploré un bon nombre d'entre elles. Le Sótano de los Planos est un gouffre qui atteint 694 m de profondeur. Le Sótano de Alhuastle descend à 410 m et comprend une verticale souterraine absolue de 329 m, record mondial en son genre. Plus à l'ouest, la Cueva de Eligio mène jusqu'à 222 m de profondeur et l'Alhuastle de Ehecoklh à 150 m et plus; ces deux cavités semblent faire partie d'un système indépendant des deux premières grottes.

SIERRA NEGRA

La Sierra Negra es una zona carstificada localizada en el estado de Puebla, cerca del confluente con los estados de Veracruz y de Oaxaca. Los fenómenos cársticos mayores se concentran en una meseta cuya altitud varía entre 1,200 y 1,500 metros. Estos se desarrollan en las calizas plisadas y afectadas por fallas del Cretáceo Inferior. En diciembre 1987 y enero 1988, un equipo de 14 espeleólogos de la SQS (Société québécoise de spéléologie) llevaron a cabo una primera expedición de reconocimiento. Durante tres semanas de búsqueda en el terreno, ellos localizaron decenas de entradas y exploraron un buen número de entre ellas. El Sótano de los Planos alcanza los 694 metros de profundidad. El Sótano de Alhuastle desciende a 410 metros y incluye una vertical subterránea absoluta de 329 metros, siendo un nuevo record mundial. Más al Oeste, La Cueva de Eligio alcanza hasta 222 metros de profundidad y la de Alhuastle de Ehecoklm a 150 metros y más: estas dos cavidades parecen hacer parte de un sistema independiente de los dos primeros.

The Revenge of Chac



1988 in TABASCO

Jim Pisarowicz

Outside the truck the rain was coming down in sheets. Just after midnight we had to abandon our camp. We sought shelter in a pavilion, built higher up on the hill just outside the town of Teapa in the park where Grutas de Coconá is located. The rain continued through the next day and finally slowed down. In 36 hours of constant downpour, approximately 1.4 meters of rain had fallen, an auspicious start to the 1988 Tabasco Caving Expedition.

The 1988 Tabasco Expedition included Warren Netherton and me, who were the sole members of the 1987 Tabasco trip. Accompanying us were Karen Rosga, who was on the initial Tabasco reconnaissance in 1986, plus Ken Allgier, Dave Lamb, and Greg Nepstad from South Dakota, Bob Kobza from Nebraska, and Shaun Larson from Washington.

The incredible rain in the Teapa area from 5 to 6 February really put a damper on caving in that locality. During the rainstorm, Ken, Karen and I went down to look at Grutas de Hueco, one of the caves we wanted to get into in 1988. When the rain started, the cave began to take a small stream, which quickly sumped the entrance. Later in the night, the cave must have filled, for a stream started flowing out of the entrance. The stream leaving Hueco eventually created a large lake that flowed into and sumped Cueva de Teapa. When the rain eventually stopped, the cave began, again, drawing in water, and eventually sucked underground the entire lake. It was an interesting sight, but not one conducive to caving.

The show cave, Grutas de Coconá, was just streaming with water. The water was coming through the overburden of limestone so quickly that it was almost drier outside in the rain than walking the trails through the cave. At the back end of the cave, the bridge crossing the lake was completely underwater. It was an interesting experience, swimming in the lake and looking down through the water at the bridge.

Cueva de Teapa was nearly sumped shut. Later in the month, we fielded one survey trip to this cave, and mapped 93 meters above Fantastic Dimensions. This passage eventually entered a breakdown maze, where the survey team felt and heard thudding noises. Apparent-

ly the passage passed under the karst hill, and was nearing the dolomite quarry on the far side of Teapa. The new survey put the length of Cueva de Teapa at 1277 meters.

Strategic Withdrawal from Teapa

Although we had only arrived in Tabasco on the evening of 4 February, by 7 February we were on the road again, seeking unflooded caves and a place to dry all our gear. We headed around the Sierra Madrigal to the town of Tapijulapa in search of a house to rent. In 1987, Warren and I had gotten into Cueva del Azufre near Tapijulapa, but did not survey the cave. We had been told by locals that several of the streams around Tapijulapa originated from caves, so it seemed a reasonable town in which to set up a field house.

Arriving in Tapijulapa, we talked to some of the children playing in the centro about finding a place to rent, and, as they scattered to the corners of the town, we settled down to a meal at Tapijulapa's only restaurant. By the time we had finished dinner, our messengers had returned with a lead on a place to rent. This turned out to be a large room in a three-unit apartment. We quickly took the place, as it included the entire roof of the building plus a hallway. Just behind our new home flowed the Río Almandro, a great place to wash up after caving trips. Being the only gringos in town, it did not take long before everybody knew us – especially since the entire roof of



Roof of the fieldhouse. (Jim Pisarowicz)

our house was covered with tents and wet caving clothes that we were always trying to dry out.

No sooner had we paid the rent, when the kids mentioned that there was a cave near the town's church. We all grabbed lights and followed them up the steep walkways and stairs to the church on the hill overlooking Tapijulapa. Because of some misunderstanding, we were told that the cave was not really by the church, but instead just down the road that ran past the church. We asked how much farther, and were told "dos kilómetros."

Three kilometers down the road the cave was still "dos kilómetros" away, but seeing as all our clothes and gear were still drying on the roof of our new home, we continued down the road. About six kilometers from Tapijulapa, the kids pointed to a side trail and a monumental set of stairs that led up the mountain. At the top of the stairs, we were to find a cave called Cuesta Chica.

Cuesta Chica

Two hundred twenty-four stairs later, we were peering into the mouth of Cuesta Chica. The entrance is about ten meters wide and one-and-a-half to two meters high. Large stalactites and columns decorate the entrance area, which quickly opens to a large chamber 30 meters wide with a ceiling height of up to 20 meters. Huge stalactites, flowstone columns, and cascades decorate the room, with the southeastern part of the cave consisting of a massive flowstone and rimstone dam cascade.

According to the locals, the staircase was built to the cave entrance because a former governor of Tabasco was particularly fond of marimba music. He thought that a marimba band would sound good playing in the cave's large chamber, so the entrance stairs were built to make it easier for people to get to the band concerts held in the cave.

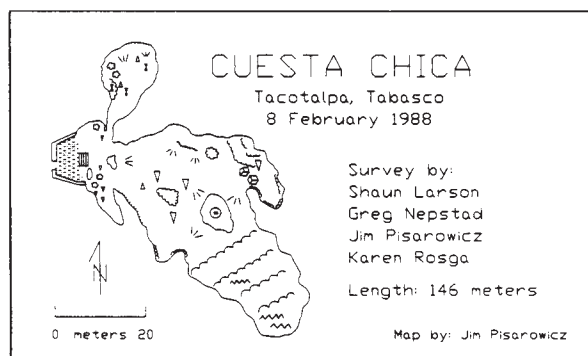
Cuesta Chica is essentially just a very large, well-decorated room. The next day, Shaun, Greg, Karen, and I returned to the cave to survey. The total surveyed length was 146 meters with no leads or airflow anywhere in the cave.

The Acid Test

The next day, 9 February, we began the survey of the cave that, in 1987, Warren and I were told was named Cueva del Azufre (azufre is Spanish for sulfur). After a more thorough questioning of the people in Tapijulapa, we discovered that the cave has several names, including Grutas de Sardina (for all the small fish that swim in the stream in the cave) and Cueva de Villa Luz (because of the numerous skylights into the cave). We settled on calling the cave Villa Luz, as this seemed the most common name.

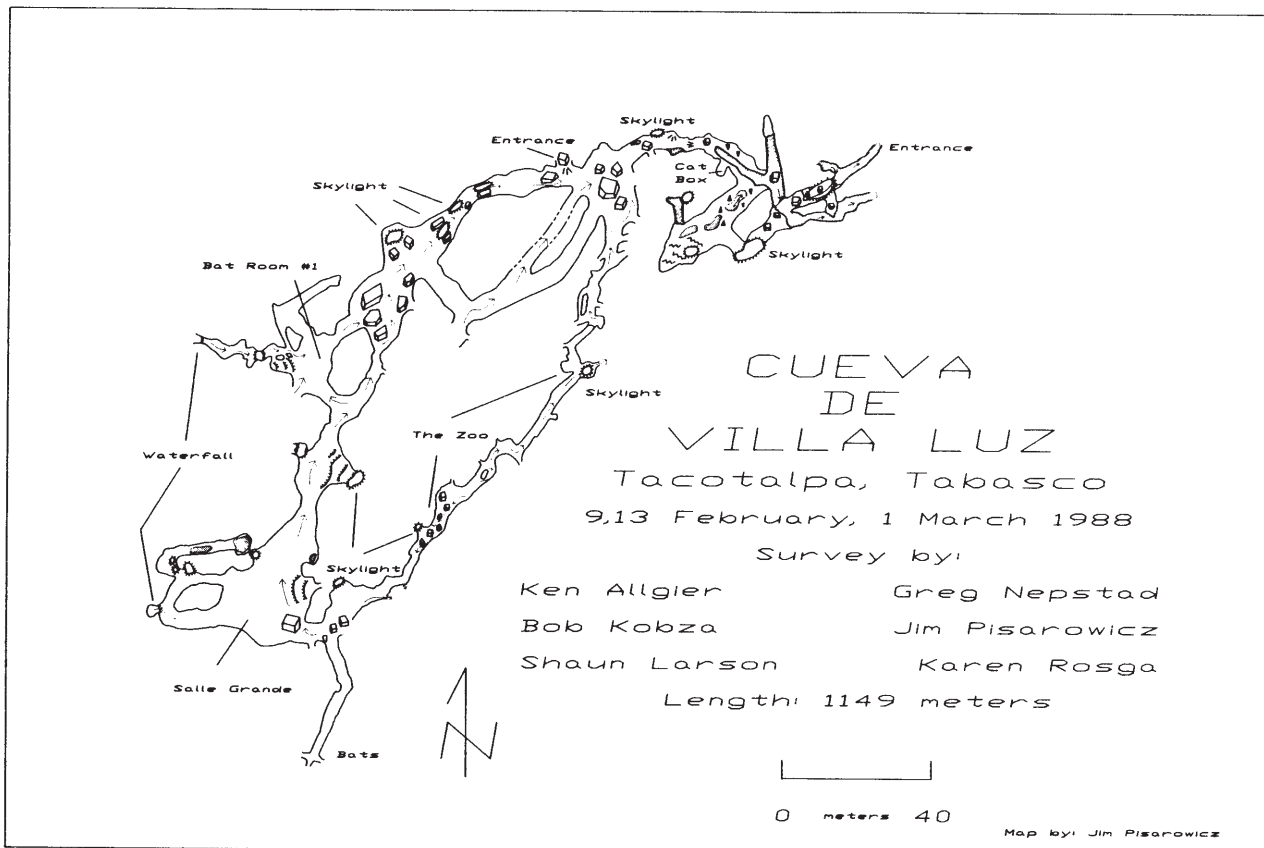
By any stretch of the imagination, Villa Luz is an incredible cave. The water flowing out of the cave is milky white with dissolved sulfur and gypsum. Inside the cave, walls are often bright yellow from all the sulfur crystals that coat the cave. Gypsum is in abundance, and there are numerous stalactites, which, in 1987, Warren and I thought were composed of moonmilk.

Arriving at one of the entrances to Villa Luz, we split into two survey parties. Karen, Bob, and I began surveying downstream, while Ken, Greg, and Shaun surveyed in the upstream direction. On the advice of Norm Pace, I had brought along multispectrum pH paper to measure the pH of the water in the cave. Although the pH of the stream registered at eight, the moist, dripping walls had a pH of one. The watery substance dripping into the cave was essentially concentrated sulfuric acid!





Incised stream passage in Cueva de Villa Luz. (Jim Pisarowicz)



Initially the acid did not cause too many problems, as the first areas we surveyed had lots of water to wash away its effects. But as the surveys progressed farther into the cave, the streamflow became less, and the dripping acid became more prevalent. The people who were using carbide lamps left the cave with the brass discolored black, and their lamps pitted from acid eating away at the metal. In one place, Bob stood up and broke off some gypsum, which dropped down his shirt, where the crystals injected acid under his skin. This is the first time I had ever been in a cave where the survey crew mutinied because they were being burned by acid.

Perhaps more interesting than the acid bath is the cave's abundant fauna. Everywhere we went, there were crawling things on the walls, and small fish and other creatures in the water. Ken, Shaun, and Karen named one passage The Zoo, because it seemed that every square centimeter was



Greg Nepstand returns from diving the Jet Stream sump in Cueva de Cerro Blanco. (Jim Pizarowicz)

alive. How some of these animals can exist in such an acidic environment should be the subject of further study.

Finally, Villa Luz was just too much for the survey teams. Acid burns, pitted carbide lamps, and clothes that literally fell apart after being in the cave made going back something to be avoided. There are still leads in Villa Luz, and maybe next year all involved will have forgotten the nastiness of the cave. After three survey trips, we had pushed Villa Luz to 1149 meters.

The Jungle and Cerro Blanco

While Cuesta Chica was being mapped, on 8 February, Bob and Warren hiked around nearby Cerro Blanco in search of other caves. In 1987, we had been told that several of the streams that flowed off this mountain originated from caves. After a tortuous 20-kilometer bash through the jungle, Bob and Warren were shown a waterfall issuing from a cave. A local resident from the Ejido Cerro Blanco said that the cave went in for a ways, but none of the locals had gone beyond some sort of obstacle that Warren could not make out from the man's Spanish.

On 10 February, Warren, Bob, Greg, and I went to the Ejido Cerro Blanco, where we got permission from the jefe to enter the caves. Then, we started up the stream course for the cave that had been located two days earlier.

After an hour of following travertine cascades upstream, we were peering up the 20-meter waterfall that leads into the cave. We put on our wetsuits, and climbed up to the cave entrance. The flow was approximately 40 liters per second, and, according to Warren and Bob, was down substantially from the other day.

The water in Cueva de Cerro Blanco flows fast and clear, in sharp contrast to other cave streams we have found in the state of Tabasco. Just inside the entrance, a small set of rapids was encountered, making the cave reverberate with the sound of crashing water. The water temperature was 22.3 degrees Celsius.



Bob Kobza climbing Pendulum Falls in Cueva de Cerro Blanco. (Jim Pisarowicz)

Twenty-five meters from the entrance, the passage forked, with the main stream coming in from the left, and an overflow route veering to the right. Because the weather outside was clear, we decided to push the overflow route first, as a rise in the stream of only ten centimeters would have put Cueva de Cerro Blanco's stream into this passage.

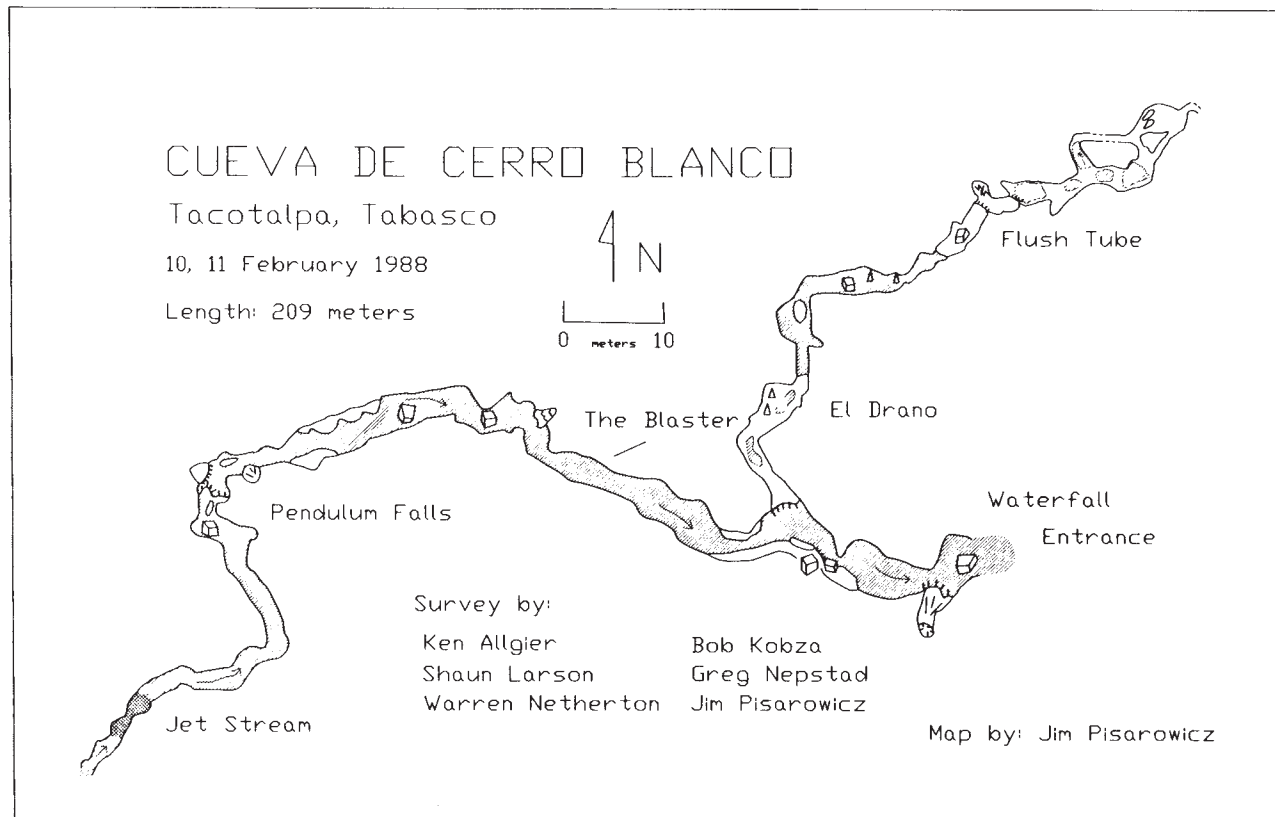
We called the overflow route El Drano because it was obvious that several days before this passage had been completely sumped. A small stream fed tiny pools, and stalactites and flowstone were everywhere. After 50 meters, this passage dove quickly down a steep flowstone cascade, the Flush Tube. Fortunately, the Flush Tube was climbable, but unluckily, the passage sumped and got too tight after only 15 more meters.

Following the river upstream involved wading against the current, and negotiating small cascades and rapids. Thirty meters farther, we came to a near sump that we called the Blaster. A strong breeze whipped the already turbulent water into a froth in an area with only

eight centimeters of airspace. The ceiling in this passage was covered with stalactites reaching down to the water. Luckily, the duckunder was short, and we were soon in wading and swimming passage again.

Just when we had decided that the Blaster was the obstacle we had been told about, we began to hear a deafening roar from around the corner ahead. There we encountered a large waterfall blocking the passage. From a room filled with spray, Bob and I were able to climb about ten meters up the side of the falls. But from that vantage it was obvious that we needed to be on the other side, at the point where the water pitched over the falls. We could see that there was another falls just around the corner. Without a way to cross the stream at this level, we could not go on. Not having brought any rope or vertical gear, we had to retreat for the day.

The next day, Shaun, Greg, Ken, Dave, and I returned to Cerro Blanco with vertical gear and rope in an attempt to negotiate the falls. Climbing to the spot that Bob and I had



gotten to the day before, I rigged a rope and pendulumed across the face of the waterfall. There, I rigged the rope for a short tyrolean. Greg then came up to help me rig up the next waterfall. At the top of that cascade, the water slackened.

The more slowly moving water was ponded in the passage, with scant airspace. Surveying through this area required negotiating several near sumps, with short duckunders in places where the stalactites grew down to the water. From ahead, we started to hear loud sounds like another waterfall, but the passage seemed to end in a sump with a five-centimeter-wide crack above the water-filled passage. Lowering my face into the water, I could see that the passage continued wide and deep, but it would be a long underwater swim that might require scuba gear. Although we had not brought tanks with us to Mexico, we did have dive masks, but we weren't carrying them with us. Again we had to retreat.

It was not until 24 February that we returned to Cerro Blanco. Bob and Greg, armed

with dive masks and underwater lights, made their way through the Blaster and up Pendulum Falls to the sump. It was decided that Bob would do the dive, with Greg remaining behind to hold a light underwater, so that Bob could find his way back if the passage didn't go.

Hyperventilating, Bob took a last breath and dove into the crystal-clear water. The underwater passage was five meters deep and five meters wide. Swimming strongly, Bob could see what looked like a turbulent surface of water ten meters farther. When he rose toward this pool with his hand held above his head, his hand broke the surface. Soon Bob's head was up, but as he went to breathe all he got was a mouthful of water. He had come up into a small room with a waterfall completely filling the chamber. He leaned against the wall of the room, so that his back broke the water and provided an airspace to breathe. Catching his breath, he then looked up at the waterfall that was hitting him in the face. It looked as if one could climb the waterfall by wedging into the crack at the edge

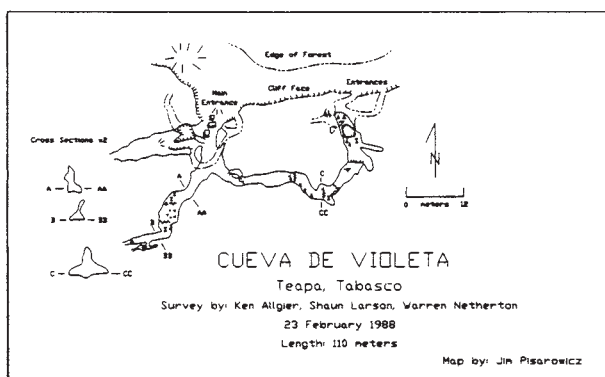
and again letting the water cascade over one's back so that one could breathe while climbing.

I returned with Bob and Greg another day to finish the survey through the sump passage, the Jet Stream. On the other side of the sump, Bob and I wedged ourselves up the waterfall, letting the water course over our backs to provide a pocket of air. The waterfall went up another ten meters. To our disappointment, all the water was coming out of a small crack that would be impossible to get through.

Small Caves

Several small caves were found through jungle bashing, but most were not worth surveying. On 11 February, while attempting to get to the top of Cerro Blanco to look for the insurgence, Warren and Bob found a small cave that Warren named Cueva de Puerco because of a pig's skull found there.

Peter Lord, whom we met up with in Villahermosa, told us of a cave he had found several years earlier, which he called Cueva de Violeta, after his wife. He had not mapped it, so Ken, Shaun, and Warren ventured into this small, muddy, stream cave and surveyed 111 meters.



A Master System

After we returned from a trip to the Yucatán to escape the constant rain (February and March are supposed to be the dry season), Peter was going to show us a river cave he had found called Agua Blanca. Agua Blanca is a state park with the main attraction being the Agua Blanca travertine waterfall. Like many of the

streams in Tabasco, this one issues from a cave. But the Revenge of Chac was still being heaped upon us. When we arrived at Agua Blanca, Peter informed us that the water was higher than he had ever seen. We arrived at the cave entrance to find it was sumped shut. An estimated ten to 20 cubic meters per second of water was pumping from the cave. The ground vibrated from the great quantity of water, and it was obvious that there was no way we could get into Agua Blanca under those conditions.

Disappointed about Agua Blanca, Peter informed us that there was a small cave up the hill from the resurgence that went in about 150 meters and sumped. Iztac-Ha, as the locals called it, had not been mapped. At least it was something to do, cavingwise, to justify the drive to Agua Blanca.

The entrance to Iztac-Ha is 20 meters wide, and the cave maintains that width most of its muddy way for about 100 meters to a sump. Peter indicated that there were no side leads, but, seeing that we had nothing else to do, we all started looking anyway. Warren and I were looking along the southern side of the main passage, when I ducked under a muddy piece of breakdown and found an almost walking-height side passage.

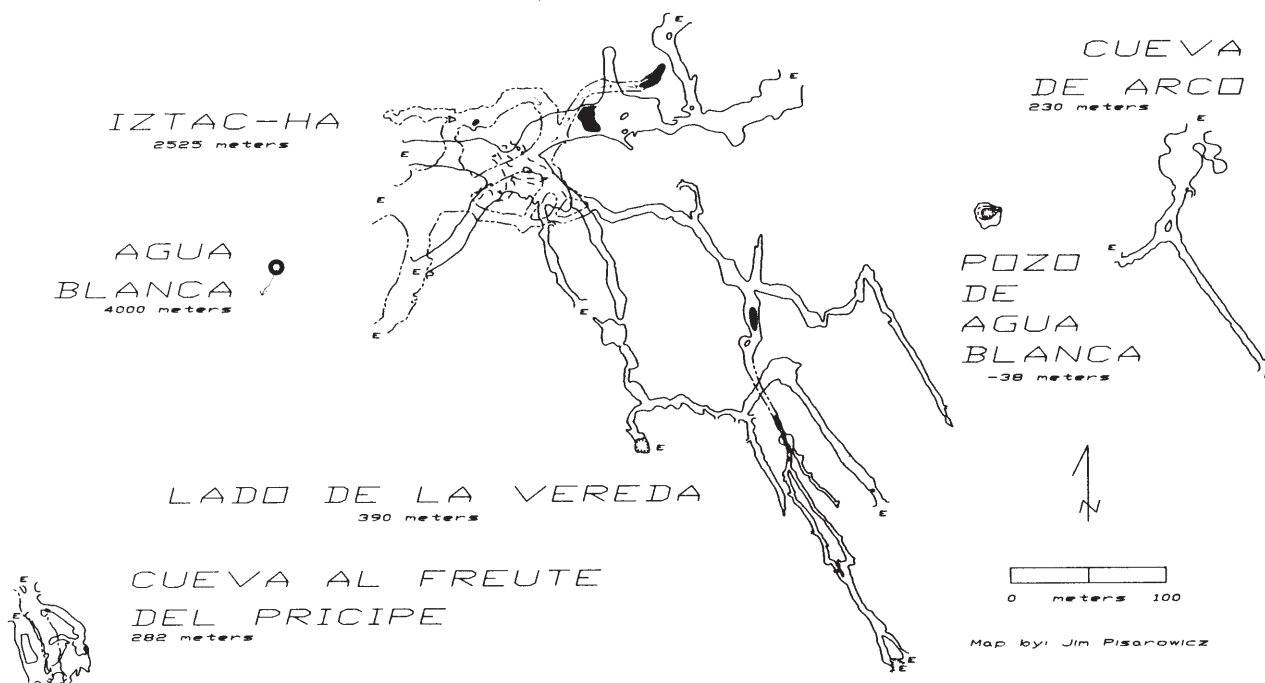
We quickly wandered down that passage until it opened in a section of rimstone dams, followed by a flowstone climb and then an-



Trunk passage in Cueva al Lado de la Verda.
(Jim Pisorowicz)

SISTEMA AGUA BLANCA

Macuspana, Tabasco



other 500 meters of virgin cave, ending in a small entrance back to the surface.

Returning to the rest of the group, we told them of our discovery, and, while they went to check leads in the new area, Warren, Shaun, and I returned to the trucks to get survey gear. That afternoon, in only seven hours of surveying, we mapped 1200 meters of cave with only one survey party. The rest of the crew went down the new passage and out the newly discovered entrance, and found another cave. It was beginning to look as if the area around Agua Blanca would keep us busy for quite a while.

As on all good caving expeditions, it seems all the good finds come at the end. With only a week to go before we had to begin the long journey back to the U.S., we had cave going everywhere. On 28 February, Ken, Shaun, and Greg continued mapping in Iztac-Ha while Bob, Dave, and I started taking photos. The next day, the new cave discovered by traveling

through Iztac-Ha, which we called Cueva al Lado de la Vereda, was mapped by Ken, Bob, Shaun, and Victor Dorantes, the president of the Grupo de Exploraciones Subterranas de Tabasco. In the process of surveying a traverse line along the surface from Iztac-Ha to Lado de la Vereda, Victor found another cave which he called Cueva de Arco.

Arrested!

Everything was going great until 2 March. Back in Tapijulapa, Bob, Greg, and I were getting ready to do a float trip in our wetsuits down the river, when we were arrested along with the other members of our party. We were taken from Tapijulapa to Tactotalpa, and questioned about stealing artifacts from the caves of the area. Apparently a story had appeared in the newspaper, *Presente*, with the title "Sigue el Saqueo Indiscriminado de Piezas Arqueologicas ("Indiscriminate Sacking of Archaeological Sites Continues"). The story went on to list

all the areas we had been caving in, and said that foreigners (i.e., we) were stealing artifacts. Stories had also been broadcast on the radio saying the same thing.

For a day, we sat in the police station in Tacotalpa until a representative from the Dirección General de Investigación y Seguridad Nacional showed up to question us. Sub-Delegado Ricardo Salvatierra Ibarra questioned us for about an hour, and then released us. We had to come to his office the next day for a briefing about what was going on. There, Peter and Dave, our best Spanish speakers, talked with Delegado Carlos A. Vega Saladaña about what was happening. Apparently our entire problem was the result of election-year politics. The opposition party to the current administration had charged the presidente with knowing that foreign nationals were in the state stealing artifacts. Fortunately for us, the Dirección General de Investigación y Seguridad Nacional were monitoring what was going on, and knew that we were who we said we were...simple, honest cavers.

Our stay with the police took away some of our last days of caving in Tabasco for 1988. On 4 March, we returned to the Agua Blanca

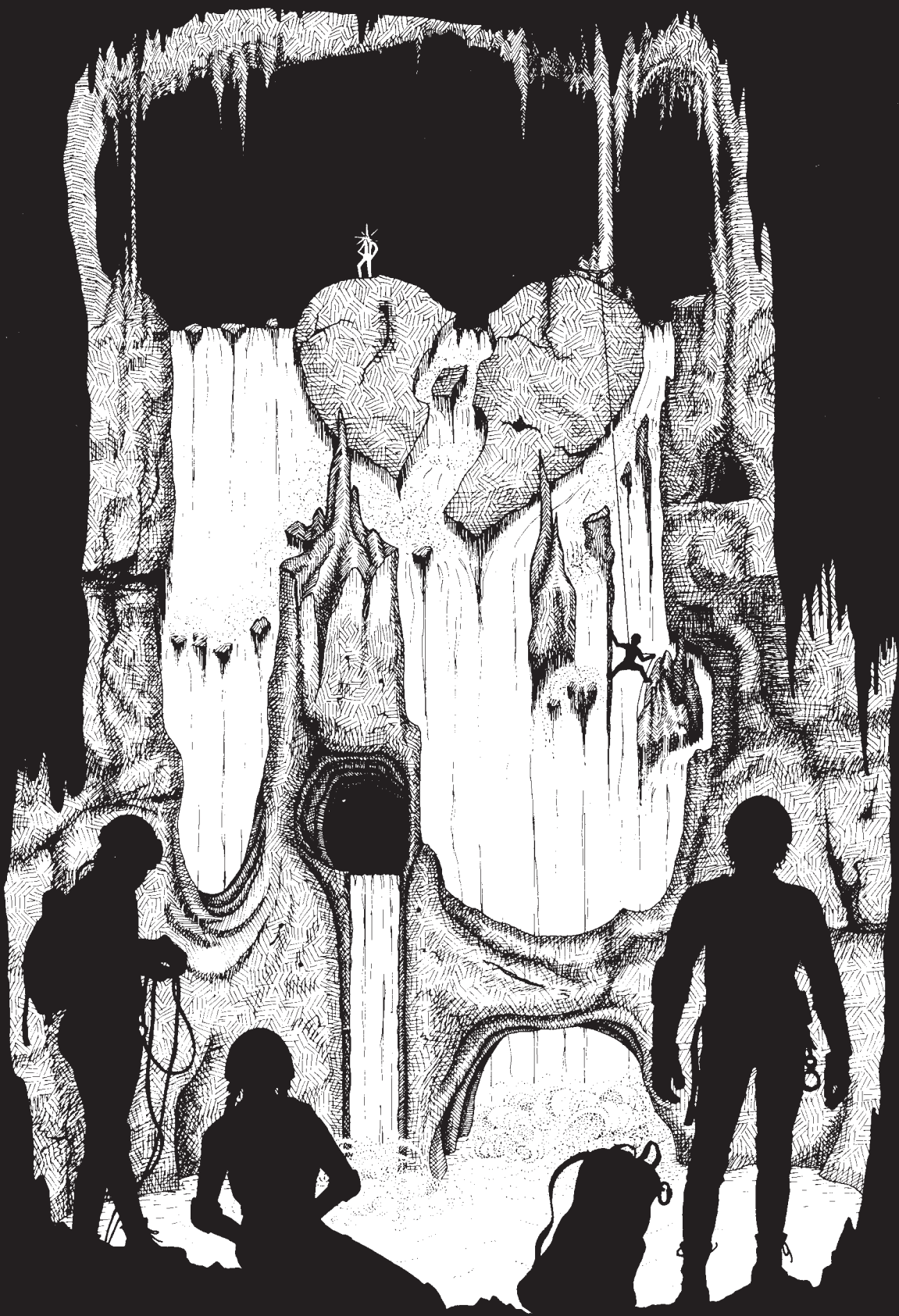
area. Shaun, Dave, and I went to try to finish Iztac-Ha, while Bob, Ken, and Greg mapped Cueva de Arco. While doing a surface survey over to Arco, that crew discovered a pit that was christened Pozo de Agua Blanca. It was a caver's dream come true. The place just seemed to have endless cave leads.

The next day, Bob and Greg had to leave for the United States, but Ken, Shaun, Dave, and I were going to stay to survey the new pit, and also try to finish off Iztac-Ha. Pozo de Agua Blanca blinded after a 33-meter drop. Back in Iztac-Ha, Ken, Shaun, and I surveyed several leads, bringing that cave to 2525 meters. While we were surveying Iztac-Ha, Dave discovered another cave, Cueva al Freute del Precipe, which we began to map, but we only got 282 meters before it was time to wrap up the expedition for the year.

Tabasco has been good to us so far. In two trips to the state, we have now surveyed over ten kilometers of cave, with known leads in all the large caves that we have found, just crying out to be explored and surveyed. It looks as if 1989 will be another Tabasco year. We hope Chac will keep more to his schedule, and allow the dry season to stay dry.

TABASCO 1988: VENGANZA DE CHAC

No obstante las lluvias incesantes en el área de Teapa, la expedición tuvo bastante éxito. La caverna más diferente fue Cueva de la Luz (o Cueva del Azufre), debido a los cristales de sulfuro encontrados en la paredes. Acido sulfúrico, el cual gotea desde el techo, perforó las lámparas, destruyó las ropas, y causó quemadas en la piel, despues de haber topografiado casi un kilómetro de pasajes. Por otro lado exploraban otra cueva llamada Cerro Blanco, la cual contiene un chorro bien caudaloso. Siendo explorada río arriba hasta que el pasaje se angostó, obstaculizando los espeleólogos. A finales de la expedición, se encontró varias cuevas nuevas, incluyendo uno que es posiblemente un drenaje principal del área.



T. GREYSTON © 1988

Tolantongo: The Through Trip



Ramón Espinasa

History

Grutas de Tolantongo is a well-known camping and resort park where a hot river (37 degrees Celsius) flows out of a cave. A little cave named El Tunel is situated a few meters above the resurgence cave. Above this is La Gloria, a 100-meter gorge with a cold little rivulet that cascades over the resurgence.

Over the years, this cave has attracted many *excursionistas* or hikers. The bravest entered the resurgence cave up as far as the Second Chamber, but the source of the water remained a mystery.

In 1979, George Veni and others began a study of the cave that eventually led to the discovery, in 1981, of a blowing hole in the travertine wall at the end of La Gloria. In 1984, they found the resurgence of the river at the other side of the same wall. But they never explored any of these, or any farther in the resurgence cave. Meanwhile, Alejandro Villagomez and others explored upstream in the resurgence cave in 1982 and 83. They scaled several very difficult waterfall climbs, ending their exploration at the top of one especially difficult cascade called the Turbine. The great

volume of water (2.5 cubic meters per second) made climbing the waterfalls very dangerous. Their explorations are described in *AMCS Activities Newsletters No. 13 and No. 15*.

Recent Exploration

It all started when a friend of mine invited me to go for the weekend to Tolantongo. As I had just been reading with interest about the explorations of George Veni and Alejandro Villagomez, I knew there were several unchecked leads. I took my helmet and lamp, a rope, and vertical gear to have a look, although I was the only caver in the group.

We stayed in the area for two days. Most of the time was spent swimming and enjoying the sun, but I also made a reconnaissance of all the known leads. First, I went upriver in the resurgence cave to the base of the climb into the Hot Legs Room to take a look at the Turbine. By then, I was certain that the best way to explore the cave was to come down from the top and not climb upwards. The Turbine totally convinced me of this, even knowing Villagomez had been up there. My compliments to his group for a very difficult bit of exploration.

Finally, I went up the La Gloria canyon with plans to repeat Jon Cradit and Eric Short's climb to reach the sumidero. Instead, when I reached the travertine hole that blows hot air, I thought it would be better to go down it. I tied the rope to an available column, and descended five meters to face a very little hole through which the river could be heard. I continued down 15 meters, through the top of a chamber full of bats, to El Balcón, a ledge overlooking the next drop. On the other side I could see the Sumidero entrance, and a very impressive cascade. Immediately, I understood why Veni's team thought it would be suicidal to enter that way: between two and three meters per second of water cascaded down a 40-meter pitch. Luckily, I was on a ledge opposite the cascade. I could faintly see the foaming water at the bottom. From this side, it was a 40-meter, mostly free drop, but from the sumidero side you would need at least ten meters of horizontal aid climbing to rig a rope out of the water.

I was very excited by my last discovery. As soon as I returned to Mexico City, I started making plans to return and continue exploration.

Rigging Through Cascades

Four days later, on 29 April, Octavio Alberola from SMES, Patrick Vanstraelen, François Guinand and Isabel (a non-caving friend of the latter) from Belgium, 250 meters of rope, and I reached Tolantongo very late at night. Next morning, we went to the resurgence area so that the others could see the beauty of the place. François and Isabel decided to stay there, so the rest of us started climbing towards La Gloria.

By 11:00 a.m. we reached the Travertine Hole and immediately started rigging. Patrick was the first down, rebelaying the rope on the ledge five meters below. We all regrouped on El Balcón. Another rope was tied there to some stalagmites, and Patrick continued down, placing a spit at the edge of the pit for a free descent to the lake at the bottom. I was next down, and, hanging from the spit, I could see him fighting the foam, trying to reach the shore. After a while, I could hear him banging in another spit, a sound that would become familiar over the next several hours. After it was set, I rappelled down into the cascade chamber, named Cascada Françoise after a Belgian girl I had met a couple of weeks earlier. When I reached the water, I could see Patrick hanging from the spit at the edge of a water chute. All the water flowed between walls only 1.5 meters apart. Unfortunately, that was going to be our route.

A traverse through the chute, another spit, and a rebelay on some flowstone led us to a lake. Patrick, belayed by me, swam near the right wall, away from the strong current, and placed a piton for a traverse. From there, a short walk in waist deep water led us to the next chute. A couple of spits were placed for a traverse along this chute. A rather exposed move to the right got Patrick out of the chute, and enabled him to rig the next drop, of ten meters, free of the water.

We found ourselves on the shore of another, bigger lake. The water arched into the void ahead, blocking the way. The heat had made Patrick very tired, so I took the lead. Climbing to the right, I managed to place a spit, from which a rappel could be made into the lake past the cascade. I swam along the right wall, to a place above the next cascade. To avoid the cascade, we chose a climb up the right wall using a couple of spits for aid. I placed the first one (probably the most tiring action inside this hot cave), Patrick the next one, and then Octavio took the lead. He led us up a series of flowstone ledges. Quite a bit of water joined the river here, coming from some unexplored crawlways. We then made a couple of tricky moves to a place where a free descent, far from the cascade, could be rigged into the foaming lake eight meters below.



Grutas de Tolantongo with El Tunel in the upper left. (Gary A. Poole)

After placing a nut, we arranged the rope, and Patrick went down first. When he reached the water, the currents kept pulling him either towards the previous cascade, or underwater. After several tries and a little bit of water swallowing, he climbed back up, exhausted. I took the lead, and somehow managed to catch the correct current, which took me towards the next chute. Two spits were placed here, one at the beginning of the chute and another at the end. A one-meter cascade flowed into a lake that looked very deep. About ten meters ahead a boulder shore could be seen. I was getting very tired, so instead of placing more spits, I decided to go for it. Bridging between the walls, with the entire river between my legs, and ignoring Patrick's protests (he is a very technical caver), I got into the lake, and, with some difficulty, swam to the shore. Here, I placed another spit for a tyrolean. The others joined me. A couple of spits later, we were overlooking an eight-meter drop to a perfectly round plunge pool, which required some elaborate bolting to avoid the water. We were very tired. It was getting late, and we had only ten meters of rope left (the entire cave was rigged, every single meter requiring some kind of belay), so we decided to end our exploration there.

Going Against the Flow

Since the noise of the water prevented any communication more than two meters apart, Patrick started mapping by himself with a topofil. Meanwhile, Octavio and I derigged. Very soon the first bag was full of equipment, so Octavio started out, while I kept derigging. Going down with the current had been easy, but going up was a very difficult struggle against the current and the growing pile of equipment. Finally, I was on the last chute, under Françoise Cascade. With a bag hanging from my harness, I had climbed up almost to the spit when the bag fell into the water, pulling me with it. Luckily, my ascender safety held the fall. After a few endless seconds, I managed to get out of the water. I repeated the climb, only to fall again. This happened three or four times, until I finally managed to reach the spit and hang the bag from it. I swallowed quite a bit of water in the process, and got very tired.

For a while, I contemplated leaving the bag there, but I finally convinced myself to haul it up. The most tiring 30 meters of my life later, I reached El Balcón, left the bag there, and climbed to the surface to cool myself in one of the cold pools of La Gloria. Patrick, who was not so tired, went down to retrieve the bag, and derig the last two pitches. We had done a 12-hour trip for only 200 meters in surveyed length and 100 meters in depth, most of it achieved in the entrance series.

The Return Trip

When I finally reached the surface, I vowed never to return to this difficult, tiring, and awfully hot river cave. But as soon as we were back, the ropes and equipment dried, and the multiple scratches and scars healed (we had explored in shorts and t-shirts because of the temperature), we started making plans to return. Meanwhile, Patrick and François left Mexico to return to Belgium. However, Françoise Esser, the girl in whose honor I had named the first cascade, and Jean-Claude (Jack) London had returned from Veracruz with a couple of weeks to spare before going back to Belgium.

On 8 May, my brother Luís and I picked up Octavio, Françoise, and Jack at Octavio's home. We did not reach Tolantongo until about 5 a.m. It was tough to get up early, but we managed to reach the travertine hole by midday. I went down first, and while waiting at El Balcón, was hit on the nose by a rock dislodged by Octavio. Blood started flowing, but soon stopped. The pain subsided, leaving behind a scar that lasted several weeks.

With the spits already in position, the only thing we had to do was place a hanger, tie the rope, and rappel down. Progress was quite fast. Soon we reached the previous end of exploration. Here, we stopped for a snack of bananas, which Françoise took out of her pack. This inspired the name Cascada de los Platanos for the next pitch.

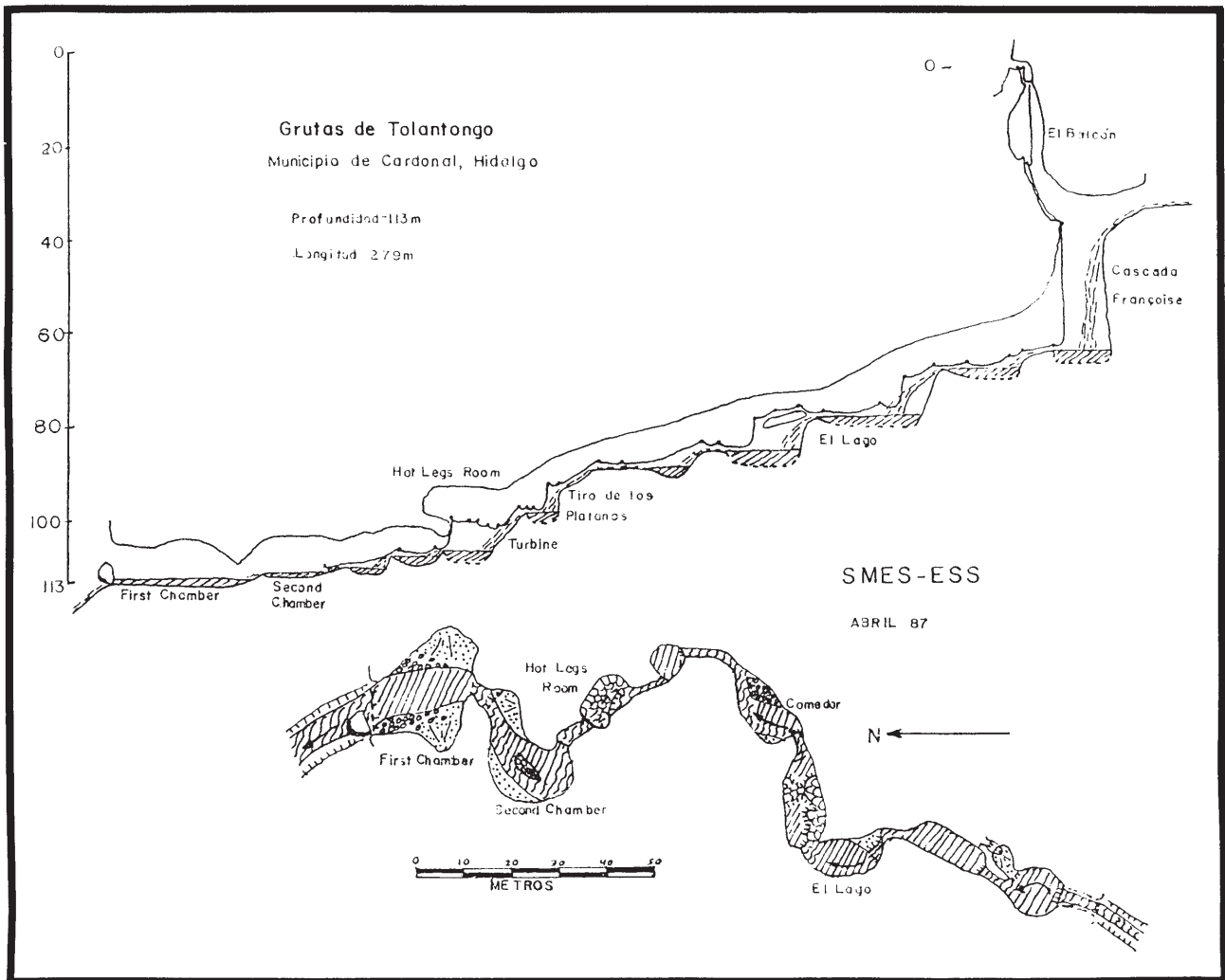
Jack went first. At the edge of the cascade he placed a spit, and, using it, he managed to place another one to the left of the water. Then he went down, followed by Luís. They placed a couple of spits at the edge of a one-meter-

wide fissure, where the water cascaded with terrible violence. This took quite a lot of time, since the rock was extremely hard, and the spits kept clogging with dust. Once this task was finished, they saw a bolt with a rope hanging from it on the opposite side of the river. That meant this was the point of furthest penetration upwards by Villagomez.

I managed to cross the river, while belayed by Jack, and reached a ledge and the bolt. Looking down, I recognized the lake below the Turbine; the resurgence was not very far away. We rigged a rope, and I went down first. By bridging across the fissure, I could avoid the water. I descended until I saw another bolt on the right wall. When I tried to place a carabiner in it, I couldn't, as it was coated by a thick layer of calcite. Knowing its strength would be lessened but trying to avoid placing more spits, I banged it with the hammer, until the coating disappeared, and the carabiner fit. Rebelaying the rope, I kept descending, reaching the lake at the same place the cascade did. This was too difficult a descent line, so I climbed up again. I noticed a line of pitons and bolts going horizontal on the right wall. Reaching them, I traversed via several difficult moves until I reached the Hot Legs Room. There I tied the rope, and yelled for the others to follow. Exhausted, I lay down in the flowing water, too hot and tired to care.

A Turbulent Connection

The others reached this room shortly, although Françoise had some trouble on the traverse. We tied the rope to some bolts, and again, I went down first. At the bottom, I swam across the lake with difficulty, as the rope would not run through my rack. Finally, I reached the shore at my farthest point of penetration upwards. I couldn't find any anchor point, so I yelled to Jack to come down with the spit kit. When he reached the water he had the same trouble as I did, but the weight of the equipment he carried pulled him underwater. Françoise, seeing this from the top, started yelling, but the cascade's noise drowned out her voice. Meanwhile, Jack was beginning to get tired. I couldn't do anything to help him, as pulling the rope only jammed it further into his descender. Luckily, the water current pushed him downstream until I could reach him, and



pull him to safety. Just then, two or three meters back up I spotted a rope sling on a column, left by Villagomez's team on their retreat. While Jack rested, I climbed up to it, belaying the rope as a tyrolean to avoid the troublesome lake.

The Through Trip Completed

From that point on, it was relatively easy to get to the exit. There was only one more chute to negotiate. I went first, bridging and downclimbing to the Second Room. There, I tied the rope, and everybody came down. Telling them to go on out, I climbed up again to take the last rope off, so that it would not be damaged by the tourists the next day.

When this was done, I downclimbed to the Second Room, expecting to find the others frolicking in the cold water cascades outside. Instead, I found them sitting at the water's edge, looking at the low-ceilinged canal between the Second and First Chambers. The passage looks rather nasty from the top. The noise from the waterfall in the ceiling in the First Chamber sounds ominous. Being 8 p.m., no daylight reached this point, so the others were afraid of entering the swift waters of the canal, as they had never been there as I had. I showed them there was no problem by letting myself float into the canal and out to a perfect night, and, most important, a cold rivulet to cool myself off. The others followed, and soon we were all embracing each other, celebrating the first through trip of Tolantongo.

Derigging

The next day, Sunday, we were preparing to derig, when Luís discovered he had left his pack in the Hot Legs Room. This wouldn't have been a problem, except that it contained all of our carbide. With electricians, we both went to pick it up, attracting quite a few tourists, who were already swimming in the Entrance Chamber. Reaching the tyrolean, I climbed up it, which proved rather difficult as it was diagonal, picked up the bag, and returned to the surface.

Soon, we were climbing up the now-familiar path to La Gloria. Luís and I derigged from the third lake down on a series of pull-downs, while Jack and Octavio derigged upwards. Françoise decided to remain on the surface to rest. The derig was uneventful. Soon, we were in the Second Chamber, where we met with Jack and Octavio, who, having finished derigging, had come down to help us. Soon, we were at the entrance, strange creatures in harnesses, with flaming carbide lamps and coils of rope, among the bathing tourists. Françoise took a few pictures as we left. We packed up camp and reached Mexico City that night.

Conclusions

This cave is surely going to become a classic in Mexico. A pull down trip is possible, provided one takes enough bolthangers (for 8mm in diameter spit), slings, two or three nuts and two 35-meter ropes. The beautiful and highly technical passage (sporting, the British would call it), and the hot, 35 degrees Celsius water will make it very attractive to Europeans and Americans accustomed to cold water. I would suggest bringing one lifesaver jacket per person, and a bolt kit, as probably most of the spits we placed will become covered with calcite, which precipitates quickly due to the high temperature. The lifesaver will help prevent unpleasant experiences such as Jack's under the Hot Legs Room. Although most of the time we used carbide, a helmet-mounted electric light is mandatory. The wind and spray frequently blow out your carbide flame, usually in some awkward spot where you don't have a free hand to relight it. Although short and not too deep, a through trip will take at least five to eight hours of very interesting, fun, and sporting caving.

TOLANTONGO

Las Grutas de Tolantongo, bien conocidas por su río caliente y facilidades para campisias, son también una cueva bien conocida entre los espeleólogos más técnicos. En 1981 la insurgencia llamada La Gloria fue visitada por George Veni, mientras tanto otro grupo dirigido por Alejandro Villagmex exploraba río arriba (42% de la cavidad en total) incluyendo La Turbina, descrito como un pasaje de alto grado de dificultad.

En 1987 las dos cuevas fueron conectadas en dos exploraciones por espeleólogos mexicanos y belgas. En cuya primera se topografiaron 100 metros de profundidad y 200 metros de longitud. El 8 de mayo se conectaron las cuevas y salieron por Tolantongo. Dichas exploraciones requirieron de amarres, desviaciones, y toda clase de técnicas, sobre cuerda pues, debido a la dificultad, metro tras metro debe estar protegido. Tolantongo se ha convertido en la caverna donde las técnicas más modernas son usadas al máximo.

1988 Italian Explorations in

G U E R R E R O



The final room in Resumidero di Ixtemalco.
(Maurizio Glavina)

Renato Dale Mule and CGEB

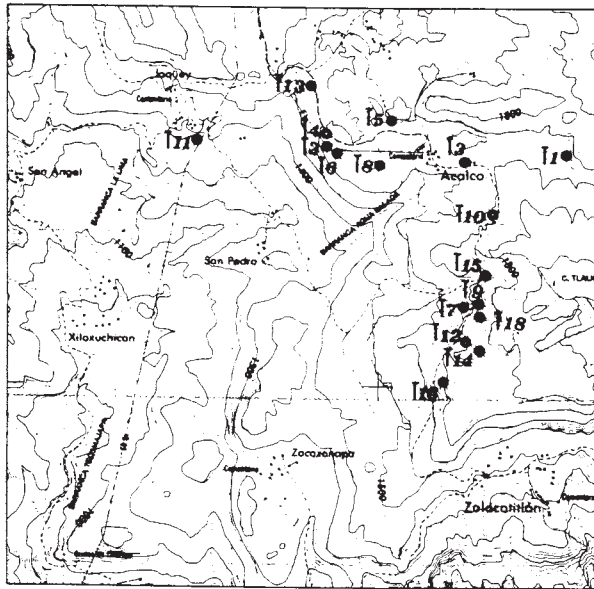
In March 1988, the Commissione Grotte "Eugenio Boegan" (CGEB) of Trieste, Italy, returned for their fourth caving expedition to Mexico. Exploration of the area visited in previous expeditions was completed, and exploration of a new area was begun.

The five-member team (a Mexican caver dropped out at the last moment) was in Mexico from mid-March to mid-April, first in the karst area close to Chilpancingo, the capital of the state of Guerrero, and then in a new area located some 80 kilometers east-southeast of Chilpancingo.

Two pairs of cavers at a time conducted exploration, while the fifth person stayed at camp to draw maps. The use of field radios to maintain communication proved to be very useful. The locals always provided their help, giving directions, and also frequently taking the cavers to the most well-known caves.

However, exploration on the plateau proved to be very difficult, due both to the large differences in elevation, and to the very thick vegetation.

Because the explorations of the last expedition were in the area from Ixtemalco and Huacalapa to Coapango (Cueva del Diablo), the first base camp was established at San Vicente, located west-northwest of Coapango in a plateau that ranges from 2000 meters in elevation at San Vicente up to 2800 meters. The borders of the plateau are: to the north, the aqueduct that runs from Omiltemi to Xocomatlán, to the west, the ridge which slopes down towards Chantipa, and to the south and east, the area visited on the last expedition. The three main caves explored in this area were Cueva del Puma (Cougar Cave), Resumidero dei Vampiri (Vampire Resurgence), and Resumidero de l'Aqua (Water Resurgence). In Cueva del Puma, boot tracks and a

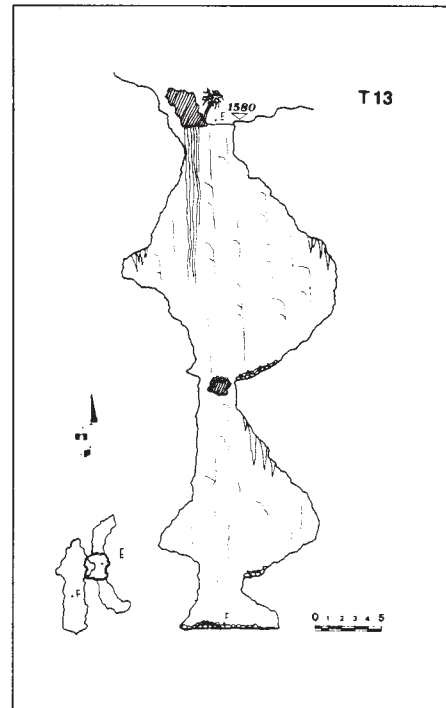


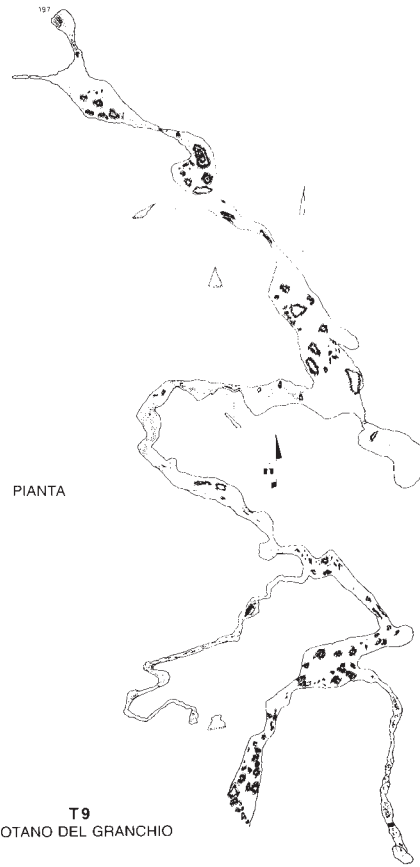
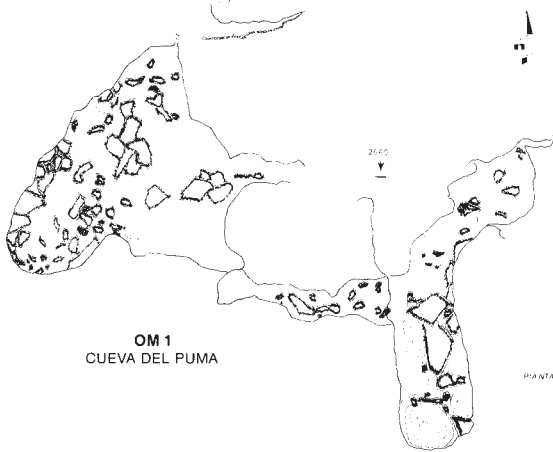
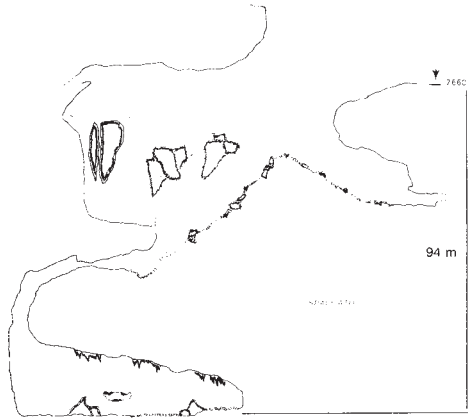
AREA MAP

pair of gloves indicated past exploration, but only to the top of the first pit. Resumidero de l'Aqua was probably the most interesting cave, ending in a vast and richly decorated room.

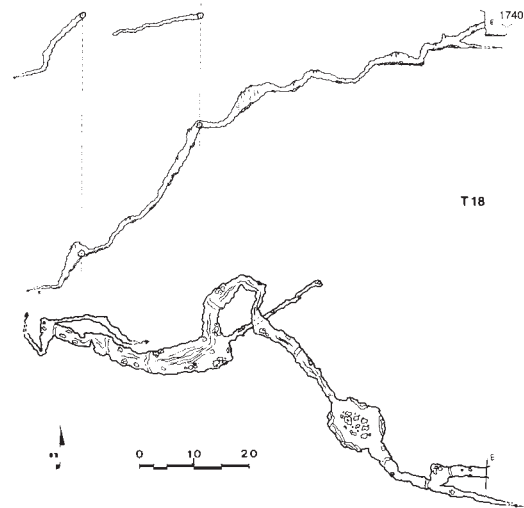
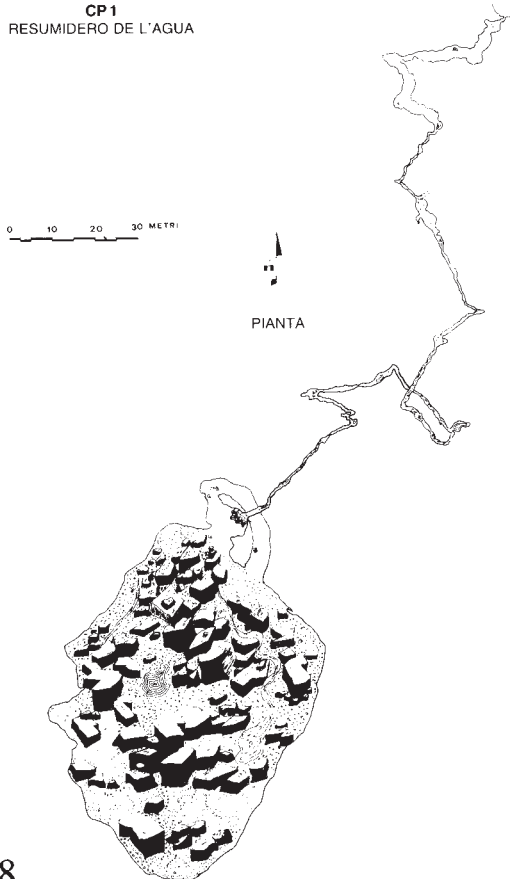
The second area visited was a hilly plateau intersected by several rivers, of which only one was found to be active, the Barranca del Aqua Salada. Elevations range from 1100 meters near San Angel-Xiloxuchicán up to 1800 meters in the hills north of Acalco (Talistahuacán). The limestone's vertical potential in the area is estimated to be about 800 meters. The main caves explored were Sótano delle Liane (Vine Chasm, 238 meters deep and 492 meters long) and Sótano del Granchio (Crab Chasm, 197 meters deep and 700 meters long). Near the town of Colotlipa, after an invitation from the owners, the upper level of a tourist cave was explored. The cave is five kilometers long, but is open to the pub-

CAVE	DEPTH (meters)	LENGTH (meters)
T 1	17	48
T 2	5	16
Cueva di Tlalistahuacán	23	245
Cueva Sacrificale	14	100
Cueva de Taposonalco	3	27
T 6	11	20
T 7	30	12
T 8	3	49
Sótano del Granchio	197	700
Sótano delle Liane	238	492
Cueva de Aclitengo	5.8	36
T 12	19	13
T 13	39	10
T 14	26	8
Cueva dei Szinclan	71	138
T 16	19	9
T 18	70	228.5
Cueva del Puma	94	310
Resumidero de l'Agua	180	375
Caverna a Sud del Cerro Prieto	30	55
Resumidero del Mescal	41	105
Resumidero dei Vampiri	16	145
Pozzo di las Pilitas	16	8.5





CP 1
RESUMIDERO DE L'AGUA

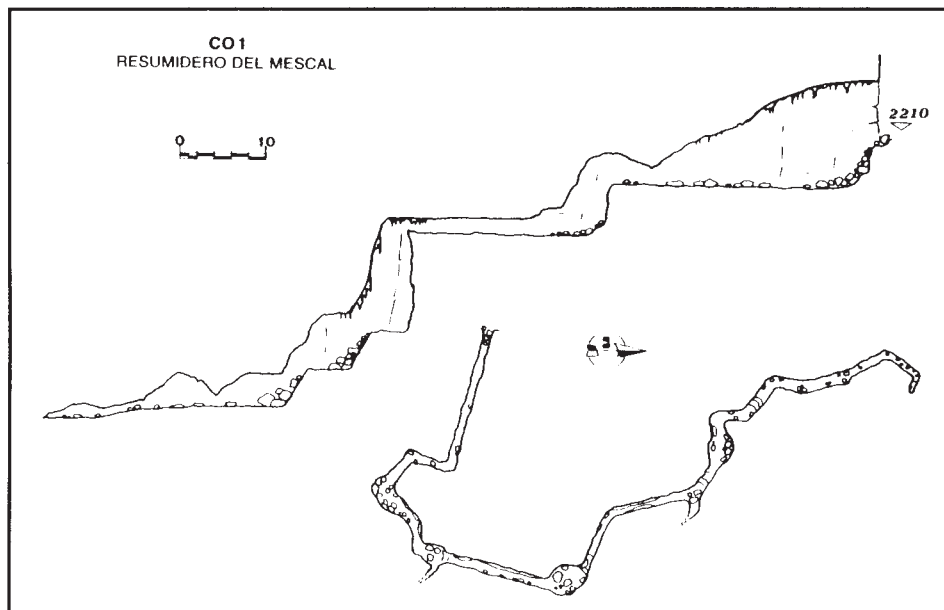
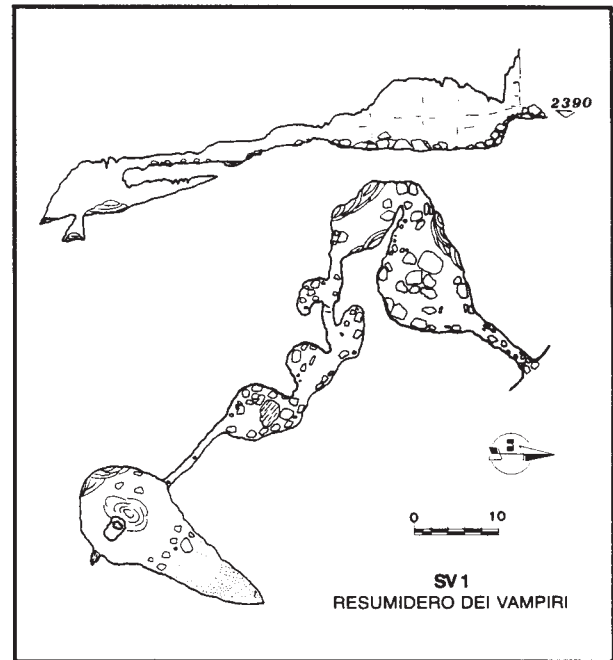


lic only for the first two kilometers. After a long and tricky aid climb, a window was reached, but the passage soon came to a dead end.

A planned visit to Sótano de Oztotempa, an old, but still in use, sacrificial pit near Atliaca, estimated to be some 150 meters deep, was cancelled due to the opposition of the local inhabitants.

The final result of the expedition is a few dozen caves found and explored, three-quarters of which are in the new area. This is a very productive result for such a small number of persons in less than a month of field work.

A detailed article concerning all the past expeditions of the CGEB in Mexico is in preparation for the next *AMCS Activites Newsletter*.



ITALIANOS EN GUERRERO -1988

En marzo 1988 los espeleólogos de Trieste, Italia del Commissione Grotte "Eugenio Boegan" regresaron para su cuarto expedición a Guerrero. Los cinco espeleos investigaron dos áreas, primero en los alrededores de Chilpancingo, y despues a unos 80 kilómetros al este-sureste. En la segunda área exploraron Sótano de la Liana, con longitud de 482 metros y profundidad de 238 metros, y Sótano del Granchio, más o menos 24 cuevas.



LA FANTÁSTICA GRUTA DE YAAX-NIK

Carlos Lazcano S.

Cave explorers usually hope for grand discoveries underground, to find the longest cave or the deepest pit, pursuing the limits of the subterranean world. Among some groups of cavers this has become a part of a philosophy in which the prowess of the group or explorer is in direct proportion to the discoveries that are made. To discover "big things" is the principle motivation of many young cavers, and I believe that almost all of us go through this stage. There exist, however, other parameters, less objective, such as the beauty of caves. This is a goal of a type of caver perhaps more mature than the seeker of records.

Beauty underground can be readily apparent on a large scale, as in the case of Sótano de las Golondrinas, as well as in small caves, where fine speleothems and erosional forms can be found. However, it should be said that beauty is subjective, depending greatly on the observer. Much also depends on the heart of the individual, what comes from inside. What underground beauties have been passed, unnoticed, by the record-seekers? Beauty underground is a work of time, of patience, of the growth of a crystal, or of a penetrating beam of light. It is a separate underground personality, different from those of the explorers. It seems to me that the cave "pushers" are the strength of caving, while the observers of beauty are the conscience and wisdom.

Wisdom, according to Bertrand Russell, is just a concept of life, right for oneself. Wisdom in caving is finding the beauty that all caves contain, the uniqueness of each. Ultimately, the caver may find a reflection of his soul.

I make these comments reflecting on my encounter with Yaax-Nik, a Yucatán cave of extraordinary beauty.

Yaax-Nik was like a bubble in the heart of the mountain: there it was born, and grew, 300,000 years ago, in the Sierrita de Ticúl, in the state of Yucatán, on the peninsula of the same name in one of the most fascinating karst regions of Mexico.

In 1952, Señor Andrés González began digging a well on his dry farm, for he needed water for his thirsty cattle. With dynamite and the strength of many arms, little by little the well was deepened, until in 1953, they intersected the small branch of a cavity at a depth of 53 meters. However, Sr. González was more interested in finding water and continued to deepen the well, until reaching the water table at over 80 meters depth. The well was never functional due to its great depth, but the door was opened on one of the most fascinating caves in Mexico.

The cave is named for its location on the old hacienda of Yaax-Nik, near the town of Yotolín. Yaax-Nik is a Mayan name meaning green tree, in reference to an abundant variety of trees in the region.

To the campesinos, simple people with no concept of underground beauty, Yaax-Nik was not regarded any differently than the multitude of other caves in the region, and Sr. González set about removing speleothems to sell in the nearby market in Ticúl. After a time, Sr. González died, and awareness of Yaax-Nik remained with a few local campesinos, who would visit it from time to time to remove formations, or to guide the odd visitor who had heard rumor of the cave. For this purpose, the locals had constructed a basket in which a person sat for the descent, to be lowered with a windlass by several persons. This safe and ingenious system was also used to raise the explorer.

In April 1985, I was living in Mérida, Yucatán, immersed in the exploration and study of the caves of that state. A friend told me of

the cave and its beauty, but he had told me about many others, so I saw no reason to visit it first. So Yaax-Nik was nearly the last to be visited on my list of a hundred caves.

It was not until February 1986 that I finally made it to Yaax-Nik. After the interesting descent of the 53-meter artificial shaft by the traditional method, I found myself in a world of fantastic beauty that I had not remotely anticipated. Deeply impressed, my delight increased as I explored almost every alcove of the cave, covered as they were with thousands of incredibly beautiful speleothems. Room by room, gallery by gallery, passage by passage, I experienced a cavern of inexpressible beauty that brought forth intense feelings within me.

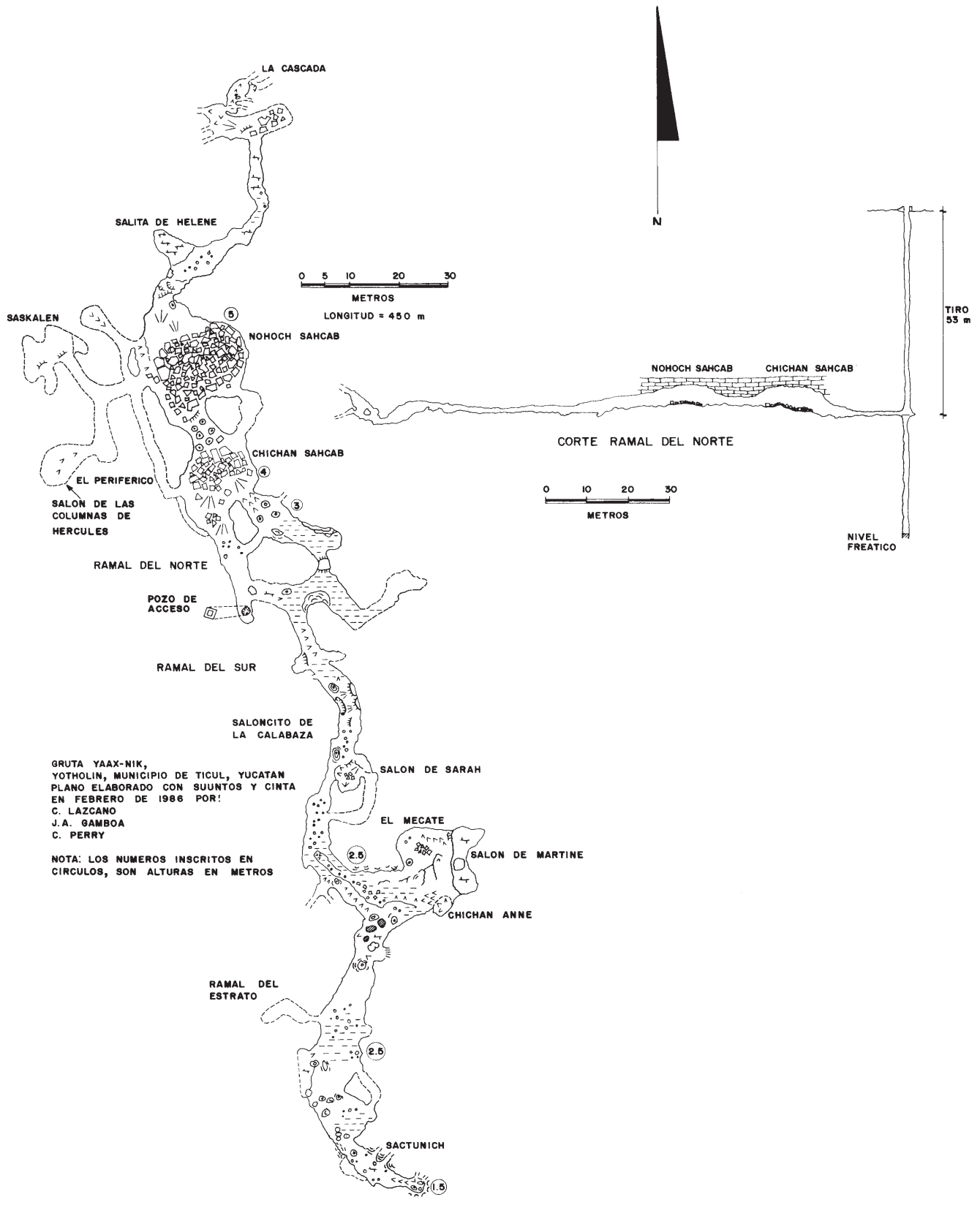
After my first visit to Yaax-Nik, I returned a few days later accompanied by José Gamboa and Carlton Perry. We stayed in the cave for three days, exploring, studying, mapping, and



Previous Page: Salón de Martine.

Right: Descending using the local technique.

(Carlos Lazcano S.)



GRUTA YAAX-NIK,
 YOTHOLIN, MUNICIPIO DE TICUL, YUCATAN
 PLANO ELABORADO CON SUUNTOS Y CINTA
 EN FEBRERO DE 1986 POR:
 C. LAZCANO
 J.A. GAMBOA
 C. PERRY

NOTA: LOS NUMEROS INSCRITOS EN
 CIRCULOS, SON ALTURAS EN METROS



Salón de Las Columnas de Hercules.
(Carlos Lazcano S.)



Salón de Sarah. (Carlos Lazcano S.)

photographing, always under the aura of its exceptional beauty. Yaax-Nik has a length of 450 meters oriented northwest-southeast, almost north-south. The entrance shaft intersects the cave almost in the middle, so we divided the cave in two, the North Branch and the South Branch. The North Branch begins as two rooms, and while they are the most spacious in the cave, they are not large. To differentiate them, one we named Chichán Sahcab (small room in Mayan), the other Nohoch Sahcab (big room). Both of them display the rare and extraordinary formations that can be seen throughout the cave. Passing Nohoch Sahcab, one enters the Salita de Helena, decorated with giant calcite crystals. The floor is smooth and crystalline, as if made of ice. Beyond, it is as if the imagination of nature went overboard, with crystals and concre-

tions covering walls, ceiling and floor. The North Branch ends in a colored flowstone cascade surrounded by aragonite.

In the Nohoch Sahcab, there are four small side passages, one of which takes you to a room we call Saskaleen (or crystalline rock). Absolutely covered in calcite, with unusual crystals that we termed arborescent, its beauty is incredible.

The South Branch, a little larger than the North, is equally fantastic and beautiful, although different: the Salón de Martine, with its crystalline floor, the Salón de Sarah, its ceiling covered with helictites, and finally Sactunich (white rock), with its fine white stalactites. But above all, our attention was drawn by the place we called Chichán Anne (little Anne), filled

with extraordinary formations covered with dogtooth spar. Here were stalactites, stalagmites, and columns covered with spar, a place unique in the underground world of Yucatán.

In both the North and South Branches, there are other small passages filled with beauty; any of these alone would impart great beauty to any cave in the world.

Although Yaax-Nik has been heavily vandalized, a large part of its beauty remains intact. The locals know less than half of the cave, and care should be taken that they don't

see more. The cave has now been brought to the attention of the authorities of the state of Yucatán, in the hope that it may be preserved as a legacy for mankind.

In closing, it should be mentioned that Yaax-Nik has not been without its tragedies. A number of years ago two youths from Mérida decided to descend the shaft by hand with their own rope. On the ascent, the first youth lost his grip after 45 meters and fell 75 meters to the bottom of the well.

LA FANTASTICA GRUTA DE YAAX-NIK

Yaax-Nik (palabra maya que significa "arbol verde") fue descubierta en 1953 por el Señor Andrés González, al escavar un pozo en su rancharía que se encuentra en la Sierra Ticul del estado de Yucatán. Un ramal de la caverna fue interceptado por el pozo a una profundidad de -53 metros. Para descender, los lugareños usaban una canasta, y así ganaban acceso a la caverna para guiar turistas y sacar espeleotemas para vender. La cueva mide 450 metros y está orientada del noroeste hacía el sureste, y el pozo se intersecta la cueva casi a la mitad. Teniendo como atractivo principal sus espeleotemas, y la cual a atraído la atención de las autoridades del estado con la esperanza de preservar su belleza para futuras generaciones.

Take nothing but pictures....

Leave nothing but footprints.....

Kill nothing but time.

Chiapas, 1986

The French and Italian Expedition

Renaud Lampli

The 1986 Chiapas expedition is a good example of how two different national groups, each speaking a different language, can overcome cultural barriers and personal interests to work together towards a common aim: explore as much cave as possible!

The expedition was jointly organized by the Abîme Club Niçois (France) and the Spéléo Club Orobico C.A.I. de Bergamo (Italy). Members of other French and Italian clubs also participated.

The team was made up of nine French cavers and six Italians. Our goal was to explore the karst region of Llano Grande, Chiapas. As this region did not turn out to be as cavernous as expected, we also spent a considerable amount of time in the karst areas of the municipality of Las Margaritas, also in Chiapas.

Llano Grande Area

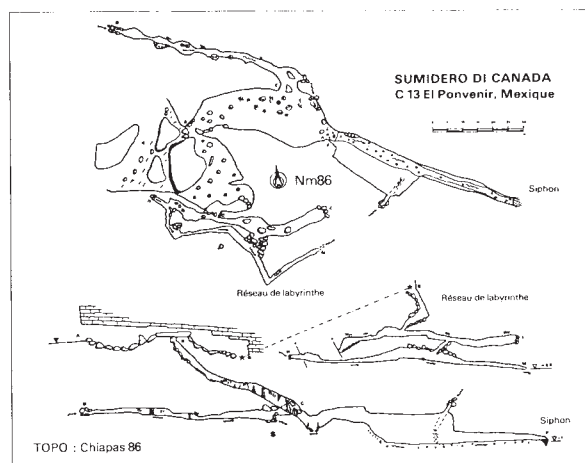
This area is located close to the Guatemala border, in the southeastern part of the state. It marks the first risings of the Sierra Madre, which traverses the region from southeast to northwest. These mountains are immediately north of the deep gorge of the Río Grijalva, which itself is just north of the small village of Motozintla.

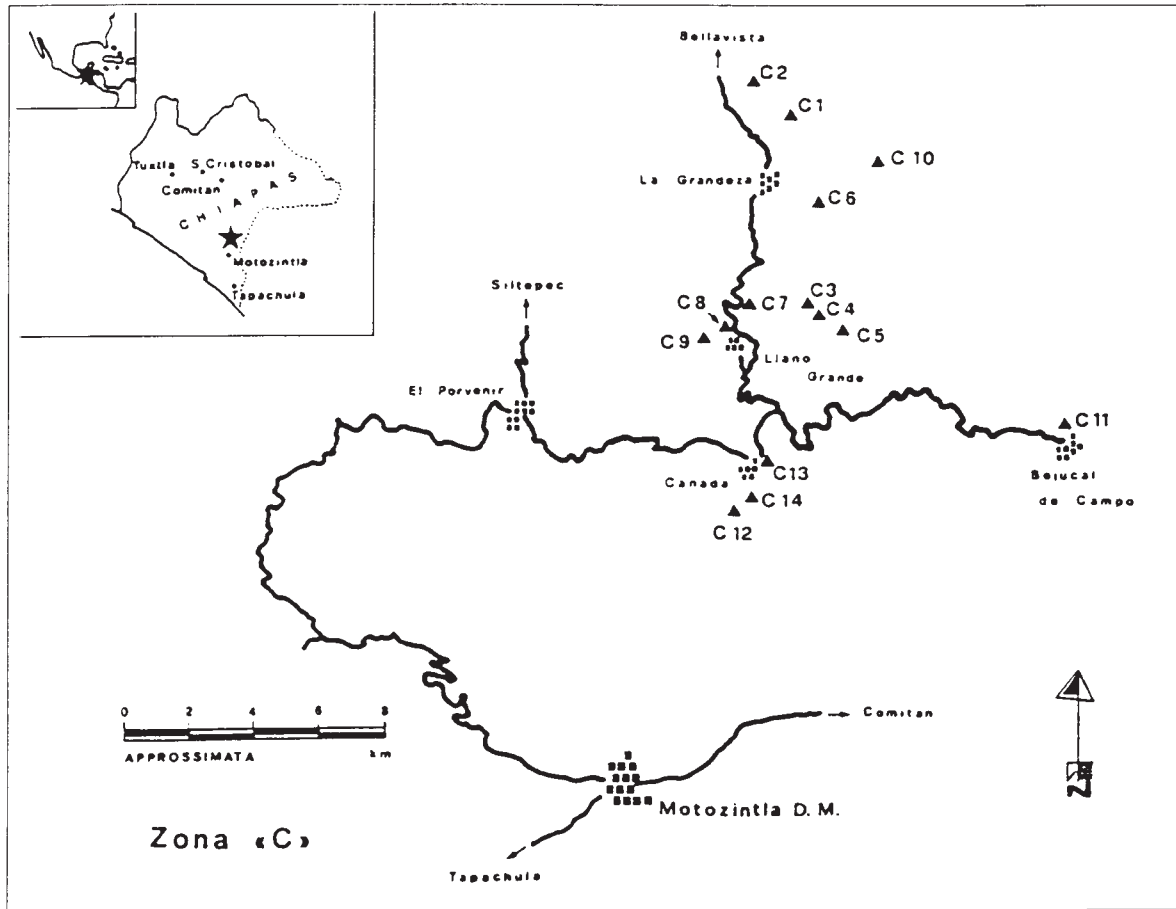
From the village, a dirt road climbs 47 kilometers to the large karst basin of Llano Grande in the municipality of La Gradeza. During the dry season, the road can be driven with normal vehicles (we had Volkswagen minibuses), but we have been told that during

the wet season it is almost impassable even with four-wheel drive.

According to the geologic map of the area, the karst consists of a large block of limestone of lower Cretaceous age. It is bounded by silts and sands of Triassic and Paleozoic age, and underlain by Paleozoic intrusions. The limestone of interest to us is generally of a darker color, stratified in irregular layers 50 to 80 centimeters thick and containing numerous fossils.

Karstification has proceeded with the creation of numerous dolines that almost join together, and have steep sides and flat bottoms. Many water conduits are seen, but very few are large enough for human penetration. The flat bottoms of the dolines are due to significant accumulations of clay that make it difficult to see the bedrock. There is a lot of precipitation in this area, even in the dry season, and karstification does not appear to be taking place at depth, but rather just below, or at the bottoms of the dolines.





During the eight days that we spent in this region, we explored and surveyed 14 caves, whose locations are shown on the accompanying map. We observed, but did not map, two or three caves that take small surface streams and follow the topography only a few meters below ground.

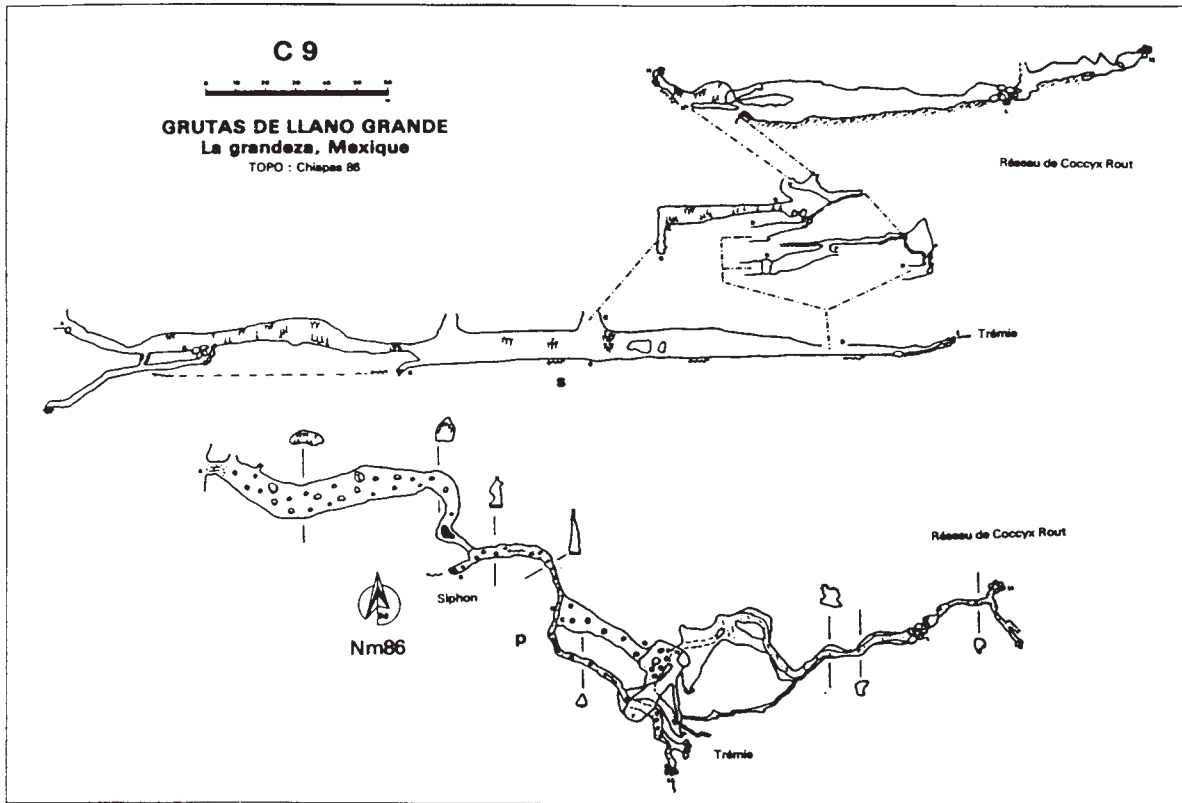
Grutas de Llano Grande (C9) is located directly opposite the village at the foot of the hill that dominates the landscape. From the moderate-sized entrance access is soon gained to a huge, very well-decorated, fossil trunk passage, averaging 15 to 20 meters wide and five to ten meters high. Arriving at a lake, one passes through a narrow section to a stream passage with a flow of about ten liters per second. The downstream passage soon ends in a sump. Upstream, the passage can be followed for a considerable distance to a waterfall barrier. The fossil trunk passage continues past the stream passage to a maze and several climbs. The Coccyx Rout area

contains a pretty meandering passage that ends in an impenetrable breakdown pile. Grutas de Llano Grande was surveyed in length and 70 meters depth.

Cueva di Miramar (C2) is a 60-meter-wide pit, located near Miramar, which is a ten minute hike past the town of La Grandeza. One can descend 38 meters on the low side of the doline to a lake that completely covers the pit floor. The cave strongly resembles the cenotes found in the Yucatán.

Grutas de las Calaveras (C3) is a horizontal cave 53 meters long, which contains the bones of at least 30 individuals, judging from the number of skulls found in the back section.

Sumidero di Canada (C13) is easily reached in ten minutes from Canada. The entrance is very large due to the crumbling of the limestone layers, and the cave is a fossil resurgence for the basin. After crossing some breakdown



to the left of the entrance chamber, one arrives at a sloping fossil passage that is heavily decorated with large, beautiful formations. This leads to a stream passage that sumps downstream, and ends in breakdown upstream. The Labyrinthe area is much smaller and contains a tight canyon with numerous breakdown blocks. Sumidero di Canada is 435 meters long and 90 meters deep.

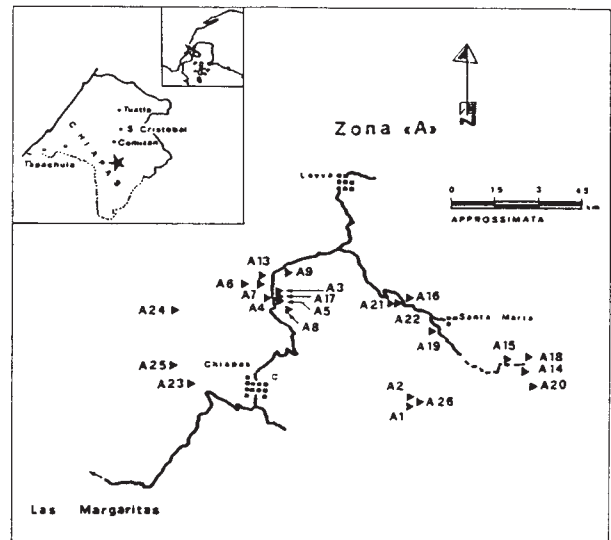
We do not think any of the caves we visited have good leads left, except for the sump in the Sumidero di Canada, which could be dived. We did not extend our investigations to the plateau, likely karstified, located on the left bank of the Río Maiz Blanco in the area of Siltepec. This plateau appears to have the same geologic characteristics as the area we explored.

Las Margaritas Area

The second area we explored was located in the municipality of Las Margaritas to the west of the town of Comitán. The relatively gentle hills rise to altitudes between 1600 and

1800 meters. From the road between San Cristobal and Guatemala, one takes the left fork at Comitán. After another 20 kilometers the road ends at Las Margaritas.

The area east of Las Margaritas is composed of Cretaceous age limestone that is lithographically different from that at Llano Grande. The limestones are generally light gray, with



few fossils. The landscape morphology is typically karstic, with karren karst in evidence on the larger blocks, and little or no vegetation. A great number of pits were observed (many of which were not dropped) during an aerial flight that took place at the end of the expedition.

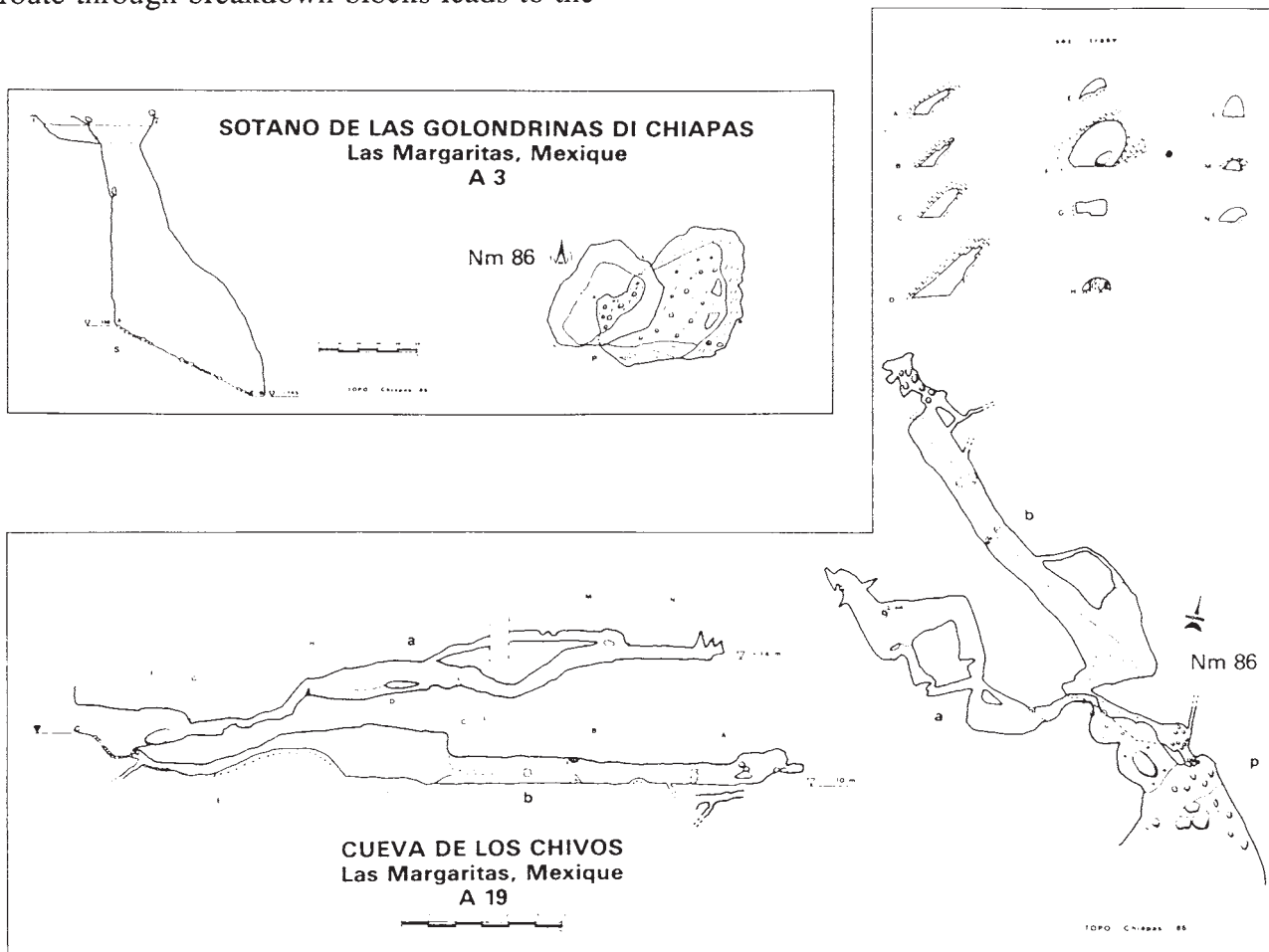
Cueva de las Golondrinas di Chiapas (A1) and Sótano de las Golondrinas di Chiapas (A3) are similar morphologically, and contain free drops of 120 and 115 meters, respectively. Both are surface pits 40 to 50 meters in diameter. The walls are vertical on one side and strongly overhung on the other.

Cueva de Los Chivos (A19) is located near Rancho de Santa Marta. The cave is located about 30 meters above a long field and is well hidden by vegetation. The entrance is large, with a roof determined by a bedding plane dipping at 45 degrees. The route to the right leads to the 'A' gallery, while on the left a route through breakdown blocks leads to the

'B' passage. The two passages are quite different: the A consists of a forced conduit that evolved by gravity in a small stream, with outside modification due to strong lithogenetic phenomena. The B passage, except for the first section, which is separated from the A passage by a curtain of flowstone, is formed along the bedding plane at about 45 degrees. The cave is 415 meters in length.

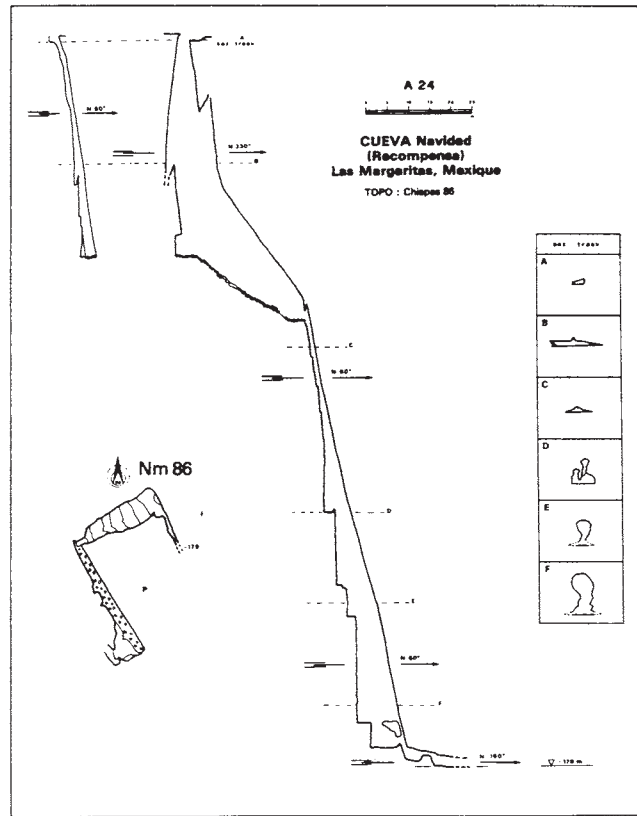
Sótano de la Rose de Cristal (A14) is a 224-meter-long cave located 3.4 kilometers past Rancho de Santa Marta. The 50-meter entrance pit leads to three small passages. The upstream passage is broken by a series of well-decorated rooms.

Cueva Navidad (A24) requires a two hour hike to reach its obscure 0.8- by 1.5-meter entrance. The cave consists of a series moderate-sized pits, following the bedding which dips at 80 to 85 degrees, and a strike of 330 degrees, eventually reaching a depth of -179 meters.



Sumidero di Santa Marta (A16) drains a large two- to three-kilometer-long karst basin, which is floored by a thick layer of clay and mud. Although no open cave is presently visible, a stream flowing at ten liters per second in the dry season gives rise to the speculation that a large stream cave may open up beyond the blockage.

This area is much larger than the first area that we explored, and we only covered a small fraction of it systematically. In the short time available we mainly explored caves that the locals showed us. Our geomorphological observations lead us to believe that the depth potential in the area is limited to 400 or 500 meters due to a hypothesized water table at the level of the Chiapas and Leyva gorges.



EXPEDITION CHIAPAS 1986

Un equipo de espeleólogos franceses e italianos exploró en dos lugares en el estado de Chiapas en 1986. En el área de Llano Grande cerca de la frontera con Guatemala, exploraron 14 cuevas. La región recibe mucha lluvia, pero se encontraron pocas cavernas, sin pasajes kilómetros al oeste de Comitán. Localizaron muchos sótanos por medio de avioneta, pero exploraron pocos, debido al falta de tiempo. Hay mucho que explorar en esta región.

EXPEDITION CHIAPAS 1986

Une équipe composée de spéléos Français et Italiens a exploré deux régions différentes à Chiapas en 1986. Quatorze grottes ont été explorées et relevées dans la région du Llano Grande, proche de la frontière du Guatemala. Bien que la région connaît un degré élevé de précipitation le karst contient des grottes assez petites à probabilité plutôt restreinte de passages plus grands. L'équipe a redéployé ses efforts dans la région de Las Margaritas, environ vingt kilomètres à l'Ouest de Comitán. Bon nombre de puits ont été observés de l'air, mais le temps limité mis à la disposition du groupe a seulement permis à ses membres d'explorer et de relever un nombre assez restreint. Beaucoup reste encore à faire dans cette région.

SIERRA ZONGOLICA RECON

Dave Doolin and
Mike Warton

Mike Warton, Mike Furrey, Joe Sandoval, and Dave Doolin set up camp in the Sierra Zongolica of Veracruz on Sunday, 22 December 1985. The group's objective was to investigate the front range of the Sierra Zongolica for caves and pits. The front range rises directly from the Veracruz coastal plain to elevations of 1300 to 1400 meters. A campsite in the cockpit karst near the village of Vásquez Vela was chosen. The range was entered at Presidio on the eastern front.

Many Sotanitos

The local landowners at camp were friendly and curious. One rancher, Señor Reyes, showed the group many caves and pits, and spoke of many more in the area. The next day, Mike Warton and Dave checked out pits on the trail to Señor Reyes' ranch, as well as those on his property. On the way, a young man showed Dave a 30-meter-deep shaft, Sotanita Bonito Chiquito. It was perhaps eight meters in diameter and blind on the bottom. On Señor Reyes' property, Mike descended Sotanita del Arbol Muerto. This shaft bottomed out at 40 meters deep, where rocks rattled for four seconds down a slot too narrow to enter.

Next, Dave dropped Sotanita de la Esperanza. The entrance is a body-sized hole that

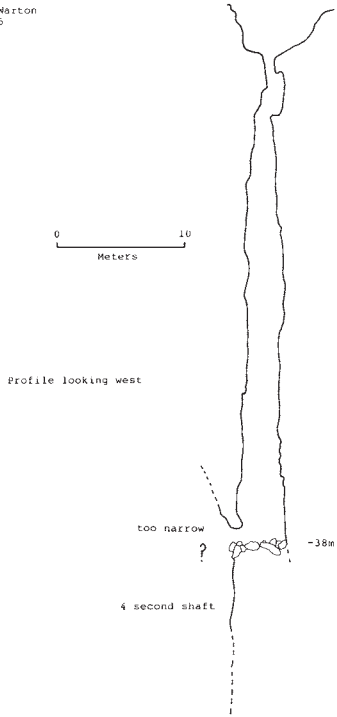


Joe Sandoval rappels into the entrance to Sotanita Bonito Chiquito. (Mike Warton)

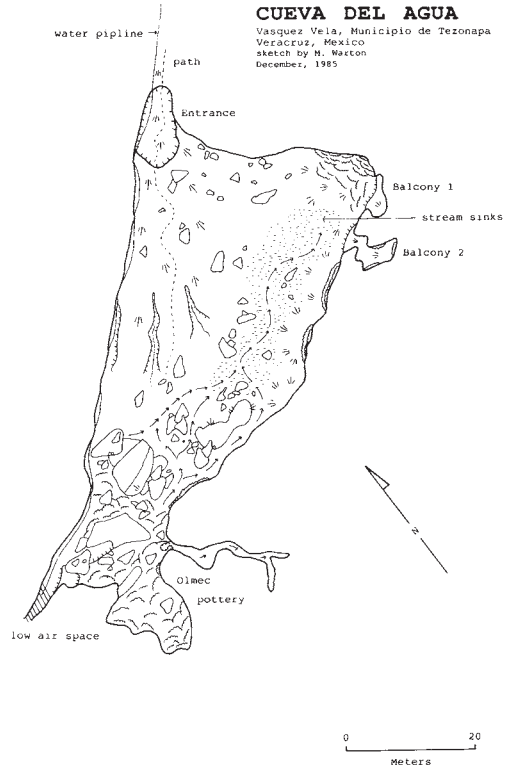
opens into a two-by-five-meter slot. This shaft bottoms out at over 75 meters depth. After that, Mike checked Sotanita del Ranchito, which dropped 15 meters to a very narrow crack. Near a karst pinnacle was Sotanita de la Vaca Muerta, a small hole dropping 35 meters to a dead bottom.

The last stop of the afternoon was Sotanita del Rancho Reyes. It had a crevice entrance that dropped 40 meters to the floor, with pits off each end of the room. One pit was 12 meters deep and blind. The other was also 12 meters deep, followed by another 22-meter drop. That evening after dinner, Dave and Mike stumbled around the karst in the dark to Sotanita del Tronco Caído, which had been shown to them the previous day. This was a nice 40-meter-deep cylindrical shaft which was overhung all the way around, except where they rigged the rope.

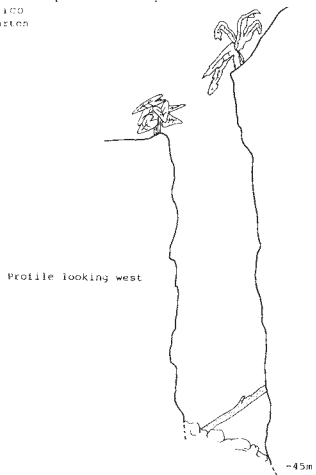
SOTANITO DEL ARBOL MUERTO
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 sketch by M. Warton
 December, 1985



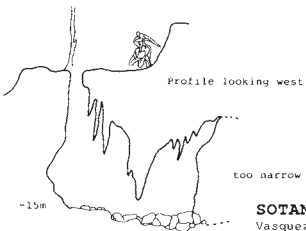
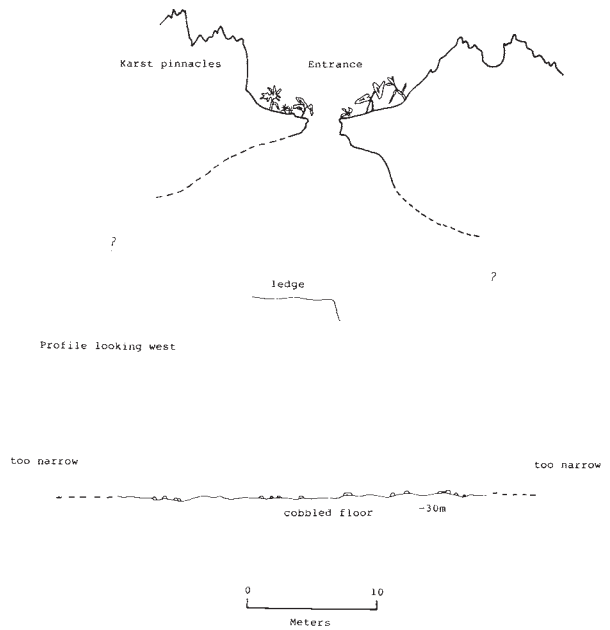
CUEVA DEL AGUA
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 sketch by M. Warton
 December, 1985



SOTANO DEL TRONCO CAIDO
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 sketch by M. Warton
 December, 1985

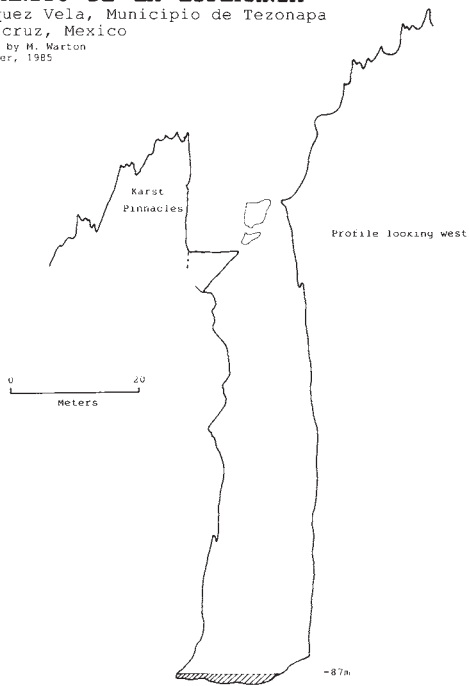


SOTANITO DEL RANCHITO
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 sketch by M. Warton
 December, 1985

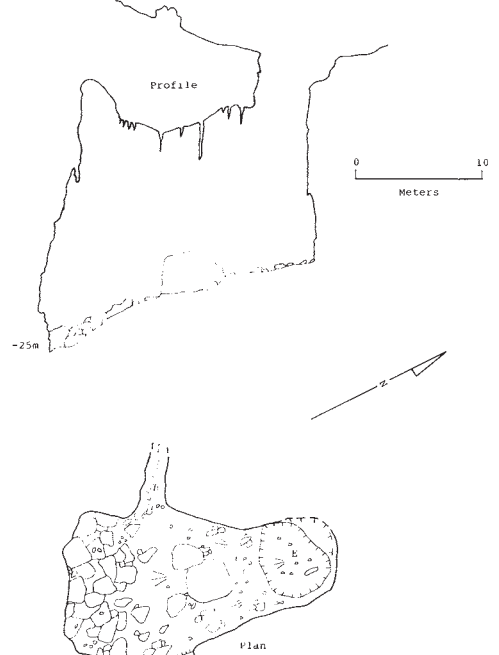


SOTANITO DEL CAMPAMENTO
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 sketch by J. Sandoval & M. Warton
 December, 1985

SOTANITO DE LA ESPERANZA
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 Sketch by M. Marton
 December, 1985

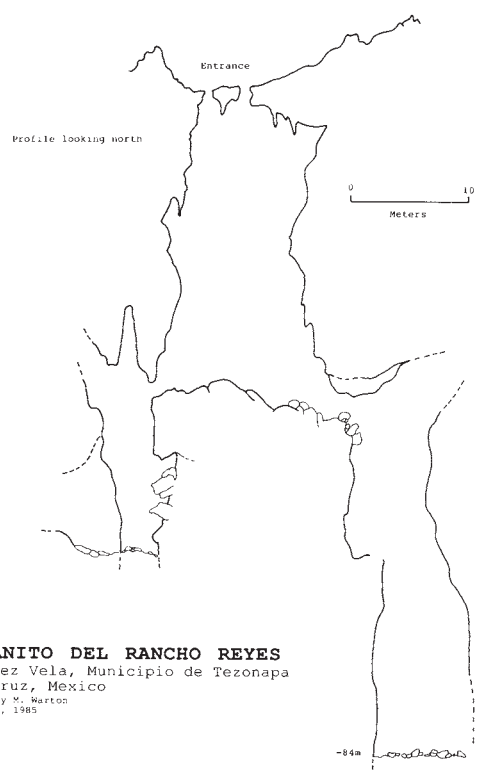


Profile



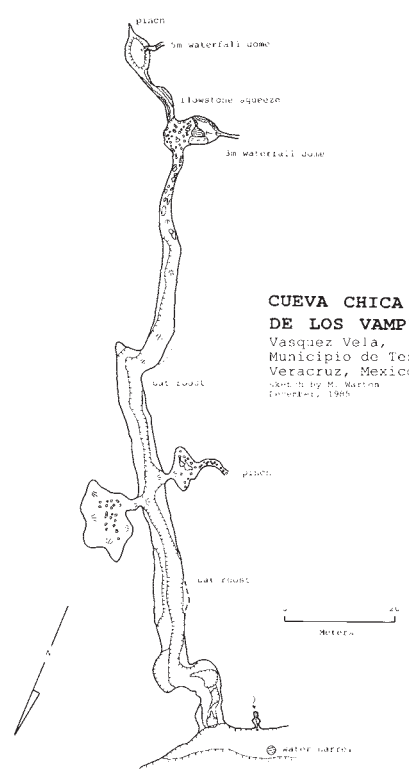
SOTANITO DE LA VACA MUERTA
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 Sketch by M. Marton
 December, 1985

Profile looking north



SOTANITO DEL RANCHO REYES
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 Sketch by M. Marton
 December, 1985

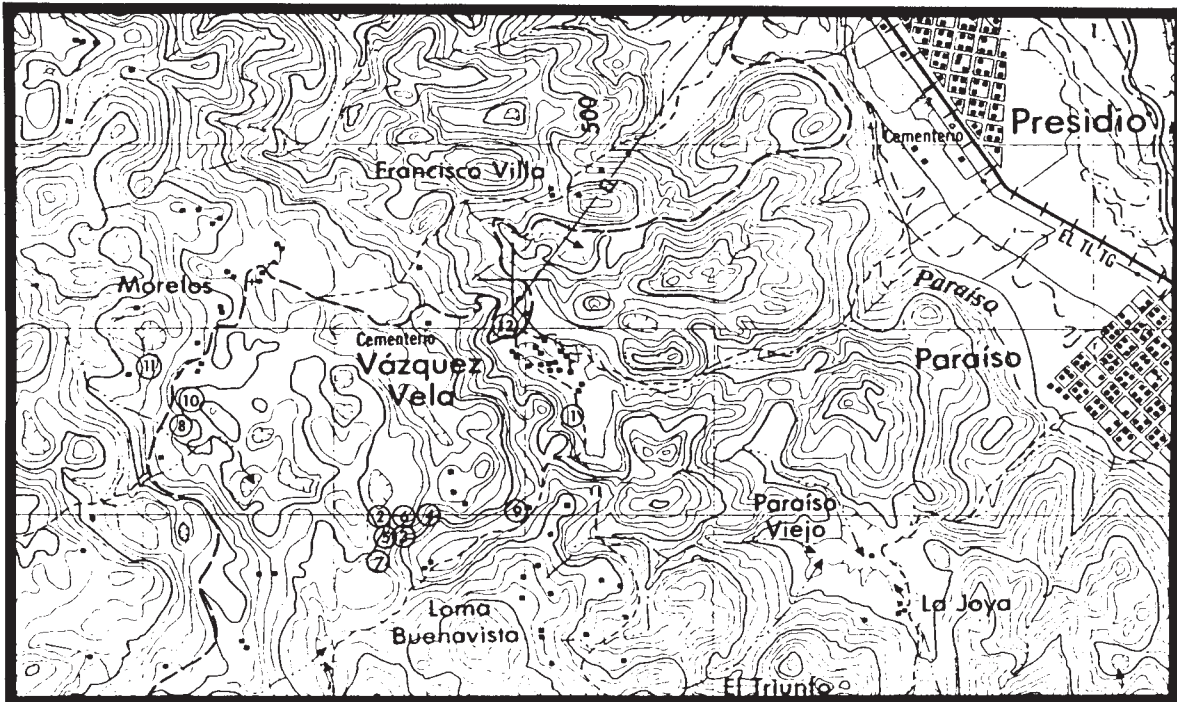
Blanch
 3m waterfall down
 Ilkamatone passage
 3m waterfall down



CUEVA CHICA DE LOS VAMPIROS
 Vasquez Vela, Municipio de Tezonapa
 Veracruz, Mexico
 Sketch by M. Marton
 December, 1985

VASQUEZ VELA AREA CAVES - KEY TO AREA MAP

- | | |
|-------------------------------|---------------------------------|
| 1. Cueva del Aqua | 7. Sotanita del Ranch Reyes |
| 2. Sotanita Bonito Chiquito | 8. Sotanita del Tronco Caído |
| 3. Sotanita del Arbol Muerto | 9. Cueva Chisa de los Vampiros |
| 4. Sotanita de las Esperanzas | 10. Sotanita del Campamento |
| 5. Sotanita del Ranchito | 11. Sótano de las Vacas Muertas |
| 6. Sotanita de la Vaca Muerta | 12. Sotanita del Camino |



TEMAXCALAPA AREA CAVES

CAVE	LENGTH	DEPTH
Cave of the Vines (Olbasco)	908 meters	215 meters
Gruta de las Gigantes de Piedra	150 meters	30 meters
Cueva del Chorro Hundido	140 meters	45 meters
Cueva de las Munecas Olmecas	150 meters	70 meters
Cueva de la Grieta	40 meters	
Water Cave No. 1	20 meters	15 meters
Water Cave No. 2	20 meters	15 meters
Cueva de la Hoya Grande	30 meters	20 meters

On 24 December, the foursome explored and surveyed Cueva del Agua. This cave was about two hours away, toward the coastal plain, and about 600 meters lower. The entrance is 12 meters wide and ten meters high, and leads down into a large room. This cave is essentially a large karst window. The stream appears out of breakdown, crosses the floor and sinks. On the way back to camp, a young man led the group to Cueva Chica de los Vampiros. This is a nice cave about 75 meters long, mostly walking and stooping passage. Two vampire bats were seen inside.

Cave Next to Camp

The next day, Dave inadvertently discovered Sotanito del Campamento next to camp. He and Joe had checked this sink several days earlier and found nothing. Dave was going to part some grass, and almost fell in. Joe checked it out, finding it to be ten meters deep and blind. Another pit found close to camp was named Sótano de las Vacas Muertas (not

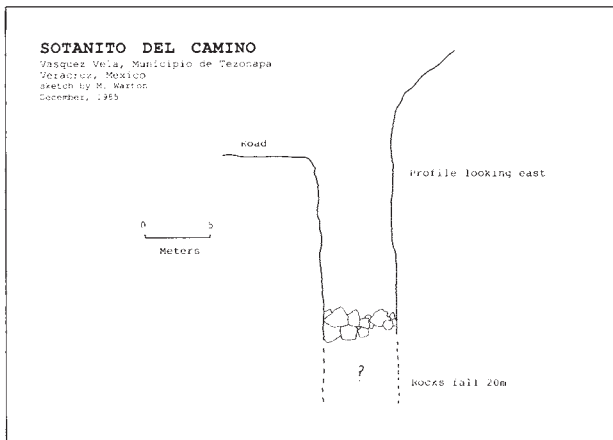
to be confused with Sotanito de la Vaca Muerta). Joe went down first, followed by Dave. The shaft measured four by five meters, and is 20 meters deep on the high side. The group broke camp in the afternoon, satisfied with their reconnaissance.

The front range of the Sierra Zongolica is heavily karsted. Cave development is primarily vertical, and entrances can appear anywhere. It would be quite easy to stumble into a hole at night, with perhaps serious consequences. Many of the smaller entrances are quite obscure even by day, being overgrown with grass and foliage. There are probably a couple of big, deep shafts to be found, if someone were to take the time to look for them. The group concludes that the entrances to any large network may be very difficult to find.

Temaxcalapa

Leaving the front range, the group then proceeded to the mountains to the west, where the area around Temaxcalapa was investigated. A number of caves and pits were located around the village of Temaxcalapa, and below the Cascada de Moyoatempa. The most major cave found was named Cave of the Vines, and was surveyed to a depth of 215 meters, and it continued wet. Belgian cavers pushed farther in 1987, and used the name Olbasco de Temaxcalapa for the cave.

A more detailed report on the caves of Temaxcalapa will be produced after the planned return trip. Included is a list of caves explored on the 1985 trip in the Temaxcalapa area.



SIERRA DE ZONGOLICA

Un viaje corto de reconocimiento a la Sierra de Zongolica en 1985 localizó y topografió 8 cavernas en el área de Temaxcalapa y 12 sótanos y cuevas en los alrededores de Vázquez Vela. La parte frontal de la sierra (Sierra Modelo) es rica en roca caliza, y el desarrollo de cavernas es básicamente vertical. Localizaron entradas aun en los lugares más escondidos. "Cave of the Vines" fue el mejor descubrimiento, topografiándose 215 metros de profundidad y 908 metros de longitud. Espeleólogos belgas exploraron en 1987 la misma cueva, pero la llamaron Olbasco de Temaxcalapa. Un reporte más detallado se producirá después de la siguiente expedición.

Reviews

Los grandes Abismos de México

Carlos Lazcano Sahagun
Inversora Bursatil, S.A. de C.V.,
Casa de Bolsa, México, D.F., 1987

Los grandes Abismos de México is probably the most well-produced book about caves ever to come from the Mexico press. This large, coffee-table-style edition contains excellent color photographs and enjoyably readable text (in Spanish) throughout. It is not an attempt to cover caves or caving in a general sense, but rather concentrates on Mexico's renowned abundance of spectacular deep shafts. These include the famous Sótano de las Golondrinas, Hoya de las Guaguas, Sotanito de Ahuacatlan, and El Sótano del Barro, and newer discoveries such as Sótano de Tomasa Kiahua and Sótano de La Lucha, among others. The author speaks from personal experience, having visited each of the pits covered. In addition to pictures and physical descriptions, there are discussions of history, biology, and archaeology, as applicable, as well as plan and profile drawings, and tables of vital statistics. Special care has been taken to point out the fragility of the cave environment and the impact of pollution.

Although presumably not written solely for cavers, the book, nevertheless, is very factually accurate and contains much hard data that would interest the active explorer. The quality of printing and reproduction of photographs are excellent, and the layout is clean and uncluttered. If one had any complaint, it would simply be that only 5000 copies of this marvelous book were produced, and it seems already to be out of print.

Mark Minton

Tepeyollotli, SMES Gaceta No. 2

Ramón Espinasa P., Editor
July 1988, México, D.F., 42 pages
(Available from AMCS)

Considering the veritable explosion in the amount of caving going on in Mexico, this double issue of the gazette of the Sociedad Mexicana de Exploraciones Subterráneas (SMES) is especially welcome. While focusing on the results of trips by cavers from Mexico City, Tepeyollotli has a distinct international flavor, with an article in English by Guadalajara caver John Pint, English abstracts for other articles, and coverage of several multi-national expeditions.

In April 1986, SMES cavers joined Italian cavers of the CGEB in an expedition to Huacalapan, Guerrero. Gruta de Huacalapan, a well-decorated cave 504 meters long, was explored, as well as Gruta de las Golondrinas, which was 406 meters long and 106 meters deep. Both are spectacular caves with huge gours spanning passage up to 30 meters wide. A tight stream cave called Resumidero de la Virgen de Tlaliztatlipa was explored to -94 meters, where high levels of carbon dioxide stopped exploration. A beautiful vertical cave named Resumidero de Ixtamalco was pushed to a sump at -245 meters. The deepest find was Sótano de las Guacamayas, with an entrance drop of 94 meters, and a total depth of 283 meters. In all, 25 caves and pits were explored on the expedition. (*Editor's note:* also see "Italian Explorations in Guerrero" elsewhere in this issue).

In three trips to the Plaza de Gallos area of Guerrero in October and November 1987, SMES cavers mapped a tight vertical cave named Hoyito de Zopantle. After reaching the bottom at 171 meters depth and 428 meters length, the three cavers took 21 hours to derig the cave on the last trip, due to its constricted

nature. Elsewhere in the state, the group returned to Gruta de las Pozas Azules, which is the suspected downstream portion of Resumidero de Izote, on 1 March 1987. The cascade at the end of the cave was climbed, and a large sump was reached beyond. In the future, they hope to lower the water level in this sump to facilitate making a connection to Izote.

Near Alpipilulco, Guerrero, Mario Gómez and Patricia López located Hoyo Blanco in May 1987. It is 65 meters in diameter and about 50 meters deep. Perhaps it should be considered a doline rather than a pit, with a small lake at the bottom in the rainy season. In Gruta de Zacatecolotla, also in Guerrero, a new lead was explored for 500 meters, and connected to the Pasaje Cola de Dragón, creating a nice loop.

In July, Ruth Diamant and Ramón Espinasa conducted a recon near Chilacachapa, Guerrero, east of Resumidero de Aclalá. They located 21 entrances, most of them active and very promising resumideros. Aclalá was explored 500 meters farther in February 1987, and the cave was mapped in December. So far it is 1300 meters long and 135 meters deep, and still goes after ten drops. Many swims must be done in traversing the cave, including the Lago de Gollum, a 243-meter swim. In the same area, a fossil resurgence named Cuaxilotla was pushed on weekend trips in June and August to a length of 1508 meters. In December the cave was finished (at a sump?) at 1620 meters. Of interest is the presence of an enormous bat colony in the cave.

SMES cavers were invited by DRACO to join them in mapping Cueva del Tecolote, near Tlamacazapa, Guerrero, in October 1987. This well-decorated cave is over 250 meters long.

"Project Rainy Season" was a SMES effort to survey lava caves near Mexico City in September and October 1986. Cueva del Aire, located near the town of Ajusco, was surveyed to a length of 1099 meters and a depth of 89 meters. It contains two parallel passages connected by a third, forming an H shape. In the Xitle lava field, several caves were explored. Cueva del V Invertida is 249 meters long and 25 meters deep, with two entrances. Cueva del

Tiro has a four-meter entrance drop and 63 meters of passage with a depth of 18 meters. Cueva del Arbol is impressive, with passages up to 12 meters wide and 20 meters high. Its length is 218 meters, and it is 14 meters deep.

A report from the Grupo Espeleológico Universitario of UNAM gives the results of their second trip to the Atoyac range in Veracruz. A total of 22 pits were explored around the village of Alvaro Obregón. Sótano No. 1 has three drops of 73, 17, and 64 meters, ending in a breakdown chamber at -153 meters. Sótano No. 2 has drops of 57 and 50 meters, after which it gets too tight at -107 meters. Sótano No. 3 has an entrance drop of 79 meters, with a second drop of 22 meters to a debris fill at -101 meters.

From 8 to 13 April 1987, Ramón Espinasa joined the recon trip for the British Black Holes Expedition to the Sierra Modelo (Tlacuilolteca) east of Zongolica, Veracruz. Many pits were located, including one 30 meters in diameter and perhaps 100 meters deep. Then Ramón and Octavio Alberola joined the Belgian expedition in nearby Tequila, where they took part in the exploration of numerous caves. These were TEQ 13 (-130 meters), Sótano del Crucero, a 101-meter shaft, TEQ 17 (-230 meters), TEQ 20 (-8 meters), TEQ 21 (-40 meters), TEQ 33, a 77-meter pit, and TEQ 34, a 110-meter pit. The British Black Holes Expedition in early 1988 is said to have resulted in the exploration of over 250 caves, with a total length of around 40 kilometers. SMES cavers took part in the exploration of Sumidero Oxtotempa near Soledad Atzompa, and La Cuevacita at Comalapa, among others.

SMES cavers also joined in the Canadian expedition to the Sierra Negra in Puebla in December 1987, and discovered Sótano de Tapoztotl. They explored down the 90-meter entrance pitch to -155 meters. In March 1988 a large SMES group mapped down more drops until they ran out of rope at a cascade at -270 meters. Elsewhere in Puebla, SMES cavers began a resurvey of Sistema Huayateño, near Cuetzalan. So far they have mapped 1658 meters, with more to go.

In February 1988, Ruth Diamant and Ramón Espinasa scouted the area around Loma Grande, Veracruz, and found Sótano de El Berro. Returning with rope, they explored down ten drops to -200 meters, and it continues.

Other expeditions covered in this issue are the 1985 PEP expedition to Cueva del Tecolote, and the 1986 and 1987 camps in Sistema Purificación. The connection through-trip in Tolantongo (see article elsewhere in this issue) is also summarized.

In a thought-provoking editorial, Ramón Espinasa endorses the Belgian technique of marking cave entrances. Using oil paint, a small circle is painted at the entrance, ideally along with an area number. An empty circle means it is unexplored. A circle with a slash through it means exploration is underway, and an "x" means exploration is finished. This system would help avoid duplication of effort, Ramón feels, even though it may violate the "leave nothing but footprints" creed. It would not be necessary on well-known caves, he says.

Tepeyollotli is obviously filling an important need, covering the burgeoning caving scene based out of Mexico City. While only photocopied on one side of the pages, the less than-ideal-print quality is more than offset by the value of the information it provides. Although it has no photographs, many cave maps are included.

Peter Sprouse



Subterráneo número uno, March 1988.

John Pint, editor.
Espeleoclub Zotz
Apartado 103 CP 45010
Cd. Granja, Jalisco. 18 pages.
(Subscription \$10 US per year.)

This is the first edition of a newsletter put out by Espeleoclub Zotz, a nucleus of cavers in the Guadalajara area organized by ex-Southern California Grotto caver John Pint. It contains trip reports (in English and Spanish) to short, local caves in Jalisco, such as Cueva de la Venta, caves near Tonaya, Cueva de la Otra Entrada near Valle Verde, and Cueva del Diablo, near La Huerta.

Subterráneo número dos, July 1988.

In their second issue, the cavers of Espeleoclub Zotz describe their various efforts to reach Resumidero de Toxin, Jalisco. Along the way, they located and mapped Gruta del Salto, near Peña Colorada, Colima. It is a well-decorated but vandalized cave about 60 meters long. Returning to the La Huerta area, they sketched and checked new passages in Cueva del Diablo, about 100 meters long. In another area (presumably in Jalisco), they located Cueva del Chapuzán, a wet cave several hundred meters long containing numerous bats. They located another cave nearby that may connect with it. A group of climbers from the Cuerpo de Exploraciones del Occidente showed the Zotz cavers a fissure cave one hour's drive from Guadalajara. Grieta Chiquihuiton is a multi-level fissure cave formed in volcanic rock, which they explored for several hundred meters, and apparently there is considerably more to it.

Peter Sprouse

Equipment & Techniques

IMPRESSIONS OF EUROPEAN STYLE RIGGING

Bill Steele

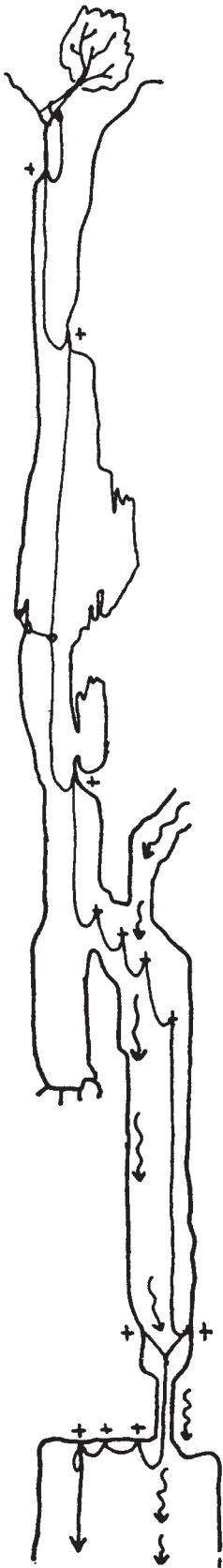
U.S. caving literature tells well the story of Bill Cuddington and his associates in the 1950's adopting the unorthodox system of single rope rappels, and ascents with prussik knots. His doom was predicted, and there was talk of kicking him out of the NSS. Thirty some years later we look back on those days with thanks that they stood their ground, enabling the development of modern systems, which use mechanical ascenders but retain the concept of single rope technique.

In the mid 1960's, use of Samson 2-in-1 rope came along. This marine braided rope did not spin in freefall. It was replaced by Bluewater, which incorporated the same sort of inner core and outer sheath construction, but was manufactured specifically for cave use. The core and sheath were attached, and the sheath was of a much tighter weave to afford superior abrasion resistance. A few years later, PMI was developed taking the state-of-the-art of caving ropes further, which is not surprising since the founders of the company were among the most experienced vertical cavers of the day.

Although ladders were predominant in European caving until the last decade, use of SRT began to get to Europe as the development came along here. What we have happening now is that American-developed SRT is coming back to us modified from overseas. There are improvements in the technique from this evolutionary and circular process.

Earlier this year, I joined the Cueva Cheve expedition. In addition to being vertical and wet in places, Cheve is colder than most Mexican caves. I was informed that the cave was rigged European style. I was not exactly sure what that meant, so did not feel prepared. Questions posed to fellow Huautla cavers who had caved with the Australians at Chichotla, and had traversed up to 900 vertical meters, only left me with more questions. I realized that I was going to have to traverse this rigging to understand it.

The basic concept of European Style Rigging (ESR) is to keep the rope from contact with rock. Stout PMI and Bluewater have allowed us to be comfortable with lowering a rope all the way down a pit and rarely bothering with intermediate rig points. ESR approaches all drops in stages, with redirectionals and rebelay as needed to keep the rope in free space.



There are good reasons why this evolved. European cavers face different conditions. Their deep caves are cold. For the most part, they are barely above freezing. The streams are snow melt. Given the colder conditions, the rock is fractured, more angular, and readily abrades rope. Cold caves are less merciful to the vertical caver waiting a turn on rope. With a long vertical drop in a cold cave, you do not want to wait. You want to keep moving to stay warm. Having the drop broken into stages allows a steady stream of climbers.

Another key factor in the development of ESR has been the ropes available to European cavers. Years ago, there were none equivalent to our specially-constructed caving ropes. So, they used climbing ropes. These ropes were far less abrasion resistant, stretchy, and more expensive. Advantageously, they were supple, lighter, and easier to pack and transport. In addition, these characteristics allowed deep cavers to carry more rope, stuff it down into their packs, and get farther on a push trip.

A flurry of letters has come into print in the *NSS News* and elsewhere in recent years concerning indiscriminate use of expansion bolts. Some caves, such as Sótano de las Golondrinas, now have many bolts where for 20 years none were present. This is where we must modify ESR. European cavers have a mind set against ropes bending over lips. The top edge of Golondrinas, however, couldn't be smoother. Rigging to outcrops of bedrock has served well enough for most climbs to have been tandem, and this writer knows of miscommunications in the pit that once resulted in three on a rope.

To me, ESR came on the scene with a bad reputation. In 1980, we hauled a Polish caver out of Sótano de San Agustín with a broken back due to a rope break. That rope was a joke. As we removed their rope from the cave we marvelled at their excesses. Bolts broke up

drops we had smoothly taken turns climbing in long stretches for years. In The Gorge of lower San Agustín they had swung around like monkeys to stay high and out of the water. Water is a joy to us, and a horror to be avoided to them.

So, what is there to learn from the European modification of our Single Rope Technique? In my opinion, there are points worthy of adopting. Modification of ERT is necessary due to the quality of ropes available to us, warmer caves and a more developed sense of conservation.

The use of redirectionals is here and growing. Rigging in Huautla has been incorporating them for three years. Ed Holladay and Jim Smith caved with the Australians, and learned the technique. It requires the initial explorer descending a drop to carry aids such as chocks, slings, and nonlocking carabiners, and to be able to read the drop so as to alter the direction of the rope to avoid waterfalls, sharp edges, or whatever. A solution hole in the wall, a crack for a chock or even a piton, is found, and a sling is attached to it. On the other end is a nonlocking carabiner through which the main rope is passed.

Rebelays are places where the rope is retied along the wall of a drop. This breaks a drop into shorter segments. It also cuts down on rope frays caused by the pendulum effect of moving laterally lower in the shaft and having the rope above rubbing horizontally. The danger with breaking up a shaft into segments, and having more than one caver on rope, is that there is no mercy should some heavy-footed individual above send a rock down on you. Fortunately, this problem is lessened by the offset nature of drops that lend themselves most readily to ESR.

A very attractive feature of ESR is the bulk of smaller diameter ropes and the

distance which can thus be covered on a push trip. One pack of slings, chocks and carabiners for redirectionals and rebelay can allow push ropes to be 10mm, even 9mm in diameter, and in Huautla we have extensively used 3/8 inch (9.5 mm) PMI. The vanguard team can carry a lot of rope, stuff quite a bit in the bottom of their caving packs, and get farther than with the donut coils of standard 7/16 inch (11mm) caving rope. If the passage ends, you derig. It is much faster stuffing rope into a pack than coiling it. If it goes, decisions can be made. Is it rigged for traffic? Is it rigged for hauling loads? Should it be rigged with stouter rope?

My big question heading into Cueva Cheve was what I would need to cross this rigging. I was told to bring a "cowstail". A cowstail is a length of dynamic cord a half meter long, usually 9mm in diameter. Webbing or static rope would work if dynamic cord is not available. There is a loop on each end large enough for a carabiner, and a loop in the middle. That is a cowstail.

A cowstail is used a lot in ESR. You keep it attached with a carabiner to your seatsling. The other end you keep handy, usually by attaching it to an auxiliary carabiner on your side. When rappelling and a redirectional is encountered, clip in the cowstail. That will keep you at the redirectional, and you will not swing away when you detach the rappel line from the redirectional's carabiner. Unclip the carabiner from the main rope, then reach up and clip it on again above your rappelling device. When you remove your cowstail from the carabiner you are past the redirectional. You use the cowstail the same way when encountering a redirectional while ascending.

When encountering a rebelay you clip the cowstail into the carabiner at the bolt, or to the loop of the knot if rigged to a natural anchor. The customary thing then is to hang from the cowstail, take off the rappelling device, and put it on the rope beneath the rebelay. I say customary, because at this point I like attaching something else too, such as a Jumar for redundancy. To resume the rappel and get weight off of the cowstail, either stand in the loop of rope you rappelled to the rebelay, or find a foothold and stand up to release the

cowstail carabiner. In Cheve, occasionally there was not enough loop to stand in, and there was no foothold because the rebelay was under an overhang. I kept a foot Jumar handy for these fun spots.

The cowstail is also used to remain attached to traverse lines, for tyrolean traverse, and other opportunities involving exposure where there is a rope to be clipped into. This year I first heard of a cowstail, used one and incorporated it into my climbing system as a permanent addition.

I traversed a 1000-meter-deep cave fully rigged with ESR using a Mitchell/chest box/two Jumar system with a third, quick-draw Jumar which doubles as the top ascender for a Texas system. That had been my faithful Huautla rig. It worked fine for ESR.

More and more American cavers have gone to a Frog climbing system. ESR is the reason why. There are only two points of attachment and it is compact, light and fast getting on and off rope. The Frog system does have its disadvantages, such as requiring more arm strength and being slightly slower on long free drops. However, on ESR it appears to be the fastest way to go.

Those with the most trouble on ESR have rope-walker systems with a Gibbs at the foot. Occasionally, riggings are diagonal, and some end up being horizontal between redirectionals when slack gets caught by features in the wall. Gibbs are quite difficult to attach in instances such as these and in Cheve those with them flapped and flailed a good bit. Beware.

In summary, I will say that I like the changes coming to us from ESR. There are some improvements. I am not sold on going all the way, because of the quality of our caving ropes, and the water encountered in our caves is rarely as dangerous as theirs. Redirectionals and more frequent rebelay make our SRT safer. The cowstail is a welcome improvement to our climbing systems. I support bolts having a place in cave exploration, but the use of them must be well considered, avoided if possible; and if the decision is made to use them, they must be placed well.

Letter to the Editor

(*Editor:* The following letter accompanied Marc Tremblay's article [in French] on the Quebec cavers' explorations in the Sierra Negra.)

The following article, depicting some new discoveries near Sierra Zongolica, is not much different from a typical *AMCS Activities Newsletter* cave exploration report. It is a detailed document of the work accomplished in a very promising sector. If the content of the article is quite typical, the form, on the other hand, is different: it is in French. Foreseeing some reactions, I want to explain what a French article is doing for the first time in the Newsletter.

Little is known about Quebec, a Canadian province that considers itself a country. We are members of a caving society, Société Québécoise de Spéléologie, which has existed for nearly 20 years. Cavers in Quebec have always been in a privileged cultural and geographic position between the European and North American caving scenes. We enjoy close contacts with speleologists from both continents. Our vantage point enables us to compare the different philosophies and techniques currently in use and try to take the best of them. As a result nobody should be surprised that we have the only caving school in North America, that we use European alpine-style caving techniques, and that we promote the American ethic of conservation, as well as cave access.

From our viewpoint, the AMCS deserves great credit for its vocation of gathering all the data it can on Mexican caves. In fact, it is managing the most complete library about karst and caves of Mexico available. This is an essential task the Mexicans will surely undertake in the upcoming future. But, with all due respect for them, they will need more efficient organization to achieve that goal.

The International Sierra

As far as I know, the AMCS was originally created by a group of enthusiastic American cave explorers of Mexican caves. Since then the Association has always encouraged everyone exploring in Mexico to send articles to the annual Newsletter. Up to now, it was easy: most of them were American cavers and few came from foreign countries. Rare were Mexican cavers. But the situation has evolved. The increasing availability of Mexican topographic maps and karst information has encouraged many foreign expeditions to investigate various areas. Thus, subterranean Mexico is receiving visits from Americans, Belgians, French, Canadians, Australians, British, Italians, Poles, Swiss and Quebecers. Some are so successful that they threaten the Huautla depth record.

For most of them, the AMCS is just another American caving group. This seems to be the feeling of most foreign cavers we met in Mexico last December. We do not think likewise, and would rather see the AMCS as a privileged way to exchange ideas and information with other groups working in Mexico. Not only is it very interesting to know what's happening elsewhere in Mexico, but it is also very important to communicate with each other. Terry Raines said it best, "We are cavers of the world".

Caving in Mexico is still healthy thanks to the careful work mostly done by American cavers. This situation might not last for long. The notoriety of Mexican caves has been known for many years but more than ever the rumor is spreading quickly in the caving world: MEXICO IS CHEAP, DEEP AND VIRGIN. I predict that more and more foreigners will come in the future. And if we (the AMCS, the Mexicans and the concerned cavers) do not take any steps to facilitate communications, Mexico may be an unhappy mess a few years from now. I can imagine unpleasant troubles like frustrated

and uncooperative locals, excessive bolting, "exploration zone" violations, and access intervention from locals or governments, etc.

Getting in Touch

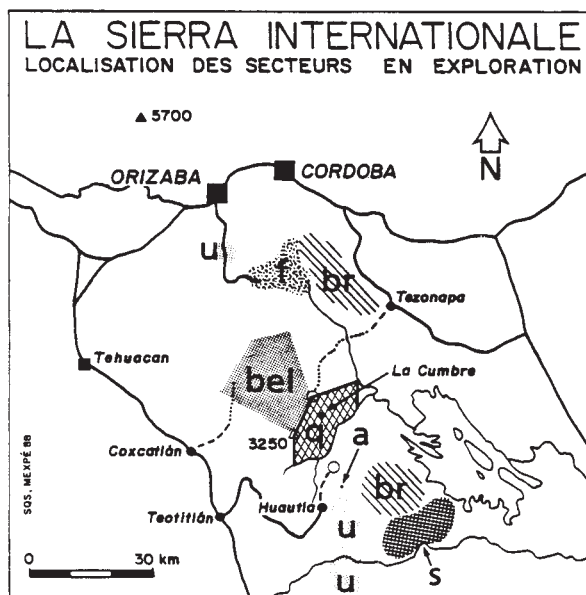
In order to preserve the caving ethics mostly respected up until now, and to mesh the different foreign expeditions, a real effort will have to be undertaken to contact all groups exploring Mexico. It will be desirable to encourage foreigners to send maximum information on their current work and convince them it's to everyone's advantage.

Also, Mexican caving organizations (e.g., SMES) should be promptly contacted about what is happening. After all, this is occurring in their own country! We have to give them a chance to control the input of foreign caving expeditions. A direct contact and information exchange between Mexicans and foreigners is the best we can hope for right now.

Accept Foreign Language Articles

Finally, the *AMCS Activities Newsletter* should be open to the publication of articles in foreign languages. While Spanish has an obvious place as the official language spoken in Mexico, I deplore the fact that very few articles are written in Spanish by Mexicans in the Newsletter. But I can see the presence of more French or Italian articles as a stimulating factor for the Mexicans to write more. Also, it will make the AMCS image of openness so appealing that it would encourage more foreign expeditions to send a report for publication. In Texas, it's probably not a big deal to go caving for a few weeks in Mexico. But as a foreign caver organizing expeditions far away, I can guarantee that this is a full-time job. Each year you have to write articles and press releases, letters for newspapers, magazines, sponsors, universities, governments, and caving magazines, etc. And I'm not even including obtaining passports, vaccinations and training, drafting of cave maps, planning logistics and all that stuff. If it is already hard to find one of us who has a ready pen in French; just imagine how difficult it is to get someone comfortable to write in English.

It may seem hazardous at first to under-



a: Australie, bel: Belgique (GSAB), br: Angleterre, f: France (FFS), q: Québec (SQS), s: Suisse, u: Etats-Unis (AMCS). mai 88

stand a text in a foreign language but from what I've experienced, and especially in a specialized discipline, you can always understand the meaning of the article by recognizing similar keywords like *grotte* and *cueva*. Often, the context and the accompanying figures help. An English and Spanish abstract should proceed the text to avoid confusion and give a good idea of what's written there.

To quiet those who fear they will be unable to read the newsletter, I don't think lots of articles in foreign languages should appear in the near future: probably less than 10% of the total. But their presence will have a very positive effect outside the States and Mexico. More foreign expeditions will be interested in joining the AMCS mission and the result will be the addition of more subscribers to the Newsletter.

Voilà! These proposals reflect the willingness of MEXPE participants to support contacts between expeditions in Mexico and the Mexican cavers. We have an opportunity to show the world that cavers can work together like never before. Finally, we must not forget we are contributing to increase Mexico's heritage, and do the best to transmit our discoveries to the Mexican people. We must think about helping them discover their underground world.

Buena exploración !
Marc Tremblay

Reply to Marc Tremblay,

Thank you for your letter and article. Your letter raises many good points. However, after considerable debate, it was decided that major articles in the *AMCS Activities Newsletter* will continue to be published exclusively in English in the near future. There are good reasons for this.

As you point out, it is very difficult to write in a foreign language. But it is next to impossible to edit and proofread in another language. Even if the necessary people volunteered, it would be logistically very difficult and time consuming. In the end, it would take even longer to put out a newsletter than it already does. It is much easier to translate the articles to English.

The *AMCS Activities Newsletter* was started in English, and English continues to be the most universal language. Some people may find this second statement objectionable. But the fact remains that more people read and speak English than any other language. An article written in French or Italian simply would not be read by as many people. You state that perhaps the Newsletter would attract more foreign readers if articles appeared in other languages. This is possible, but I suspect that the main reason that the *Newsletter* may not be well read in other countries is because it is not as readily available or heavily advertised there. Finally, I'd like to point out that *Caving International*, the superb publication on international cave exploration that was produced in Canada several years ago, contained articles written exclusively in English.

I appreciate your view of the AMCS as a special organization whose aim is to promote communication and co-operation amongst all groups caving in Mexico, not just Americans. Indeed, this is the primary goal of the AMCS, and we are glad that you share our vision. In general, the AMCS has been highly successful in collecting and organizing information from nearly all groups, foreign and domestic, who are caving in Mexico. The AMCS maintains an extensive library of publications and has many for sale. The *Newsletter* is the primary means of distributing the information gathered. Each year the AMCS tries to contact *all* of the groups who have made significant

cave discoveries in Mexico since the last *Newsletter*. Unfortunately, there are a few groups who do not reply, or do not submit articles. However, to the best of my knowledge, no group has ever refused to submit an article because of language differences. Articles for this and past issues have been submitted in Spanish, French, and Italian. However, rather than print these articles in the languages in which they are written, they are translated to English.

Although your article does not appear in French, please do not conclude that the AMCS is not interested in communication with its foreign readers. A few years ago the *Newsletter* began to include Spanish abstracts for all articles. And it is in direct response to your letter that I have included French abstracts with the articles that were submitted in French. It was also my intention to include an Italian abstract with the Guerrero article, but the article arrived too late. Perhaps in the future all articles submitted in foreign languages could be made available in their original language through the AMCS for the cost of copying and postage.

In another effort to promote communication, this issue contains two address lists: one of Mexican caving groups and the other of contributors to the *Newsletter*. In addition, the AMCS and SMES are co-sponsoring the first Mexican caving convention this December.

Finally, I'd like to add that just because the *AMCS Activities Newsletter* is currently printed in English by American cavers does not mean that this could not change in the future. The *Newsletter* has evolved greatly over the years, from a brief, frequently published newsletter to a much longer, more professional publication. The editorship has also changed. This is the first *Newsletter* that has not been solely produced in Austin, Texas. Perhaps in the future the *Newsletter* may be produced in Mexico or elsewhere. Other changes are also possible, as the AMCS continues to respond to the changing caving scene in Mexico.

The AMCS welcomes additional letters addressing this and other topics of general concern to the readership.

Carol Vesely

Directory of Mexican Caving Groups

Since the first edition of this directory was published in *AMCS Activities Newsletter No. 15* in December 1985, the number of Mexican caving groups on it has grown by three. Asterisks (*) denote groups which may no longer exist.

DRACO

José Montiel Castro
Manuel F. Soto No. 131
Colonia Constitución de la República
07460 México, D.F. Tel. 7-57-76-76

SOCIEDAD MEXICANA DE EXPLORACIONES SUBTERRANEAS

Ramón Espinasa Perena
Fuente de la Península #19
Tecamachalco 53950 México

GRUPO EXPEDICIONARIO XAMAN-EK

Calle 13 No. 10
Colonia Porvenir
México 15, D.F. Tel. 5-56-88-04

ESCUELA DE GUIAS ALPINISTAS DE MEXICO, S.C.

José Luis Beteta Beteta
Av. Baja California No. 200
México, D.F. 06760

GRUPO ESPELEOLOGICO UNIVERSITARIO

Avenida San Jerónimo 1032
San Jerónimo Aculco Lídice
10200 México, D.F.

ESPELEOCLUB ZOTZ

John Pint
Apartado 103 CP 45010
Cd. Granja, Jalisco Tel. 13-94-43

ASOCIACION DE EXCURSIONISMO DEL INSTITUTO POLITECNICO NACIONAL

Ricardo Arias Fernández
Av. Othón de Mendizabal Ote. #20-264
Col. La Patera Vallejo
México D.F., 07710 Tel. 5-87-17-23

GRUPO DE EXPLORACIONES SUBTERRANEAS DE TABASCO

Victor Dorantes
Gregorio Mendez 1110, Piso 4
Esq. Ruiz de la Peña
Villahermosa, Tabasco

ASOCIACION ALPINA DE MEXICO

Sergio Zambrano
Las Huertas 93-C
Colonia del Valle
03100 México, D.F. Tel. 5-48-30-35

ASOCIACION MEXICANA DE BUCEO EN CUEVAS

Angel Soto Porrua
Av. Presa Don Martín 21
Col. Irrigación 11500
México, D.F.

GRUPO ESPELEOLOGICO MEXICANO

Jorge de Urquijo Tovar
Salnica #233 Col. Electricistas
México D.F. Tel. 3-96-16-36

CLUB ALPINO ESPELEOLOGICO TRES DE MONTERREY

Claude Bachr
Casa de Sr. Pinzón
Tepehuanes 1722
Col. Mitras Centro
Monterrey, Nuevo León

Cubiculo de Montañismo

Espeleología
Dirección General de Actividades
Deportivas y Recreativas
Universidad Nacional Autónoma de México
Puerta 8, Estado Olímpico
Ciudad Universitaria
04510 Coyoacán, D.F.

Saltillo Scouts group
Alfonso Ochoa M.
Piedras Negras 1608
Col. República
Saltillo, Coahuila 25280

CLUB POTOSINO DE MONTANISMO
Y ESPELEOLOGIA *
Benjamin Oliva
Avanzada No. 695
Colonia las Aguilas
San Luis Potosí, SLP

Tel. 3-26-44

ASOCIACION MEXICANA
DE ESPELEOLOGIA *
Eleonor Ledesma
Zaragoza No. 20
Col. Buenavista
México 3, D.F.

Rolando Montano Fraire
Real de los Reyes 77
Nogal 3
Colonia Los Reyes
04330 Coyoacán, D.F.

Aguilas Espeleo-Club
Ing. Claudio Espinosa Anguiano
San Luis Potosí, SLP
CP 78310

Tel. 2-17-72

MEXPELEO 89

26-30 December 1989

The first major international caving convention in Mexico is being planned for 26 to 30 December 1989 in Ciudad Valles, SLP. Jointly sponsored by the Unión Mexicana de Agrupaciones Espeleológicas (UMAE) and the Association for Mexican Cave Studies (AMCS), this event will provide a great opportunity for Mexican and American cavers to meet and cave together. The Valles area is a spectacular caving area, with many famous caves such as Sótano de las Golondrinas nearby. Planned events include caving trips, slide presentations, and special interest workshops on different aspects of Mexican caving. There will be a camping area adjacent to the convention facilities, and there are also several good hotels nearby. For more information, phone or write for a Mexpeleo 89 circular.

UMAE
Ramón Espinasa
Fuente de la Península No. 19
Tecamachalco, México 53950

Tel. (905) 251-2986

AMCS
Peter Sprouse
P.O. Box 7672
Austin, Texas U.S.A. 78713

Tel. (512) 467-2283

Contributors

Jay Arnold
10129 Sassafras Woods Ct.
Burke, VA. 22015

Peter Bosted
4000 Farm Hill Blvd. #310
Redwood City, CA. 94061

Jim Coke
Excursiones Akumál, S.A.
Postal 1345
Cancun Q.R., Mexico

Sheck Exley
Cathedral Canyon
Rt. 8, Box 374
Live Oak, FL. 32060

Bill Farr
709 S. Primrose Ave. #A
Monrovia, CA. 91016

Patty Kambesis
1026 S. Candler St.
Decatur, GA. 30030

Renaud Lamml
4 rue des Coustasses
06140 Tourettes-sur-Loup par Vence
France

Karlin Meyers
18 William Penn Dr.
Stoney Brook, NY. 11790

Mark Minton
Dept. of Chemistry
University of Texas
Austin, TX. 78712

Reanato Dale Mule
Via G. Matteotti 3
1-34138 Trieste, Italy

Dale Pate
2607 Park View Dr.
Austin, TX. 78757

Ramón Espinasa Perena
Fuente de la Península #19
Tecamchalco, Edo. de Mexico
C.P. 53950 Mexico

Jim Pisarowicz
Wind Cave National Park
Hot Springs, SD. 57747

Carlos Lazcano Sahagun
Correo Federal Pacific 230
San Ysidro, CA. 92073

Jim Smith
1688 Hwy. 185, Apt. 2
Bowling Green, KY. 42101

Marion Smith
P.O. Box 8276
Ut Station
Knoxville TN. 37996

Peter Sprouse
P.O. Box 8424
Austin, TX. 78713

Bill Steele
507 Lively Dr.
San Antonio, TX. 78213

Bill Stone
7739 Laytonia Dr.
Derwood, MD. 20855

Marc Tremblay
Société Québécoise de Spéléologie
4545, av. Pierre-de-Coubertin
C.P. 1000, Succursale M
Montreal, Quebec H1V 3R2 Canada

Carol Vesely
709 S. Primrose Ave. #A
Monrovia, CA. 91016

Mike Warton
3508 Valley Pike Rd.
Cedar Park, TX. 78613

