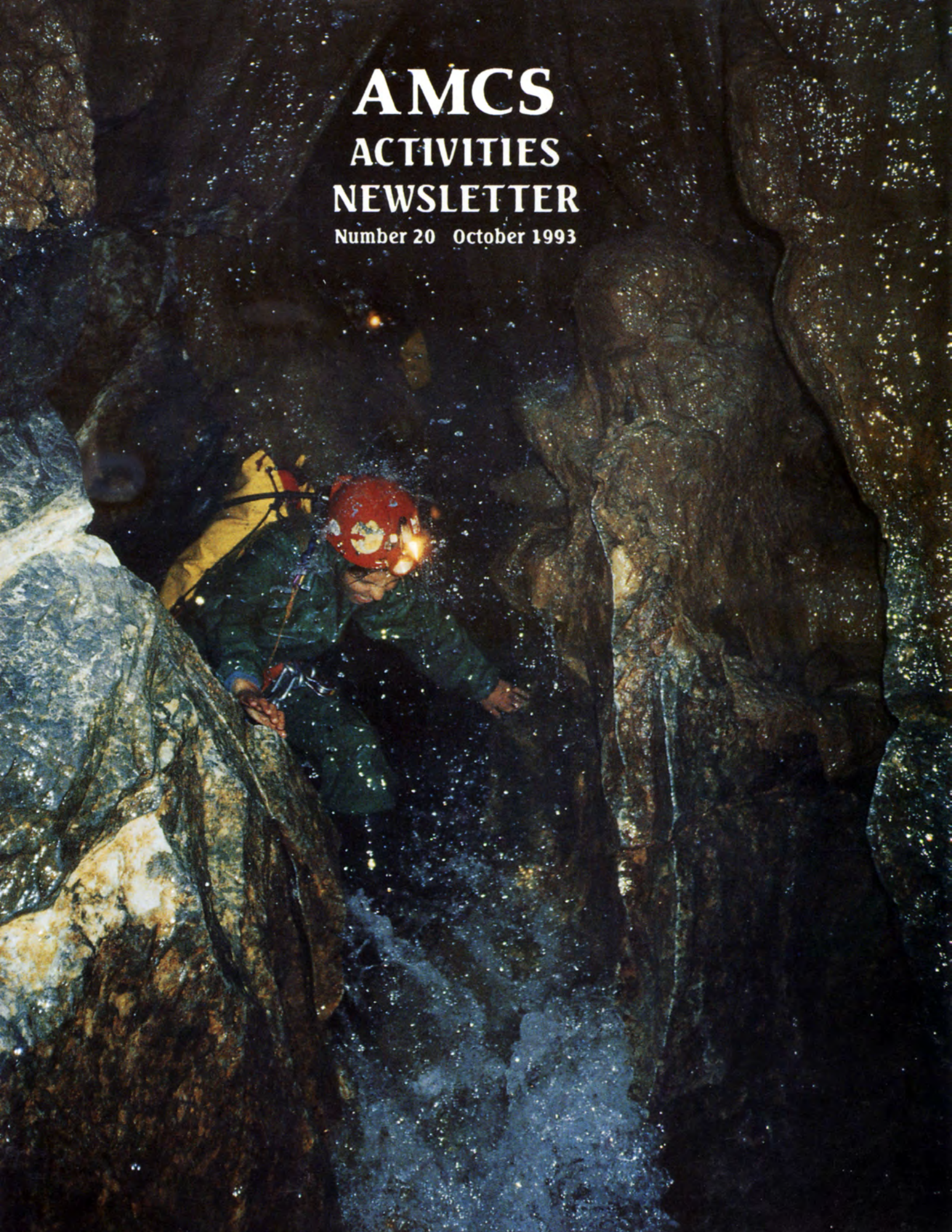


AMCS ACTIVITIES NEWSLETTER

Number 20 October 1993





AMCS

ACTIVITIES NEWSLETTER

Number 20

October 1993

The *AMCS Activities Newsletter* is published by the Association for Mexican Cave Studies, with assistance from William Russell. This issue was edited by Bill Mixon, with help from Katie Arens, Jeff Horowitz, Susie Lasko, Mark Minton, Gary Napper, Peter Sprouse, and Alex Villagómez.

The *Activities Newsletter* seeks articles and news items on all significant exploration and research activities in the caves of Mexico. Photographs suitable for the covers and other full-page applications are also sought. They need not relate to an article in the issue, but the original slide or negative must be available on request for printing full-page photos. All material may be sent to the AMCS address. Those planning an article may contact the AMCS for the name of the editor and the schedule for the next issue. Better yet, just send it now. There should have been an index to numbers 16 to 20 in this issue, but, after completing the rest of the issue, the editor was too burned out to do it and did not want to delay the issue long enough to make other arrangements. Anyone who would be willing to prepare an index to cave and place names in one or more of those issues may contact the AMCS, and maybe we can pull together an index for the next issue.

The Association for Mexican Cave Studies is an informal, nonprofit organization dedicated to the exploration, study, and conservation of the caves of Mexico. All previous issues of the *Activities Newsletter* are available, as are various other publications on caves and cave life in Mexico. Write for a list of publications.

**ASSOCIATION FOR
MEXICAN CAVE STUDIES
BOX 7672
AUSTIN, TEXAS 78713**

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Front cover

Ruth Diamant in the Swim Gym, Sistema Cheve, Oaxaca.
Photo by Mike Frazier.

Back cover

Jim Brown rappels into the Left Hand Sump, Sistema Purificación, Tamaulipas, with a MK-4 rebreather on his back.
Photo by Bill Stone.

Frontispiece

Herb Laeger surveying near the back of Cueva del Mano, Oaxaca.
Photo by Peter Bosted.

Page 5

Susie Lasko climbing in Sótano de Amezcua, Coahuila.
Photo by Peter Sprouse.

Page 29

Charlie Savvas lights up a totem in the Cardassian Borehole, Cueva del Tecolote, Tamaulipas.
Photo by Peter Sprouse.

CONTENTS

- 4 Authors' addresses
7 Mexico News *Mark Minton and Nancy Weaver*
25 Deep Pits of Mexico List *Peter Sprouse*
26 Long and Deep Caves Lists *Peter Sprouse*
- 31 Proyecto Cheve Expedition 1993 *Mike Frazier*
44 Deepest Karst Conduit System *Louise D. Hose*
46 Cueva del Mano *Carol Vesely*
55 Lava Tubes of the Suchiooc Volcano *Ramón Espinasa-Pereña*
60 Tampumacchay Cave, Colima *John J. Pint*
61 La Sima del Chikinibal *Francisco Ruiz*
65 The Tepetlaxtli System, Puebla *Mauricio Tapie Vizuet*
70 The Underwater Caves of Quintana Roo *James G. Coke IV*
72 The Infiernillo Sump Revisited *Bill Stone*
84 Diving in Quintana Roo: Three Reports *Steve Gerrard*
88 The Cave at Bolonchen (history) *John Lloyd Stephens*
93 Searching for the Big One at Xilitla *Gerald Moni*
109 Proyecto Iztaxochitla *Francisco Ruiz*
117 More Discoveries in the Cuetzalan Area *Jim Pizarowicz*
122 Cueva de las Abejas Africanas, Colima *John J. Pint*
124 Reconnaissnce in Chihuahua *Jim Pizarowicz*
127 The Cave That Runs through the Mountain *John J. Pint*



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NEWS

MEXICO NEWS

Compiled by Mark Minton and Nancy Weaver

CHIAPAS

The Italian expedition Garrapata '89 to the Selva el Ocote found seventeen caves with a total length of 3.5 kilometers. Among the more significant discoveries are the large **Sima del Chute Redondo**, which reaches a depth of 200 meters, **Sima de Viente Casas**, with its single large drop of 180 meters, multidrop **Cueva del Lacandon**, **Cueva de San Anton**, and their longest, at 1027 meters, **Cueva del Chute Redondo**. The last contains an enormous chamber over 100 meters in diameter. *Source: SottoTerra* 83, 1990(?).

Work continued in the Arroyo Grande area (see *AMCS Activities Newsletter* 18 and 19) in early 1993. **Sima de Soconusco** was surveyed to 283 meters deep and 1.5 kilometers long, and it continues at a pit with air flow. A hoped-for connection between **Cueva de Queso Grande** and **Cueva del Arroyo Grande** was not found, but the surveys increased to 2041 meters and 9154 meters long, respectively. Five-hundred-ninety-meter-long **Cueva de La Poza** also failed to connect, although it passes under Arroyo Grande. Eight other surveys were initiated, including two more very deep blind pits, **Cueva de la Funda**, 198 meters deep, and **Sima Don Juan**, 278 meters deep and one of the ten deepest in Mexico. Several crews will return in 1994. *Sources: Don Glasco, D.C. Speleograph*, April 1992; Miles Drake; Nancy Pistole.

CHIHUAHUA

The entrance to **Cueva del Diablo** near Jiménez resembles a fossil centote. Several small passages lead away from the bottom and join to form the

main gallery, which in turn gives access to several complex areas that are incompletely explored. The cave is well known locally and was being considered for commercial development, but it was found to be unsuitable for tourists. So far, 580 meters have been surveyed, with many leads remaining. *Source: Mauricio Tapie V. [Earlier, less complete maps of this cave appeared in AMCS Newsletter, vol. 5 no. 2-3, June 1977, and AMCS Activities Newsletter 19, 1992.]*

COLIMA

Work by the Sociedad Mexicana de Exploraciones Subterráneas in the Cerro Grande area of Colima and Jalisco is covered in detail in the book *Las Cavernas de Cerro Grande*, by Carlos Lascano S. (1988). There are sections covering climate, geology, and karst, in addition to descriptions and maps of the caves, which are mostly vertical. The deepest is **Resumidero del Pozo Blanco**, 241 meters deep, with a 233-meter entrance pitch (see *AMCS Activities Newsletter* 13). The longest is **Resumidero de Toxín**, 3005 meters (*AMCS Act. Nl.* 15). Several other caves have drops in excess of 100 meters.

Zotz cavers have also been active on Cerro Grande. Three pits, **Guajalote I and II**, 70 and 60 meters deep, respectively, and an unnamed pit, also 70 meters deep, were found near El Guajalote. These cavers found it beneficial to go during the rainy season, since it helped settle the dust in the area. *Source: Juan Blake and Jesús Moreno, Subterráneo 7, January 1991.*

A preliminary report on the biospeleology of the Cerro Grande area, especially focusing on **Pozo**

(Resumidero) de La Escondida has been published. *Source: José G. Palacios-Vargas and Victor Granados, Mundos Subterráneos 1, August 1991.*

Zotz cavers have explored several new rooms and interconnecting passageways right next to, but so far not connected with, **Cueva de el Salto** near Peña Colorada. *Source: John and Susy Pint, Subterráneo 7, January 1991.*

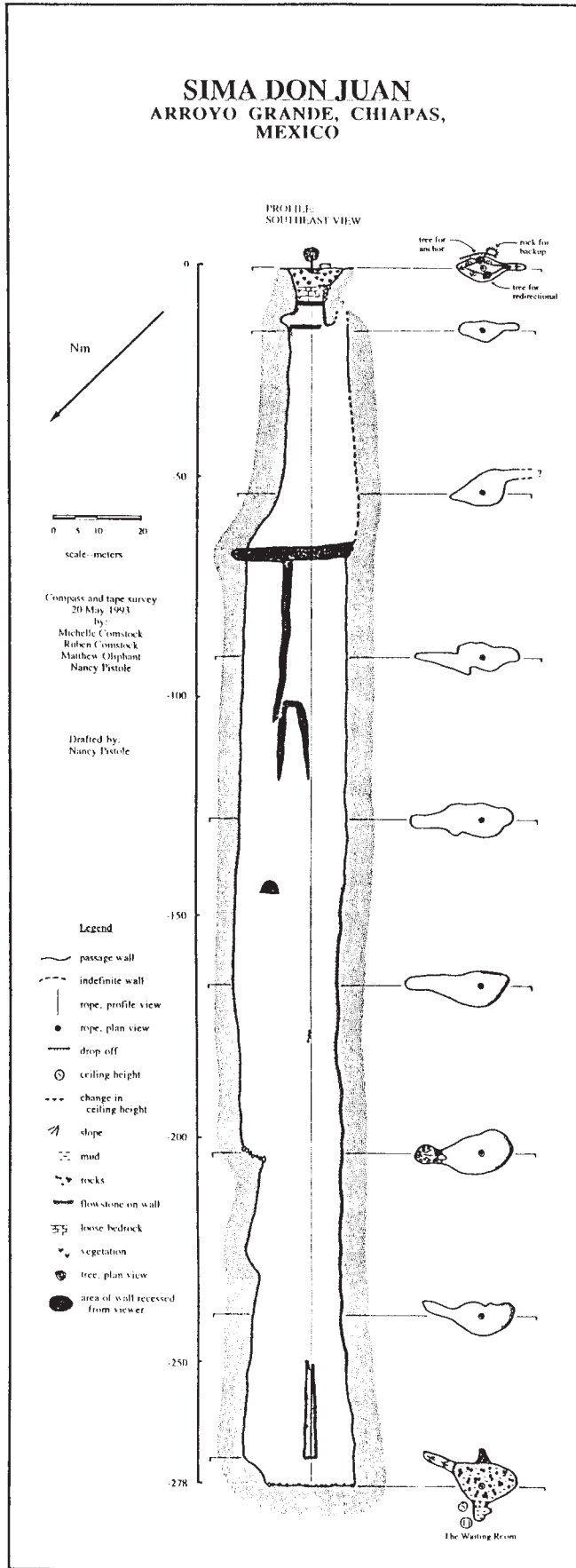
The fissure maze **El Chiquihuitón** has been surveyed to over 400 meters, with no end in sight. This mapper-unfriendly and biologically active cave also harbors histoplasmosis. *Source: Subterráneo 8, 1991.*

A more detailed description of **Pozo Sin Aire** (see *AMCS Activities Newsletter* 19, "Mexico News") has been written by John Pint and Claudio Chilomer and published in *Subterráneo 8, 1991.*

COAHUILA

On February 5 and 6, 1993, a group of Texas cavers mapped **Sótano de Amezcua**, an interesting pit in northern Coahuila. This pit had been located and initially explored by Joel King, and it had been found to contain blind catfish. A large sink in a flat mesa funnels down to the 65-meter entrance shaft, which intersects a stream passage. The upstream passage quickly goes to a sump, the Catfish Parlor. The downstream passage is initially a low crawl, then it opens into a tall, incised canyon. Just before the downstream sump is a high inlet, but a lead climb proved it to be blind.

One thousand meters to the east, another cave was explored, but not surveyed. **Cueva de Rancho Seco** was about 100 meters long and contained



various mummified mammal remains. This part of northern Coahuila contains the second-largest limestone zone in Mexico, yet very little of it has been explored for caves. *Source:* Peter Sprouse.

In July 1993, Texas cavers investigated an area near Mesa de las Tablas, east of Saltillo. A phreatic maze cave called **Cueva de los Llanitos** was mapped to about 400 meters in length. It has a 12-meter entrance drop. Nearby, two blind pits were explored; the deepest was **Sótano del Hongo**, 58 meters deep. *Source:* Peter Sprouse.

GUERRERO

Sociedad Mexicana de Exploraciones Subterráneas cavers have extended **Sótano del Platanar (APE-3)**, see *AMCS Activities Newsletter 19*) to 239 meters deep and 1316 meters long, deepest in the Chilacachapa area and third longest. Beyond the vertical section, a bad-air-filled borehole leads to a sump. A fossil continuation above the sump was left unexplored. *Source:* Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

Club de Exploraciones de México, A.C. cavers explored **Cueva del Arbol** near Cacahuamilpa. This cave is found in conglomerate and has several vertical pits, down-climbs, and crawls that lead to a small room with a huge stalactite 12 meters long. One caver became seriously ill with histoplasmosis and required five months to recuperate. *Source:* Jorge Morales, *Tepeyollotli 5*, July 1991.

The maps of **Cueva de Agua** and **Cueva del Coyote** (see *AMCS Activities Newsletter 18*) have been published. The latter is 67 meters deep and formed in conglomerates. *Source:* Ruth Diamant and Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

SMES cavers have discovered an extension to **Cueva del Borrego** east of Chilpancingo. They plan to return for further exploration. *Source:* Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

On May 11, 1991, there were multiple fatalities in **Gruta del Río San Jerónimo**, one of the **Dos Bocas**. A

largely inexperienced group of eight was caught in a flash flood while traversing the river an hour and a half from the entrance. This cave is obviously very dangerous during the rainy season. *Source:* Ernesto Mendoza Romero, *Base Draco* 8, December 1991.

The second international Mexpeleo convention was held in late December 1992 in Taxco. Over one hundred cavers attended the event, hosted at a grand old hacienda by SMES. Among the prime attractions were **Gruta Cacahuamilpa**, the **Dos Bocas**, **Gruta del Río San Jerónimo** and **Gruta del Río Chontalcoatlán**, and the state's deepest, **Hoyo de San Miguel**, with twelve pitches to -455 meters. **Gruta de San Miguel**, an archaeological cave with a chamber over 100 meters in diameter, was also visited. There was a resurvey of 1500-meter-long **Sumidero Zacatecolotla**. *Source:* Peter Sprouse.

HIDALGO

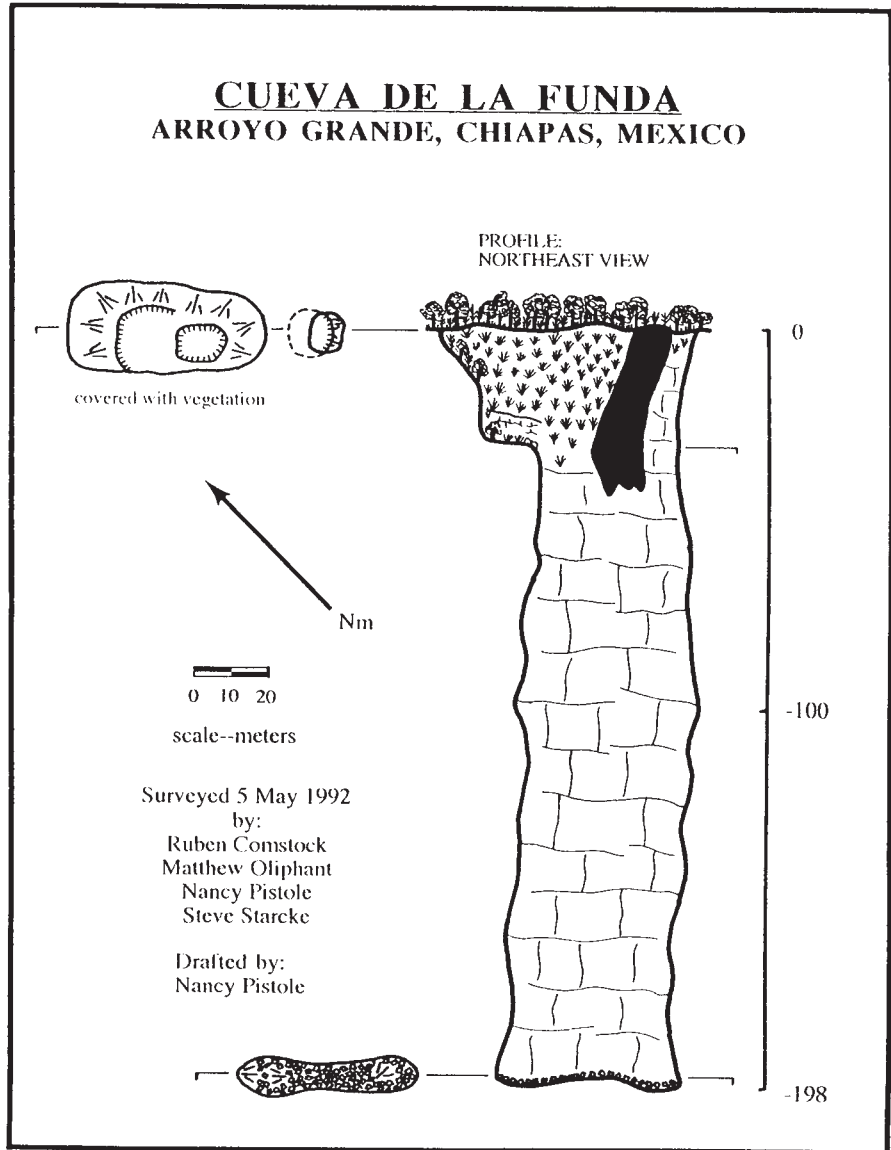
Sótano del Perro Vivo was first surveyed in 1983, but the notes were lost (see *AMCS Activities Newsletter* 15). It has now been resurveyed and the map published. A biological study was also conducted. Only 50 meters away lies 275-meter-deep **Sótano de la Laguna**, which contains several drops, the longest being 93 meters. *Source:* Rocio Bernal, et al., *Mundos Subterráneos* 1, August 1990.

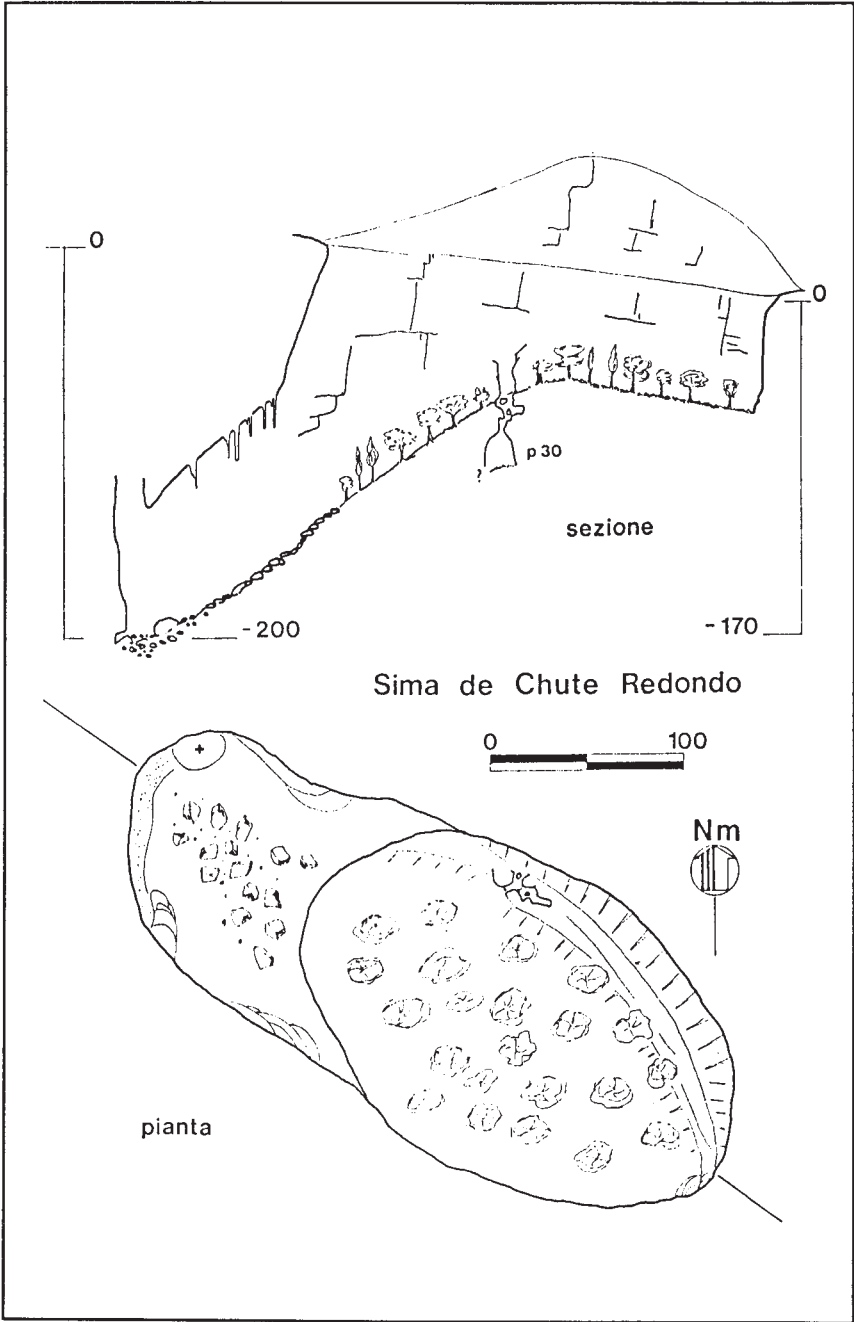
JALISCO

The map of **Cueva Cuata** (see *AMCS Activities Newsletter* 19) has been published. There is also a more detailed description of the exploration of **Sótano de Paso Real** (see *AMCS Act. Nl.* 19). *Source:* John and Susy Pint, *Subterráneo* 7, January 1991.

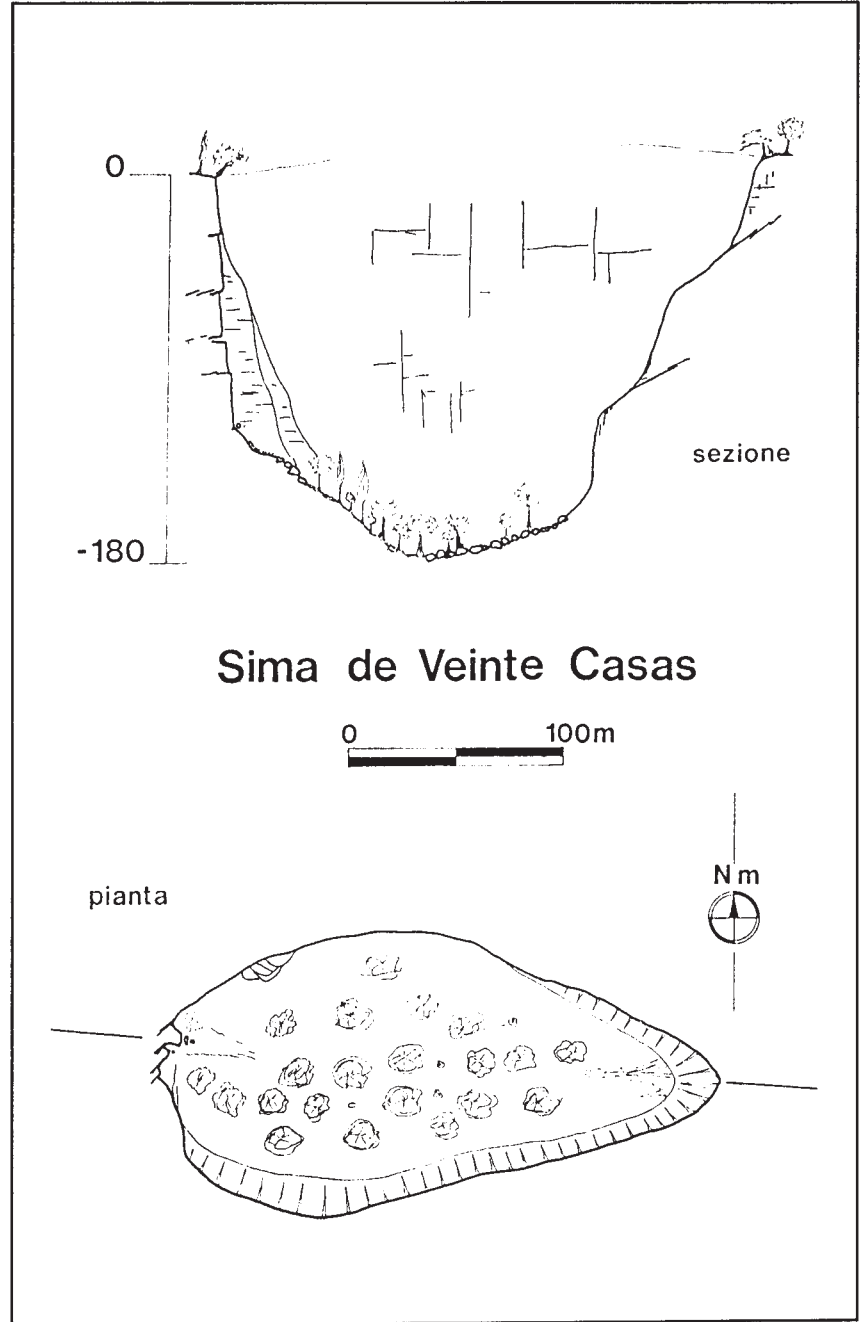
Also in the Paso Real area is the well-decorated **Cueva del Tigre**. Nearby **Sótano de San Miguel** remains unexplored due to the extremely unstable nature of the walls and ceiling. *Source:* Susy Pint, *Subterráneo* 8, 1991.

Barbara Luke climbing in Sótano de Amezcuca, Coahuila.
Peter Sprouse.





Sima de Chute Redondo



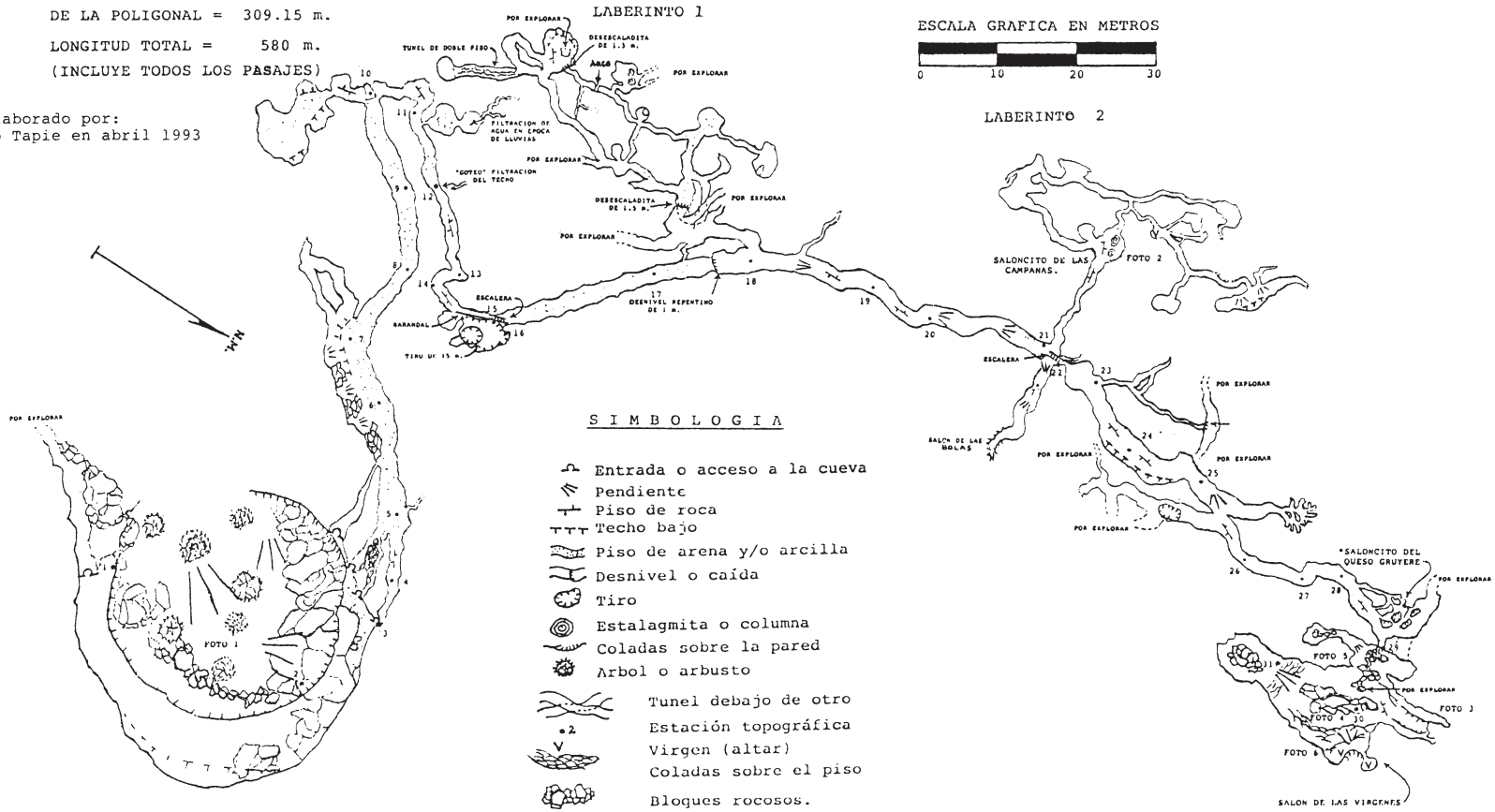
Sima de Veinte Casas

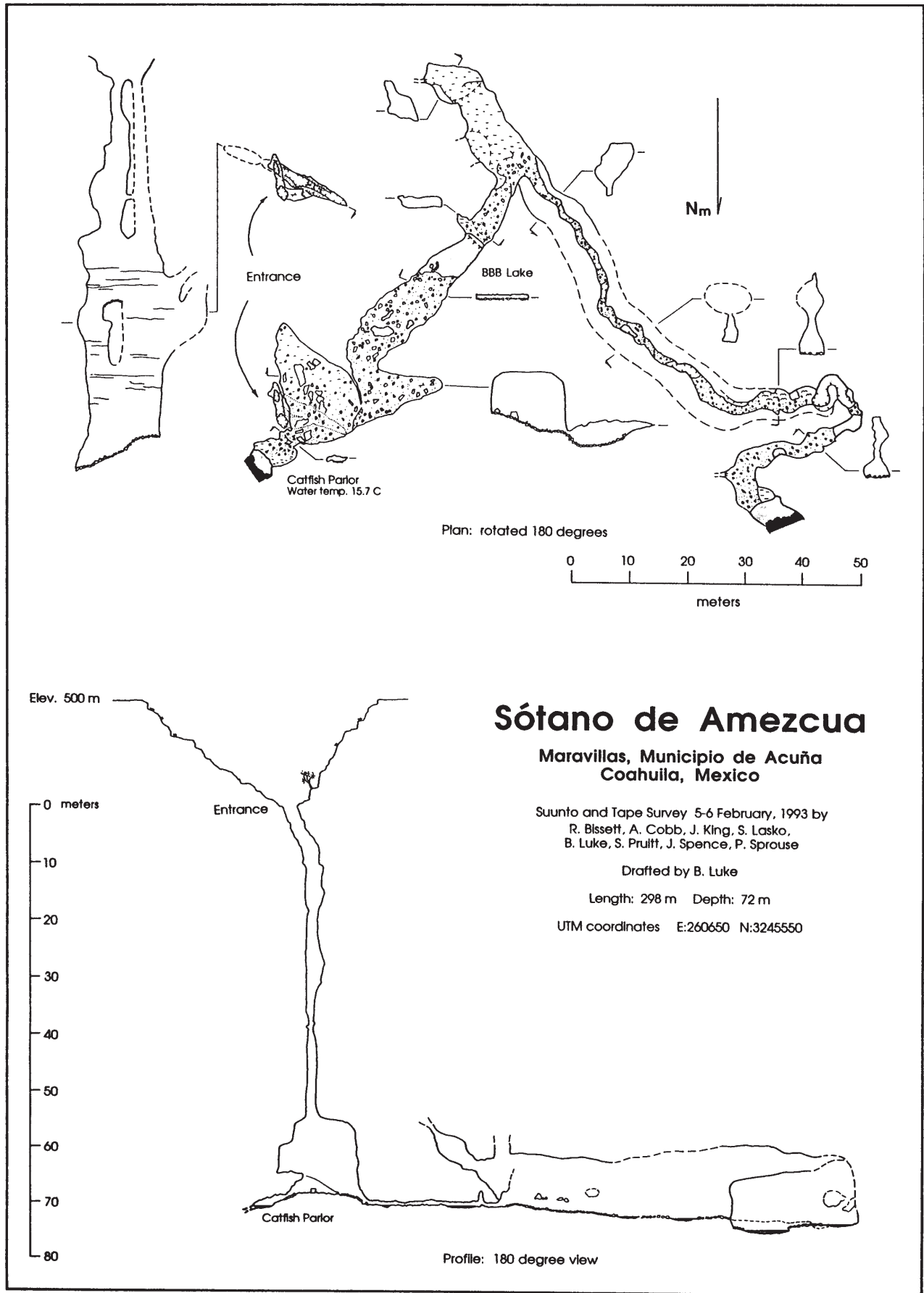
CUEVA DEL DIABLO

LUGAR: Jimenez, Chihuahua.
 LONGITUD DEL TUNEL PRINCIPAL
 DE LA POLIGONAL = 309.15 m.
 LONGITUD TOTAL = 580 m.
 (INCLUYE TODOS LOS PASAJES)

Plano elaborado por:
 Mauricio Tapie en abril 1993

NOTA: EL LABERINTO 1 SE
 SE PRESENTA COMO ES APROXIMADO, YA QUE NO SE REALIZO TOPOGRAFIA DE ESTA AREA DE LA CUEVA.





Zotz cavers explored another bad-air pit, **Pozo Sin Fondo**, near Jalapa. Although rocks rattled down for eight seconds, the pit turned out not to be that deep. Just below a small shelf, a carbide lamp could no longer be kept lit, and the cavers beat a hasty retreat after only one person reached the bottom. *Source: John Pint, Subterráneo 7, January 1991.*

See also under Colima for the SMES report on the caves of the Cerro Grande area.

MÉXICO

Cueva de Cerro Prieto is an archaeologically important shelter cave located at 4050 meters elevation on the volcano Nevado de Toluco. There is also ample evidence of modern ritual use of this cave. *Source: Ismael Arturo Montero García, Base Draco 8, December 1991.*

Cueva de los Brujos is an important ritual cave located at the base of the volcano Iztaccihuatl in Amecameca. Both healing ceremonies and agriculturally-based weather propi-

tations are actively performed here. *Source: Ismael A. Montero García, Mundos Subterráneos 2, September 1991.*

NUEVO LEÓN

A review of cave fauna in the state, focusing on **Gruta del Palmito (Grutas de Bustamante)**, **Grutas de García**, and **Grutas de Nevada** by José Palacios-Vargas has been published in *Mundos Subterráneos 2*, September 1991.

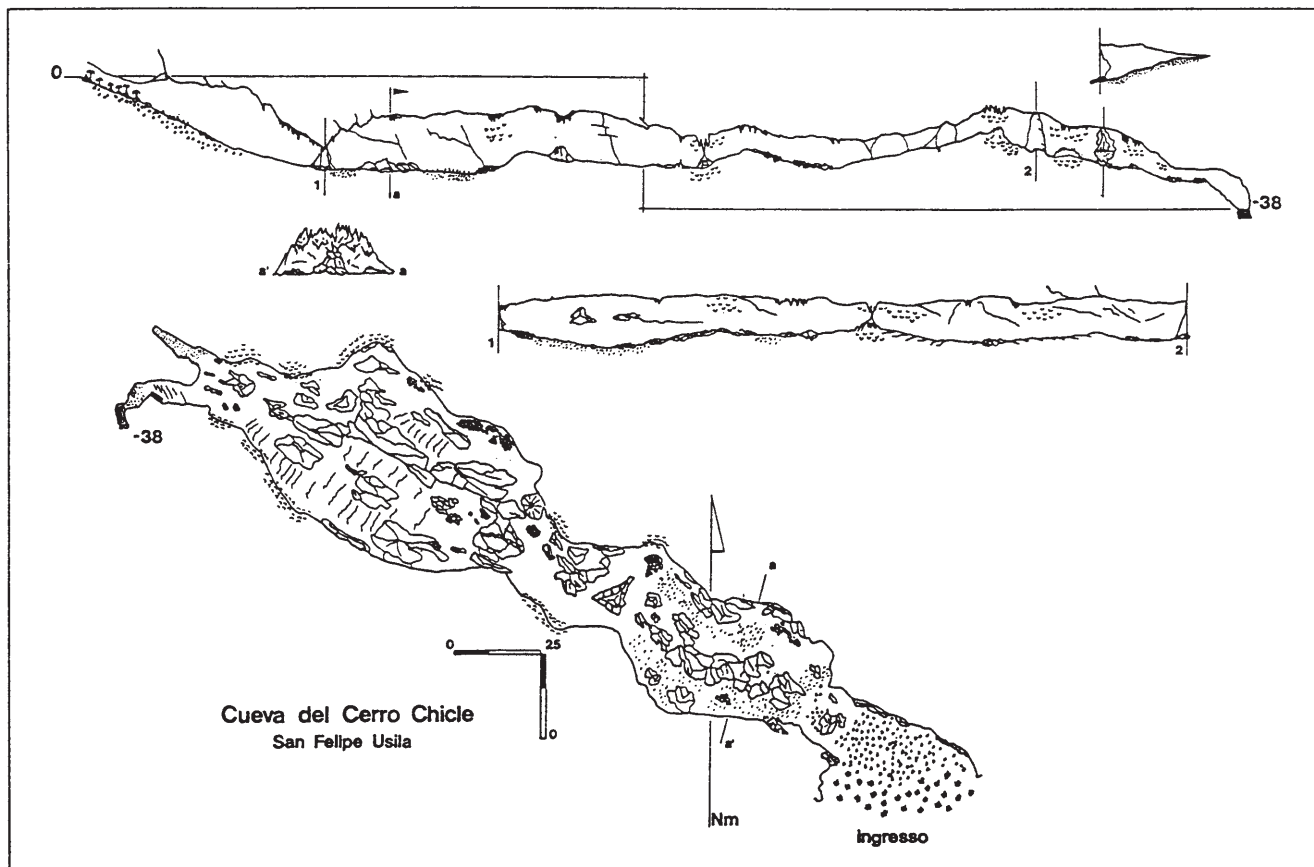
After being devastated by Hurricane Gilbert, Bustamante Canyon, home of **Gruta del Precipicio** and campsite for nearby **Gruta del Palmito**, is being refurbished. Trees are being planted, and the new road has even been paved. Campsites are being constructed throughout the canyon. *Source: Oren Tranbarger.*

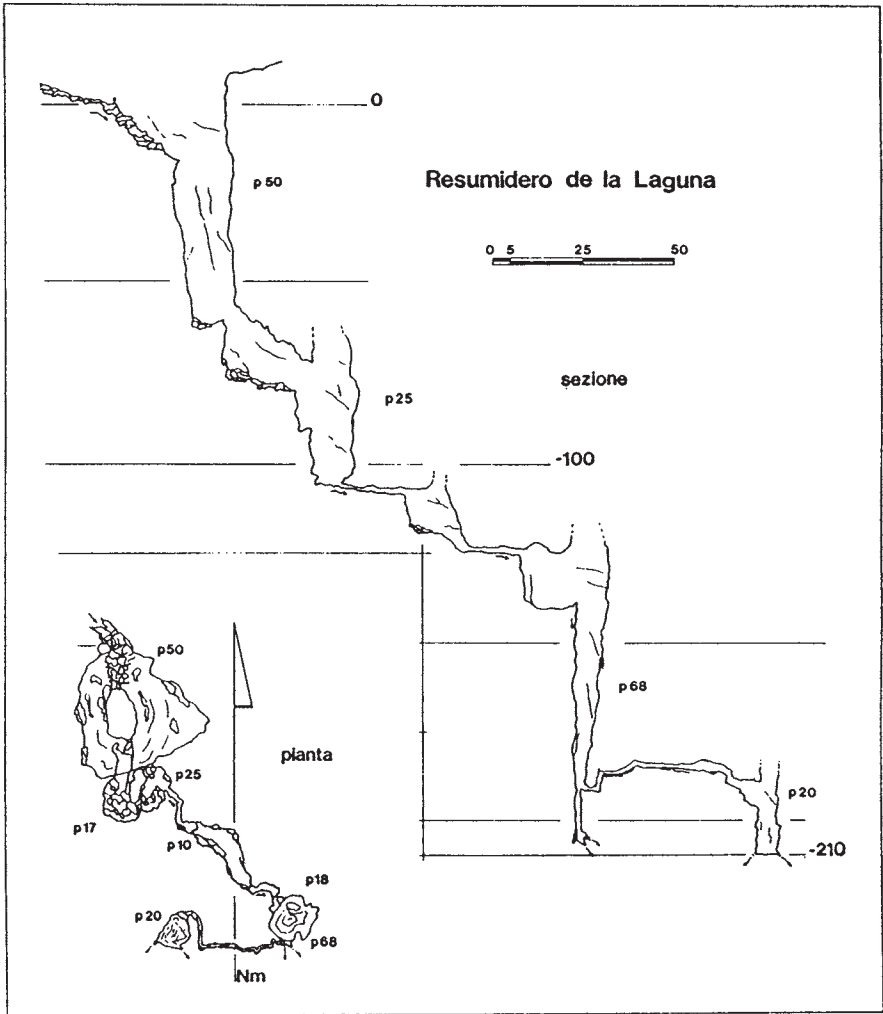
OAXACA

From January to March, 1991, the Italian expedition Río Aparecido '91 found fourteen caves in the area of Llano de Canoa, due east of Oaxaca City. **Resumidero Abajo de la**

Laguna is a short, multi-drop cave 210 meters deep. **Cueva de Vitaliano** was the largest cave, at 1.5 kilometers long and 297 meters deep, but it contains only a few short drops. The deepest pit found was **Resumidero del Burro**, a single drop of nearly 100 meters. A reconnaissance to the San Felipe Usila area (see also report of the British Black Holes Expedition, *AMCS Activities Newsletter 19*) turned up **Cueva del Cerro Chicle**, a large formation maze cave that was also of archaeological interest. *Source: SottoTerra 88, January-April 1991.*

A joint Swiss-American expedition to Cerro Rabón in the spring of 1993 was very successful. P17, a new cave with a 200-meter entrance drop, was connected at a depth of 600 meters to the main cave in the area, **Kijahe Xontjoa** (see *AMCS Activities Newsletter 19*). From a camp at nearly 1000 meters depth, a substantial amount of new passage was added to the survey, bringing the total length to about 18 kilometers and the depth to about 1185 meters. In many of the passages at the bottom of the cave, a



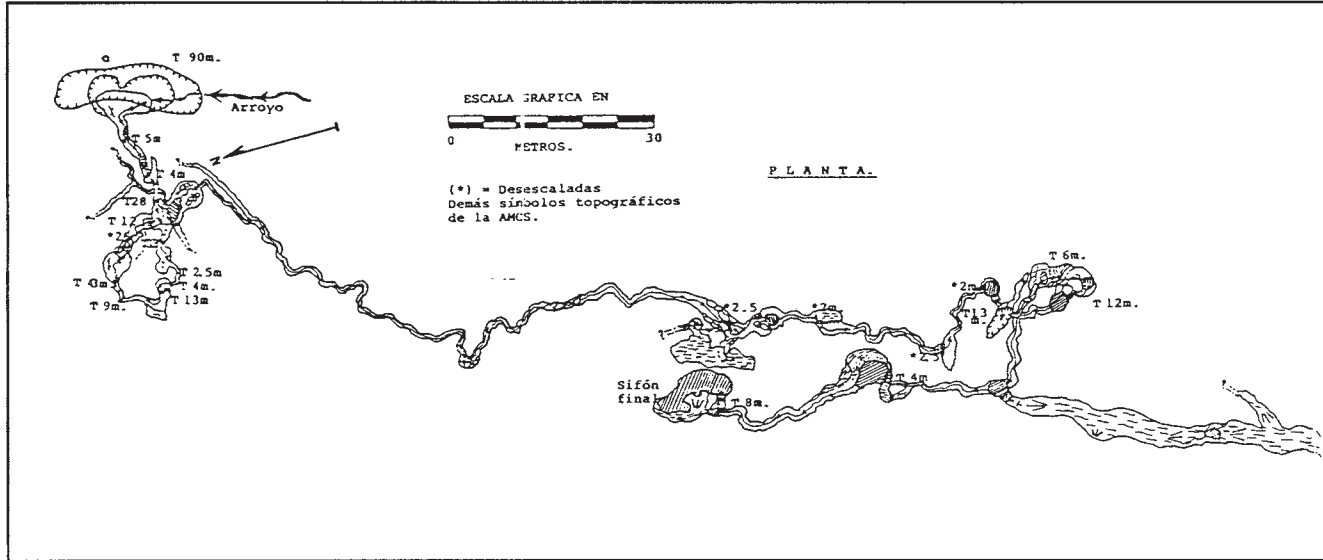


deep rumble could be heard, presumably from an as yet unseen river. Two kilometers were also surveyed in other caves in the area. A possible resurgence-area pit with a river on its floor has been located near Tilpan, but not entered. Xontjoa is now deeper than the originally supposed resurgence on the Río Uruapan. Source: Bill Steele.

PUEBLA

Near Tlacotepec de Díaz lies the 90-meter entrance shaft to **Sótano Tapoztotl** (see *AMCS Activities Newsletter* 19). Exploration has continued to a deep sump at -348 meters. However, while leaving the cave, the group found a horizontal gallery near the bottom. Several leads remain, with the length to date being 595 meters. Nearby and higher is **Sótano Casán**, so far explored only to the edge of a big pitch at -30 meters. The possibility exists for a connection between these two caves. Source: Pablo and Mauricio Tapie V., *Tepeyollotli* 5, July 1991.

Contributions of Sociedad Mexicana de Exploraciones Subterráneas cavers to Mexpé 4, the Canadian expedition to the Sierra Negra (see *AMCS Activities Newsletter* 19) have been published. Early in the expedition, **Nelfastle Tlacuátetl** and **Nelfastle de Nieve (TP4-13)** were connected, which gave easier access to the bottom of the latter. Their main discovery, however, was **Sistema Xalltégoxtli**, two large adjacent resurgence caves, each over one kilometer in length. One of them ends



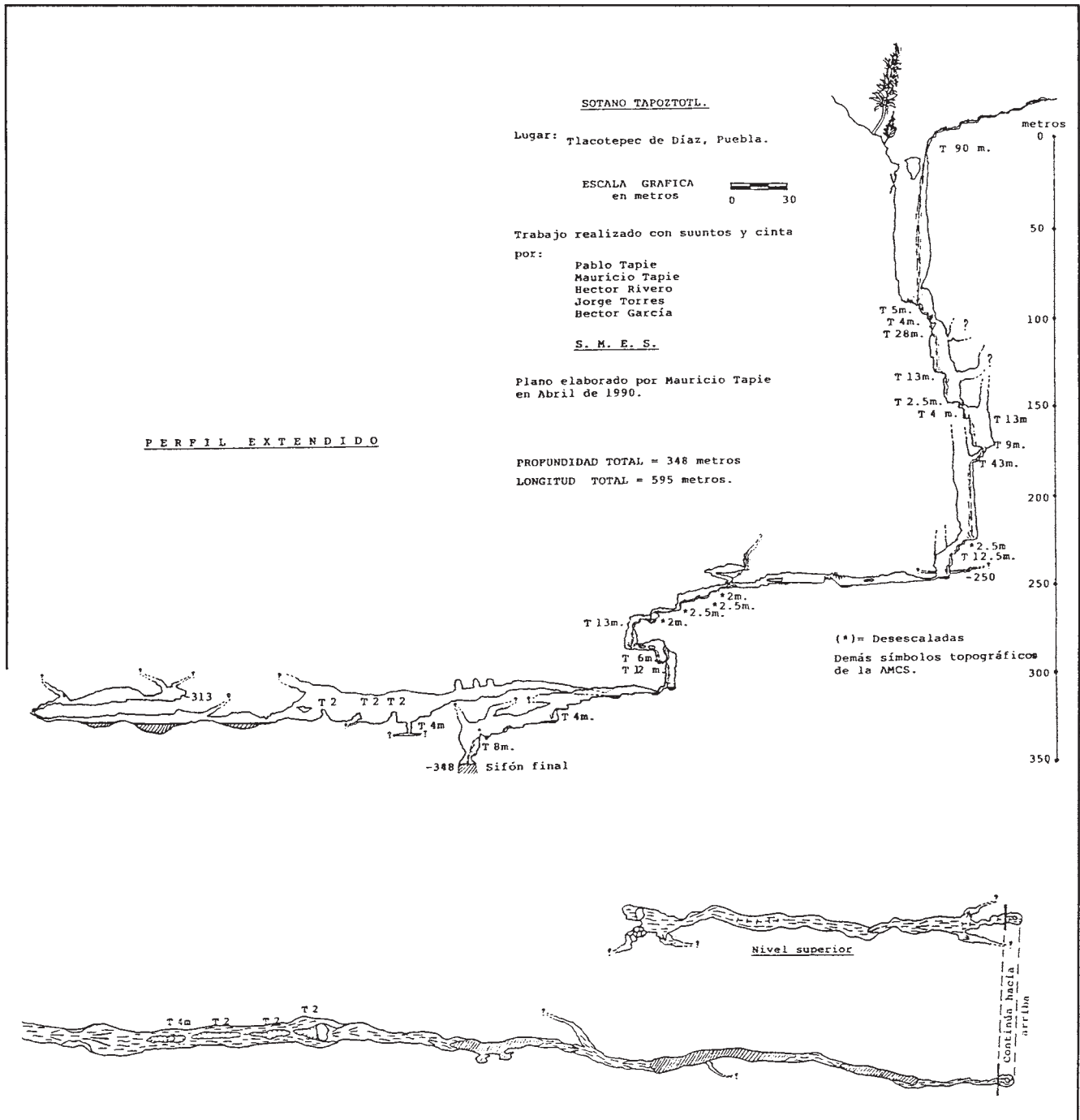
very close to the bottom of **Sistema de Angel**. Source: Ruth Diamant, *Tepeyollotli* 5, July 1991.

A hydrologic model for the Sierra Negra has been proposed. Although only a few pieces of the puzzle have yet been found, major drainage appears to be toward the northwest, to the Río Coyolapa. There seem to be two major drainage systems, centered on **Sistema de Angel** and **Nelfastle de Nieve**. Source: Steve Worthington,

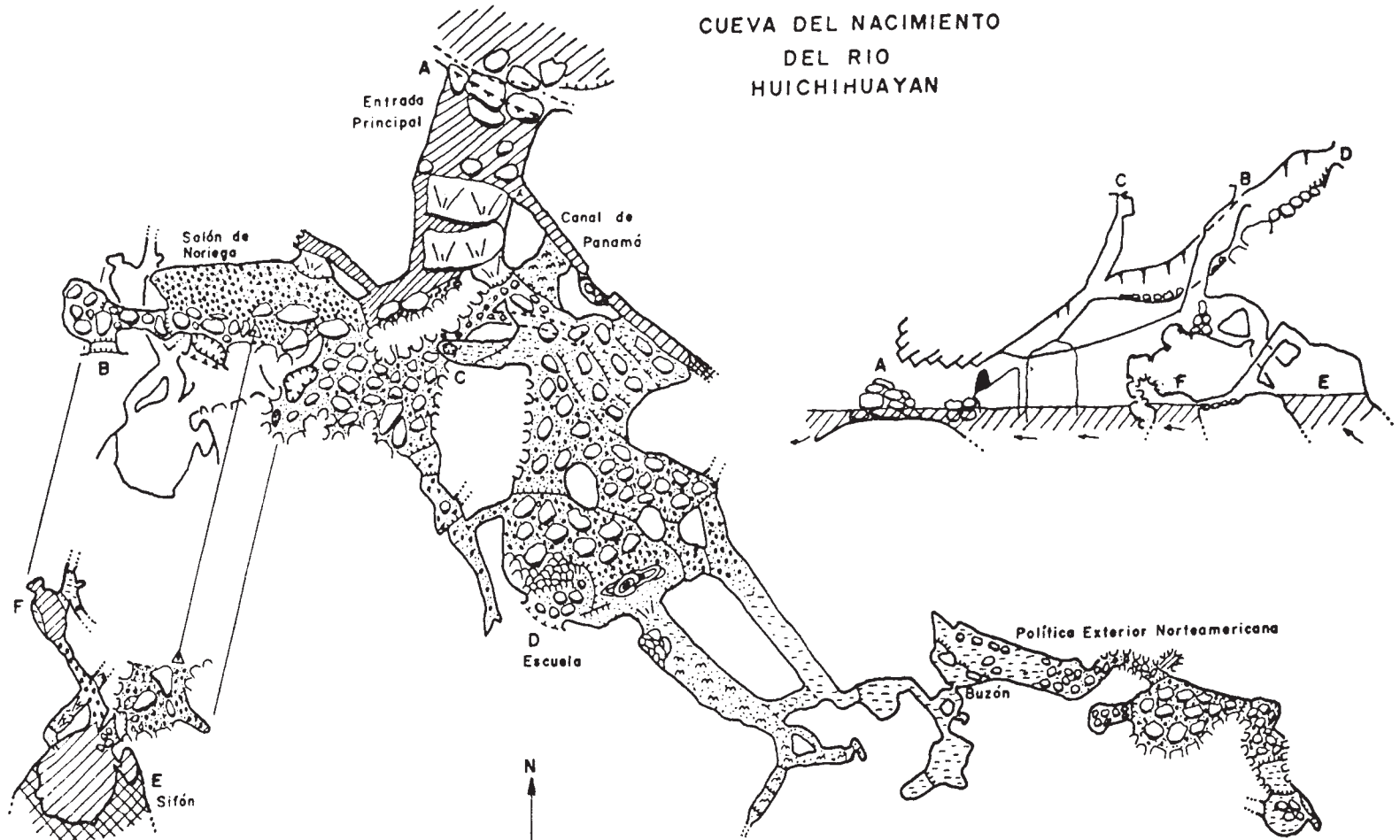
Sous Terre / Canadian Caver joint issue, Winter 1992-93.

During the 1970s and beginning of the 1980s, several large cave systems, most with active streams, were explored around the village of Cuetzalan in northern Puebla by American, Canadian, British, Belgian, and Mexican cavers. Unfortunately, much of the data was never published. In 1989, the Sociedad Mexicana de Exploraciones Subterráneas decided to

adopt the project, starting with the resurvey of the main caves. By 1991, the **Huayateno** system had been mapped to a length of 4711 meters. In December 1991, an expedition started the mapping of the **Cuetzalan** system, with the cooperation of several members of the British Northern Cave Club. In three weeks, 17 kilometers of passages were mapped in several caves, and the resurgence of the main cave system was tentatively located. In November 1992, again with British



CUEVA DEL NACIMIENTO DEL RIO HUICHIHUAYAN



Longitud: 655 m



SMES

CUEVA DE CALIFORNIA

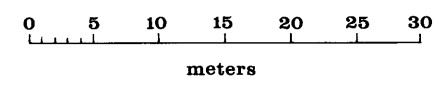
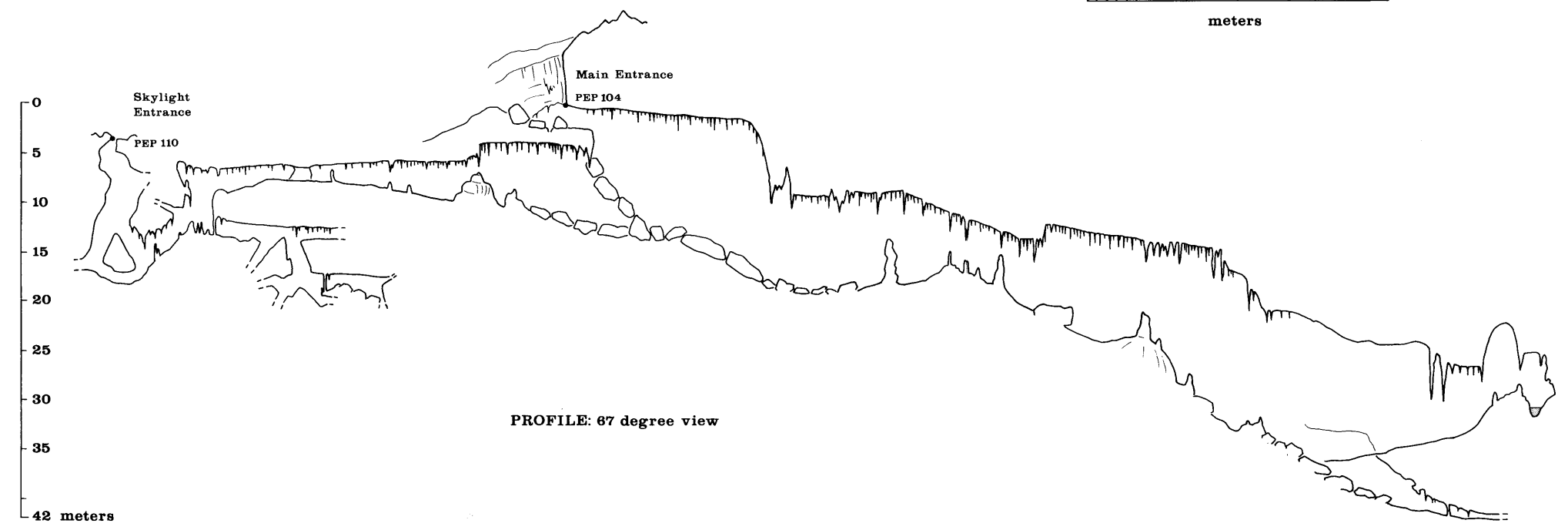
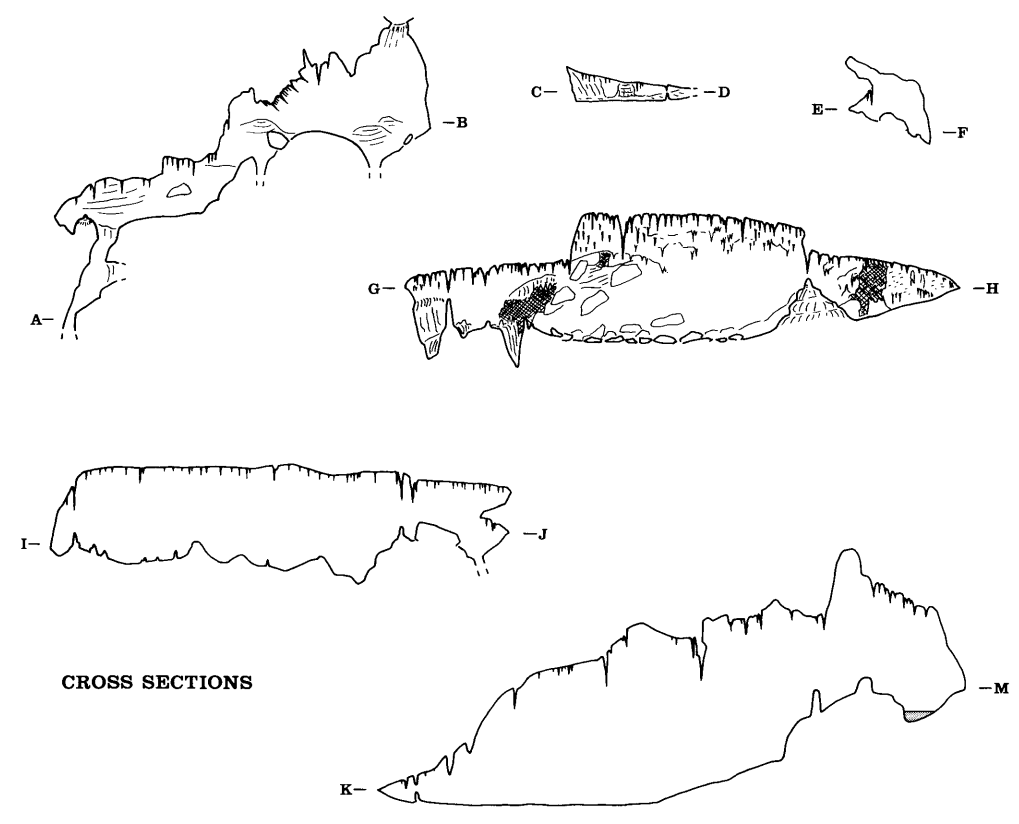
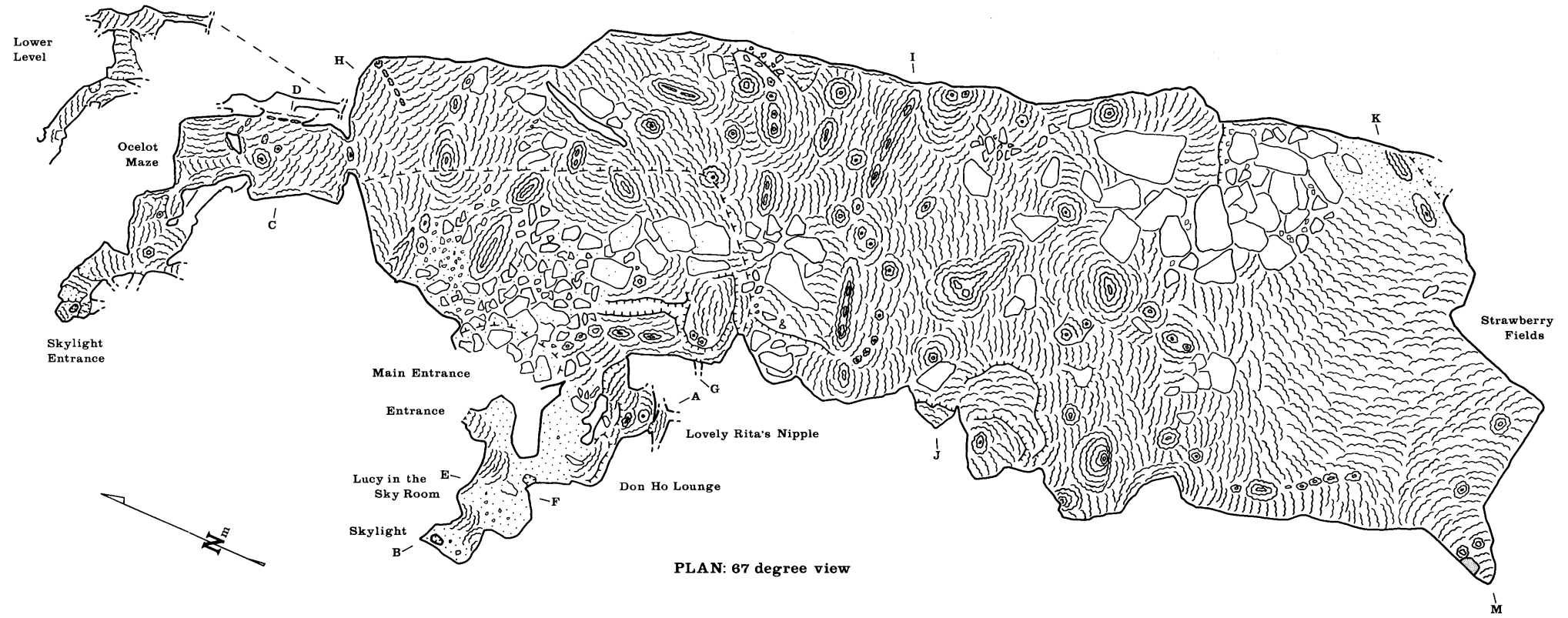
Rancho Nuevo, Municipio de Güemez
Tamaulipas, México

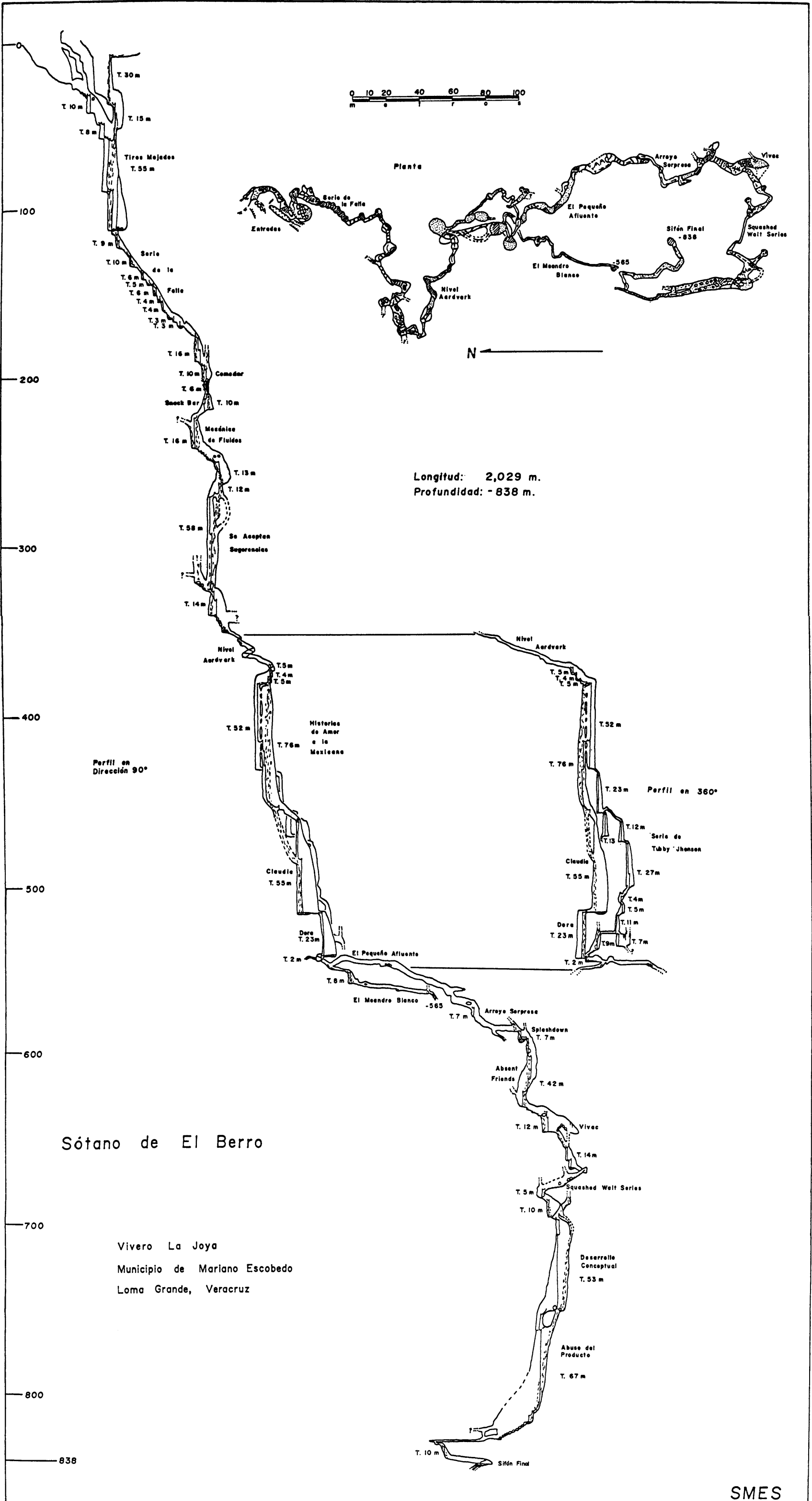
Suuntos and tape survey 9-10 April 1982
Jerry Atkinson, Jim Pisarowicz, Peter Sprouse, Terri Treacy

Drafted by Peter Sprouse
Plotted by ELLIPSE

Length: 250 meters Depth: 42 meters
UTM coordinates: X= 454,495E Y= 2,642,230N Z= 2520

PROYECTO ESPELEOLOGICO PURIFICACION





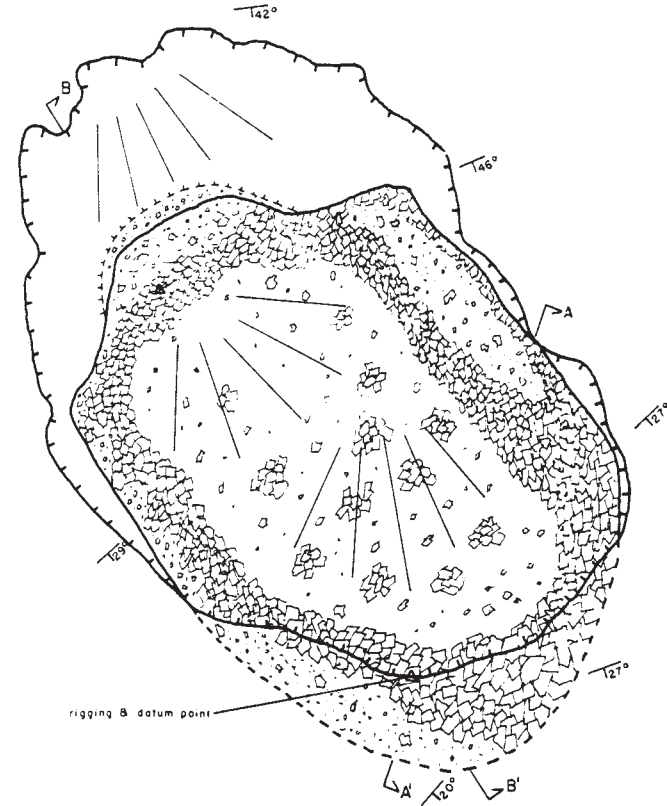
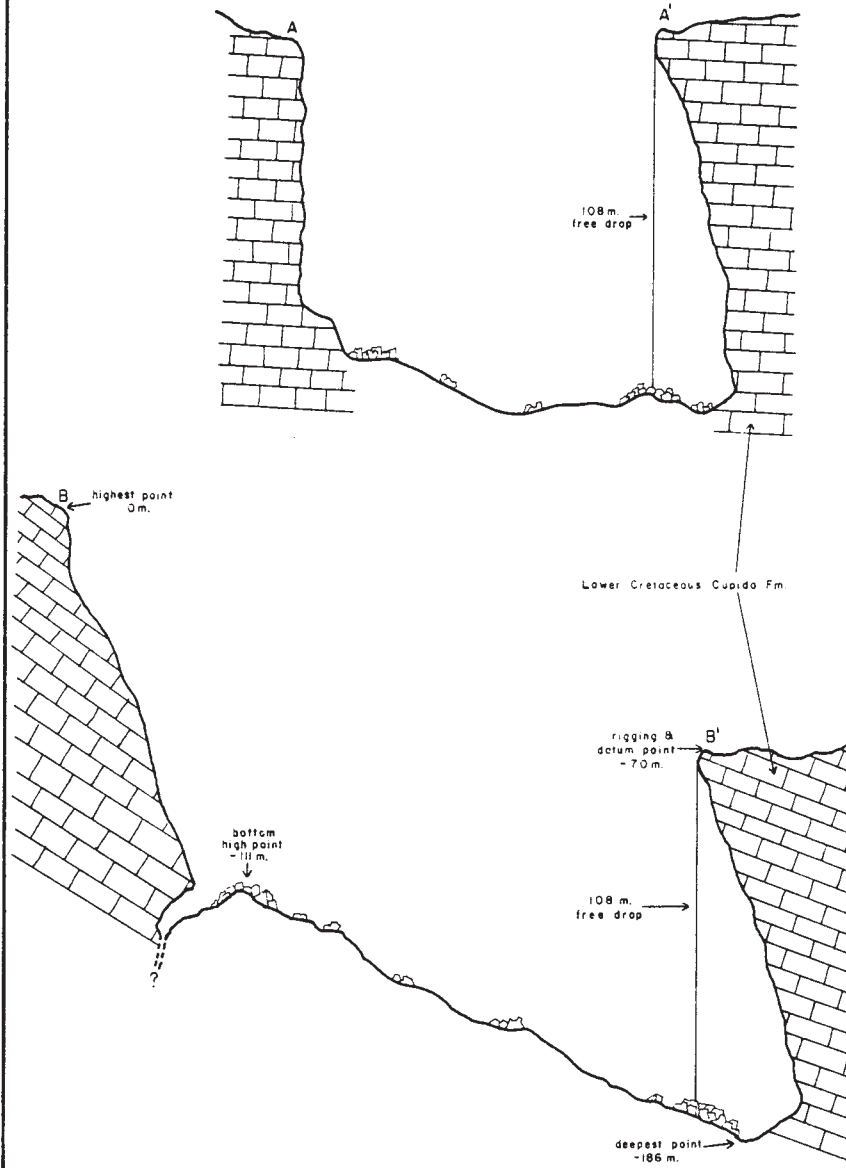
EL HUNDIDO

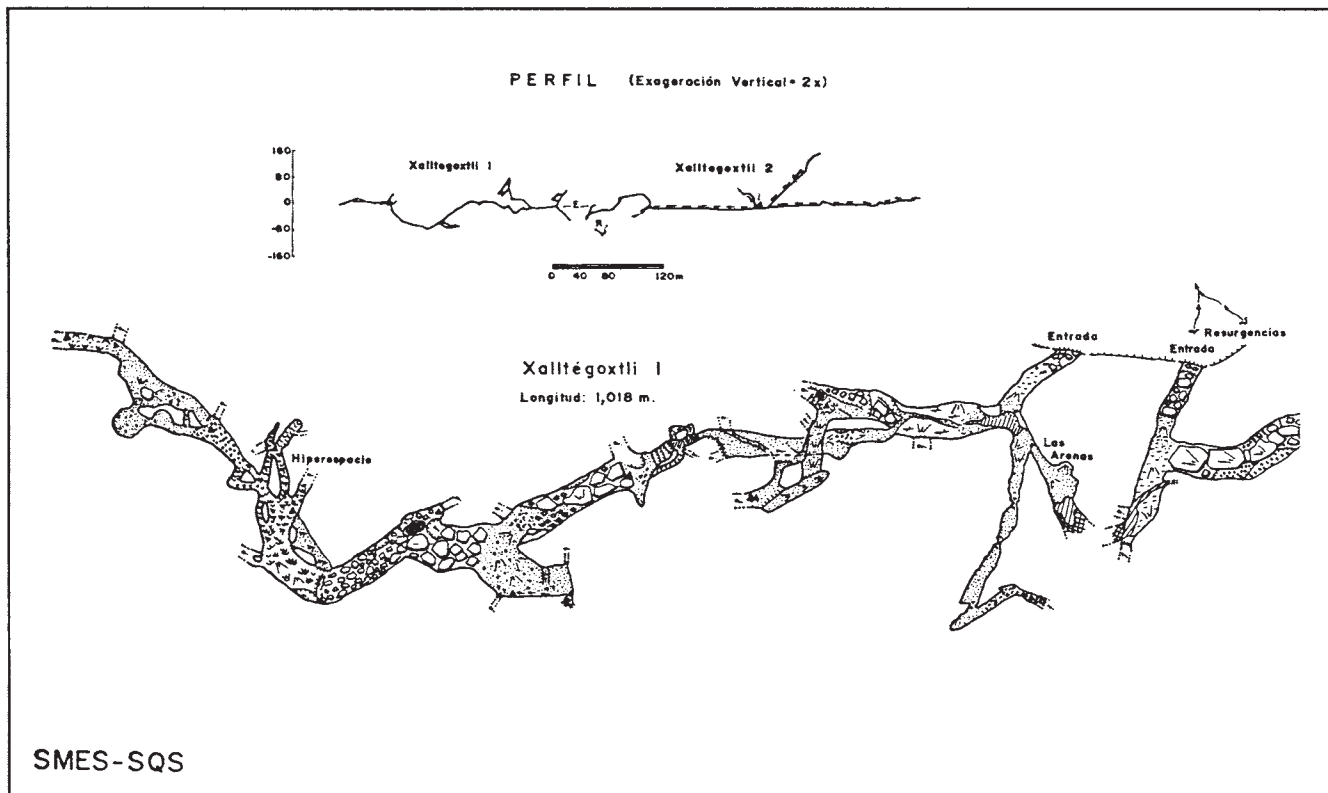
TAMAULIPAS, MEXICO

SUUNTOS & TAPE SURVEY BY MIKE PADGETT,
JOHN MIKELS, NICK MORALES, JACK CONKLIN,
ARMANDO CANALES & JOHN FAUST

P.A.S.S. & A.M.C.S. MAY 16, 1973

DRAFTED BY JOHN MIKELS, JUNE 1973





cavers, the resurvey of **San Miguel** was started, with 2 kilometers being mapped.

In April 1993, a second Mexican-British expedition was fielded. More than 24 kilometers was surveyed in several caves. The connection between the **Resistol** river and the **Chichicaseapan** river established an underground drainage network of over 25 kilometers, of which 21,137 meters have actually been connected. **Sistema San Andrés**, a parallel system underneath the nearby town of San Andrés, was explored and mapped to a length of 8103 meters. **Sima Chapultepec** was mapped to 2034 meters in length and connected to not-yet-remapped **Sistema Zoquiapan**. A fossil resurgence named **Cueva de Alpatat** was located. It might be connected to the main drainage, and, so far, 1951 meters have been mapped in this promising cave. *Source:* Ramón Espinasa-Pereña.

Draco cavers have completed the survey of **Resumidero Oztoquito** (see *AMCS Activities Newsletter 16*) at 1008 meters. After an entrance drop of 122 meters, the passage sumps both upstream and downstream. They still hope to connect to nearby

Resumidero Oztoque by diving. *Source:* José Montiel C., *Base Draco 8*, December 1991.

QUERÉTARO

Club de Exploraciones de México A.C. cavers visiting **Sótano de Macho Rey (Sótano de La Escondida)** near Ahuacatlán found the terminal sump was open. The new passage led to a room followed by a constriction. The new depth is over 250 meters. *Source:* Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

SAN LUIS POTOSÍ

The **Cueva del Nacimiento del Río Huichihuayán** has intrigued cavers for decades as a possible entrance to a huge cave system. A river resurges from the cave, which must be one of the major drains for the Xilitla highlands. A detailed map has finally been made by the Sociedad Mexicana de Exploraciones Subterráneas of the complex but small amount of breakdown-filled cave accessible above water level. Most importantly, a good dive site in solid rock has been located. (A previous dive attempt is described in *AMCS Activities Newsletter 10*.) *Source:* Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

Cavers from Mexico and Texas explored several small caves between Ahuacatlán and Xilitla during **Mexpeleo '89**. The most significant was **Sótano de Tres Pozos**, with an 80-meter entrance drop. This may be the same as the cave of the same name found by the British expedition of 1985-86, although the British didn't mention the garbage dump found at the bottom by the more recent explorers. **Cueva del Rincón de la Barranca** is a resurgence cave that might be enterable in dry weather. *Source:* Ricardo Arias Fernández, *Tepeyollotli 5*, July 1991.

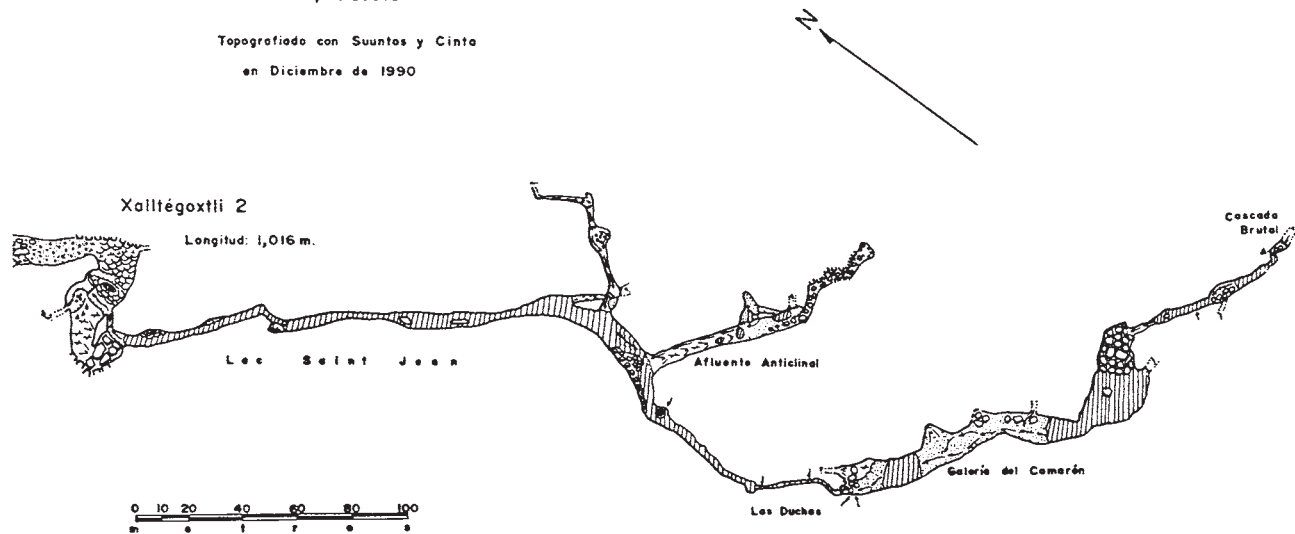
Mexican and Italian cavers found **Sótano de los Cuates**, a 120-meter drop three hours' walk from Aquismon, in May 1990. *Source:* Ramón Espinasa-Pereña, *Tepeyollotli 5*, July 1991.

Further details and additional maps, including an extended profile of **Resumidero el Borbollón**, of the Asociación Potosino de Montañismo y Espeleología exploration mentioned in *AMCS Activities Newsletters 18* and *19* have been published. The group also visited **Sótano del Toro**, which contains a very deep pit, estimated at

Sistema Xaltégoxtli

Huitzilatl, Puebla

Topografiado con Suuntos y Cinta
en Diciembre de 1990



about 100 meters, **Sótano de las Llantas**, a blind 76-meter drop, and **Sótano del 77**, with a 77-meter entrance pit, among others. Resurveys have begun in **Cueva de La Puente** and **Gruta de Catedral**. *Source: Tsaval 2*, December 1992.

Texas cavers explored a new area outside of Xilitla over Thanksgiving 1991. Only a hundred meters from their camp at the end of the road was **Sótano de Leones**, a blind pit approximately 100 meters deep. **Cueva de Tres Días de Gracias** was a short multi-drop cave about 50 meters deep. **Cueva de la Tarántula** was a forked pit 37 meters deep. *Source: Troy Shelton, Texas Caver*, June 1992.

A documentary film has been made of 478-meter-deep **Hoya de las Guaguas** by Mexican cavers and Mexican television channel 11. The cavers used traditional single-rope techniques, while the film crew was lowered and raised by a portable crane. The film was intended to carry a strong conservation message, unfortunately more needed than ever now that easy access has led to a proliferation of trash at both Guaguas and nearby **Golondrinas**. *Source:*

Ricardo Arias Fernández, *México Desconocido*, October 1992.

TABASCO

In the summer of 1989, a group of Swiss and American cavers explored **Cueva de Agua Blanco** (see *AMCS Activities Newsletter 16*), which there is local interest in commercializing. A second entrance was discovered, and 3.5 kilometers of passage were surveyed. There were millions of bats in the cave. **Cueva de las Magníficas** was also surveyed, for a little over a kilometer. Both caves contain ancient Mayan pottery. *Source: Spelunca 43*, September 1993; *Stalactite*, 1990.

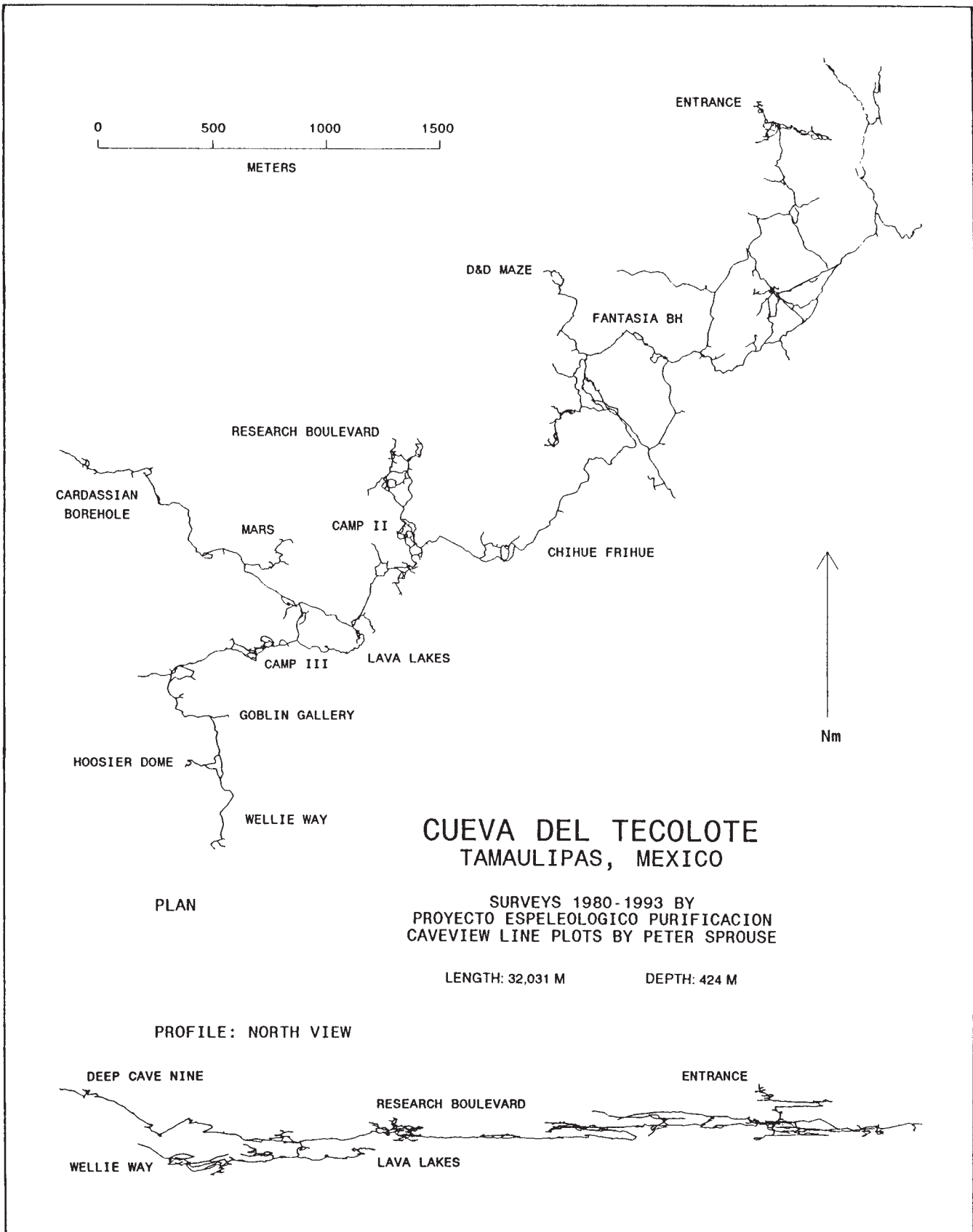
TAMAULIPAS

A new women's record for depth in scuba diving was set in early September 1993 by Ann Kristovich of Texas. At the same time, her partner Jim Bowden became the second deepest male cave diver. They went to -169 meters and -227 meters, respectively, in a water-filled pit north of Tampico. The current overall depth record of -265 meters was set by Sheck Exley in **Nacimiento del Río Mante** in 1989 (see *AMCS Activities Newsletter 19*), and the previous women's record of -122 meters was set by Mary Ellen

Eckhoff at that same site. There are plans to return to the new pit in December for a new record of over 300 meters. As does the Mante site, this pit extends well below sea level. *Source: Jim Bowden*.

An attempt to continue the resurvey of **Sótano de Venadito** on the way back from Mexpeleo '92 in January 1993 had to be aborted due to the presence of Africanized bees at the lip of the entrance pit. *Source: Don Broussard*.

Thirteen cavers of the Proyecto Espeleológico Purificación returned to **Cueva del Tecolote**, northwest of Cd. Victoria, in March 1993 to push the cave from a nine-day underground Camp III. A total of 3912 meters was added to the length of the cave, making it 32,031 meters long. In the main downstream drain, the Wellie Way, a large sump was reached not far past the previous limit of exploration. Several side passages off the Wellie Way were pushed, but no way around the sump was found. A number of passages were mapped in the vicinity of Camp III. Just east of camp, a major stream inlet called the Lava Lakes was pushed. Nearly a kilometer of



Greg McNamara lights up the dipping beds in the Death Coral Borehole, Cueva del Tecolote, Tamaulipas.
Peter Sprouse.



meandering stream maze was mapped, heading back toward the Camp II area. To the west, various side leads were checked off the Death Coral Borehole. A small blowing tube that contained the camp's water supply led to a larger series of interconnecting rooms named Mars. At the end of the Death Coral Borehole, a climb at Farpoint led to a major upward extension. The Cardassian Borehole turned out to be the largest passage yet found in the cave, up to 50 meters wide. It climbed up to nearly the same level as the entrance. The highest point terminated in a spectacular display of helictites, called Deep Cave Nine. *Source: Peter Sprouse.*

PEP cavers have also been cave-hunting above Tecolote near Las Chinas. In November 1992, five new pits were explored, the deepest being **Pozo Tetrico**. This pit was explored down five drops to a pinch at about 105 meters depth. A return trip in February 1993 attempted to enlarge the pinch, to no avail. Two other pits were mapped at that time. **Pozo Pozole** was bottomed at 57 meters, after three pitches. **Pozo Jesuplástico** had five pitches with a well-decorated middle level and ended at 78 meters deep. *Source: Peter Sprouse.*

When cavers returned to **Cueva Paraíso Difícil** (see *AMCS Activities Newsletter 19*) in November 1992, they were astonished to find that water had flowed at least a meter deep out of the main entrance. This passage is at least 30 meters above the normally active stream level. Items left on ledges around the campsite just inside had been completely washed away. The main objective was for Matt Oliphant to put up an aid route to the overhung lip of the large passage continuing across the top of the big room. This was accomplished impressively quickly with the aid of an electric hammer-drill, but the borehole ended abruptly after only 100 meters at a

massive flowstone plug over 40 meters high. The active upstream passage out of the big room was pushed and surveyed to a deep lake, where it sumped.

On the next trip, in April 1993, John Schweyen planned to dive the upstream sump, only to find water levels lower than ever. The sump was open as a blowing low airspace, Surfs Up, that shortly opened into the largest dimensions yet for this passage. A couple of hundred meters were surveyed to a drafting hole in the floor, a good lead. The downstream passage out of the big room was also surveyed a short distance, but it surprised us by leading to another drop for which we had no rope. The cave is now over 1300 meters long and 100 meters in vertical extent. *Source: Mark Minton.*

Several smaller caves in the Purificación area are described in the second issue of the PEP's own newsletter. These include early discoveries such as **El Hundido**, a huge but blind free drop of 108 meters, and **Cueva de California**, which is basically a large, well-decorated room over 100 meters long. High on the mountain is **Sótano de la Rama**, a short multi-drop cave 150 meters deep. There is also a more detailed article on the discovery and early exploration of **Cueva Paraíso Difícil** than appears in *AMCS Activities Newsletter 19*. *Source: Death Coral Caver 2, October 1992.*

VERACRUZ

Full details of the exploration of **Sótano de El Berro** (see *AMCS Activities Newsletter 19*) have been published, along with a well-drafted map. In the middle section of the cave, a parallel shaft series was found that bypassed the wettest pitches. Total depth is 838 meters, and the length is 2029 meters. The cave is extremely cold by Mexican standards, only 8°C. It is the deepest cave explored primarily by Mexican cavers to date. A search for resurgences did not succeed in finding any enterable springs. *Source: Ramón Espinasa-Pereña and Ruth Diamant, Tepeyollotli 5, July 1991.*

YUCATÁN

In February 1993, Florida cave diver Carl Sutton died from complications of oxygen toxicity while doing a dive to -90 meters on compressed air in **Cenote Ucil** (see *AMCS Activities Newsletter 15* and *19*). His partners Dan Lins and Hilario Hiler survived, and his recovered equipment was found to be fully operational. *Source: Underwater Speleology, March-April 1993 and July-August 1993.*

One of the more important caves in the state is 2500-meter-long **Actún Ix Pukil** (**Caverna de Calcehtok**). Although known since 1850, it was not surveyed until 1990. Considerable archaeological work has been done at the site, which shows signs of occupa-

tion from the Mayan Classic Period to the early twentieth century. *Source:* Jorge Pérez, *Mundos Subterráneos* 3, August 1992.

RESCUE CONFERENCE

During the three-day weekend of February 5, 1993, the Mexican Red Cross held a conference aimed at reorganizing their National Cave Rescue Service. A handful of non-Red Cross cavers were also invited. Dr. José Palacios of the Unión Mexicana de Agrupaciones Espeleológicas attended, as well as Sergio Santana of Unión de Rescate e Investigación de Oquedades Naturales and José Montiel of Asociación Espeleológico Zotz.

The conference took place at the

brand-new Red Cross Training Center in Toluca, about an hour from Mexico City, which will eventually be their main disaster-coordinating headquarters, in case another earthquake flattens the capital. Here, Red Cross personnel from all over Mexico came to discuss their problems and successes in trying to set up a cave rescue system. It was a curious mixture of mountain climbers, cavers, and many representatives of Red Cross units that were interested in the concept of cave rescue, but who had no experience whatsoever.

The concept of starting with non-cavers and ending up with a network of skillful cave rescuers is unusual, to say the least. So is the approach of doing most of this training at a school. However, when you put together the

determination of Commander Arturo Montero with the organizational abilities and military discipline of the Red Cross, the odds look in favor of eventual success.

The participants from the Mexican caving community took turns encouraging the new Red Cross rescuers to cooperate with local caving groups in order to get lots of experience in lots of caves, a concept that Commander Montero strongly favors.

The conference closed with rappels and climbs on the side of a five-story training building. Meanwhile, some of the invited cavers explored a labyrinth of low passages in the basement that will be used as part of the training courses given by the new Red Cross School of Speleology. *Source:* John J. Pint.

TAKE NOTHING BUT PICTURES
LEAVE NOTHING BUT FOOTPRINTS
KILL NOTHING BUT TIME

DEEP PITS OF MEXICO

Peter Sprouse
September 1993
Depth in meters

1	Sótano de El Barro (El Sótano)	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	Sima Don Juan	entrance drop	Chiapas	278
9	Resumidero del Pozo Blanco	entrance drop	Jalisco	233
10	Sótano del Aire	entrance drop	San Luis Potosí	233
11	Sistema Ocotempa	Pozo Verde	Puebla	221
12	Sótano de los Planos	second drop	Puebla	220
13	Sótano de Eladio Martínez	entrance drop	Veracruz	220
14	Sótano de Coatimundi	entrance drop	San Luis Potosí	219
15	Sótano de Sendero	entrance drop	San Luis Potosí	217
16	Resumidero el Borbollon	first drop	San Luis Potosí	217
17	Sima del Chikinibal	entrance drop	Chiapas	214
18	Cueva del Tizar	entrance drop	San Luis Potosí	210
19	P17	entrance drop	Oaxaca	209
20	Nacimiento del Río Mante	Macho Pit	Tamaulipas	206
21	Hoya de las Guaguas	entrance drop	San Luis Potosí	202
22	Sistema de la Lucha	entrance drop	Chiapas	200
23	Sistema H3-H4		Puebla	200
24	Kijahe Xontjoa	sixth drop	Oaxaca	199
25	Sima La Funda	entrance drop	Chiapas	198
26	Sótano de Soyate	entrance drop	San Luis Potosí	195
27	Sótano de Alpupuluca	entrance drop	Veracruz	190
28	Cuaubtempa	Pozo con Carne	Puebla	190
29	Sótano de Tepetlaxtli #1	entrance drop	Puebla	190
30	Sótano de Puerto de los Lobos	entrance drop	San Luis Potosí	189
31	Sótano de Hermanos Peligrosos	second drop	Veracruz	186
32	Hoya de la Luz	entrance drop	San Luis Potosí	180
33	Ahuihuitzcapa	entrance drop	Veracruz	180
34	Sima de Veinte Casas	entrance drop	Chiapas	180
35	Sima del Cedro	entrance drop	Chiapas	175
36	Sótano de la Cuesta	entrance drop	San Luis Potosí	174
37	Sima Dos Puentes	entrance drop	Chiapas	172
38	Sótano de los Monos	entrance drop	San Luis Potosí	171
39	Sótano de Otates	third drop	Tamaulipas	171
40	El Socavón	entrance drop	Querétaro	171
41	Sótano de los Ladrones	entrance drop	Oaxaca	170
42	Nita Diplodicus	entrance drop	Oaxaca	170
43	Sótano de Tepetlaxtli #2	entrance drop	Puebla	170
44	Sótano de Agua de Carrizo	Flip Pit	Oaxaca	164
45	OC8	entrance drop	Puebla	160
46	OC4	entrance drop	Puebla	160
47	Kijahe Xontjoa	Void Drop	Oaxaca	155
48	Pozo de Las Chinas	China Well	Tamaulipas	154
49	Ventana Jabalí	skylight drop	San Luis Potosí	153
50	Sótano de Coatituesday	entrance drop	San Luis Potosí	147

LONG CAVES OF MEXICO

Peter Sprouse
September 1993
Length in meters

1	Sistema Purificación	Tamaulipas	78961
2	Sistema Huautla	Oaxaca	52653
3	Cueva del Tecolote	Tamaulipas	32031
4	Sistema Cheve	Oaxaca	23300
5	Sistema Cuetzalan	Puebla	22432
6	Nohoch Nah Chich	Quintana Roo	20400
7	Coyalatl	Puebla	19000
8	Kihaje Xontjoa	Oaxaca	18500
9	Sistema Naranjal (Najaron-Maya Blue)	Quintana Roo	18255
10	Toucha Ha (Cenote Zapote)	Quintana Roo	12192
11	Atlixicalla	Puebla	11700
12	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
13	Sistema Ojos (Ojos, Palmas,Tic-Te-Ha)	Quintana Roo	9438
14	Cueva de Arroyo Grande	Chiapas	9154
15	Cueva Quebrada	Quintana Roo	9000
16	Nelfastla de Nieva (TP413)	Puebla	8500
17	Sistema San Andrés	Puebla	8103
18	Sistema de Angel (Ehocoklh)	Puebla	8000
19	Sumidero Santa Elena	Puebla	7884
20	Cueva Yohualapa	Puebla	7820
21	Cueva de la Peña Colorada	Oaxaca	7793
22	Cueva de Comalapa	Veracruz	7750
23	Sótano de Las Calenturas	Tamaulipas	7730
24	Atepolihuit de San Miguel	Puebla	7700
25	Sótano del Arroyo	San Luis Potosí	7200
26	Cueva del Mano	Oaxaca	6798
27	Actún Kaua	Yucatán	6700
28	Xongo Dwi Ñi	Oaxaca	6500
29	Sumidero de Jonotla	Puebla	6381
30	Gruta del Río Chontalcoatlán	Guerrero	5827
31	Sistema H31-H32-H35	Puebla	5745
32	Gruta del Río San Jerónimo	Guerrero	5600
33	Los Bordos	Chiapas	5211
34	Cueva de Agua Blanca	Tabasco	5200
35	Grutas de Juxtlahuaca	Guerrero	5098
36	Veshtucoc	Chiapas	4930
37	Sac Actún	Quintana Roo	4877
38	Sistema Ocotempa	Puebla	4720
39	Sistema Huayateno	Puebla	4710
40	Cueva del Nac. del Río San Antonio	Oaxaca	4570
41	Sistema Atlalaquia	Veracruz	4530
42	Sótano de la Tinaja	San Luis Potosí	4502
43	Sótano de Japones	San Luis Potosí	4500
44	Cueva Escalera	Oaxaca	4500
45	Sótano de Agua de Carrizo	Oaxaca	4477
46	Sumidero de Pecho Blanco No. 2	Chiapas	4435
47	Sótano del Río Iglesia	Oaxaca	4206
48	Sistema Zoquiapan	Puebla	4107
49	Sima del Borrego	Guerrero	4087
50	Aztotempa	Puebla	4000

Joe Oliphant twirls the
hook at the Research
Boulevard climb, Cueva
del Tecolote, Tamaulipas.
Peter Sprouse.

Peter Sprouse
September 1993
Depth in meters

DEEP CAVES OF MEXICO

1	Sistema Cheve	Oaxaca	1386
2	Sistema Huautla	Oaxaca	1353
3	Akemati	Puebla	1200
4	Kijahe Xontjoa	Oaxaca	1185
5	Sistema Ocotempa	Puebla	1070
6	Akemabis	Puebla	1015
7	Sistema Purificación	Tamaulipas	955
8	Sonconga	Oaxaca	943
9	Guizani Ndia Guinjao	Oaxaca	940
10	Nita Cho	Oaxaca	894
11	Sótano de Agua de Carrizo	Oaxaca	843
12	Sótano de El Berro	Veracruz	838
13	Sótano de Trinidad	San Luis Potosí	834
14	X'oy Tixa	Oaxaca	813
15	Nelfastla de Nieva	Puebla	778
16	Nia Quien Nita	Oaxaca	767
17	Nita Ka	Oaxaca	760
18	Sistema H31-H32-H35	Puebla	753
19	Sonyance	Oaxaca	745
20	Nita Xonga	Oaxaca	740
21	Yu Nita	Oaxaca	704
22	Aztotempa	Puebla	700
23	Sótano de los Planos	Puebla	694
24	Resumidero el Borbollón	San Luis Potosí	678
25	Sótano de Tilaco	Querétaro	649
26	Nita Nashí	Oaxaca	641
27	Sistema Atlalaquía	Veracruz	623
28	Cueva de Diamante	Tamaulipas	621
29	R'ja Man Kijao	Oaxaca	613
30	Nita He	Oaxaca	594
31	CH54 (Meandre-Qui-Traversal)	Puebla	588
32	Sótano de las Coyotas	Guanajuato	581
33	Sótano Arriba Suyo	San Luis Potosí	563
34	Sistema de Angel (Ehecoklh)	Puebla	533
35	Sótano del Río Iglesia	Oaxaca	531
36	Sótano de Nogal	Querétaro	529
37	Grutas de Rancho Nuevo	Chiapas	520
38	Sótano de Ahuihuitzcapa	Veracruz	515
39	Sótano de las Golondrinas	San Luis Potosí	512
40	Hoya de las Conchas	Querétaro	508
41	Sótano del Buque	Querétaro	506
42	Pozo de Montemayor	Nuevo León	501
43	Cueva del Tizar	San Luis Potosí	500
44	Nita Chaki	Oaxaca	493
45	Hoya de las Guaguas	San Luis Potosí	478
46	Cueva de la Canoa	San Luis Potosí	466
47	Sistema Cuetzalan	Puebla	464
48	Cueva de San Agustín	Oaxaca	461
49	Cueva de Agua de Carlota	Oaxaca	460
50	Sótano de Lutevio	San Luis Potosí	457



ARTICLES



PROYECTO CHEVE EXPEDITION 1993

Compiled by Mike Frazier

This article is a compilation by several authors about the history and current exploration of Sistema Cheve in the Sierra Juarez in the state of Oaxaca, Mexico. Contributors are Peter Bosted, Peter Haberland, Nancy Pistole, Carol Vesely, and Mike Frazier. Other participants 1993 in the expedition were Stan Allison, Eric Brand, Don Broussard, Harry Burgess, Don Coons, Ruthy Diamant, Ramón Espinasa, Luís "Thompson" Fernando Guinea, Louise Hose, Joe Ivy, Gerardo González Jimenez, Patty Kambesis, Herb Laeger, Matt Oliphant, Steve Porter, Ed Sevcik, James Wells, and Skip Withrow. Thanks to this year's sponsors: the Richmond Area Speleological Society for a generous grant for cave gear, Pigeon Mountain Industries for great rope, Dogwood City Grotto for a fully equipped Sked stretcher, and the NSS Exploration Fund for cash. We sure do appreciate their help.

Frazier: From the discovery of Sistema Cheve's main entrance in 1986 by California cavers Bill Farr and Carol Vesely through the 1993 expedition of almost two dozen cavers, dreams of a deeper cave filled the heads and hearts of its explorers. Through the combined efforts of over fifty cavers representing six countries (Australia, Canada, Germany, Mexico, Switzerland, and the United States), ten expeditions have surveyed 23 kilometers of cave to a depth of 1386 meters. Cheve is now the deepest known cave in the Western Hemisphere and eighth deepest in the world. Camp III, at the end of the cave, is one of the most remote underground camps. Jim Smith and the 1990 expedition demonstrated the roughly 2500-meter vertical hydro-

logic extent of Cheve by tracing with fluorescein dye. The straight-line horizontal extent was shown to be at least 17 kilometers. The dye, introduced at the main entrance, was observed emerging from Nacimiento de Agua Fría (which may be referred to by several other names) in the Santa Domingo Canyon, which connects to Cueva del Mano. See the article by Louise Hose in this issue for the latest information about the depth of the dye trace.

Cueva del Mano at the resurgence has been surveyed to 7 kilometers in length, and it spans 1 kilometer of straight-line distance. The upper cave, Sistema Cheve, spans 3 kilometers of straight-line distance. A gap of about 13 kilometers horizontal distance and 1100 meters depth is still unexplored. A new entrance in the middle karst, which lies between the upper cave and the resurgence, could be the key to unlocking the system.

Pistole: In January 1993, Louise Hose was in Concepción Pápalo, close to Cheve. Louise, with Skip Withrow, Emi Janecek, Matt Oliphant, and me, was recording the locations of cave entrances with two Global Positioning System receivers. The trip was funded in part by a grant from the National Geographic Society Committee for Research and Exploration. Louise, Matt, and Emi went to Santa Ana Cuauhtémoc with fresh optimism, because elections had been held in November, and there was now a new presidente. The new presidente was very cordial, looked at the permission letters, and said yes, we could go into the canyon. A date was set, arrangements were made for burros, and the three returned to Pápalo to pack for the trip. Louise, Matt, and I returned on the appointed day, ready

to go. When we found the presidente, he apologized profusely, and said the town's people did not want us to go into the canyon, so we couldn't go. We needed to bring a government official from Oaxaca City, and the presidente would call a town meeting so a vote could be taken on giving us permission. He refused to tell us any reasons for the denial, or why the town insisted on an official. Louise, Skip, and Emi had to return to the United States, so Matt and I went to Oaxaca and found a government official who would go to Santa Ana to represent us. The official, Luís Javier Valeriano González, was an outdoor enthusiast who was interested in caves, so he genuinely wanted to help us with the project. When Luís, Matt, and I arrived in Santa Ana, the presidente wasn't there, but we were assured that the encargado, second in command, would hold the town meeting, since they were expecting us. Meanwhile, the secretary wanted to take Luís around and show him all the things the town was lacking, such as medicines for the health center and telephones. (Ah, the reason for the official from Oaxaca). The meeting was set for 6 P.M., but it didn't start until 8 P.M. It was very formal. Matt and I were seated at one end of a big meeting room with the officials of the town and Luís. Individual local people and small groups were brought in and seated according to some set order. The encargado introduced us, and then Luís presented the Cheve Project and explained why we wanted to continue exploration, emphasizing the scientific aspect. When it was time for questions, everybody was silent. Finally, several different people told stories of why they didn't trust us. Two of the more

outrageous stories were that a big helicopter flew in to take out the cavers and bunches of gold and silver during the trip in 1990. The other story concerned the same trip; cavers supposedly entered the caves and never came out again. After each account, Luís explained that the rumor was not true, and reiterated the benefits of our work. When the townspeople ran out of excuses, a vote was taken, and we were granted permission to go to the resurgence. The stipulations were that Matt and I could go down for one day with Luís and an escort from the town. In February we could have several more people go down for five days, again accompanied by a Oaxacan official and a town escort. The February trip would coincide with the Cheve trip, so other cavers would be available, and Louise would be back with the GPS units.

The next day Luís, Matt, and I were up at first light and ready to go before 7 A.M. We were accompanied by five men from the town, and one tough little dog. We wasted no time hiking from the town to the Río Frío, over 6 kilometers with almost a thousand meters in elevation loss, in less than two hours. Luís, Matt, and I took a quick tour of Cueva del Mano, the longest of the resurgence caves. Matt and I selected a site for future GPS readings. We were prepared to give a mini geology lesson, but the Santa Anans did not seem very interested in any of our activities. After lunch we

headed back to Santa Ana.

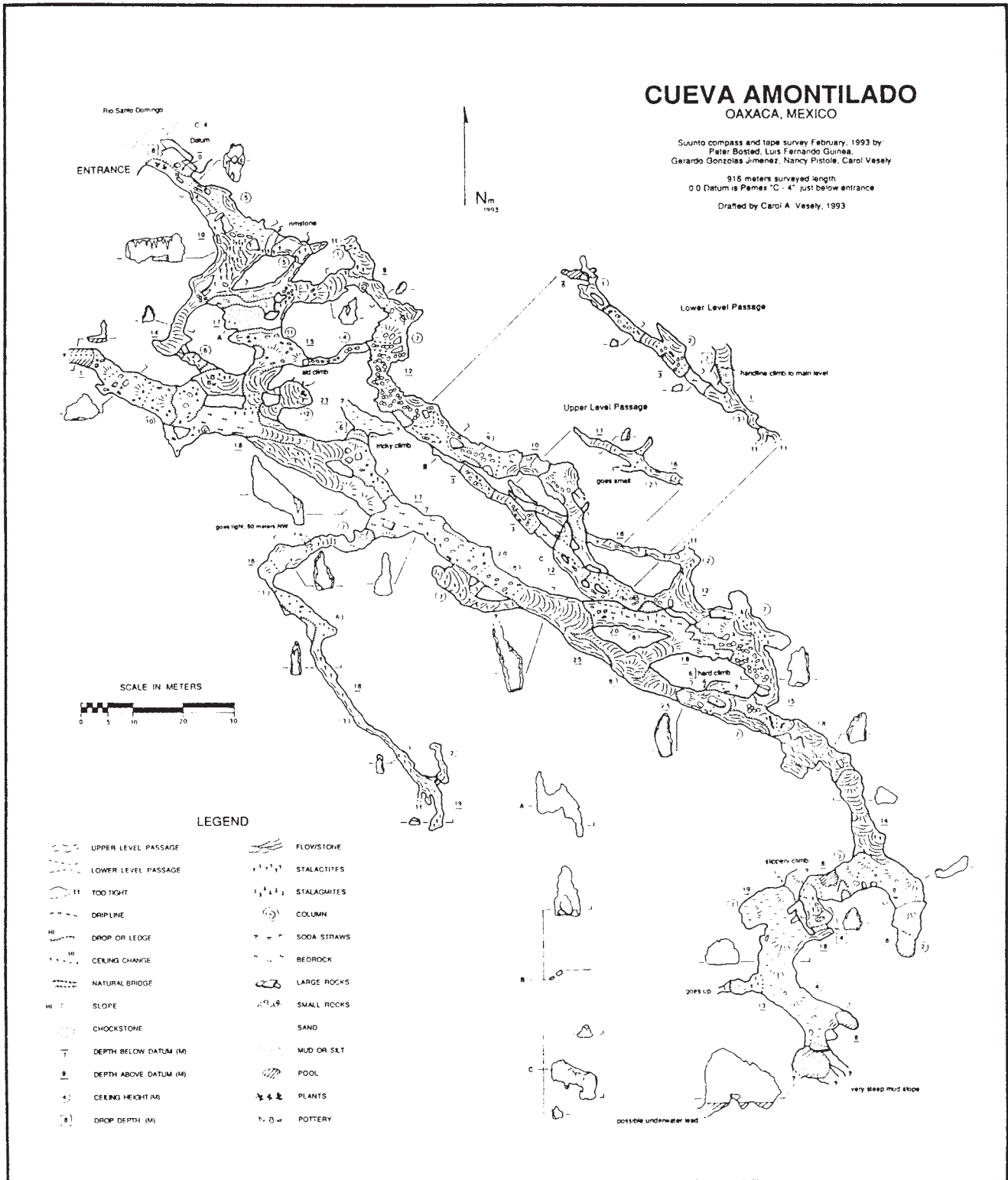
Although Matt and I had made it down to the resurgence once, there was no guarantee that Santa Ana would not renege on the February trip. After Louise arrived for the Cheve trip, she continued down to Oaxaca to pick up Luís. Luís could not leave the office for a week, so he appointed two Oaxacan Cruz Roja volunteers to go instead, Luís "Thompson" Fernando Guinea and Gerardo González Jiménez. Louise stopped by Cheve to set up synchronized time schedules for GPS readings with Skip, then headed to Santa Ana with the two Oaxacans and Don Broussard. They talked to the presidente to confirm our permission and arrange burros for the next day. I drove to the middle karst, near San Miguel Santa Flor, to pick up Carol Vesely and Peter Bosted. They had just returned from a long caving trip, so we did not get to Santa Ana until the next morning. The next day the burros were loaded and ready to go by 7 A.M., so Don started down into the canyon with the burros and the driver. Louise, Thompson, and Gerardo started down about an hour later. Peter, Carol, and I drove into town about 9 A.M., packed our stuff, and then headed down. Out of the three groups, Don and the burros were the only ones that got to Río Frío quickly and uneventfully. No one in Louise's group had been down to the resurgence, so they were going on verbal instructions. Within half an

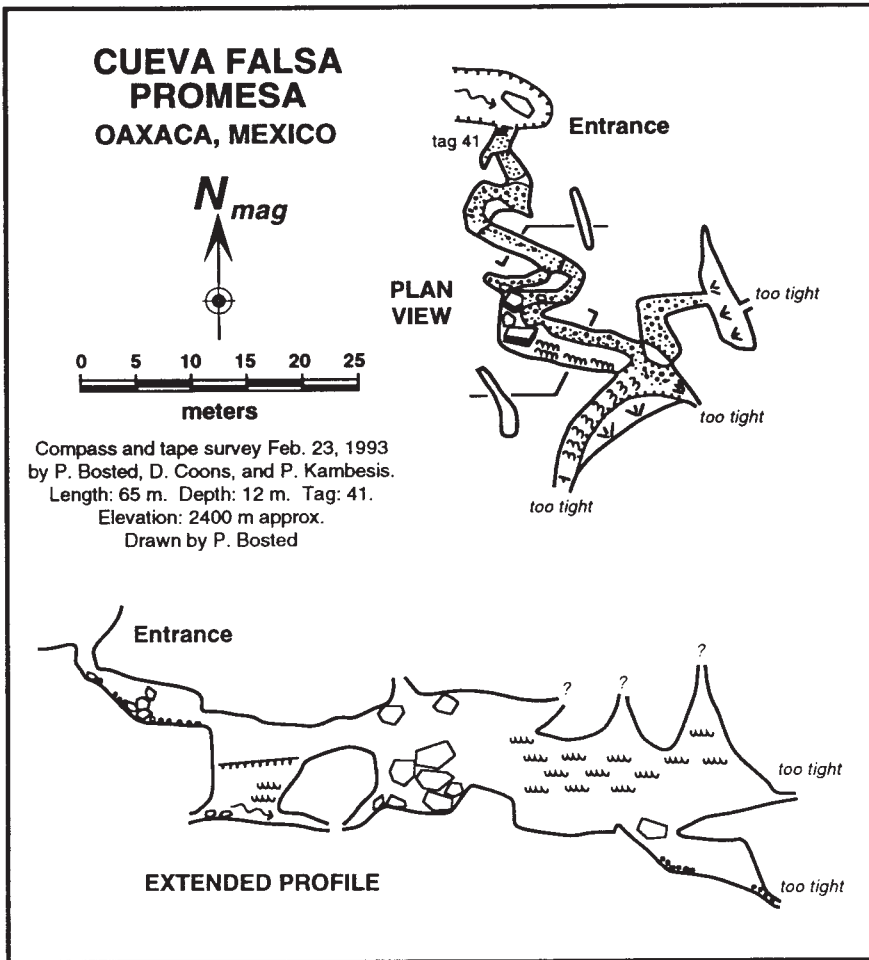
hour on the trail, they took a wrong turn, and they spent the rest of the day bushwhacking their way into the canyon. Peter, Carol, and I followed the trail most of the way, and then got off the track within sight of our goal. It was frustrating, because all three of us had been down there before, and we all knew where we were supposed to be going, but we couldn't find the trail. We also ended up bushwhacking. By late afternoon, everyone had found the campsite and set up camp. We did a little looking around at the cave entrances, but decided to save our energy for the next day. After breakfast, Louise and Don went right to work setting up the GPS unit and making surface surveys from the cave entrances to the GPS site. The readings would actually be taken in the afternoons. Peter, Carol, Thompson, Gerardo, and I went to Cueva del Amontillado. The cave had been found at the very end of the 1990 trip, and a lead climb had been required to get to the entrance. A bolt had been placed, and a small wire had been run through the hanger so that a rope could be pulled up without redoing the climb. Much to our surprise, the wire was still there. With a little bit of finesse, we pulled a rope through the hanger, and then Peter went up to secure the rope properly and tie it to a backup anchor. The cave had several big interconnecting passages, but was mostly smaller walking passage, with some crawlways. We headed back to camp after dark, even though we had not quite completed mapping. The next day, Peter, Carol, and Thompson went back to Amontillado to finish the map and check out any last leads.

Louise and Don were satisfied with the GPS reading site from the day before, so they had time to explore until the afternoon readings needed to be taken. The three of us hiked and swam down the Río Santo Domingo several kilometers to the Huautla Resurgence. We tried taking GPS readings near the resurgence, but the canyon walls are steep and tall, and the



Louise Hose and Don Broussard monitoring the satellite receiver in the Peña Colorada. *Nancy Pistole.*





Vesely: On February 16, 1993, Peter Bosted, Don Coons, Pat Kambesis, Ed Sevcik, James Wells, and I set out for the long four-wheel drive to a field camp in the middle karst. Matt Oliphant and Nancy Pistole accompanied the crew to San Miguel Santa Flor, where we showed our letters of permission to the town officials. Arriving in the late afternoon, we established camp in beautiful Llano Cantando, a small clearing surrounded by tree-covered hills, located below Cerro Monte Flor. Water was available at a spring about fifteen minutes away, and the main road and a trail junction were nearby. It was very foggy and began to drizzle soon after we arrived.

After establishing camp, the group split into three teams that went on short scouting trips to familiarize themselves with the area. In 1989, a trip by Bill and Pat Stone, Mark Minton, Pam Smith, and Noel Sloan had located three promising entrances on the eastern side of the mountains. The big question was whether these caves were part of the Cheve drainage or if they headed east, towards the Río Seco. Another scouting trip by Bill Farr, Eve Laeger, and I in 1990 had revealed three additional entrances high above the town of Santa Flor. There was no doubt that these were a part of the Cheve drainage. Finding these leads based on descriptions in the written reports made when the entrances were tagged became one of our first priorities.

On the first half-day ridgewalk, Peter, James, and I independently relocated an unnamed cave labeled with tag 73. According to Stone's tag report, this cave went down two short drops to a probable sump, with the water likely resurging at a doline 2 kilometers to the east. This did not sound especially promising. But the cave's easy access, its entrance 4 meters wide by 8 meters high, and the air flow made it our most appealing prospect. In addition, the cave seemed to be located along a north-south trending lineament or possibly a contact between two different limestones. The following day, Peter, James, and I returned and began surveying at the entrance, which is located at the bottom of a grassy doline just to the south of the main road. We immediately

units could not find enough satellites for a position. We went up the Peña Colorada canyon a little ways, until it was time to head back to camp. Most of the traveling in the river canyons is swimming and hiking. It gets very hot during the day, so the swimming is the best part of the trip.

On the last caving day, Peter and Louise made a trip to the very end of Mano to assess the feasibility of diving some of the sumps and to look at the geology. While Louise was looking in the last sump with a face mask, Peter found a narrow passage that was blowing air. A little ways up the passage, they found a small stream. This is the first running water that has been found in any of the resurgence caves so far. They had limited time and no survey gear, so they had to turn around and leave. Meanwhile, Carol, Thompson, Gerardo, and I mapped the connection between

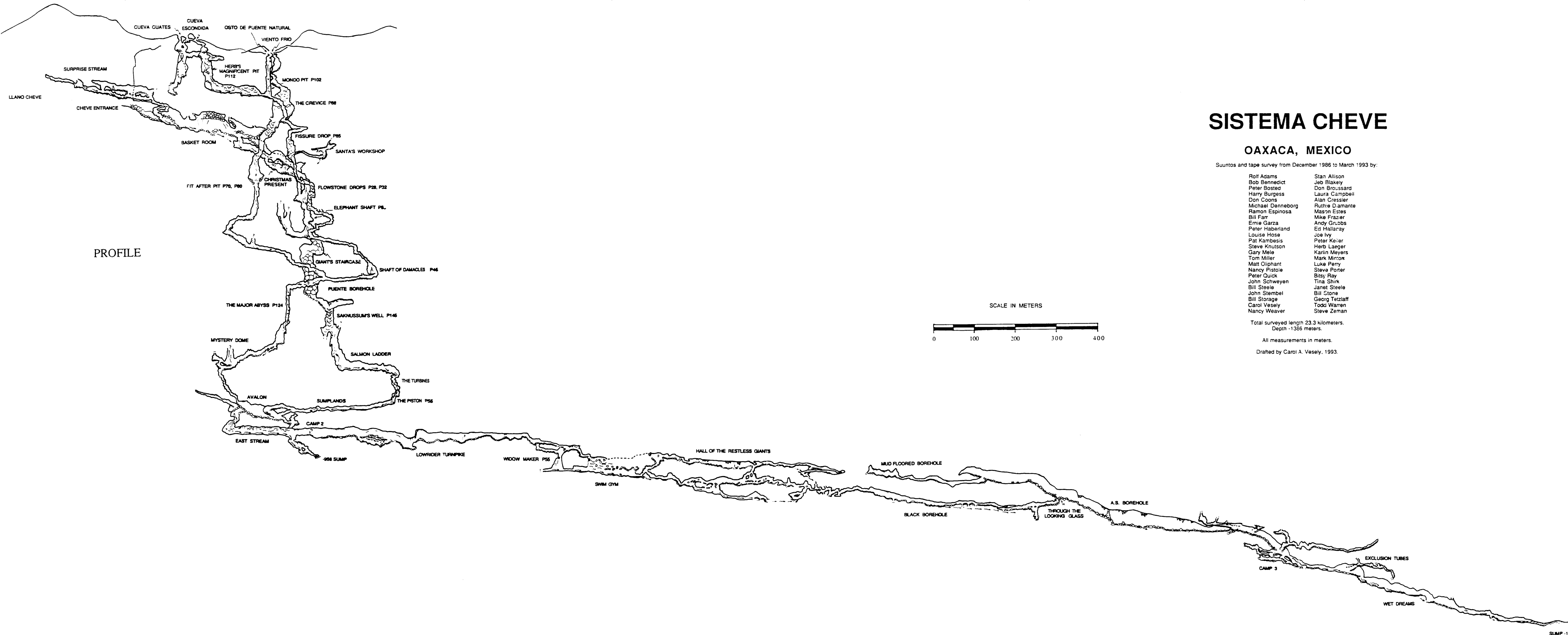
Mano and Cueva del Mono. The connection had been made on the 1990 trip, but a map would help tie in some sumps to get a better idea of where the water is in the system. When we reached Mano, I noticed the air flow; on the one-day trip I had made the month before, the air had been stagnant. We speculated that since it was later in the dry season, a sump might have opened up further in the cave. With Peter and Louise's discovery lead and the renewed air flow, we got excited about returning to the area for more exploration.

On the last day, the hike out of the canyon was steep, but quick and uneventful compared to the hike in, since we stayed on the trail the whole way. When we left, everybody seemed to be on friendly terms in Santa Ana. The area deserves more attention, but we can only wait and see what surprises Santa Ana might produce.

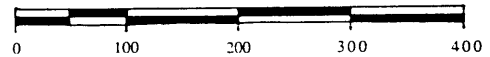
SCALE IN METERS

0
200
400
600
800
1000
1200
1400

PROFILE



SCALE IN METERS



SISTEMA CHEVE

OAXACA, MEXICO

Suuntos and tape survey from December 1986 to March 1993 by:

- | | |
|-------------------|----------------|
| Rolf Adams | Stan Allison |
| Bob Benedict | Job Blakey |
| Peter Bosted | Don Broussard |
| Harry Burgess | Laura Campbell |
| Don Coons | Alan Cressler |
| Michael Danneberg | Ruthie Damante |
| Ramon Espinosa | Mason Estes |
| Bill Farr | Mike Frazier |
| Ernie Garza | Andy Grubbs |
| Peter Haberland | Ed Hallacray |
| Louise Hose | Joe Ivy |
| Pat Kambesis | Peter Keiler |
| Steve Knutson | Herb Laeger |
| Gary Mele | Karin Meyers |
| Tom Miller | Mark Miron |
| Matt Ophant | Luke Perry |
| Nancy Pistole | Steve Porter |
| Peter Quick | Bitsy Ray |
| John Schweyden | Tina Shirk |
| Bill Steele | Janet Steele |
| John Stempel | Bill Stone |
| Bill Storage | Georg Tetzlaff |
| Carol Vesely | Todd Warren |
| Nancy Weaver | Steve Zeman |

Total surveyed length 23.3 kilometers.
Depth -1366 meters.

All measurements in meters.

Drafted by Carol A. Vesely, 1993.

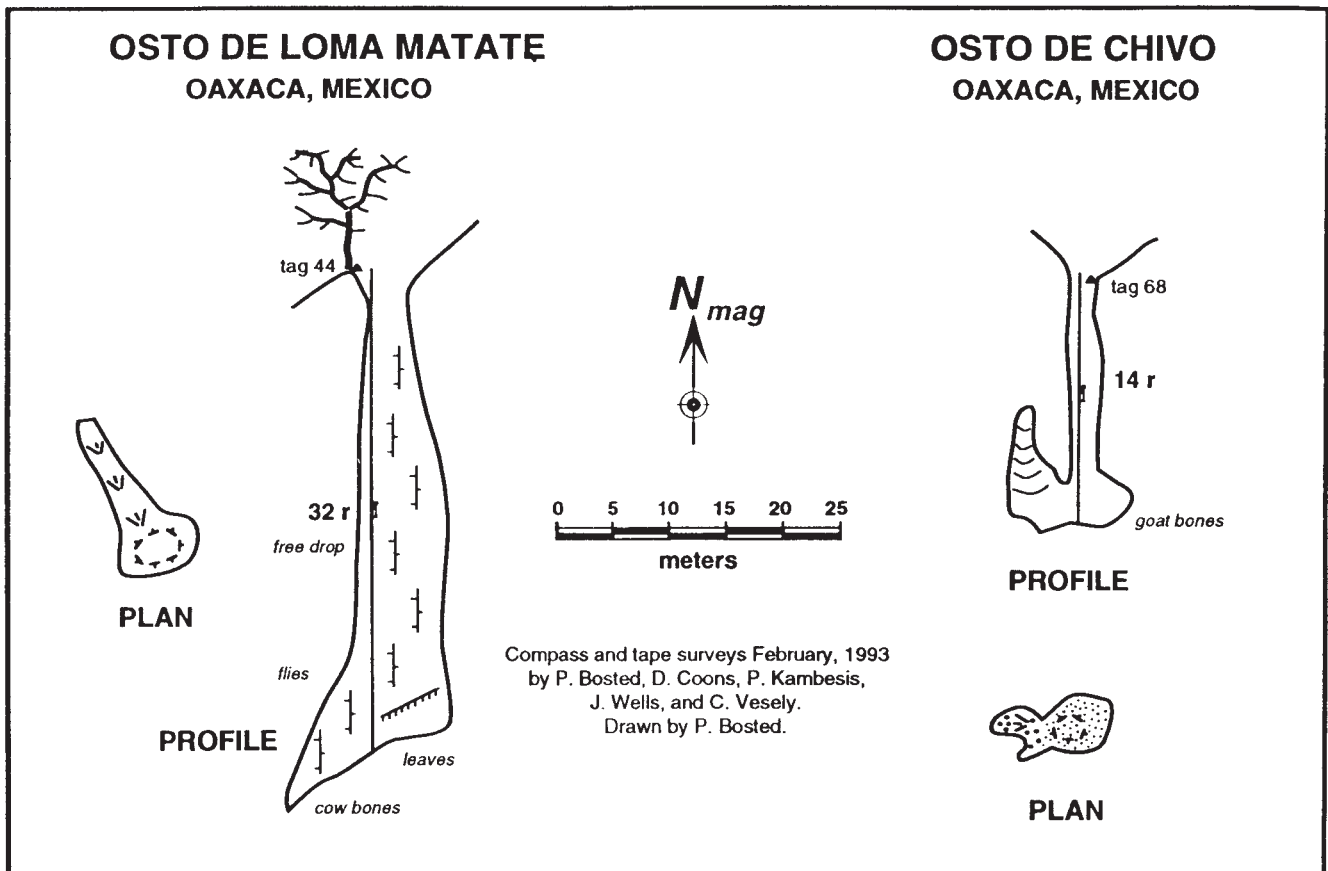
descended a 5-meter dirt climb. The clean-washed passage continued to stair-step down. A 4-meter climb led immediately to a 5-meter climb, both requiring rope due to the slickness of the rock. Beyond this, the ceiling dropped suddenly to a low squeeze flooded with water. This was the "probable sump" that had stopped the original group. Peter, who was lead tape, said that it looked grim, with maybe only 5 centimeters of air space. Next, James crawled into a better position to assess the situation, and reported it looked tight with maybe 15 centimeters of air space. While completing my sketch, I listened to them discussing methods to lower the water level and mentally prepared myself for the worst. When it turned out better than expected, I exclaimed, "Why, it's only a puddle!" This inspired the name Cueva Charco, Puddle Cave. After this, no one had any problems surveying through the "puddle." On the other side of the puddle, the cave opened a little, but soon dipped back down to another pool, longer than the first. We contin-

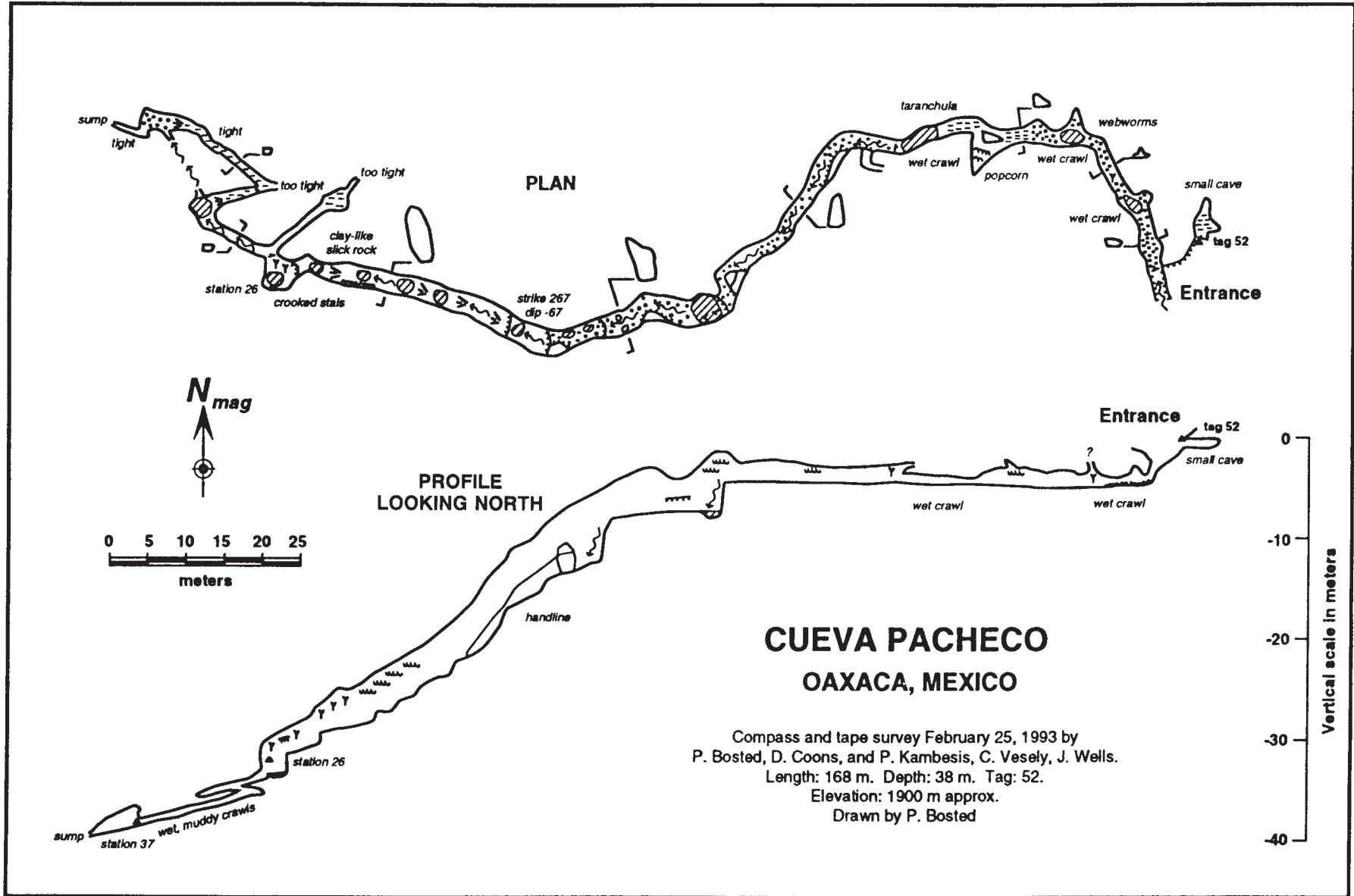
ued down a series of chimneys and climbs interspersed with short crawls and squeezes. There were more puddles, and finally my survey book took a dive into one. The wet paper made it hard to keep the book neat, so I ended the survey. We had surveyed 250 meters in fifty-seven stations, for a depth of over 90 meters. Although the passage was not particularly spacious, the air flow was good.

Two days later, Peter, Don, and Patty returned to Charco with more rope and vertical gear. They continued following the water down more fissures and pothole passages. Soon they came to a 12-meter drippy pit, where they rigged a rope in the water. The cave continued as a low horizontal passage to a very tight spot. Then, it opened into a canyon, leading to a 9-meter pit. A few infeeders joined the main passage at this point, making it a little wider and much taller. They continued down a series of progressively longer climbs, rigging a handline for one. Finally, Don went down an "intimidating" climb only to be stopped at the top of an impres-

sive pit. At this point the passage was more spacious than it had been since the entrance. But after 295 meters in seventy-seven stations, the team was out of rope. The cave was then over 180 meters deep and seemed more promising than ever. The hot topic was whether Charco was headed towards Cheve or to the east. Back at camp, a quickie line plot revealed that the last survey station was, in fact, directly below the entrance.

The next day, James, Ed, and I took our turn pushing Charco. We were impressed with the amount of grim passage the others had surveyed. As James put it, "there are many places where you can stand or sit comfortably, but you can't move anywhere without crawling or climbing." Ed, the largest of our group, had to try the tight spot from several different angles before he was able to squeeze through. We finally reached the pit where the others had stopped. A small stream cascaded down the 33-meter drop to a 15-meter-long room. The water continued through the breakdown floor, and we followed it down more





pothole passage. This led to another low water crawl, only this time it was more than just a puddle. The 20-meter-long wet crawl had at least one ear-dip section, or more if you weren't careful. But the air flow beckoned us on. Beyond was the most pleasant part of the cave, a narrow walking-height passage with a stream on the floor and flowstone decorations. Next, we rigged a 5-meter drop, but after a few more stations the way got grim again. Ed, who was lead tape, could feel the cold breeze in his face as he looked ahead another 8 meters through a low air-space bellycrawl. With thirty-seven survey stations, making Charco 268 meters deep, we headed out. We arrived back at camp at 6:00 A.M. after a seventeen-hour trip. The line plot revealed that Charco was 735 meters long and finally heading west towards Cheve; additionally, its bottom was 100 meters lower than Cheve's deepest point.

A few days later, Patty, Don, and James returned to Charco. They descended the 33-meter pit and continued to the end of the previous exploration. Don pushed the low, wet lead until it opened into about 10 meters of 1-meter-high passage. Then it degenerated to a very wet, gravel-floored bellycrawl with a small ceiling channel. Patty took the lead. She pushed the gravel ahead of her to enlarge the passage enough to wiggle through the 3-meter-long Horror Crawl. On the other side, it opened up again to stooping- and walking-size passage. The air flow was still good, but more digging would have been needed for the others to fit. The three then derigged the cave, and there are plans to return again next year.

Peter and I decided to try to relocate the three caves Bill Farr and I had discovered above San Miguel Santa Flor five years ago. I remembered the caves as being along the contact between the metamorphic rocks and the limestone. All had small crawlway entrances. Two had good air flow and two took small streams that ran off of the metamorphics. To get to the area from field camp required a three-hour hike gaining about a thousand meters in elevation, through the fields and forest on the trails above town. I quickly relocated the first cave, which is right near the power lines and only

about 20 meters from the trail. It had three entrances and took a small stream, but it got very tight after only about 20 meters. The second cave had better air flow and opened up just inside the crawlway entrance. We explored it for about 50 meters, and it seemed to be getting larger and more promising as we went. I wasn't able to relocate the third entrance. When Patty, Peter, and Don returned to survey the second cave a few days later, they discovered that it ended only 15 meters further. They named it Cueva Falsa Promesa, False Promise Cave.

Much of our time was spent ridgewalking for new entrances. Just above Charco, James and Peter located two caves. Cueva de Loma Matate was basically a fissure cave, mostly open to the sky. While James was checking this lead, Peter and I were defending our gear from an overly aggressive steer that had decided that webbing looked tastier than grass. Next, Peter descended Osto de Loma Matate, which turned out to be a 32-meter dead-bottom pit. On another ridgewalking trip, Don, Pat, and Ed hiked downhill from Hierbabuena and rediscovered Osto de German. Ed dropped the 37-meter pit and followed the cave down for a vertical total of 50 meters. After this they continued hiking uphill towards Cerro Monte Flor, passing a spring and a small cave, before locating another osto (the local word for "pit"). Don dropped the 40-meter pitch and ran out of rope. The cave continued sloping steeply down another 40 meters and he could hear water below.

Another day, a local man who lives at the base of Cerro Tepalcate showed James, Don, and Pat two cave entrances located in the sink behind his house. The upper hole was a small, dry cave, and the lower one was too tight, but took a small stream. The next day, Don and Peter returned to the lower Cueva Pacheco and dug through the cobble fill into ever-enlarging passage. They returned to camp and enlisted James, Pat, and me to help them survey. The cave began low and sleazy, with a small stream over a cobble floor and a couple of slimy mud wallows. Patty had the joy of reading instruments only 30 centimeters away from a tarantula resting on a mud bank in the water crawl.

Finally, the cave opened into walking passage with slick, dark, clay-like bedrock. We descended a series of three climbdowns, one requiring a handline due to the slippery rock. The cave was getting bigger and better, but unfortunately there was no air flow. After a couple more survey shots we came to a nicely decorated room. But the only way on was a tight, muddy tube that headed down about 30 meters past more cow bones to a disgusting sump. Cueva Pacheco was surveyed to 168 meters in length.

Peter and I left for the resurgence area, and Don, Pat, James, and Ed drove across the San Miguel valley to the town marked Joya Durazno on the map. They had a letter of permission for Joya Durazno, but, unbeknownst to them, they were actually in the neighboring town of San Felipe de Jesús. Fortunately, the locals were friendly, and after a few hours of small talk the group was able to "correct their political incorrectness." Accompanied by some local guides, they went in search of an osto high on the hillside. They never found this pit, but the next day the guides led them to two others. These were both located just above the river in the Cañon de Cerro Bravo (or the San Miguel Canyon). The first was 22.5 meters deep, and the second was 30 meters deep. Both were dead-bottomed, and the first contained bats. The next day, they hiked back down to the river, encountering several springs along the contact with the metamorphics. They found a small shelter cave and a pit, the bottom of which was below the river level. The locals told them of other holes nearby, but the group ran out of time. A larger expedition to the middle karst area is planned for next year.

Posted: During the 1990 expedition, Dan Clardy and I had discovered Cueva Palomitas, Popcorn Cave. It is a tight, wet, cold cave located high above the headwall of Cheve. In 1992, this cave was surveyed to a length of 525 meters and a depth of 183 meters, with exploration stopping at the top of a 150-meter pit. In 1993 there were two trips into Palomitas. Stan Allison and I talked James into joining us and hiked up to the entrance, which is about 100 meters higher than the main

Cheve entrance. The cave was colder and wetter than I remembered, and the infamous Gnarly Passage had gotten no easier. Five hours later, after rigging all the drops on the way in, we finally arrived at the big pit. We intended to replace the 8- or 9-millimeter rope left from last year with a thicker one, but it turned out the one we had brought was the same thickness. Stan spent the next two and a half hours putting a bolt in the incredibly hard, cherty rock to keep the rope out of the small waterfall that had severely chilled both him and Dan Clardy when they had dropped the pit last year. The bolt also served to protect the rope from abrasion. By this time, James and I were really cold, and Stan had chipped his tooth, so we fought the altitude and gnarliness to emerge finally under a star-lit sky well after midnight.

Frazier: Late in the Cheve expedition, there was a second Palomitas trip, when Skip Withrow and I returned to the gnarly Popcorn Cave. After reaching the end of the known cave, I placed a hanger and bolt where Stan had drilled earlier. I hooked a bolt in rebelay fashion to avoid the water and reduce the load on the anchor above. I proceeded down the rope to its end, still 5 meters above the floor. The rebelay had served its purpose of preventing rope damage, but had left the remaining rope a bit too short. With no way to reach the ground and no way to stay warm, I ascended back up the rope, warming as I went. At the top I found Skip shivering. Skip had found a longer piece of rope stashed behind a rock. We discussed re-rigging, but decided instead to leave.

Frazier: On Monday, February 22, 1993, Matt Oliphant, Stan Allison, Joe Ivy, and Herb Laeger entered Cheve bound for Camp III. The next day Ramón Espinasa and Ruthy Diamant from Mexico, Peter Haberland, and I followed after the first group. The two groups met at Camp III Wednesday evening. The first group had spent that day pushing the breakdown pile. Thursday morning, Herb decided to investigate a stream-level passage, while Ramón, Ruthy, Peter, and I went to the Wet Dreams area. We split into two teams just

above Nightmare Falls, and Ramón and Ruthy went to visit the terminal sump, while Peter and I pushed a high fissure climb found the previous year (see *AMCS Activities Newsletter* 19). The climb went almost straight up, before breaking into walking passage. Peter and I surveyed for several hours, bagging about four dozen shots and encountering a drop. We left for camp and needed rest. Meanwhile, the crew at the breakdown pile returned with no success. On Friday, Herb, Stan, and I returned to the passage above Wet Dreams. Herb christened it the Pray for an End Passage. It had everything you don't want to find in a passage and more, including wet, muddy, exposed climbs, rock fall, and uphill fissure squeezes with sharp, snagging protrusions. Who goes to Mexico to crawl, anyway? We rigged a rope where Peter and I had stopped previously, and Stan descended to find that all leads were dead ends except for the possibility of another fissure drop. Having neither rope nor enthusiasm for fetching more, we left the area.

Near the beginning of the Wet Dreams area, the BO survey connects to the BQ survey. This is the westernmost passage in Cheve, and perhaps the most promising passage to circumvent the breakdown pile. Stan and I opted to explore this possibility. After a few wrong turns, we reached the end of the BQ survey. We pushed several small crawls in an effort to find a way through. Lacking success, we elected to return fresh the next morning. While we were pushing the crawls, Joe and Ruthy were pushing the stream passage Herb had found the day before. The rest of our gang continued banging their heads against the breakdown pile.

The morning of February 27 saw Ruthy, Ramón, and Herb routing for the surface. Peter and Joe left to survey Herb's passage, said to be the most beautiful found in the cave to date. Matt, Stan, and I returned to the BQ survey, hoping to find a way through this time. After we used a crowbar and rope to remove a few wedged rocks, Matt and I were able to lower Stan head-first down a squeeze where the ceiling and floor soon became close friends—too close to let a mere caver come between them. We

extracted Stan by his feet and left the area.

On our way to the Wet Dreams area, we had noticed a lead marked with a tantalizing "?" on the map. Because of the wind direction, we surmised that it connected to Wet Dreams, but we weren't positive, of course. Matt lent his whistle to Stan, who then headed down the lead. Matt and I headed back toward camp. Although we never heard the whistle back at camp, Stan did verify that the passage connected to Wet Dreams.

The next day, Peter, Joe, and I left camp ahead of Matt and Stan, who caught the two of us by the time we had reached Camp II. Matt and Stan continued their march to the surface, arriving at the llano after midnight. Peter, Joe, and I stayed the night in Camp II, reaching the surface and feeling glorious sunlight on our faces around noon.

Pistole: On Thursday, March 4, Steve Porter, Don Broussard, Harry Burgess, and I headed into Cheve for a second deep camp. Even though we had done most of our packing the day before, last-minute details kept us busy all morning, and we didn't get started until 1:30 P.M. The trip to Camp II was rather uneventful, for me, at least. Steve, Don, and Harry had not been past Saknussem's Well, so most of the trip was covering new territory for them. Steve got a bit of a work-out at the end of the Salmon Ladder. He rappelled down a low-angle waterfall, but the end of the rope was tied off on the other side of a pool. His rack got stuck at the low point in the rope, and he couldn't get his weight off the rack to remove it from the rope. Even worse, he was chest-deep in running water. With some help from Don, and a lot of struggling, he was able to free himself. After that we moved at a steady pace, but it still took almost twelve hours to get to Camp II. It is always such a nice feeling to arrive at an underground camp that is completely stocked with supplies. We laid out sleeping bags and pads and cooked a big dinner of freeze-dried food. In no time at all, we were sound asleep.

Needless to say, we were not up at the crack of dawn, if that is even possible in an underground camp.

We had been planning to move on to Camp III, but none of us was up to another long trip. Instead we went back upstream to the 23-Meter Drop to check out some leads in the Sumplands area. Our first lead was right at the base of the 23-Meter Drop, where the route rejoins the stream. Upstream about 20 meters, there is a 2-meter waterfall into a pool, but the passage is big and continues above the waterfall. There is also an 8-meter waterfall going into the center of the same pool, but that water is coming out of a crack in the ceiling. Previous exploration had stopped here because it looked like it would be a wet and cold push, requiring wetsuits. We decided to try to climb past the waterfall at the end of the day, so if we did get wet, it would be a short trip back to camp.

Close to the top of the 23-Meter Drop is a 12-to-15-meter drop through some house-sized boulders that had never been checked. We rigged it, surveyed our way down, and came to a small stream passage. First we went upstream, but the passage seemed to quickly choke in breakdown. Then we went downstream, and after some squeezes, the passage opened up to a tall canyon. The floor soon became too steep and slippery to climb down without a rope. From what we could see, however, the water disappeared in a waterfall just like the 8-meter waterfall at the base of the 23-Meter Drop. We tied a piece of flagging tape

to our last survey station, which was as far down as we could safely reach, then continued back to the beginning of the survey and derigged the rope.

Our next lead was in the Connection Room (named after the Puente Natural connection), not far from the top of the 23-Meter Drop. The Connection Room is now known as Avalon, in memory of Chris Yeager. There were some holes along one wall. After some scouting, we found a place to climb down, and we found some walking passage with pretty formations. The passage ended in a sandy squeeze, and through the squeeze we could hear water. We followed the sound of the water through some breakdown, and, lo and behold, we came to the stream we had just seen in the previous lead. It turns out we had just not checked the upstream breakdown closely enough. We surveyed from the stream back into Avalon. We checked out several more leads, but did not find any more passage.

On the way back to camp, we attempted the upstream section at the bottom of the 23-Meter Drop. Harry climbed on the wall above the pool and found plenty of holds. He was easily able to climb up to the top of the 2-meter waterfall, and he found walking passage with knee-high water. Don and I followed him, but the passage only

continued 30 meters before we were faced with an 8-meter waterfall climb. Harry tried traversing along the wall to get close to the waterfall, but the walls were overhanging and did not have very many holds. The climb would have to be a technical climb with aid. We hadn't brought the survey gear, but now that we know we can get to the passage without getting wet, we can survey that section on the next trip to the area. We went back to camp to hot food and dry sleeping bags.

On Saturday, the plan was to continue on to Camp III. Although Steve and Harry were ready for the trip, Don said he was not up to a potentially long and tiring trip. After some discussion, we decided that Don would stay at Camp II while the rest of us went to Camp III. We made sure that Don had enough to do to keep busy without going far from the camp. I had been to Camp III the previous year, but now I was the only one who knew the way, and I wasn't sure how much I would remember of the route. We also had directions written out by Mike and Matt. Between my memory and the directions, we had almost no trouble finding the way. I like the trip between the two camps, because the passage varies so much. However, there is a lot of climbing up and down for just a little overall elevation loss. Camp III was a welcome sight, and we unpacked sleeping bags and cooked dinner.

The next day, the three of us set off to familiarize ourselves with the end of the cave. A lot of exploration had been done since I had been there, and of course Harry and Steve had not seen anything. With map in hand, we went to the Wet Dreams area. It was as beautiful as I had remembered it. The handlines had seen better days, after several seasons of being beaten by the water. On one climb, a rope was missing, so we tied all our spare pieces of webbing together for a makeshift



Nancy Pistole and Harry Burges between Camp II and Camp III in Cheve. These natural wall markings give the name to the A.S. Borehole.
Steve Porter.

Ruthy Diamant and Peter Haberland between Camp II and Camp III. Mike Frazier.

handline. When we got to the sump, we took a lunch break, and Steve took pictures of us at the end of the cave. There aren't many leads left in Wet Dreams, so we headed out and over to the formidable breakdown wall that has stopped major exploration for several years. We found the leads that were marked on the map, and poked around some. Since it was getting late, we were trying to get a sense of the area more than find a breakthrough. To get back to camp, we went a small and windy way that had been found the year before. Over dinner, we got psyched for pushing the breakdown and finding the long-sought passage to the resurgence.

On Monday, we headed straight for the breakdown. The first lead we checked was up a previously rigged climb on the other side of a very exposed (and rigged) traverse. The lead called for a small person, which pretty much eliminated Steve and me, but it had Harry's name all over it. Harry gave the push his best shot, but whoever said the lead was for a small person must have been thinking of the little people in *The Hobbit*. Next we went to another area, where air had been blowing the previous day. The air had been blowing out of the cave that afternoon, and it was still blowing out of the cave in the morning. We had been told that the cave "breathes," but the air-flow direction never changed for the two days we were in the breakdown. The baffling thing was that the air had been blowing in the opposite direction during our trip in from Camp II to Camp III. Later we found out that a weather system had blown in for the two days we were in the breakdown, so the barometric pressure had changed greatly, causing an interruption in the cave's normal breathing cycle. We could follow the air in our lead for a while, but then the flow seemed to dissipate into many holes in the breakdown. Harry was determined to find a way through. In the afternoon, Steve and I headed back to camp to look for some digging tools. Steve found a hammer and crowbar, so he went back to give Harry the weapons. I started packing up the

camp and doing an inventory.

We had made arrangements with Don to be back in Camp II by Tuesday night. We tried to get an early start, but by the time we packed up everything, it was late in the morning. Our last job was to burn all the burnable trash from the past two years. We made a pile of trash and doused it with gasoline. Harry bent down to light the pile with his carbide lamp, and got a big surprise when he found out how volatile gasoline is. Luckily he was unhurt, and didn't even singe his beard. We immediately started up the A.S.

Borehole, where we watched the fire light up the whole passage. We left quickly, but the smoke still caught up with us before we got Through the Looking Glass.

The trip out was uneventful. Even though there is about 200 meters of elevation gain between the camps, the trip out took the same amount of time as the trip in. We had been dreaming of a big, hot dinner waiting for us when we arrived at Camp II. Don didn't have a dinner cooked for us, but he had the fixings ready, and when he heard us coming, he started heating water. Don had tried to push two streams that entered the cave close to camp, but didn't find any new passage. He had also done an extensive camp inventory and read several books while we were gone. He was well-rested, and ready for the trip out of the cave.

On Wednesday, we headed out of the cave. As usual, we did not get an early start, and we actually left camp after 1 P.M. We burned the trash at Camp II right before we left, and this time Harry was a bit more careful with his carbide lamp. Steve and Don went ahead, and Harry and I surveyed the stream passage we had found at the bottom of the 23-Meter Drop. The passage required only a few survey shots, and we caught up



to Don and Steve at the Turbines. Since it is slower for four people to travel through the cave, especially at drops, Harry and I took a snack break, while Don and Steve continued on. We met again at Saknussem's Well, but there are enough rebelayes on the climb there that everyone could keep moving. At the top of the Giant's Staircase, Harry went ahead of the rest of us, because he was getting cold. Don, Steve, and I set a steady pace for the rest of the way out. We got to the surface about 3 A.M., which is about the worst time to leave the cave. The temperature outside was below freezing. The moon was full, so the llano was bright and pretty. The three of us decided that warm sleeping bags were more inviting than freezing outside while trying to cook dinner, so we went to our tents and snacked in bed.

Haberland: Stan Allison, Mike Frazier, Herb Laeger, Carol Vesely, Skip Withrow, and I hiked to the upper karst in an effort to find another entrance to the system. The plan for the three days was to spend the first day hiking and establishing a temporary camp, the second day exploring, and the final day returning. Our original plan was to travel light and move fast, but the lack of surface water

negated this idea. Thus we carried three days of water per person, a six-person dome tent, two ropes, two sets of vertical gear, food, stove, fuel, GPS receiver, and so on.

This is definitely not West Virginia karst. These rocks are rough and sharp. They stick up like loose teeth, or razor blades meters high with pointed tops; and no matter how large or how densely clustered, at any step the rocks can shift or break off. Deep, dark fissures in between are ready to swallow an incautious leg. The sparse, thorny vegetation is in collusion also. Either the thickets hide crevices, or they hold you back bodily. Or the cacti prick your hands, arms, legs, or ass and draw blood just as you struggle to make this climbing move across a 5-meter-deep and 1.5-meter-wide fissure. Why are we here? The view of course. At 2800 meters, we are well above the strato cumulus, and we have a clear view of many other high ridges and, of course, some of the sinkholes and enclosed valleys that we need to check. Why are the ridges so denuded of top soil and the rock exposed like bony fingers? The bedrock has dissolved around the very abundant joints, so it has turned into a sieve. The soil was just sucked down and presumably is being washed away in numerous small or awesomely large cave passages. The drainage from the surface is so diffuse that I don't expect any large cave development near

the surface. But then I am surprised and stupefied to be shown a 50-meter-deep pit, right at the very top of a karst ridge. The ridge descends very steeply on both sides. There is no modern drainage into this pit. After a second, offset 16-meter drop, this cave is choked by flowstone, with no connection anymore to passages below.

Between the ridges are deep valleys with abundant moss and hardwoods; we aptly chose names for the valleys such as Enchanted Forest, Emerald Sink, Murk Wood. As we thrashed through these lush depressions, we often realized that we were surrounded by ridges on all sides. Instinctively we descended to the bottom center of these large sinkholes, expecting some kind of entrance. Usually we were disappointed, and found only that the vegetation, mud, and forest soil had choked off what may have been the drain. One spectacular but dashed hope was a 30-meter-deep, steep-sided sinkhole, with the sheer cliff wall on the west holding a tall, cathedral-arched opening. After negotiating the scree slope at the bottom of the entrance, we squeezed past some large wedged boulders, came upon dry, gnarly, popcorn-encrusted chambers, and soon reached a total breakdown and flowstone choke. Historically there may have been large, open drains here, but long ago they have been abandoned and sealed themselves.

As we descended down yet an-

other wooded karst slope, the view ahead through the trees appeared rather strange, as if we were entering a fog-shrouded volcano crater. The bottom of this depression was a large, flat, treeless meadow of grass grazed short. After hours of scrambling on uneven ground, the easy walking on the short grass was like paradise. About a dozen obvious sinks were scattered throughout this meadow. Somewhere beneath our feet the soil was being sucked away. Visions of deep pits and huge chambers played in my mind. Reality was, though, that all the sinks were closed by mud and soil; some held green slimy standing water mixed with cow urine. While this llano had been our major goal and was very disappointing in terms of cave entrances, we still had some leads left. Beyond the far wall of this large sink starts the northward, continuously descending drainage of the Aguacate. The tributary valleys and gullies that we hiked through were predictably dry. Boulders and washouts indicated, however, that water flows here at some times. Perhaps there is still a chance of finding openings here into the system below. We did find Hummingbird Pit, just over 30 meters deep, but nothing else of note.

Frazier: We're all excited about re- turning to this fine system. The lure of exploration continues to challenge us as we plan next year's trip to connect Cheve to the resurgence.

Expedición del Proyecto Cheve 1993

Durante la expedición del Proyecto Cheve en 1993 finalmente se obtuvo permiso para así regresar al área de el cañon de Santo Domingo. Algunas cuevas cerca de la resurgencia fueron topografiadas, las cuales se localizan entre Cueva Cheve y la resurgencia. La más profunda fue Cueva del Charco con 300 metros de profundidad. Dos campamentos subterráneos fueron elaborados en Cueva Cheve, sin grandes resultados.

SISTEMA CHEVE WORLD'S DEEPEST KARST CONDUIT SYSTEM

Louise D. Hose

Cueva Cheve is the eighth deepest explored cave in the world, exploration having extended to a depth of 1386 meters. Cavers working in the area, however, have suspected that the actual extent of the system is much greater, perhaps the greatest vertical extent in the world. This spring, we confirmed our suspicions. The system has a proven depth of 2525 meters, including a hydrological link not yet explored. A combination of precision Global Positioning System work, a visually positive dye trace, dry cave exploration, two sump dives, and traditional cave surveying was used to measure the depth of the system. (The second deepest measured karst hydrologic system is Napra Cave in the

Caucasus, Republic of Georgia. It is reported by Kazharsky (*ref. 1*) and A.B. Klimchouk to be 2355 meters deep.)

Exploration by Proyecto Cheve in the upper part of the system began in 1986. The depth of the upper part is now 1386 meters, and its length is 23.3 kilometers. The highest entrance, Cueva Escondida at an elevation of 2798 meters, was physically connected to Cueva Cheve by project members (2).

In 1990, Smith (3) placed fluorescein dye in the stream entering the main Cueva Cheve entrance. Explorers in the cave reported that the dye reached Camp III, near the terminal sump, in three days. Sheri Engler and

Nancy Pistole observed green water emerging eight days later from a spring in Santo Domingo Canyon at an elevation of 291 meters. The spring, Agua Fría de Santa Ana, had been dived to a depth of 18 meters in 1984 by Bill Stone and John Evans, who called it the Western Resurgence (4). The dive connected the spring to Cueva Mono, a dry cave discovered and explored by Peter Quick on the same expedition.

In 1989, Mark Minton discovered the entrance to Cueva del Mano. This cave has been connected to Cueva Mono by project members, and the explored length of the lowest portion of Sistema Cheve is presently over 7 kilometers. The explored limit of the



elevation of Cheve entrance	2654
elevation of water level at Agua Fría	291
vertical extent of dye trace	2363
elevation of Escondida entrance	2798
elevation reached by cave dive	273
vertical extent of karst conduit system	2525
All figures are in meters; elevations are above mean sea level.	

Louise Hose exploring upstream in the Cheve resurgence. *Don Broussard.*

resurgence part of the system ends in dry, going passage.

To determine the precise, relative positions of the Escondida and Agua Fria entrances, double-differenced differential GPS was utilized. Using two Navpro 5000 receivers, the absolute elevation of a point near the Escondida entrance was determined. A second series of tests determined the precise relative locations and elevation change from this control point to two sites near Agua Fria de Santa Ana. Using Magellan Systems version 2.10 carrier phase processing, multiple tests varied by less than 2 meters. The distance of this one "survey shot" was over 18 kilometers.

Traditional compass and tape surveys, using backsights with only one-half-degree tolerance, were made to connect the control site and the two GPS stations to the Escondida and Agua Fria entrances. The final depth of the system also includes the depth reached by the 1984 dive.

Once our primary objective was accomplished, the GPS receivers were used extensively for less precise applications. One unit was carried by a Cheve Project team while they successfully searched for a specific sinkhole noted on the topographic map. Another unit was used to great benefit while mapping the geology of the area on a very foggy day. The locations of new caves were quickly and accurately established using the units. We were quickly convinced that we will all want GPS receivers soon.

Support for this project was provided by the National Geographic Society Committee for Research and Exploration, UNAVCO, Magellan Systems, and the University of Colorado at Colorado Springs. My team was Don Broussard, Emily Janecek, Matt Oliphant, Nancy Pistole, and Skip Withrow. Valuable help was provided by Mark Minton and by Manuel Aragón Arreola, Gerardo González

J., Luis "Thompson" Guinea, Dr. Germán Cruz Martínez, and Luis Javier Valeriano. The assistance of our five friends from the city of Oaxaca was absolutely critical in achieving access to the resurgence area, as the Cheve Project had been denied access for the previous two and a half years. I am especially grateful to them for their support.

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- (1) Kazharsky, O., 1991, Deep Hydrologic Systems in Caucasus, *GEO²*, v. 20, p. 34-35.
 - (2) Hose, L.D., and Bosted, P., 1993, Cueva Cheve—1992 Expedition Report, *NSS News*, v. 51, p.4-11.
 - (3) Smith, J.H., 1991, Hydrogeology of the Sierra Juárez, *AMCS Activities Newsletter*, n. 18, p. 82-86.
 - (4) Stone, B., 1988, Vine Cave and other Tales from the Peña Colorado Canyon, *AMCS Activities Newsletter*, n. 14, p. 50-58.

Sistema Cheve

"El Conducto Subterráneo de Karst Más Profundo del Mundo"

En la primavera de 1993, radio receptores del *Global Positioning System* satélites fueron usados para así medir exactamente las elevaciones de la entrada de la Cueva Cheve, Oaxaca, y la resurgencia en el cañon de Santo Domingo. La diferencia vertical entre Cheve y la resurgencia es de 2363 metros. Añadiendo también la profundidad del sifón de la resurgencia y otros puntos hidrológicos arriba de la entrada de la Cueva Cheve, extiende así el potencial a 2525 metros.

CUEVA DEL MANO EXPLORING THE BOTTOM OF THE DEEPEST KARST SYSTEM

Carol Vesely

Could it really be true? Could the highly decorated, friendly passages of Cueva del Mano really be the bottom of the world's deepest cave? With a vertical relief of less than one hundred meters, Mano certainly couldn't lay claim to any depth record as it now stands. But with the successful dye trace between Cueva del Mano and Cueva Cheve, some twenty-four hundred meters higher in elevation, the possibility of a 2.5-kilometer-deep cave system now exists.

The Río Frío de Santa Ana Resurgence in Oaxaca, Mexico, intrigued cavers the first time they laid eyes on it. The water is cold and clear, unlike the water in the Río Santo Domingo, into which the spring empties. It issues from a scenic four-by-three-meter entrance in a cliff decorated with pink algae, blooming bromeliads, and hanging cacti. Bill Stone and company first spotted this impressive *nacimiento* while searching for the Huautla resurgence during the Peña Colorada expedition in 1984. Stone called it the Western Resurgence, since it was the western-most of the springs the team located. Despite the fact that it was on the opposite side of the river from Huautla, the cold water and volume of flow encouraged the Peña Colorada cavers to hope that Sistema Huautla was the source of the spring. Bill Stone dove there and found a spacious maze of passages with strong current. At one point, he surfaced in a small air-filled chamber. Here, he was able to talk with Peter Quick, who had come in through a dry entrance nearby. After his dive, Bill concluded that the Río Frío was unlikely to be the Huautla resurgence, so the Peña

Colorada cavers concentrated their efforts elsewhere.

It wasn't until 1988, a year and a half after Bill Farr and I had begun the exploration of Cueva Cheve, located on the south side of the Río Santo Domingo, that cavers' interest in the Río Frío de Santa Ana resumed. By this time, Cueva Cheve had been pushed to over a kilometer deep, and everyone was curious about its total depth potential. On a solo backpacking trip, Don Coons located three possible resurgences. The first was to the east of Cheve on the Río Condor, which would have given the cave a maximum depth potential of a little over a kilometer. The second was northeast on the Río Seco, but it seemed to issue from the wrong side of that river. The third, the Río Frío de Santa Ana, was due north. All bets were on the latter, for the water was colder, indicating that it may have come from higher elevation, and Cheve was heading in that direction.

At the beginning of the spring 1989 Proyecto Papalo expedition, Bill Farr dumped optical brightener into the Cueva Cheve stream. Midway through the expedition, we returned to the resurgence to retrieve the dye bugs that Don had placed while backpacking. Before hiking down the mountain, we asked and received permission from the presidente of the friendly town of Cueyamecalco, in whose jurisdiction we mistakenly thought the resurgence was located. As we hadn't been planning to do any serious caving, Mark Minton, Don Coons, and I had only one flashlight apiece. On the hike to the Río Frío de Santa Ana, we passed a small creek bed not more than 500 meters upriver. We followed it upstream to a

low rock outcrop containing a stoop-sized entrance, blowing air. Flashlights in hand, we explored perhaps a hundred meters of mazy passages, leaving many leads. At one point, my light began to fail. As I sat in the dark waiting for the others to return, I noticed a tiny glowing bug, not more than a couple of millimeters long.

We continued to follow the cliff face down the Santo Domingo toward the spring. We came to a large, dry entrance Don had seen when he placed the dye bugs. It was an obvious shelter with the head of a monkey (*mono* in Spanish) carved and painted on an old column. At the back of the shelter was a short belly crawl that opened into a walking passage after only a meter. Don was amazed at the strong breeze blowing out of the crawl. He swore there was no noticeable air flow on his earlier trip only a few

The Río Santo Domingo.
Peter Bosted.



Reprinted, slightly revised, from the *California Caver*, summer 1990.

weeks before. We had only explored a short distance when my light began to fade again. Don and Mark went another 20 meters to a narrow fissure blowing air.

We finally made it to the resurgence. While Don retrieved the dye bug and I took photos, Mark went searching for more caves. After about a half hour, Mark returned to report that he had found the most promising cave yet. Don and I were skeptical and hardly very enthusiastic about having to cross the cold and swift spring waters in order to get there. But Mark's enthusiasm convinced us. After crossing the stream, we climbed a near-vertical, jungle-covered, unstable hillside to reach a small hole. Just inside, we found a *mano*, an old hand tool used for grinding. Don christened our latest discovery Cueva del Mano. The wind in Mano was the strongest yet, and the passage dimensions were seldom less than walking. Dry formations lined the walls and ceilings. Despite our failing lights, we explored over a hundred meters before turning back. We passed numerous side leads. After seeing the Río Frío de Santa Ana ourselves and finding the blowing caves nearby, we were certain that the water from Cheve had to come out there. We were very disappointed when the dye trace came out negative.

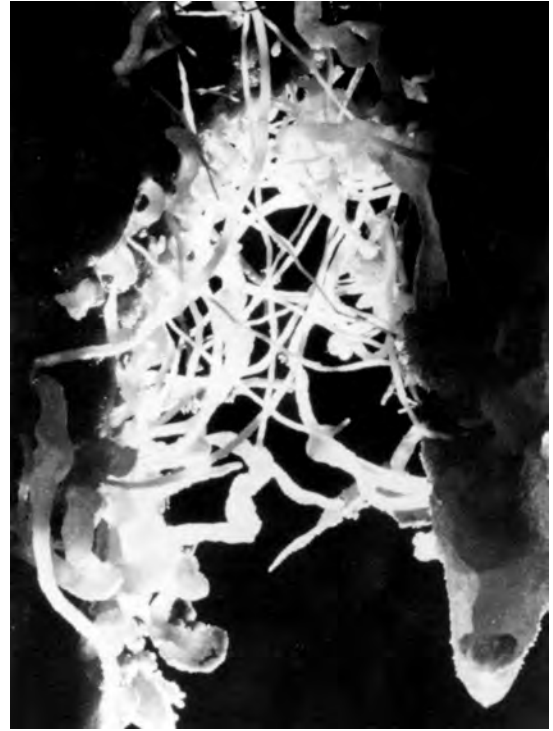
At the end of the 1989 expedition, Bill Farr and I returned to the resurgence area to begin surveying the caves. We packed light for the long 1400-meter descent to the river. We planned to spend three days there, one day surveying in each of the three caves. We began with the most promising, Mano, of course. We quickly surveyed the 150 meters that Mark, Don, and I had scooped. At this point, we reached a junction. We chose to climb up an 8-meter-high breakdown pile to the right. At the top was another junction room, festooned with 3-meter-long draperies, large flowstone mounds, and cave pearls. Numerous bats distracted us as they flew by, inspiring the name Bat Junction. From Bat Junction, we surveyed down a 6-by-6-meter borehole heading south into the mountain, in the direction of Cheve. The borehole became larger and better decorated the

farther we went. We were excited by the thought that we might be headed into the heart of the bottom of Sistema Cheve. But it was all just too easy. Reality caught up with us after another 100 meters. The passage ended in a flowstone plug with no airflow.

We returned to Bat Junction and followed another well-decorated passage, this one heading northeast and blowing strongly. But at station 45, Bill suddenly felt very ill. His head and stomach ached, and he was running a fever. I scouted ahead about 50 meters to yet another junction. Then we headed out. We had surveyed about 350 meters.

Bill slept fitfully that night and awoke feeling even worse. He was certainly in no shape for caving. If we both got sick, we would be stranded in the canyon with little food and no one to help. We decided to try to hike out. I managed to stuff nearly all of our gear into my backpack. Bill was able to carry a light day pack with the few remaining items. It was a long, hot six-hour hike back up the mountain, me with a heavy load and Bill so sick. Mysteriously, Bill's illness disappeared a day later, as quickly as it had come.

I was anxious to return to Mano, so as part of the 1990 expedition, I planned a two-week trip to what we were now referring to as the resurgence area. Without a positive dye trace, we still weren't certain that these caves were related to Sistema Cheve, but I was 99 percent convinced that they were. On February 25, we met in Cuicatlán before driving up the mountain. On the resurgence trip were Peter Bosted, Bill Stone, Nancy Pistole, Joe Razo, Herb Laeger, Eve Laeger, and I from California, Sheri Engler from Kentucky, Jerry Fant from Tennessee, and Randy Spahl and Ian McKenzie from Canada. Don Coons, Bill Stone, Matt Oliphant, Michael Denneborg, and Georg Tetzlaff (the last two from Germany) accompa-



Helictites in Cueva del Mano.

Peter Bosted.

nied us to the friendly mountain village of Cuyamascalco, where we spent the night. We had recently learned that the caves were under the jurisdiction of the town of Santa Ana Cuauhtemoc, so in the morning we went there to get permission. We had official letters from Oaxaca City, and Joe speaks excellent Spanish, so permission was no problem. The Santa Ana presidente did insist that we hire burros from their village and use their shortcut to the river. We had originally planned to go through Cuyamascalco, as we had in the past. We agreed, and at 8:00 A.M. the next morning we loaded six mules and burros with our group gear and food. We carried our own backpacks full of caving and camping gear. The Santa Ana shortcut turned out to be a real improvement over our original route, shorter, shadier, smoother, and somehow less steep as well.

We established base camp under an immense tree about 200 meters up river from the resurgence and just before the narrows along the Río Santo Domingo. The jungle was full of life, most of it to be avoided. Bug repellent was the most popular item in the first-aid kit, as we all adjusted to the fact

Buena Vista

Oaxaca, Mexico

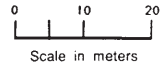
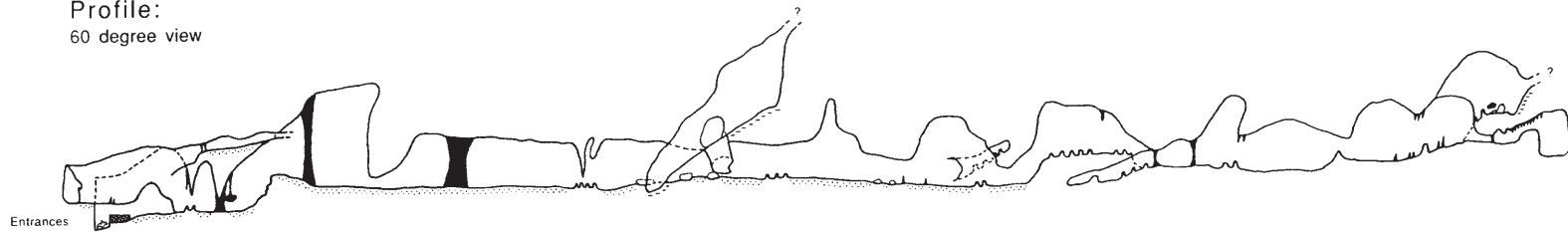
Compass and Tape Survey
6 March 1990

Sheri Engler
Nancy Pistole
Carol Vesely

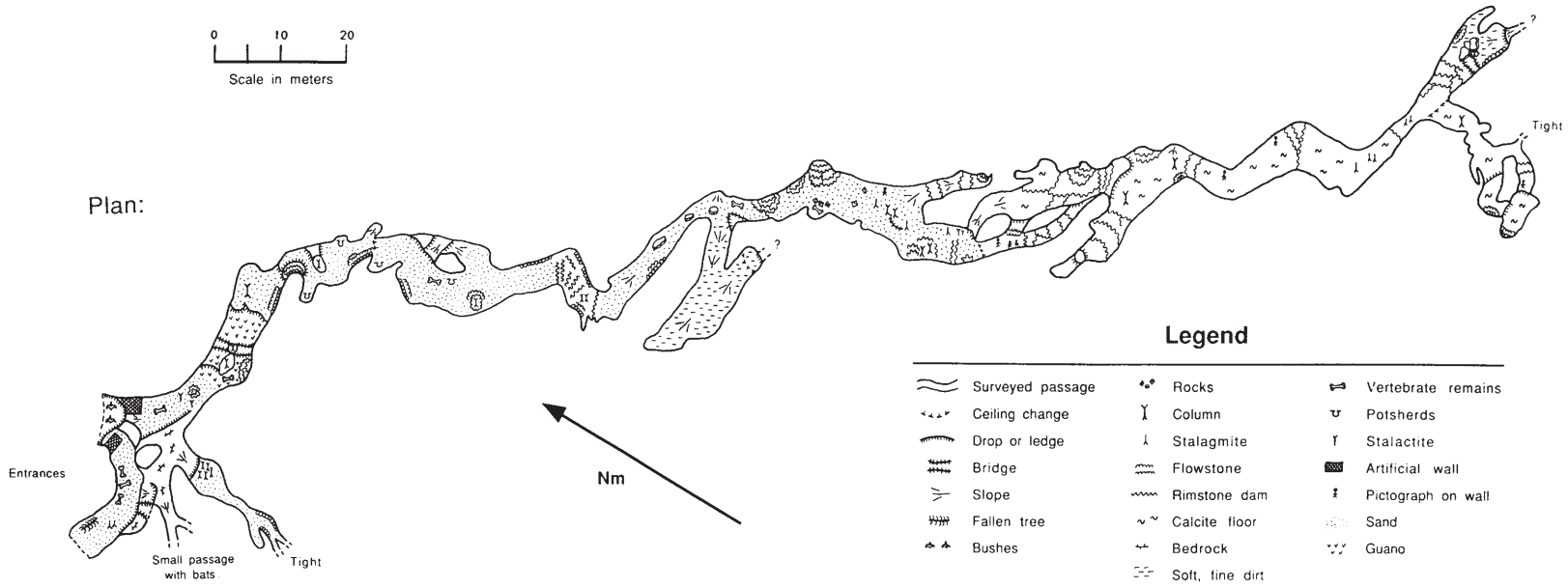
Survey Length: 356.3 meters

Map drawn by Nancy Pistole

Profile:
60 degree view



Plan:



Legend

- | | | |
|------------------|-----------------|--------------------|
| Surveied passage | Rocks | Vertebrate remains |
| Ceiling change | Column | Potsherds |
| Drop or ledge | Stalagmite | Stalactite |
| Bridge | Flowstone | Artificial wall |
| Slope | Rimstone dam | Pictograph on wall |
| Fallen tree | Calcite floor | Sand |
| Bushes | Bedrock | Guano |
| | Soft, fine dirt | |

Carol Vesely descends the
Contact Climb in Cueva del
Mano. *Peter Bosted.*

that you could get fifteen bites on your exposed flesh in the time it took to use the latrine. Once we arrived, we never stopped itching. In addition, we saw three monkeys and a coral snake near camp. Nevertheless, everyone agreed it was a beautiful place.

The next morning, February 27, we divided into three survey teams, one for each cave. Nancy, Sheri, and Peter headed into the cave farthest from the resurgence. At the entrance, they encountered a swarm of butterflies, and they named it Mariposa. They found a maze of sand- and mud-floored passages averaging 3 to 4 meters high and wide. They surveyed 251 meters and left leads.

Meanwhile, Bill, Jerry, and Herb entered Cueva del Mono. Rather than surveying in, they explored ahead and soon located the lake where Peter Quick had spoken to Bill Stone on his dive; the dive line was still in place. Wading through the lake and following a blowing side lead brought them to a junction at survey station MA13. They had connected Mono to Mano. They followed the Mano survey back to its entrance and decided to go ridgewalking for the rest of the day.

I took Randy and Ian to the place in Mano where Bill and I had stopped surveying the year before. We followed the spacious walking passage northwest to an end only 70 meters farther. Next, Randy led the way up a series of exposed climbs to a small, blowing entrance. We tried for about two hours to dig and bash our way through the opening, but it was just a bit too tight. We retreated with 219 meters surveyed and another airy climb left unchecked.

The next day, I volunteered for camp and cook duty to get this chore out of the way. It seemed unwise to leave camp unattended for any length of time. Therefore each person had to spend one day guarding camp and cooking dinner for the group.

Nancy and Sheri returned to Mariposa, this time accompanied by Joe. They rigged a 3-meter drop and surveyed a big loop that rejoined the



known cave at a pit found the day before. Next, they mapped a formation-filled crawlway with good air, stopping at a grim spot after surveying 181 meters.

Before heading into Mano, Peter reviewed the survey notes from the year before and spied a "major lead." Ian, Randy, and Peter discovered that this went to a large, sloping rift passage with holes to a lower level in the floor and large flowstone rooms up dip, on a higher level. They chose the middle level. This headed south to Pothole Way, a clean-washed passage with a beautifully scalloped floor. At the junction with the upper leads, the passage headed down and got bigger, still clean-washed. Suddenly,

it went down a sandy slope to a large sump. Randy climbed a nearby dome, but could not find a way to bypass the lake. Their total survey was 435 meters.

Meanwhile, Herb, Bill, and Jerry took up the arduous task of searching the area for more caves. From the cliffs on the north side of the river, you could see many enticing holes of the south side. The problem is that you have to climb through cactus jungles to get to them. The ridgewalkers discovered a small blowing hole and shelter.

On March 1, I was eager to return to Mano with Peter, Randy, and Ian. We began by surveying the lower-level leads off the sloping rift. One lead

went to a 10-meter pit. We eventually came to the bottom of the same pit via a different route. Finally, we took an upper route off the rift, and this led to a beautiful room, 15 by 25 meters, with bats flying from unseen passages beyond. We ended the survey at this enticing spot, after a total of 458 meters.

The Mariposa crew of Nancy, Sheri, and Joe surveyed another 177 meters of crawlways and loops. They returned to camp excited by the cool airflow in their last lead, a going passage 3 by 4 meters. They were convinced that their reward for surveying all the tight stuff lay just around the bend.

The next day, Nancy, Sheri, and Joe anxiously returned to Mariposa. They followed their blowing passage to a sump pool and a drop with no air. The air appeared to vanish in an impossibly loose climb near the sump. Disappointed, they checked a few side leads and called the cave done. A total of 700 meters had been surveyed in the four trips.

Peter, Ian, and I returned to the great formation room, later named the Backstage, where we had stopped the day before. We began by surveying a crawlway, the Canadian Borehole, off the base of the room. It got progressively smaller and ended in a fissure that was too tight. Next, Ian and I tried to find a way to climb down the 30-meter pits in the floor. Meanwhile, Peter managed to

squeeze behind the meter-thick flowstone curtain that gave the Backstage its name. He came back with tales of borehole. We were dubious until we saw the 8-meter-diameter passage for ourselves. Peter's Perfect Borehole had a hard-packed mud floor, nice formations, and, best of all, it headed southeast. After several stations, we came to an overlook into a massive junction room. The Fin Room had a large projection of rock that jutted out from one wall, making the room very confusing to traverse. We chose a lead heading south from the room and came to an area of curved stalactites over a meter long. All the formations were bent in the direction of the entrance and the prevailing wind. The Curved Stalactite Passage continued down a rimstone slope and through a formation squeeze. On the other side, it followed the contact between a reddish-brown limestone on the ceiling and a smooth, gray, marbleized rock on the floor. The dip was to the west. The Contact Passage was headed in the right direction, and it felt as if it would keep going forever. We surveyed for hours and finally called it quits at station 99, after 586 meters. The passage showed no signs of ending, but we wanted to get back to camp before midnight.

Also that day, the ridgewalking crew returned with news of an exciting new discovery about 70 meters above the river and half a kilometer downstream from camp. Buena Vista

had two entrances with a breathtaking view both up and down the river. Herb had reached the cave by a 70-meter rappel.

On March 3, after a short night's sleep, the three of us resumed surveying in Mano where we had left off the night before. At one point the passage sumped, but we managed to find an easy bypass. A little later the passage abruptly seemed to end at a climb along a fault. At the top of the 8-meter climb, we crossed some small pools and again found ourselves following the contact. The sloping rift became wider, until the walls were 60 meters apart. Finally, the passage took an abrupt turn down dip to a terminal-looking pool, which we did not check closely. Hoping to find a bypass, we headed up dip over 100 meters, but this way to the south pinched out. Our only consolation was a beautiful little helictite garden at the top of the rift. With 650 meters surveyed, we headed out, arriving at camp around 1:00 A.M. Field calculation indicated that we were a kilometer south into the mountain at our farthest point.

That day, Bill rappelled down from the top of the cliff and rigged a 70-meter rope from the entrance of Buena Vista to the river. Eve, Nancy, Joe, and Randy ascended the river rope. But they were not the first to visit the cave. Despite the difficult access, the ancient Indians had been there and built 1.5-meter-high walls in the entrances. Buena Vista turned out to be a classic Hollywood-style cave, spacious, warm, dry, and well decorated, with a smooth, hard-packed floor. The only large side lead contained lots of bats and guano. The air was stale, and all passages appeared to be choked with flowstone.

The next day, since our southern lead in Mano had presumably ended, Peter, Randy, and I decided to try a different tactic, to head north, up dip, and see if we could intersect an older passage that might bypass the sump. We began surveying one of the larger leads off the Fin Room. This went to an immense overlook 20 meters above



Carol Vesely admires the formations in the Curved Stalactite Passage, Cueva del Mano. *Peter Bosted.*

the floor. As we were setting up to take a photograph, Nancy and Ian entered the Fin Room. They had just finished checking one of the pits in the floor of the Backstage. Instead of going to a stream passage as hoped, the 30-meter pit only led to a deep pool. From the overlook, we had a bat's-eye view of Nancy and Ian wandering around the Fin Room looking for the borehole that led out. We finally shouted directions and resumed surveying. Our walking-height passage headed up a steep slope covered with white flowstone. This was the prettiest passage we had found to date, and Peter named it the Red and White River. We surveyed 242 meters and stopped at what appeared to be the crest of a drainage divide.

On March 5, Nancy and Ian tried to return to Buena Vista to survey, but they found that someone had stolen the bottom 20 meters of the rope. Muddy bare footprints indicated that he must have used the rope to scale the cliffs, cut off a section, and doubled it for part of the descent. This was very disconcerting, and we were glad we had had someone in camp watching the rest of the gear.

Ian and Nancy, as well as Herb, Eve, Joe, and Bill, spent the day ridgewalking. New holes were always being spotted, but most were extremely difficult to reach. Nearly everyone agreed that an eight-hour cave trip was easier than ridgewalking.

Sheri, Jerry, and I headed into Mano to check a very promising lead Ian had briefly scouted three days earlier. This turned out to be an excellent choice. Initially, we climbed a 20-meter-wide breakdown pile to reach a 15-meter-diameter borehole filled with knee-deep guano. We saw no bats, only tons of slimy, smelly guano. After about 200 meters, the I-Guano-Go Passage came to a flowstone overlook into a huge passage below. Sheri and I talked Jerry out of climbing down without a rope. Retreating to the Curved Stalactite Passage, we surveyed a series of small tubes with good air, returning with 235 meters of survey.

Meanwhile, Peter, Randy, and Joe surveyed side leads off the Contact Passage in hopes of finding a way farther south. They found many loops and a sump, but no way on. They

surveyed 345 meters.

Armed with a rope to do the long rappel from the top of the cliffs, Nancy, Sheri, and I headed for Buena Vista the next day. There was a spectacular view from the cliffs, even if we did have to fight our way through cactus and thorns to get there. Rushed for time, we quickly surveyed the 356 meters of known cave. I took several pictures, but you could easily spend a day in Buena Vista for photography. Surprisingly, there was some airflow in the cave this time. We didn't have time to check the high leads, since we wanted to get back down the treacherous cliffs before dark. We derigged both ropes on our way.

Randy, Jerry, and Ian returned to the I-Guano-Go Passage armed with a 15-meter rope. At the bottom of the pitch, the borehole continued south, the guano quickly giving way to clean-washed floor and many formations. This appeared to be a major section of the cave, with numerous side leads. They surveyed south as much as possible, eventually reaching an overhung 5-meter drop. With 655 meters surveyed and many going leads, they left the cave after a long trip.

On March 7, with so many good leads in Mano and time running out, I felt it was important to send as many teams as possible into the cave. Bill, Jerry, and Joe headed back to the place where the survey had ended the day before. They got even farther south, in mostly large passages, eventually reaching another sump, farther east but almost as far south as the one at the end of the Contact Passage. A muddy climbing lead near the sump was left.

Ian, Sherri, and I also headed to the big passages below I-Guano-Go Drop. We surveyed a bunch of loops and discovered a promising high climbing lead near the end of the day. It looked as though it opened into a large upper level. On the way out, we



Sheri Engler looks out of one of the entrances to Buena Vista from the top of an ancient stone wall. *Carol Vesely.*

met Bill's team; the two teams had gotten another 800 meters of survey.

Peter, Randy, and Herb again tried to push south in the side leads off the Contact Passage. At the highest point in the rift maze, they found directional aragonite. They also found some beautiful helictites and a long lake they took their boots off to cross, but no way on. They netted 530 meters of survey, with more tubes left in the area.

On the final day in Mano, Peter, Sheri, Randy, and I headed back to the Red and White River Passage. There was not an inch of wall, ceiling, or floor not decorated with flowstone. After taking plenty of pictures, we split into two teams to do a leapfrog survey. Randy and I went down the walking passage about 100 meters to begin surveying. We came to an 8-meter climb up that led to an interesting breathing hole through the flowstone. For several minutes there would be no air flow at all. Then the air would slowly build until it made a loud, continuous noise. After another minute, it would die down again. We

thought we must be hearing the wind along the cliff face. But no daylight was visible. I wrote the date and station number on a piece of flagging tape and threw it through a small crack in the flowstone. Perhaps some day we will find it on the other side. The four of us surveyed only 178 meters. When we plotted the data at home, we discovered that the breathing hole is not near the cliffs, but very close to the end of Buena Vista.

Nancy, Ian, and Jerry were more successful. Jerry was able to bash footholds in the muddy, crumbly rock and make it up the climb near the sump. Unfortunately, it didn't go. However, it was full of the prettiest helictites in the cave. Jerry was also able to find a way to climb into the big lead our team had spotted the day before. They surveyed down a gorgeous borehole with dry crystal pools and lots of flowstone. They returned to camp at 6 A.M. with 489 meters surveyed. On one of their rest breaks they decided to play a joke on me. They made up a phony page of survey notes, complete with a sketch showing a huge borehole leading to a breakdown pile with Camp III in Cheve on the other side. No wonder they had such a long trip.

March 9 was our last day at the resurgence area; the eleven days had gone by so quickly. We had added over six kilometers of new passage to Mano and surveyed 700 meters in Mariposa and 350 meters in Buena Vista. And the day before, the

ridgewalking crew had found their most promising hole yet, Cueva Amontillado. Sheri and I stayed in camp to pack group gear, while the majority of the group went on a river trip through the narrows to retrieve a dye bug that Jim Smith had placed in the Huautla resurgence. Meanwhile, Peter and Joe ascended a rope that Herb and Bill had left hanging in Amontillado. They explored a few hundred meters to a promising bolt climb. Back at the cliff entrance, they set a bolt and rigged a doubled wire so that we could pull a rope up when we returned.

Half of the group decided it was worth an extra five dollars each to have their personal packs hauled back up the mountain. They hired additional burros from Salamon, a very kind man who lives on a farm a kilometer up-river. They left early to hike up the trail to Cuyamacalco with Salamon. By 8:00 A.M., the rest of us were packed and ready for the burros from Santa Ana to arrive to haul the group gear. But the burros never showed. We were stranded with the group gear. After waiting two hours, we decided that the vehicle drivers (Ian and I) and those people with planes to catch would hike up to Santa Ana and arrange for burros to come down the next day for the others and the group gear. Peter, Joe, and Jerry made it to their planes on time, but Sheri and Nancy ended up stranded at the resurgence for two extra days.

Luckily, there was plenty of leftover food to eat. We finally convinced the people of Santa Ana to send burros.

Nancy and Sheri's only reward for this unfortunate inconvenience was seeing the resurgence water turn bright green from dye that Jim Smith had dumped into the Cheve stream only eight days earlier. It took the water two days to travel to Camp III, near the deepest point in Cheve, and then only six more days to go the remaining 17 kilometers. Thus, Mano truly is the bottom of the world's deepest cave, hydrologically at least. This gives the system a total depth potential of over 2500 meters. Now, all we have to do is find the way through.

Despite the burro problems, overall this was one of the best trips I've been on. The people were great. Everyone was highly motivated to cave, ridgewalk, write trip reports, reduce data, and help with group chores. There was lots of beautiful cave to explore, and there were no personality hassles to ruin the fun. It made all the months of preparation well worthwhile.

Many thanks to all the sponsors of the 1990 expedition: Bob & Bob, PMI, Patagonia, Koehler Wheat Lamps, and the NSS. Also thanks to all the people who bought T-shirts and expedition reports to help support the project. The generosity and support of these groups and people were very important to the success of the expedition. We certainly appreciate it.

Cueva del Mano

Cueva del Mano es la cueva de mayor dimensión en las cercanías de las resurgencias del Sistema Cheve en Oaxaca. Cueva del Mano fue descubierta en 1989, y en la primavera del 1990 más de 6 kilómetros han sido topografiados y la cual se dirige básicamente en la dirección de la Cueva Cheve. Se registró el sistema de rastreo en la Cueva del Mano proveniente del Sistema Cheve. En la zona de los nacimientos también se topografiaron 700 metros en la Cueva de la Mariposa, 350 metros en la Cueva Buena Vista, y descubriendo también la Cueva del Amontillado.

Cueva Mariposa

Oaxaca, Mexico

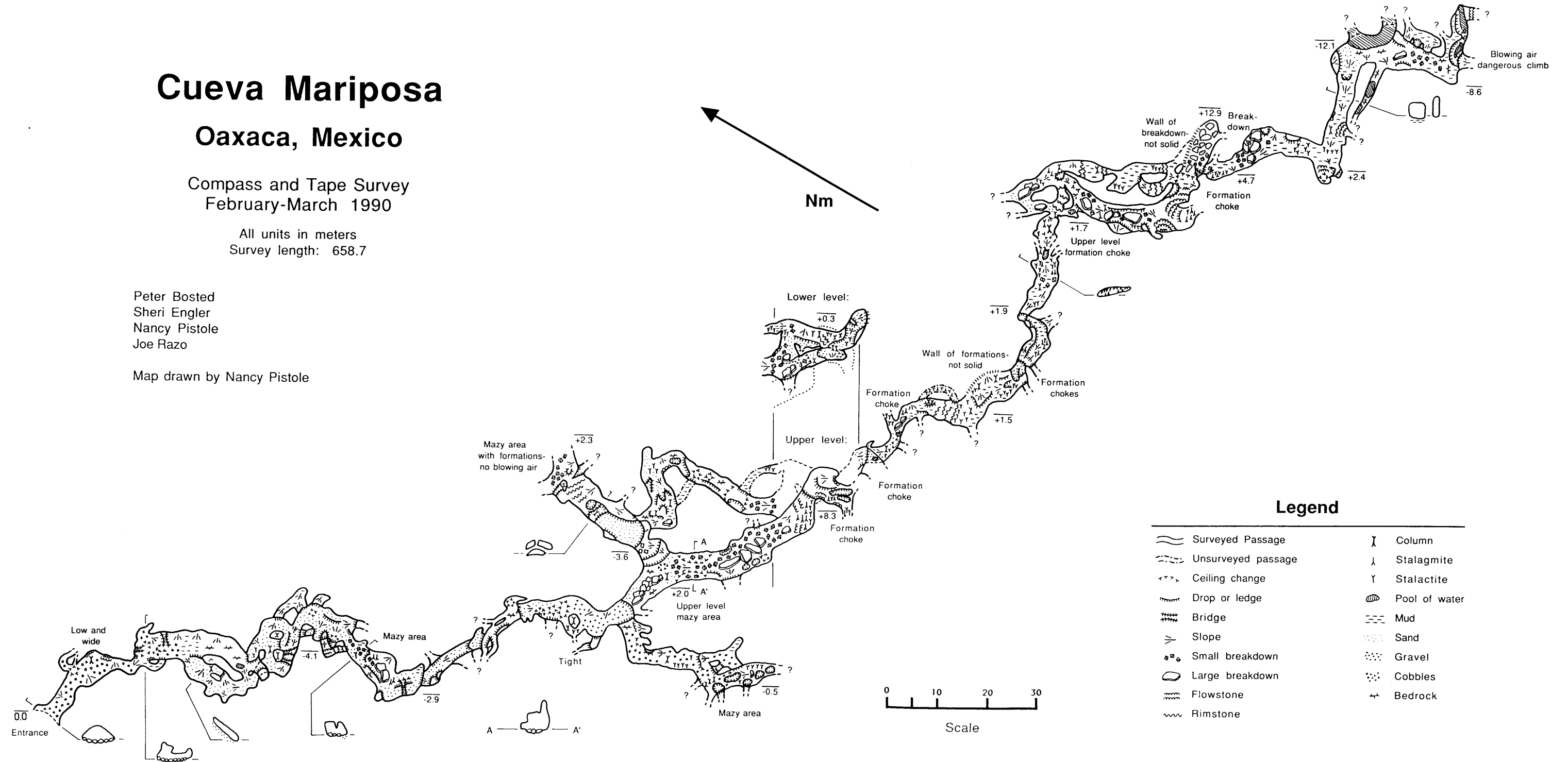
Compass and Tape Survey
February-March 1990

All units in meters
Survey length: 658.7

Peter Bosted
Sheri Engler
Nancy Pistole
Joe Razo

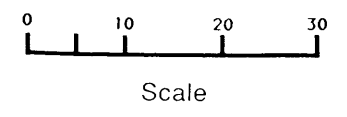
Map drawn by Nancy Pistole

Nm



Legend

- | | | | |
|--|--------------------|--|---------------|
| | Surveyed Passage | | Column |
| | Unsurveyed passage | | Stalagmite |
| | Ceiling change | | Stalactite |
| | Drop or ledge | | Pool of water |
| | Bridge | | Mud |
| | Slope | | Sand |
| | Small breakdown | | Gravel |
| | Large breakdown | | Cobbles |
| | Flowstone | | Bedrock |
| | Rimstone | | |



LAVA TUBES OF THE SUCHIOOC VOLCANO

Ramón Espinasa-Pereña

In 1986 the Sociedad Mexicana de Exploraciones Subterráneas established what was then called Project Rainy Season. This was an effort to survey lava tubes in the numerous volcanoes located in the Sierra Chichinautzin, a monogenetic volcanic field between the cities of México and Cuernavaca. As the name implies, it was "something to do until the rains go away and we can do some proper caving." Primarily on weekends, we mapped 6 kilometers in over thirty lava caves on the flows of Xitle, Teuhtli, Yololica, and Chichinautzin volcanoes. The mapping effort proceeded at a very gradual pace, due primarily to the nature of the caves: dark with sharp rock, and not really too exciting to explore.

In 1991 I had the good fortune of entering the Institute of Geography at UNAM, which has extensively supported our studies of the lava tubes. This coincided with the initial reconnaissance of the Suchiooc lava flow, where we have concentrated the efforts of the Proyecto Chichinautzin, as it is now called, during the past two summers. We were surprised to find a very interesting set of lava tubes, each with its own character, that have inspired a lot of research on my part into the mechanics of lava-tube formation. This, together with the energy injected by Tachi and Luis Fernando, two new SMES members who live in Tepoztlán at the foot of the Suchiooc lava flow, resulted in the mapping of the longest and deepest lava tubes in Mexico, the discovery of a very interesting archaeological site, and numerous weekends of excitement, discovery, and fun. We now consider lava tubes to be at least as interesting and beautiful as any other type of cave.

In 1991, several of us made a trip to the famed Cueva del Diablo, supposedly located near Tepoztlán, and reputed to be a very long lava tube. After several wrong turns, we finally located it near the town of Santo Domingo. The spirit of the team being quite mellow at the time, we proceeded to explore first, "leaving the survey for the way out," which naturally resulted in no survey at all. We discovered a very complicated network of large tunnels that we barely touched in the limited time available. Inquiries about other caves in the general vicinity were answered with "no" and vague recollections about large caves high up in the sierra to the north.

Not recognizing the potential of the area, we did not return until my brother Luiz and my father located Cueva del Ferrocarril near San Juan Tlacotenco; their descriptions interested everyone, so we decided to start the systematic survey of this new cave.

Due to the dry season not really happening that year, we actually started in February 1992, and we mapped Cueva del Ferrocarril in four weekends to a length of over 2 kilometers. This cave is a complex of anastomosing tubes at different levels, almost all of them with nice, smooth pahoehoe floors. They have exceptionally well preserved flow structures, which proved to us that beautiful lava tubes are not something fictional. The complicated pattern of the cave and the number of new features to be included on the map generated more than one headache while surveying.

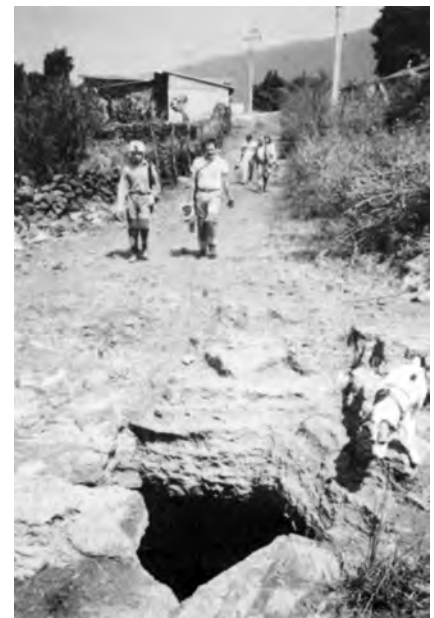
As we were entering this cave on what was to be the last trip to the area, we met two boys coming out of the cave. Humberto ("Tachi") and Luis

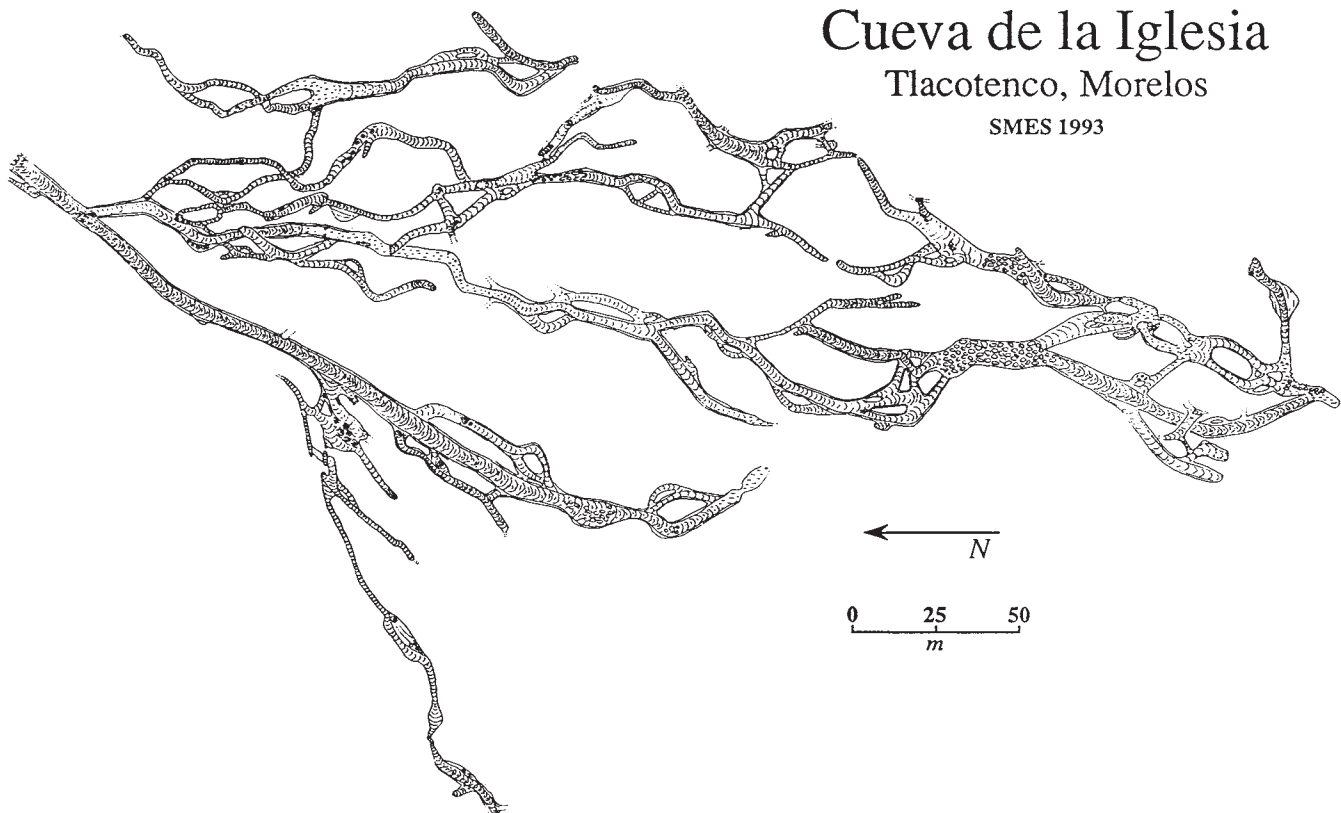
Fernando demonstrated a lot of interest and offered to help us. At the end of the day, as we left them in Tepoztlán, I gave them my phone number, not knowing what the consequences would be. Two days later, Tachi called to tell me about several new entrances that they had discovered that afternoon, and so we arranged to meet them the following weekend. This was going to repeat itself the whole summer, as the caving bug got hold of these two new cavers.

The trend of Ferrocarril pointed toward the town of San Juan Tlacotenco, and the first entrance that Tachi showed us was located just behind the church, earning it the name

The entrance to Cueva de la Iglesia is in one of the streets of San Juan Tlacotenco.

Peter Sprouse.





Cueva de la Iglesia Tlacotenco, Morelos

SMES 1993

Cueva de la Iglesia. This entrance, a typical tube-roof collapse, is said to have been made when a tractor passed over it a couple of years before. It gives access to what we originally thought was a simple cave, with one large passage and a secondary, smaller branch. As the first side leads were checked, each and every one of them turned into a complex of branching tunnels that sometimes rejoined known passages and sometimes headed in new directions. Mapping during five trips has brought the length to over 3 kilometers, making it the longest lava tube mapped in Mexico. In general, it can be said that it is similar to Ferrocarril, to which it comes within 150 meters at one point, but the segments between intersections are longer, so the main passages are better defined. Some of the best flow structures in the area, such as lava rafts, lava stals, lava balls, dams, cascades, and levees, are preserved in this cave, along with the first calcite formations encountered in the area.

Simultaneously with the exploration and mapping in Iglesia, two new caves were found higher up on the

slope, and they were named after the owners of the fields in which the entrances are located. Macaria is a short but interesting cave 500 meters long that comes very close to the choke that ends Iglesia in the upflow direction. The distance separating them is only 20 meters. Marcelo is a 1500-meter-long cave that is characterized by very large tunnels with quite a bit of breakdown. Its exploration was made interesting by the complex of large tunnels and overflows in the middle portion.

These four caves are located in a side flow off the main flow of Suchiooc, and they are here called the Tlacotenco System, for the town under which they are developed. Their complex pattern is due to the emplacement of the lava by repeated budding of lava toes that developed a chilled surface but preserved liquid lava in their interiors. Coalescence of some of these microtubes by continued flow of lava through them remelted the intervening walls, generating the complex pattern. As the tubes drained, lower tubes pirated the lava, creating the interesting flow structures.

Having more or less finished the mapping of Sistema Tlacotenco—no cave in the Suchiooc has been totally finished, as there are enterable leads in all of them that have not yet been mapped—we got the aerial photos of the area, which allowed us to determine that Cueva del Diablo, which we had visited in 1991, was located in the low section of the main Suchiooc flow, so we decided to map it. In three weekend trips during July, we surveyed over 2 kilometers of large canyon-like passage, with occasional bridges separating the canyon into upper and lower levels. Some of the largest passages in the area, up to 15 meters in diameter, are in this cave, and they are really quite impressive. Another trip, this time for photos, was also very enjoyable. The cave has a series of dendritic passages that join the main tube downflow as a series of inlets, which is quite strange for lava tubes.

Having located the source of the flow at the Suchiooc volcano on the aerial photos, two reconnaissance trips were made. One, starting from Parres, entered a network of old logging roads

that led into the remote area of the Sierra Chichinautzin, where Suchiooc is located. This volcano is at the top of the high slopes that terminate at Tepoztlán, 800 meters lower. At the base of the volcano, several small caves were checked, and another cave was explored to the edge of a pitch into a large passage. Due to the difficult access, no trip has gone back to this high area, although we intend to return there in the near future. The second recce trip started at Tlacotenco and followed the Camino Real (a large path, more or less well maintained) that climbs the slopes that form the main lava flow, at the middle elevations. Three entrances were immediately located in the main flow, all of them pitches ranging from 5 and 20 meters deep. Although we did not know it at the time, we were on the verge of one of the most interesting discoveries made up to then.

In November, we started the exploration of the highest entrance found, Cueva de Tatamasquío. A 15-meter entrance pitch left us in a canyon-like passage that we first explored upflow past a climb to a sudden and disappointing end within sight of the entrance. But downflow was another story. A large canyon, sometimes dividing into upper and lower levels, seemed to go forever. Most of the progress was made along large ledges (levees) or between huge breakdown walls made by the collapse of lava linings on the sides of the tube. After

about 200 meters, we could see light coming from a skylight almost 25 meters above us, in the center of a very impressive chamber that we immediately recognized as Cueva de Chimalacatepec, one of the most impressive entrances we had found during the recce trip. A hundred meters further, our passage seemed to lose its floor at the edge of a pitch surrounded by breakdown blocks. We could see the continuation in front of us, but it was unreachable from our level.

Sergio Nuño, smelling more cave beyond, soon found a way down between the blocks. With some gymnastics, he reached a lower level that quickly popped into the large passage beyond. It was incredible: a large canyon, 5 meters wide by over 30 meters high that disappeared into darkness. Unfortunately, 100 meters later the passage suddenly diminished in size to become a body-size tube with a spiny aa floor, where all the airflow disappeared. With over 500 meters mapped to a depth of nearly 100 meters, we were content to leave it at that.

On the way down to San Juan, just beyond the Chimalacatepec ranch, we encountered an old man who, when asked about caves in the area, promptly showed us Cueva de Iztaxiatla. It is very near the Camino Real and, from our calculations, was located near the known end of Chimalacatepec. The next weekend we were back. The 15-meter entrance

pitch was rigged with some difficulty, and we soon reached a moderate-size passage that immediately ended downflow, but upflow it went, oddly, to the edge of a short pitch. This was also rigged, requiring a bolt, to reach a passage that went upflow to the edge of a very dodgy climb. Clearing all the loose blocks at the edge and figuring the sequence of Tango dance moves necessary to get down it took us almost two hours, but we finally made it. At the bottom was another passage heading both up and down, with a lot of airflow in both directions. Heading upward first, we soon reached a large canyon similar to the one at the end of the upper cave. We followed it to a climb down and a large headwall that seemed to mark the end of the cave. But there, at the bottom of the wall, was a small hole that we immediately recognized as the end of Chimalacatepec. From this side it looked more inviting, so Tachi grabbed a hammer and proceeded to bash it open. After removing the more obnoxious spines, he slithered through, and we had our connection. Down from the Tango Climb, we entered a narrow, breakdown-strewn passage that suddenly opened to a round tunnel. In the middle of a crawl, we found some broken pottery that showed we were not the first in this part of the cave. The tunnel seemed endless, and progress was made uncomfortable by the unstable breakdown blocks that make up the floor. Mapping as we went, we soon reached a large dome with an apparent passage above. After almost seven hours, we left the cave, still going at the base of a conspicuous block.

We now had a cave over a kilometer long and over 150 meters deep. Since it was pointing straight toward Cueva del Diablo, 300 meters lower and two kilometers away in a straight line, our hopes of breaking depth records were high. We went back the following weekend. A couple hundred meters beyond our last survey station we reached a crawl. When we got through



Ruth Diamant examines lava stalactites caused by hot-gas remelting of the ceiling. *Peter Sprouse.*



Chris Lloyd lights up lava channel in Cueva del Ferrocarril. *Peter Sprouse.*

it, we were astonished. Many large vases of pottery and small jade figurines stood on ledges and on the floor of a 10-meter section of passage. Careful not to disturb anything, we continued our survey. Those not surveying quickly passed us, in search of other artifacts.

The passage changed into a large tunnel covered with house-size blocks that required careful footing to traverse. Suddenly we reached a round, flat-floored tunnel 15 meters in diameter. In the distance, we could see the others as mere specks of light a hundred meters away. When we reached them, they were investigating another set of pots, located at the first passage intersection in the whole cave. The passage to the right ended abruptly 20 meters beyond, and the main passage also ended soon in a giant lava sump (undividable, obviously), and there we found the most impressive pottery in the cave.

We finished the survey at 1.4 kilometers and just over 200 meters deep, far from any record, but the archaeological materials made up for it. A review of the literature showed that this is probably the deepest lava tube in the Americas. The 1992 rainy season had

ended, and we were quite happy with our results.

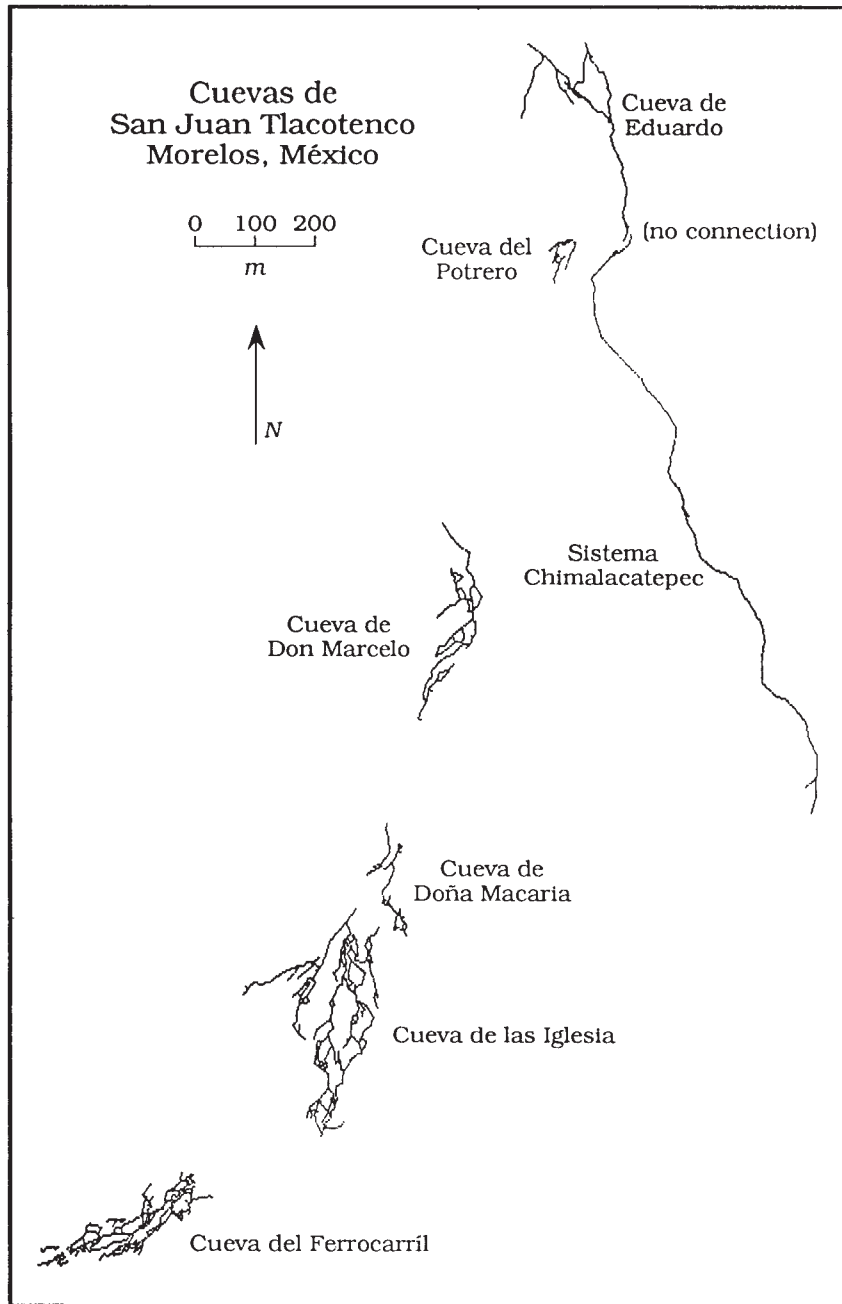
As the rainy season of 1993 started, we planned a trip to Chimalacatepec. The intention was first to make a complete traverse of the system, entering through the highest entrance, going all the way to the bottom and all the way back up. Our second goal was to make a thorough report on the archaeological material, since the National Institute of History and Anthropology (INAH) officials in the state of Morelos had showed interest in our discoveries. The trip took place on June 19, and it was a very interesting and challenging one, for a lava tube, taking more than nine hours to complete. The photos and report that resulted prompted INAH to organize an expedition, so the next weekend we accompanied over twenty archaeologists through the lower entrance to see the site. The recovery of the pieces has started, and,

hopefully, they will soon be on display in the Tepoztlán museum, but I must say that part of me is sorry that they were removed, for the cave has now lost a part of its magic.

We returned to the area on July 10 with the intention of mapping Cueva del Potrero, a small cave near Chimalacatepec's higher entrance. But we never got around to it, because as we were approaching it a young man named Eduardo offered to take us to another cave. When we reached it, we were impressed; the entrance is one of the largest in the area, with a pitch 9 meters deep and 20 meters wide. The first survey trip produced over 400 meters of passage, rarely out of sight of the entrance. The main passage was barely looked at, but it seems to be even more difficult to traverse than anything in Chimalacatepec. Large breakdown blocks and several pitches in rotten rock stopped our progress. Eduardo also mentioned several other caves higher up, and he said he knows entrances all the way to Suchiooc. We will continue exploration.



Ramón Espinasa examines pahoehoe floor in Cueva del Ferrocarril. *Peter Sprouse.*



Cuevas de Lava del Volcán Suchiooc

Espeleólogos del SMES han estado explorando y mapeando cuevas de lava del volcán Suchiooc en la Sierra Chichinautzin, Morelos. Varias cuevas se han encontrado por el poblado de San Juan Tlacotenco: Cueva del Ferrocarril de 2 kilómetros, Cueva de la Iglesia, con 3 kilómetros la más larga en México. En el poblado de Santo Domingo se mapeó la Cueva del Diablo, con 2 kilómetros de longitud, y la Cueva de Chimalacatepec, cual contiene artefactos, siendo estos estudiados por el INAH.

TAMPUMACCHAY CAVE, COLIMA

John J. Pint

This cave is located a short distance south of Colima City, Colima, not far from an ancient burial site. Grupo Espeleológico Zotz has been mapping it since September of 1992, usually in small bites, since the temperature is around 80°F. In fact, shorts and Teva sandals have proven ideal for negotiating the guano-covered breakdown and ever-intriguing crawlways.

Tampumacchay has a lot going for it. You can watch the nightly departure of the bats right from your campsite, and twice we've seen boa constrictors dining on unfortunate creatures plucked from the air in the low entrance tunnel. Besides bats, the cave is full of evil-looking, but innocent, *canctos*, which we have been told are the cave-dwelling cousins of vinegarroons. Two white *canctos* were recently spotted in a yet-unsurveyed passageway.

Just when we were about to start mapping the cave, we received the unexpected gift of a digital level from the SmartLevel Corporation for testing as a clinometer. This turned out to be a godsend, as we soon found out

we were dealing with passages on three levels, sometimes one above the other.

Last New Year's Eve, we welcomed 1993 with a midnight toast in what is now called the Champagne Ballroom. Eleven days later, several members of the group who were not used to Mexican caves, including French geologist Henri de St. Pierre, woke up with fever and a hacking cough. Tampumacchay, it seems, really does offer everything, including histoplasmosis.

On our last mapping trip we got into a Swiss-cheese labyrinth that we thought would lead us to a continuation of the main trunk passage. Instead, we ended up *on top* of the trunk passage. Off to one side of a wide, upper-level room with a rather low ceiling, we came upon a wicked hole in the floor, maybe four meters in diameter. This is shaped like a funnel and coated with a thin layer of very slippery guano. A friend was videotaping our meanderings, and, when we saw the results a few weeks later, I discovered that I had used just about all the four-letter words in my vo-

cabulary when I ran into this awesome caver-catcher and had to edge my way around it to reach the far wall. A 7.7-meter fall awaits anyone who, like an ant lion's unsuspecting victim, takes a one-way ride down this giant funnel.

While the large passages of the cave are as black as night, the smaller ones are usually long, low galleries broken up by frequent columns and sparkling with formations. By far the most unusual we've seen is the *Gâteau Mille Feuilles* (Thousand Layer Cake), which really does resemble a pastry-lover's dream.

As present we have mapped only 336 meters of the cave, with more than twenty leads awaiting exploration, including two that definitely lead to *mala aire* (CO₂). Our map is starting to look like a bowl of spaghetti, and we wonder where we are going to put future additions.

Le Gâteau Mille Feuilles
(Thousand Layer Cake) in
Henri's Gallery. John Pint.

La Cueva del Tampumacchay, Colima

El Grupo Espeleológico Zotz ha estado explorando esta cueva compleja cerca de la ciudad de Colima. Esta cueva contiene una colonia de murciélagos y *canctos*. 336 metros se han topografiados, sin embargo existen más de 20 pasajes vírgenes, algunos de ellos con un exceso de CO₂.



LA SIMA DEL CHIKINIBAL

Francisco Ruiz

with Claudia Galicia and Javier Vargas

In May 1991, our friends Angelica Calderón and Arturo Ortega found, near Comitán in Chiapas, a pit with a mouth at least three times wider than Golondrinas and whose depth was estimated at 250 meters. When they talked with the authorities in Nueva Cruz about the possibility of exploring the cave, the comisario asked for an official letter before he would allow them to descend the pit. In March 1993, after a delay of almost two years, we used our school vacations to make the trip to Nueva Cruz, which is the nearest village to the cave. The ejido of Nueva Cruz belongs to the municipio of Independencia, and it is easy to locate on the INEGI 1:50000 topographic map El Triunfo (E15D84). The crew on the Chikinibal '93 expedition were Claudia Galicia, Leopoldo M. Rojano (Polo), Francisco Ruiz (Curro), J. Antonio Soriano, Javier Vargas, and Hatuey Viveros.



The adventure started on March 11, when we left El Naranjo. We arrived at Nueva Cruz after hiking three hours through a pine forest. The comisario was not at home, and we accepted the invitation of Don Abelardo, the man who showed the pit to Angelica and Arturo, to see a cave that he said was not far from Nueva Cruz. We took about 40 minutes to reach the stone arch that gives the cave its name, Cueva del Arco. We entered by the horizontal entrance, which connects with a 15-meter pit in a room open to the sky. From here, two narrow passages go only a few meters. The Cueva del Arco is a very nice, well-decorated cave, but we did not map it, because Don Abelardo told us that the Sima del Chikinibal was nearby.

The view from the edge of the sima was amazing, and we were very excited by the seven seconds that a thrown stone took to reach the bottom. We knew that we were looking down one of the last big pits that was still unexplored in Mexico.

When we returned to Nueva Cruz, the comisario was waiting for us. We gave him a letter from UNAM, but he told us that, before giving official permission to explore, he had to consult with the other ejidatarios. That afternoon, we met with the neighbors of Nueva Cruz, and we explained our plan. We were surprised that instead of objections, we found only a lot of curiosity, and at the end of the meeting a photo of them and us was taken, this being the beginning of a real

friendship. During the first rappel into Sima del Chikinibal, Javier is wearing protection against bees. *Leopoldo Rojano.*

friendship.

On March 12, we left Nueva Cruz about noon, and Don Abelardo and his *compadre* were hired to help us carry the equipment to the cave. We ran behind Don Abelardo for about an hour, and finally we arrived at the pit, which takes its name from the *chikinibes*, evergreen oaks, that grow everywhere there. The pit mouth is ringed with jungle, and our friends from Nueva Cruz made a foot-path around it. In the meantime, we rigged the drop from the lowest point. Javier had the honor of being the first to descend. In the early descents, we used protective veils, long clothes, and gloves, because we knew about the existence of Africanized bees in the area, and we did not want an attack like the ones that have been occurring on other long drops in Chiapas. The second one to try the drop was Polo, and he descended with the end of the tape to make the first real measurement, which proved to be 180 meters. After Soriano descended, he, Polo, and Javier set up a bivouac, while the others finished their rappels, and then they started to open up a trail across the bottom. By the time the complete crew was down, night had already fallen, and we agreed to leave the job of mapping the bottom for the next day. Since we had eaten nothing since early morning, dinner tasted delicious, but when we finished it the fatigue hit us, and we slept under the shadow of the opening, outlined by the starry sky.

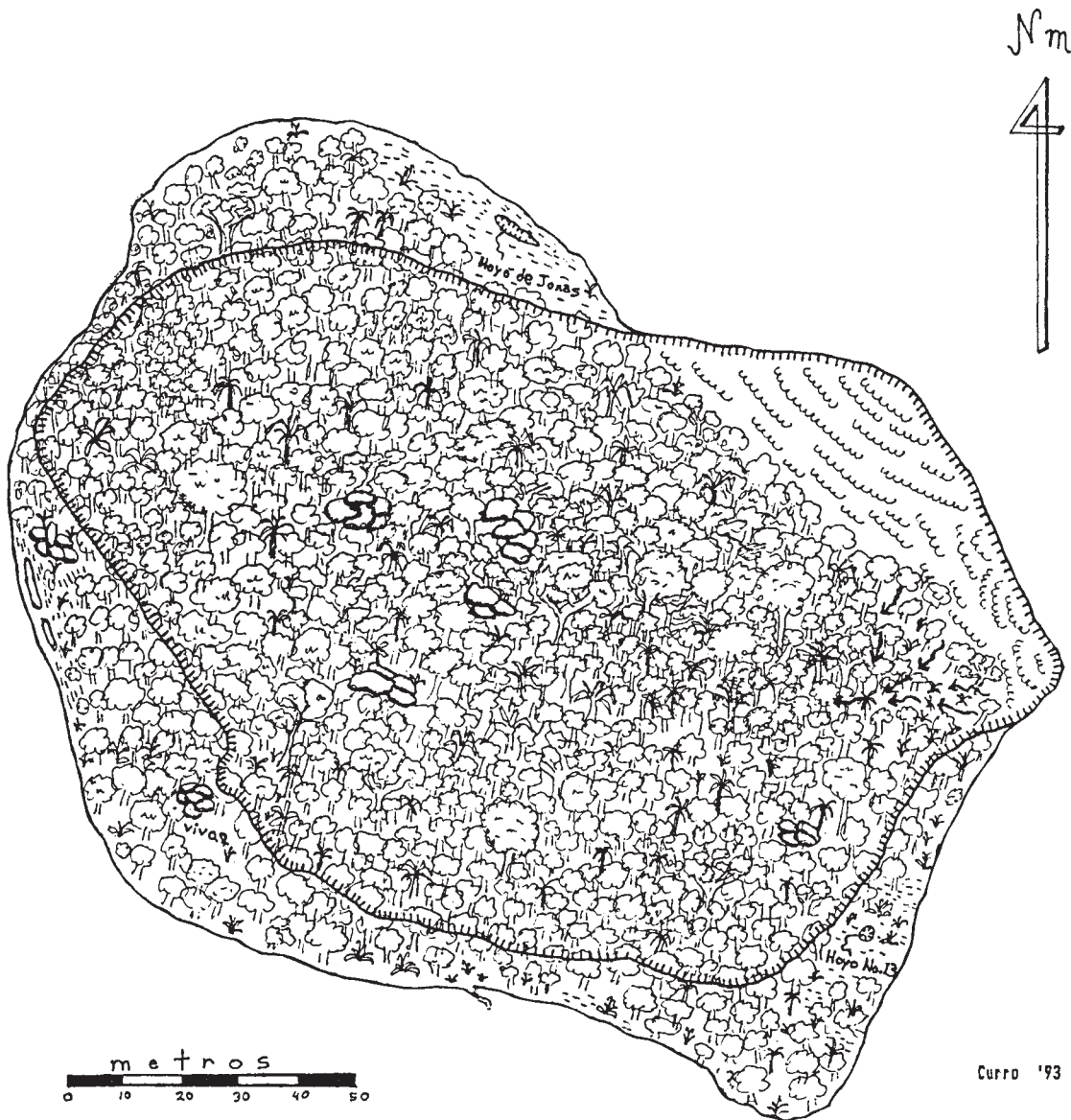
The thirteenth started with an uncomfortable rain, and the cold drove us out of our sleeping bags very early. After we ate a hot breakfast, we decided to split up into two teams. Javier, Polo, and Hatuey climbed up to measure the pit from the highest part, and

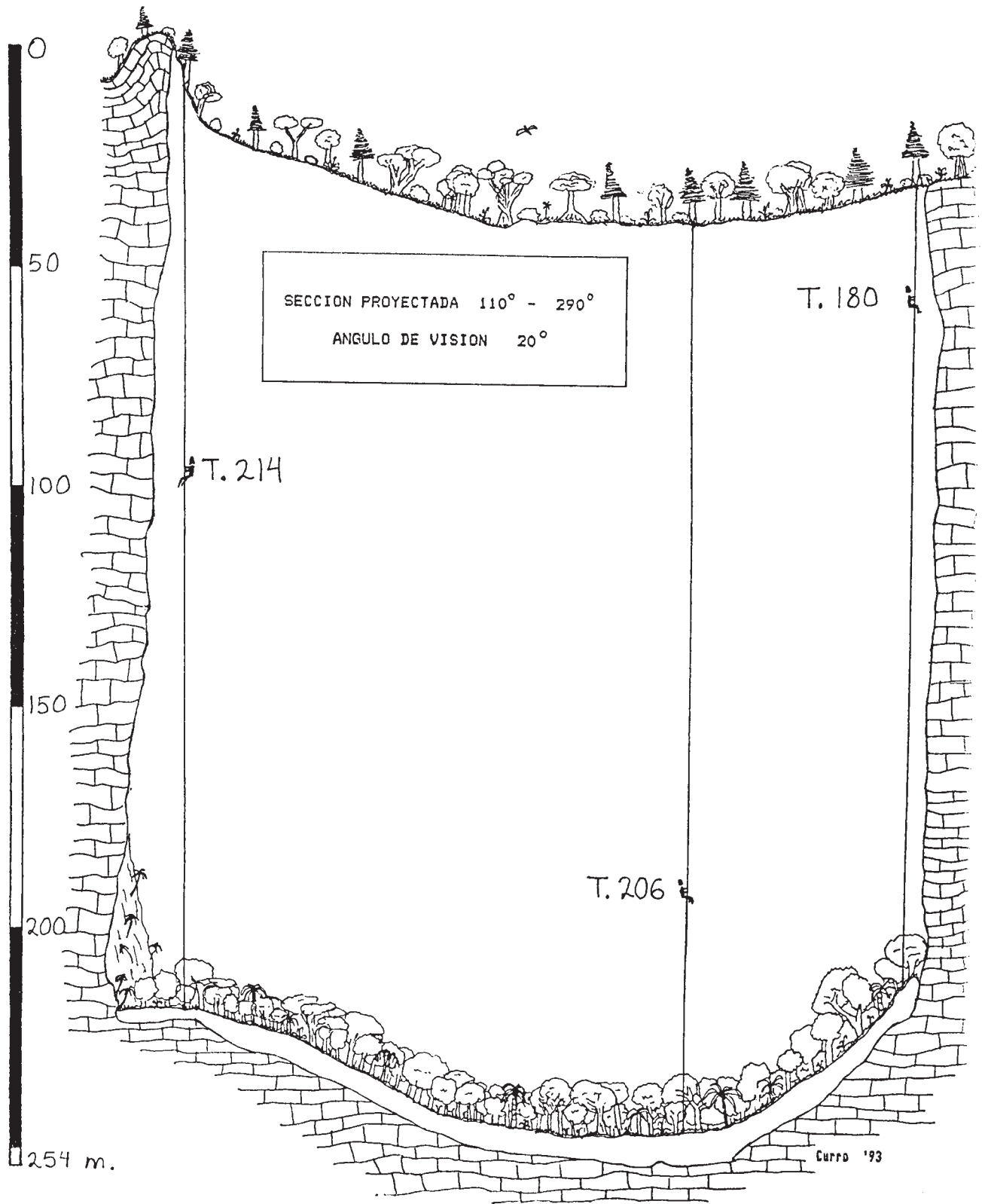
SIMA DEL CHIKINIBAL

Nueva Cruz, Mpo. de Independencia, Chis.

Topografiado con cintas y Brunton en Marzo de 1993 por:

C. Galicia L. N. Rojano F. Ruiz J. A. Soriano J. Vargas y H. Viveros





Claudia, Curro, and Soriano started to map the bottom, but their work was not easy, because in many places the jungle was very dense, and Soriano had to use a machete to pass through it. In contrast with the sub-alpine forest at the top, Chikinibal's floor has a tropical forest, probably a remnant of a more general forest during warmer times. Around noon, the top crew dropped the end of a tape, which was received by Claudia and Curro, who confirmed that the pit's depth is indeed over 200 meters, because the measurement gave 214 meters, which means that Sima del Chikinibal is the third-deepest pit in Chiapas, after Arroyo Grande and Don Juan, and the seventeenth in Mexico. We spent the rest of the day surveying the bottom, and we found three possible continuations of the cave, but the

weather outside was very bad, and we climbed up as soon as we finished surveying the diameter.

To us, a trip to Chiapas usually meant a hot, tropical experience, but March 14 was like a bad dream, and in honor of the cold, we spent the whole day in our sleeping bags. Fortunately, the next morning provided us with a delicious, warm, big sun that dried our clothes and revived our spirits. We left face team mapped the lip of the pit from the high side to the low one, and they measured the pit in a place that lands in a depression in the bottom, this time getting a depth of 206 meters. As soon as the inside team finished their exploration and climbed out of the pit, we derigged and returned to Nueva Cruz, where we spent a night before returning to Mexico City.

Excited by the great results of our first expedition to the municipio of Independencia, we are now planning another one, which will also include the ejidos of Nueva Virginia and San Antonio, where we know about another pit that looks like the Sima del Chikinibal. To avoid duplication of effort, we want to contact the group of French cavers who have been working at San Antonio and also, the people say, at Nueva Virginia, where they did not explore anything, because a bee attack forced them to end their expedition. That is all we know about the French team; it was collected by Angelica and Arturo when they visited Nueva Virginia and descended 50 meters without reaching the bottom of an open-air pit there.



Francisco Ruiz at the top of the pit. *Leopoldo Rojano.*

La Sima del Chikinibal

Este tiro de grandes dimensiones cerca del poblado de Comitán fue descendido y topografiado en marzo de 1993. El tiro más profundo es de 214 metros y la profundidad total de la cueva es de 254 metros.

THE TEPETLAXTLI SYSTEM, PUEBLA

Mauricio Tapie Vizuet

On August 7, 1992, I was invited on an exploration trip to the Sierra Negra in the state of Puebla by Ricardo Arias Fernández, president of the Grupo de Espeleología del Instituto Politécnico Nacional, an avid caver and a very good friend. At about 10:00 A.M., Gilberto Pantaleón, José (Pepe) Guerrero, Ricardo Arias, his wife Margarita Maldonado, and I boarded the bus in Mexico City, bound for Tezonapa. Early the following morning, we found ourselves on the unpaved road leading directly to Tlacotepec de Díaz, Puebla.

When we arrived in the town, we talked with the presidente of the municipio, who gave us a document to help us avoid problems with the village of La Cumbre. The people in that area were unhappy about a group of foreigners who, they maintained, had looted some caves, and they would likely expect us to do the same. Due to an intense rain that began just as we were preparing to climb up to La Cumbre, we had no choice but to stay and spend the night in Tlacotepec de Díaz.

On Sunday, August 9, we arrived at La Cumbre, talked with the village authorities, and left some clothing and toys for the community. Since it had again started to rain, we spent the night in La Cumbre. It wasn't until August 10 that the sun at last came out, and the morning was beautiful. We left La Cumbre and headed off on our way to the sótanos. After walking about half an hour, we reached an enormous fracture that becomes a large *cañada* approximately 900 meters long and 300 meters wide, located 1.5 kilometers east of La Cumbre along the road to Ojo de Agua. We set up

base camp on the surface a few meters from the Ojo de Agua road.

On Tuesday, August 11, we began the work of opening a path with machetes and locating the most suitable route for descending the sótanos. Each of us took his personal caving gear and approximately 100 meters of rope. Meanwhile, Margarita stayed alone in base camp, awaiting our return. All that day we spent opening a path, and the sink began to incline very steeply, so that we had to use rope to descend 40 meters into the sink, and even then there was no actual pit in sight. So we decided to return to base camp, since rain was again keeping us company, as was becoming customary.

On Wednesday, we decided to divide into two groups. Ricardo Arias, Margarita Maldonado, and José Guerrero would try to reach the edge of one of the pits by following a very steep and apparently direct slope down into the great *cañada*. Meanwhile, Gilberto Pantaleón and I would carry a 300-meter rope around the ravine, with the intent to descend along the high part of the sink, which appeared to lead directly to a pit. Nevertheless, at mid-day both groups found themselves at the edge of a sótano with an entrance drop of 30 meters. We hadn't yet found either of the two deep pits, and this new sótano had no great vertical extent. It was located right on the western edge of the large ravine. We later named it Sótano Tepetlaxtli No. 3.

While Ricardo and Pepe explored this pit and Margarita waited there at the edge as support, Gilberto and I decided to open an adequate path to the large pits, and we set out again uphill, with Don Fidel Mendoza as a guide. We soon reached the Ojo de Agua road, then walked some 400 meters along it, to where we again

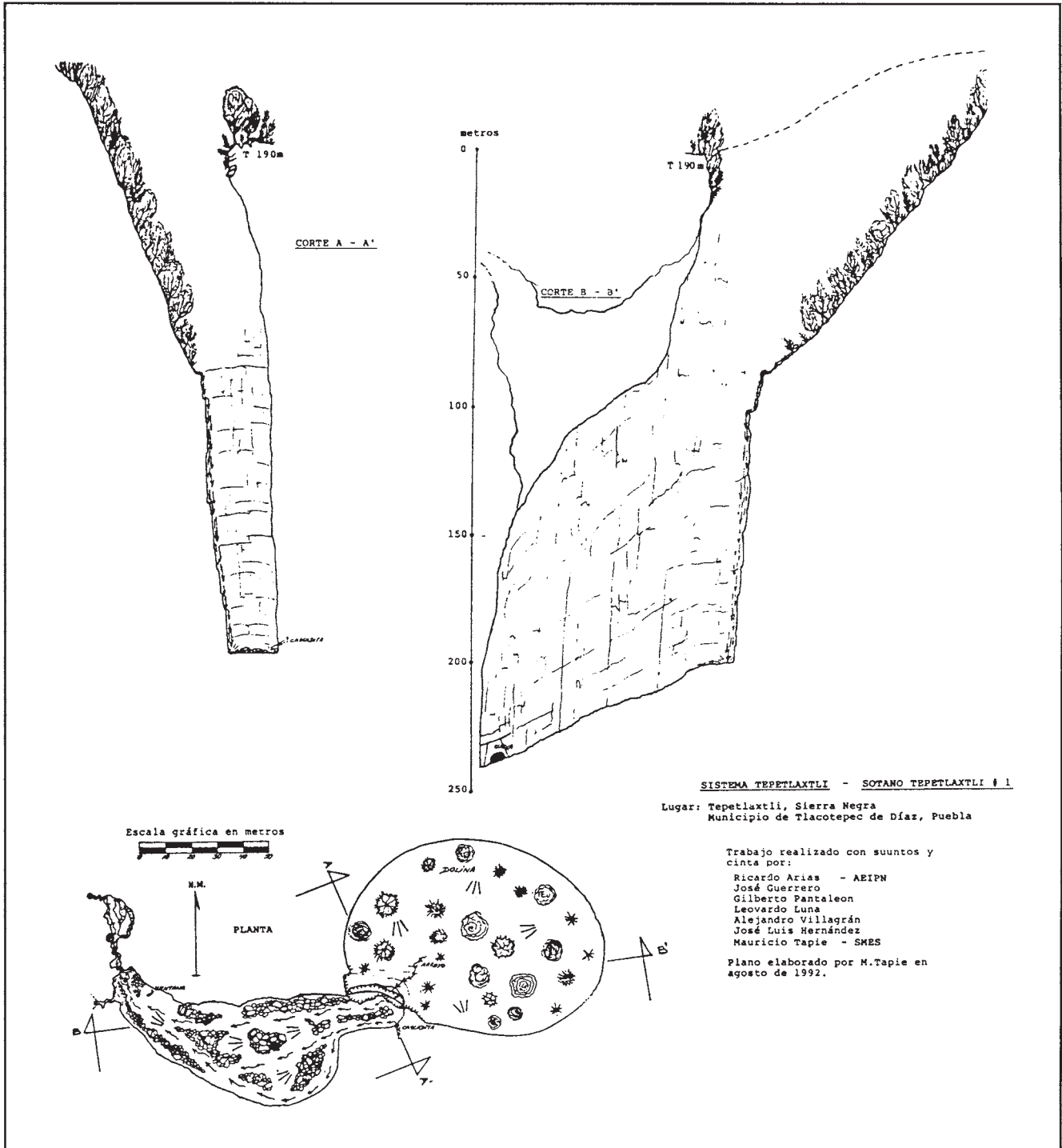
descended into the large sink. Chopping a trail with machetes again, about 150 meters down into the sink we came upon a large drop. We later called this pit Sótano Tepetlaxtli No. 1. We continued down the sink and found Sótano de los Dos Troncos, which we saw was a skylight through which the bottom of the first drop in Sótano Tepetlaxtli No. 1 can be accessed.

About 50 meters further along, we found ourselves in the deepest part of the sink and at the edge of an entrance 15 meters in diameter. Facing us was a wall of limestone that continued into the depths of a sótano, Sótano Tepetlaxtli No. 2. Several cracks and another cave, which probably connects to Sótano Tepetlaxtli No. 3, were also noted. On the way back to camp, Don Fidel showed us a very small sótano, which he assured us had been 30 meters deep before it had been filled up.

When we had climbed out of the sink and reached the Ojo de Agua road, we circled around the large ravine to retrieve the rope, which we had left in the care of Don Moises Rojas at his house. On the way, we met Ricardo, José, and Margarita, who had completed exploration of Sótano Tepetlaxtli No. 3. That evening in camp, we enjoyed an excellent dinner and discussed the day's events. We shortly had to take shelter in the tents, however, since the usual downpour was falling again.

On Thursday, August 13, we again divided into two groups. Ricardo and Pepe would explore Sótano Tepetlaxtli No. 1, and Gilberto Pantaleón and I would go to the bottom of the sink to explore number 2. At about 10:30 A.M., Gilberto and I left our friends at the edge of number 1,

Translated from Spanish by Gary Napper.

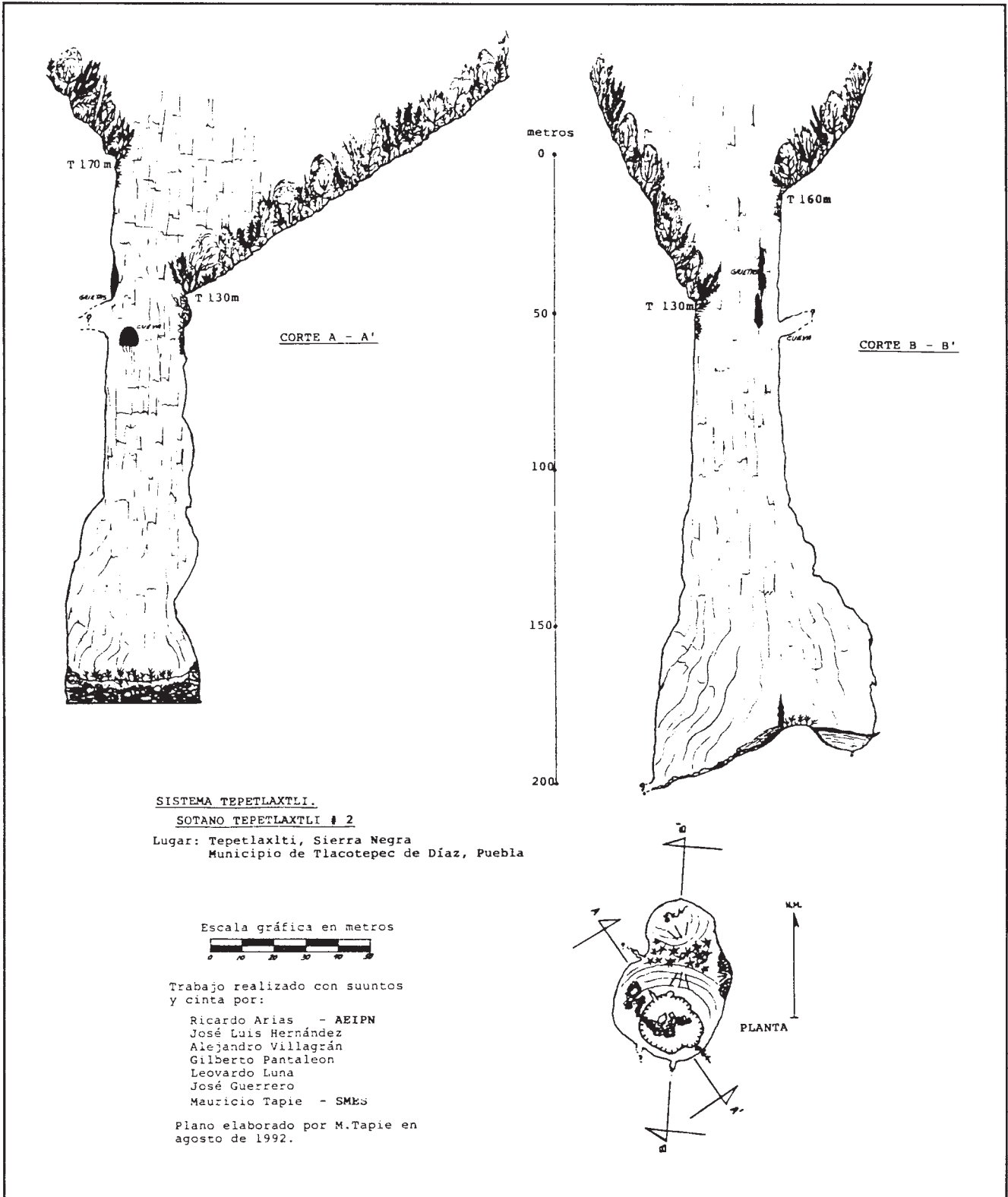


made our way to the deepest part of the sink, and soon found ourselves at the edge of the pit. We quickly prepared to descend the great abyss, and after finding tie-offs back in the trees to keep from sliding into the pit, I found myself at the edge.

The bottom wasn't visible because of the mist that forms inside the pit. I continued my descent, machete in hand, removing moss and small plants

that kept me from seeing if the rope was rubbing on any sharp, rocky protrusions or if any of the rocks were on the verge of falling. Fifteen meters below the lip, while hanging on the rope, I placed a bolt and continued my descent. I put on another pair of brake bars and soon passed through the cloud of fog, but I had to stop my descent and climb back up a few meters, since I'd noticed a dangerous

block about 70 centimeters in diameter that was threatening to fall. At this point, I was about 70 meters above the floor, which was now visible. I had to use all the strength in my arms and push with both my legs against the wall in order to move that heavy rock. When it came loose, I pendulumed a few meters out into the pit from the force I'd used to dislodge it, and I heard a tremendous crash as it

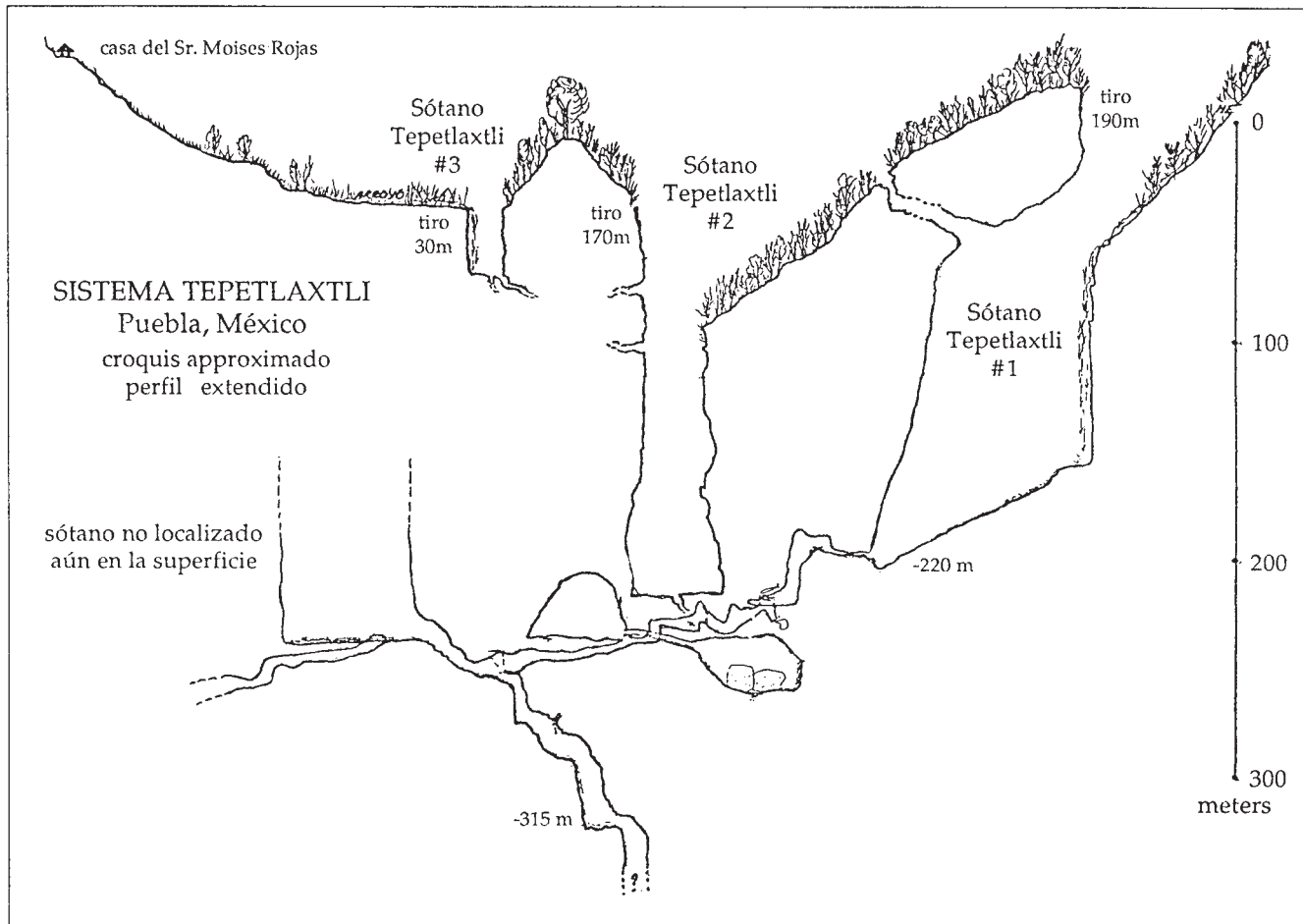


hit the bottom. After that, I reached the bottom with no great problems. It is a special emotion one feels when he is the first human being to reach the bottom of a great unexplored abyss.

Gilberto finished his rappel soon

afterwards, and we both worked on mapping the pit. At 2:00 P.M. it began to rain, and two waterfalls formed, one just to each side of where the rope was rigged. On our ascent, we would be in the water for the first 50 meters.

After taking a few photos, Gilberto started his climb, as we had no equipment for a bivouac. On the surface, we decided to leave the line rigged and return the following day to continue the exploration, since the main



descending passage located on the bottom of the sótano was still unexplored. There was also an ascending chimney that might lead to passages. The drop on the low side of this beautiful pit is 130 meters, and on its high side the drop measures 170 meters.

We climbed up the steep sink to camp. The rain had made the trail muddy and slippery. Pepe and Ricardo told us that they had placed a bolt in Sótano Tepetlaxtli No. 1, but hadn't done the drop. They estimated the drop at 250 meters.

Friday, we again split into two groups. Pepe and Ricardo would finish rigging Sótano Tepetlaxtli No. 1, while Gilbert and I would retrieve the rope from Sótano Tepetlaxtli No. 2 and then try to join the other party as soon as possible, so we could all explore number 1 together. At about noon, Gilberto and I finished derigging number 2, and soon thereafter Pepe and Ricardo found us. They had placed another bolt, and the rope was rigged and ready in number 1. Never-

theless, they still hadn't descended the pit, and so didn't know its exact depth. It began to rain again, and we decided to all return together to base camp and to explore the pit the next day.

On Saturday, after a good breakfast, we all arrived together at the edge of Sótano de Tepetlaxtli No. 1. Only Margarita stayed above in the base camp, acting as a support team. I again led the descent, and I quickly crossed two rebelayes that Ricardo and Pepe had rigged to bolts in the first five meters of the drop. From that point, the view is beautiful, since the drop is completely free, though the bottom is not easily visible. As I mentioned before, a very special sensation arises when one descends a virgin pit of such magnitude. On the one hand, there is the feeling of uncertainty from being unable to see the bottom with any clarity, and there is also the feeling of being privileged, knowing that one is the first to touch

the bottoms of these colossal drops. This pit, whose depth we had originally estimated to be 250 meters, actually measured 190 meters, and it surely takes its place on the list of the great vertical drops of Mexico.

The bottom is a large breakdown slope descending from east to west in a great room 25 meters wide by 80 meters long. While Pepe started his rappel, I took a few minutes to shoot a few photographs. At the bottom of the great room, however, I noticed a large dark area, as if the emptiness were inviting me toward a second deep drop. I didn't resist the invitation and quickly entered the shadows. Instead of a vertical drop, I entered a horizontal passage that drains all the water flowing through the breakdown slope and falling from the surface. I followed the downward course of the water and soon was faced with the unpleasant surprise of a sump in a small passage. I promptly returned to the large room, just as Pepe finished his rappel. We mapped



The bottom of Sótano Tepetlaxtli No. 1.
Mauricio Tapie.

the cave, and I took a few photos. At the bottom of the room's south wall, a small fossil passage led to a drop of about 15 meters, which we didn't descend.

It began to rain, and we decided to return quickly to the surface, since Ricardo and Gilberto were awaiting us there and might be worried about us. Pepe started the climb. Because of the great roar of the water, I'd be

unable to hear him when he got off rope, so we calculated that at most he'd need an hour to finish the climb. Thus we agreed that I'd start to climb at 6:00 P.M. But a half-hour later the falling water had become such a massive cascade that it covered practically all the northeast wall of the pit.

Even so, I decided to climb, and I must confess that the first 40 meters were torture, since I was directly under the waterfall. A little further up, though, I could pendulum and occasionally avoid the torrent of water. About 80 meters from the floor, I reached the level where the water volume was reduced enough that I could stop my desperate ascent, and I rested hanging on the rope, watching that fantastic panorama. The bottom

was invisible due to spray and fog emerging from the depths, which joined the steam rising from my body. I should mention the great spirit of companionship Ricardo and Gilberto showed by waiting for us to emerge at the edge of the pit, with nowhere to take shelter from such a storm. In spite of the nearby base camp, they didn't retreat to it, but preferred to be sure that we were safe. That night, in

spite of the continuing rain, we feasted with a good dinner and talked over our successful exploration.

On Sunday, August 16, Ricardo, Margarita, and Gilberto left and began to make their way down the mountain toward Tlacotepec de Díaz. We parted with a firm embrace and a promise that we'd soon continue our exploration of the beautiful Tepetlaxtli System. At noon, José Luis Hernández, Leobardo Luna, and Alejandro Villagrán arrived from La Cumbre. They're all cavers from the I.P.N. Speleology Group, good friends and enthusiastic cavers with whom I'd previously spent time during our exploration of the 329-meter Petit Québec pit in Sótano de Alhuastle. Unfortunately, I had to return to work in Mexico City. I went down by way of Zacatilihuic, without passing through La Cumbre.

The second group's explorations focused on Sótano Tepetlaxtli No. 1 and achieved good results. They descended the drop, measured at 17 meters, where we had stopped and continued on to a depth of 315 meters, at the edge of a drop about 50 meters deep. They also connected to the bottom of an unexplored sótano, the entrance to which has not yet been located on the surface. It's likely that Sótano Tepetlaxtli No. 2 also connects with the system, which would connect three great sótanos with vertical drops of more than 150 meters, and there is a possibility that the system could reach great depths.

El Sistema Tepetlaxtli, Puebla

Cerca del poblado de La Cumbre se encuentra una dolina, la cual contiene dos tiros profundos: Sótano de Tepetlaxtli 1 y 2. Tepetlaxtli 1 tiene un tiro de 190 metros y la cueva continua hasta una profundidad de 315 metros hasta un tiro de aproximadamente 50 metros. Tepetlaxtli 2 tiene un tiro de entrada de 170 metros.

THE UNDERWATER CAVES OF QUINTANA ROO

James G. Coke IV

In the past nine years, over thirty independent underwater cave systems have been cataloged on the mainland of the state of Quintana Roo. Despite a total of more than 67 kilometers of surveyed passage, this catalog is clearly not complete. Today's investigations are constrained by the state's limited road network, which barely touches hundreds of square kilometers of trackless jungle. Therefore all of the current cave sites are located within 12 kilometers of the Caribbean coast. Their development at the interface between fresh and salt water has provided interesting mapping and biological and archaeological studies.

One is obliged to mention also the underwater caves that are being explored on the island of Cozumel. On its western coast, both Cueva Aerialito and Cueva Quebrada have a major "ojo de agua" entrance on the ocean, each of which is linked to numerous island cenotes. Quebrada is currently the longest of the two, containing over 9 kilometers of cave passage. Both caves contain significant archaeological and biological finds. But the vast majority of the underwater caves of Quintana Roo are on the mainland.

Most of the caves in the table have more than one cenote or karst window entrance. Sistema Naranjal leads the group, with nine connected cenotes. In all, well over forty different cave entrances are represented in the list.

Two different techniques are utilized when surveying underwater

caves. Both processes rely on a fixed guideline in the cave, while each has its own advantages and handicaps. In selecting the method to be used, the survey team is constrained by the project's desired degree of accuracy, the team's level of surveying proficiency, and, most importantly, the team's ability to operate safely in various underwater cave environments.

The most expeditious approach is the grade-3 knotted line survey. During the normal survey process, both azimuth and depth are recorded by ordinary diving instruments. Depth changes between underwater stations can be noted directly; this is equivalent to the information gotten with the clinometer in surveys of dry caves. The distance information is estimated by counting knots put in the guideline before it was installed, together with an estimate of the additional distance to the nearest knots. This method can give distances accurate

to about 10 percent. The advantage of this style of surveying is that one caver can gather all of the basic survey data in a relatively short period of time.

The grade-4 survey is achieved by using a depth computer, a Suunto side-reading compass, and a fiberglass tape. While a lot more precise, two cavers with a carefully defined set of signals and tasks are needed for this practice. It is also three times slower than the grade-3 survey. In many instances, both grades are used during a cave survey. A survey may begin using grade-4 techniques, but as exploration progresses further into the cave, the amount of available time for surveying decreases. The survey may then change to the faster grade-3 methods. Underwater surveying is conditional on the amount of air available, always reserving enough air for a safe exit.

As a result of these methods, both



The skeleton in Sistema Naranjal. *Jim Coke.*

Current Lengths
Underwater Caves of Mainland Quintana Roo, Mexico
James G. Coke, 17 June 1993

cave name	feet	meters
Nohoch Nah Chich	67000	20400
Sistema Naranjal	59891	18255
* Mayan Blue	40856	12453
Sistema Ojos	30965	9438
* Naharon	19035	5802
* Dos Ojos	18675	5692
Sac Actun	16002	4877
Zapoté	15105	4604
Carwash	9430	2874
Esqueleto	9326	2843
Sistema Pondazul	7507	2288
* Dos Palmas	7467	2276
* Tic-Te-Ha	4823	1470
Vaca-Ha	2137	651
Balancanché	1593	486
Paradise Bay	1045	319
Calica	850	259
El Garceno	652	199
Ucil	200	60
Laguna Abejas	200	60
Tankah	?	?
Cenote Abejas	?	?
 total survey (42.06 miles)	 222098	 67696

* Naharon and Mayan Blue are parts of Sistema Naranjal. Dos Ojos, Dos Palmas, and Tic-Te-Ha are parts of Sistema Ojos. Their lengths are included in the lengths of the systems and have not been individually added to the total.

Nohoch Nah Chich and Sistema Naranjal have grown to be two of the longest underwater cave systems in the world. Nohoch has been the focus of organized exploration camps during the past three years. Since its average depth is only 9 meters, long trips are possible without decompression. Fielding as many as five survey teams in a day, these camps have accelerated the explosive growth in the known length of the cave. Naranjal is another giant labyrinth of interconnected underwater tunnels. It has an average depth of 18 meters, and it would be possible to explore every passage in Sistema Naranjal without passing through any of its cenote entrances. During a recent survey trip, a human skeleton was discovered deep within this cave. Indications are that this presumed paleo-Indian walked into the cave in search of fresh water. His remains lay undisturbed in a distorted fetal position; perhaps he was unaware of the concept of redundant torches. A radiocarbon date from charcoal taken from the same depth as the skeleton suggests that the submerged caves of Quintana Roo may have been dry about 9500 years ago.

With such a wealth of discoveries already made, what will the future hold? With time and persistence, we may begin to grasp in their entirety the marvelous caves that lay within the region's limestone.

Los Cenotes de Quintana Roo

Más de treinta cenotes han sido explorados y topografiados en el estado de Quintana Roo, con una longitud total de 67 kilometros. Los cenotes han sido medidos con las líneas de seguridad usadas por los buceadores, algunos topos han sido hechos con brújula, y la distancia medida con los nudos de las líneas guías. La profundidad se ha medido directamente con el marcador de profundidad para buceo.



THE INFIERNILLO SUMP REVISITED

Bill Stone

Had someone told me a year ago that I would find myself at the bottom of Sistema Purificación in the spring of 1993, as opposed to the bottom of Sótano de San Agustín, I would have given good odds against that happening. We were, as everyone knew, supposed to be going to San Agustín. Soon. Any year now. Nonetheless, May 14, 1993, found a small, gritty, and quite unusual group of individuals inhabiting the expanse of Camp I in Cueva Infiernillo. This story is about how that gritty group came to be at Infiernillo in the spring of 1993, instead of Sótano de San Agustín, and what they did there.

The story began in 1981. In April of that year, a diving effort was conducted at the bottom of Sótano de San Agustín, the primary entrance to Sistema Huautla, in an effort to extend exploration beyond the terminal sump discovered in 1977. Special high-pressure, light-weight composite Scuba tanks were used for the first time on that project, which took six weeks' effort, involved a ten-day underground push based from Camp III, and brought about the splintering of the Huautla Project. All those differences have since been resolved, as time erased the memories of what the differences were in the first place, but I vaguely recall that at least some of it had to do with "hauling tanks." Nonetheless, the San Agustín Sump was ultimately explored to a depth of 28 meters at 285 meters from dive base, where a large underwater gallery was discovered that led both up and down stream. Few people are aware that, by a substantial blunder made in poor visibility, the final 100 meters of guideline were laid not towards the springs, but upstream towards the Sótano del Río Iglesia. The deepest point in

Sistema Huautla, at -1353 meters, is marked by the end of that dive line. Further diving efforts were determined to be logistically impossible owing to the restlessness of the sherpas and the impending arrival of the rainy season. However, during the same expedition the fossil resurgence at the Peña Colorada was discovered, opening a possible avenue for continued exploration of the base-level cave.

In 1984, a four-month expedition was fielded to the Peña Colorada with the objective of reaching the far side of the San Agustín Sump, 10 kilometers distant, from below. A successful link between the two would result in a cave system with a surveyed depth of 1639 meters, not counting the depth that might be added in the final sump leading to the exit, dye traced by Jim Smith in 1988, and now known simply as the Huautla Resurgence. Explorers from the United States, Great Britain, and Mexico joined the team, and in 1983 they spent nearly a month training for the expedition. Shortly before the departure for Mexico in the spring of 1984, a conversation between Bob Jefferys, co-leader of the expedition, and Mark Minton took place in Austin, Texas. Jefferys had offhandedly asked Minton what he thought the chances of success were for a connection with San Agustín. Without hesitation, Minton replied, "Zero!" Such pessimism was, of course, the stuff that fuels madmen to do the impossible. This time, unfortunately, it was proven correct.

Extensive cave diving was involved at the Peña Colorada, in addition to more than 500 meters of rope work. Siege logistics, involving the use of seventy-two of the experimental composite tanks, allowed the team to reach a point 4 kilometers from the entrance. More than 25 percent of that dis-

tance was through passageways totally underwater, in seven distinct sumps. The team spent twenty-three days based in two underground camps situated beyond these flooded tunnels. Ultimately, progress was stopped, as it had been on the 1981 expedition, by the inherent inefficiency of the diving apparatus, where precious gas was exhaled into the water with each breath.

Following that expedition there commenced what was to become a ten-year odyssey into the complex world of closed-cycle life-support systems in an effort to develop cave-diving backpacks that would enable the final exploration of the Huautla "main drain." Closed-cycle life support means that no gas leaves the system that is composed of the human user and a machine meant to keep the user alive. It can be demonstrated that such a system, at a depth of 100 meters underwater, is more than fifty times as efficient, pound for pound, as the high-performance diving apparatus used in Huautla in 1981 and 1984. How does it do that? (Or as Bill Steele would say, "How dey do dat?"). When a person inhales, only a small fraction of the available oxygen is actually metabolized. The rest is exhaled into the atmosphere or, in ordinary diving apparatus, into the water as a column of bubbles. In a closed-cycle system, the gas is exhaled into a portable processing plant that removes the carbon dioxide and measures the concentration of the remaining oxygen. If the oxygen level falls too low, an onboard control system injects a small amount of pure oxygen, in an attempt to maintain a specified concentration. The gas is then made available to the user for breathing over and over again, until

the oxygen supply, carried in a tiny tank in the backpack, is exhausted.

The real power becomes apparent when one begins to calculate the logistics for operations at such places as San Agustín and the Peña Colorada. Four kilograms of recharge material, including pure oxygen and carbon dioxide absorbent, equals eight hours of continuous diving, independent of depth. Translation: You can eliminate compressors from the logistics loop and move a diving team into a multi-ump system in alpine style. Of course, all of the above is theoretical. Actually constructing such a system that is safe for cave diving is another matter altogether.

Initially we approached the Department of Defense contractor who manufactured the Mark 16 rebreather for the Navy Seals. They were not interested in cave diving. Neither was NASA. But there were some useful concepts embodied in the Mark 16 and the Shuttle spacesuit. There were also features that were unacceptable in a cave diving environment, such as a lack of redundancy. In other words, complete failure of either system would ensue if the wrong part failed catastrophically.

Three years later, we were at Wakulla Springs in northern Florida with a prototype cave-diving rebreather that came to be known as the MK-1, although some called it FRED, for Failsafe Rebreather for Exploration Diving. Now FRED was a tad on the heavy side, weighing in at 93 kilograms, and a tad on the bulky side—about the size of your kitchen table—well maybe not quite that big, but big enough. In all fairness, though, it was an experimental platform that allowed us to learn about rebreathers in the most direct fashion. What worked worked, and what did not sent you scrambling for a bailout regulator. And there was plenty that didn't work, including the four onboard microprocessors, which refused to acquire sensor data. It was not uncommon to see someone test-diving the MK-1 while someone else followed closely behind with a set of wrenches, tightening the myriad fittings that made up its pneumatic arteries. Once it was properly tuned, no bubbles escaped. This gave the safety divers the willies, since they were never sure whether

the test diver was simply very good at breath holding or was dead and having peculiar postmortem muscular twitches that vaguely resembled swimming.

But FRED did have one thing. That sucker had range. On December 3 and 4, 1987, an individual using it spent twenty-four hours continuously underwater. When the unit was examined following that dive, it was found that less than half of the consumables had been used up. While we were engrossed in trying to coax FRED into doing things it clearly wasn't about to do, others on the team scooped 3.3 kilometers of underwater tunnels at Wakulla.

By the fall of 1989, two years later, the second generation system, the MK-2, was ready for testing in north Florida. This unit weighed 48 kilograms, and, although it was initially billed as a twelve-hour system, we never were able to get much more than eight out of it. Certain architectural aspects were similar to the MK-1, but it was radically different in almost all other respects, particularly from a functional engineering standpoint. The counterlungs, flexible breathing bags into which the expelled gas is collected underwater, were moved from the back of the rig to a compact jacket worn by the diver, which also included a buoyancy compensator. This dramatically reduced the breathing effort at all swimming attitudes. It had a head-up display, or HUD, for conveying critical information to the diver directly through the mask, so he never had to look at a standard alphanumeric display, although one was included as a backup. And it had six onboard computers, which also didn't work—well, not until the summer of 1990.

One of the problems that arose from having so many computers, displays, and sensors involved was that there were a lot of electrical cables running around. In the MK-1 we had used thick, industrial quick-connect cables that weighed about 2 kilograms each and were, from a logistics point of view, self-defeating. So we found a source of miniature underwater connectors that would allow us, at any time, to connect any electrical subsystem to another. We thought

this was rather clever, since in a pinch on the far side of a sump a trained user could reconfigure the system in the event that some component went offline or a cable was somehow cut. In practice this proved to be a near-fatal design flaw. In late November of 1989, at Jackson Blue Spring, Brad Pecel was conducting an after-dark kitup to simulate sump diving. Some twenty minutes later he and his safety diver were down at the 12-meter level in the entrance tunnel of the cave, some 80 meters in. There, without warning, Pecel suffered an oxygen convulsion and blacked out. The safety diver, as had been rehearsed, placed a regulator in Pecel's mouth and towed him out. Although he fully recovered from the incident, it shook the confidence of the team in the rig, and the return to San Agustín, then optimistically scheduled for the spring of 1990, was postponed until 1991.

What happened to Pecel could only have occurred in a unit such as the MK-2, which is to say, a fully redundant system in which there are two of everything. That evening, while checking connections, Pecel mistakenly plugged his oxygen partial-pressure display into the wrong system, the one he was not using. When this display read low during his descent into the cave, he used the manual override system to add more oxygen. Ultimately the oxygen content in the breathing loop went toxic and induced the convulsion.

Another two years went by while we tackled the problems of system reliability. Ultimately we developed our own electrical connectors that met the robustness and simplicity needs of a cave diving rig and eliminated the possibility of a future incident such as experienced by Pecel. Fully 50 percent of the mechanical components in the system were redesigned for range enhancement and weight reduction. The range was nearly doubled, to 16 hours, by using CAD optimization on the gas processor, while the weight was reduced to 44 kilograms. The real changes, however, occurred when we expanded the engineering team to include three more experts in semiconductor technology. The electronics control and advisory system was reduced in size

by a factor of four by going to a full surface-mount device architecture. The number of components was subsequently reduced, and the reliability increased dramatically. In December of 1991, the new unit, the MK-3, was tested by several members of the team and deemed to be ready for replication. While machine shops and subcontractors worked steadily for the next three months building components for nine rebreather core modules, plans were laid to conduct a two-month training exercise in the spring of 1992 and to carry out the expedition to San Agustín in the spring of 1993.

The 1992 exercise began slowly, with nearly two weeks of full-time work by eight team members just to assemble the rigs. But this had been by design, since everyone knew that when the time came and the chips were down and you were alone beyond some god-forsaken sump inside the heart of the Huautla Plateau, there was only one person who was going to fix the rig. Therefore, everyone had to know it by rote. And there was no better way to do that than by assembling it from scratch and making it work. And they all did. By mid-March 1992 the operation was moved to New York City at the North American Hyperbaric Research Center, run by International Underwater Contrac-

tors. There, with the hospitality of Andre Galerne, president of IUC, and Glen Butler, who graciously offered to operate the complex for a solid week gratis, we began to put the rigs and the team through the first serious tests. The advantage of using a hyperbaric chamber lay in the fact that we could push the limits of the system—for example uncontrolled descents and ascents, and pushes to extreme depth (80 meters) with several gas mixtures—undercontrolled, dry conditions where a safety attendant could help you out and the worst thing that could happen would be to have to ditch the mouthpiece and inhale cabin atmosphere at a simulated depth of 80 meters. Which, if you had been breathing helium-oxygen, would have given you a hell of a buzz, since the cabin was pressurized with air. In actual practice it made no difference, since everyone, despite instructions from Butler to make the switch to heliox at 50 meters, stoked their rigs with nitrogen to enhance the buzz. When Butler refused at one point to take the chamber below 80 meters, Rob Parker busily wrote a message on a tablet with a felt tip marker and then held it up to the view port. It read, "What, mate, no more depth?"

We did, of course, find a few problems with each rig, and it was not uncommon during the course of that

week to find pairs of individuals up at late hours with electronic test instruments checking wiring, computer boards, sensors, and connectors. All were, by this time, unabashedly aggressive in tearing the rigs down and putting them back together. By late March we moved the operation to Jackson Blue Springs again, where we would spend the next month. During that time four divers, Jim Brown, Noel Sloan, Rolf Adams, and I, spent enough underwater time on the rigs to be comfortable on solo 300-meter-penetration dives into the spring at 30-meter water depths. The British contingent, Ian Rolland and Rob Parker, had time restrictions and left shortly after reaching Florida.

When the expedition wrapped up on April 19, Sloan indicated to me that he felt the odds were slim for conducting the San Agustín operation in 1993. There was too large a variation in the number of hours logged on the rigs by the various team members, he explained. That same day, with two hours to spare before being taken to the airport to catch a plane back to Australia, Rolf died at Hole in the Wall spring while trying to pack in one final tourist dive. He was using classical Florida cave diving equipment, since our safety rules restricted the rebreathers to use at Blue Spring, where the water was clear, there was no silt, and you had the benefit of a strong current to get your butt out in the event of a problem. Hole in the Wall was more committing, with no flow and serious silt. This incident has been reported in detail in the cave diving journals and need not be dwelled on here, save to say that its impact on the team was profound, though perhaps not as much as it would have been had he been on a rebreather. What it did underscore was the alternative that weighs upon your mind each and every time you put on that gear and go underwater with rock over your head: do it right, or die. I had plenty of time to ponder that while flying to Sydney to deliver Rolf's eulogy in May.

Sheck Exley diving in Wakulla Spring, Florida, with the MK-1 rebreather. *Bill Stone.*



Following the completion of the 1992 training exercise, it was clear that we had to expand the core team of rebreather-certified cave divers. Furthermore, several key members of the original team had not been able to log the needed underwater hours on the rigs, and so plans were made to begin a search for additional personnel and to return to Jackson Blue Spring in April of 1993 for a final two-month training mission.

Between June and December of 1992, we received requests from numerous individuals wanting to participate in the expedition. From that list of volunteers, five candidates had sufficient background experience and commitment to join the team. Steve Porter, an engineer with the Minnesota Department of Transportation and a cave diver with ten years experience, set aside five months in the spring of 1993 to participate in the Cueva Cheve expedition in Mexico to gain vertical caving experience and then join the San Agustín team in Florida. Barbara am Ende, a marine geochemist finishing her PhD at the University of North Carolina and a nineteen-year veteran cave explorer, followed a similar path. Tom Morris, chief biologist for the 1987 Wakulla Springs Project, Kenny Broad, a PhD student in anthropology with extensive cave diving experience, and Bill Farr also joined the team as rebreather divers. These five and the original seven, Rob Parker, Ian Rolland, Sergio Zambrano, Angel Soto, Jim Brown, Noel Sloan, and I, plus cinematographers Leo and Mandy Dickinson, completed the new core team of fourteen.

Extensive data had been recorded following each dive in the spring of 1992, and from these logs a ten-page list of suggested "fixes" was produced. Software and hardware upgrades in response to these requests were completed in March of 1993, thanks to countless hours of work by the engineering team and generous grants from Rolex U.S.A. and private philanthropists. The new rig, the MK-4, represented a 30-percent change in the mechanical appearance of the system and a complete rewrite of the sixteen thousand lines of onboard code.

By April 4, 1993, base camp was operational at Jackson Blue Spring near Marianna, Florida. Florida Public Utilities again had graciously offered to host the team for the month of April. Nine core modules for the new rebreather system, the MK-4, were assembled on site; six of these were used to construct four single and one twin (redundant) rebreather backpacks. The concept of reconfiguring a rebreather from basic building blocks was one considered critical to the success of the San Agustín expedition. By the end of April, this concept was taken to the level where a rig could be broken down into components, transported to a suspended platform over the spring that was identical to the light-weight system that will be used on the expedition, reassembled, used for an actual mission into the spring, and then broken down and transported back to base camp. The principle was that no load would be greater than 15 kilograms, a reasonable amount to carry in a backpack while doing vertical work.

Using the modular nature of the MK-4, Rolland and Porter assembled a compact single-rebreather backpack with dual gas supplies to provide redundancy in these critical areas. This design proved extremely reliable, and during the course of the next month it was determined that a safe exploration radius for the device was one kilometer (two kilometers round trip) at 30-meter water depth. Dozens of dives at this range limit were conducted during April. The simplicity of this design was such that a single individual could prepare, don, and dive the rig without any assistance. Its safe range, however, was controlled by the amount of open circuit "bail-out" gas carried by the diver, not by the range of the rebreather, which was eight hours. The logic of this system resides in the ability of the rebreather to allow a diver to penetrate great total distance in multiple sumps, such as those in San Agustín, with greatly reduced tank volumes. Individual sump dives are expected to be less than a kilometer in length, and the open-circuit bailouts are safety bottles that will not normally be consumed. The same bailout bottles will be used in each subsequent dive.

The more sophisticated dual system, MK-4R, has an effective eight-kilometer exploration radius due to its lack of dependence on open-circuit technology for bailout. In the event of an emergency, the user can switch to an auxiliary eight-hour closed-circuit system. As one might imagine, two rebreathers plus the standard open-circuit bailout bottle represents a rather intimidating array of gadgetry. Nevertheless, this system was used for the longest-duration dives of the training exercise. Visiting Swiss diver Olivier Isler logged a dive of more than six hours on April 15 on the MK-4R, and long-distance cave dives of greater than 1 kilometer penetration were conducted by Farr, Stone, and Sloan. This system will be required in San Agustín should any of the underwater tunnels exceed a kilometer in length.

In mid-April, the team was visited by AT&T representatives Larry Sherrets and Jimmy Joy, who provided a crash course in fiber-optic communications technology. Using the equipment they brought, a 1-kilometer loop of line was reeled out into the spring by Brown and Sloan. Of particular note was the fact that Brown made a splice between two spools of line in the main tunnel at 30 meters water depth. This system functioned flawlessly for the remainder of the month, providing quality full-duplex voice communications through compact headsets. Sherrets also demonstrated that live TV, complete with audio, could be transmitted through this line. The weight of the cable is 6 kilograms per kilometer, and its breaking strength is 60 kilograms. It comes in 300-meter and 1-kilometer spools that are self-unloading from their containers (no reels required). We now anticipate that, at the least, a communications link will be available from surface base camp to Camp III, Dive Base, and possibly to Camp V, if the team is successful in cracking the San Agustín Sump.

By the end of April, up to ten dives per day were being logged to the main tunnel in Jackson Blue Spring at a depth of 30 meters. One hundred and thirteen missions were successfully completed without incident, and the operation was packed up for the

next phase, which involved deep diving on heliox. The Mexican members of the team, Zambrano and Soto, returned home at this stage to begin work on obtaining state and federal permits for the expedition for 1994. A meeting was held with the Governor of Oaxaca, Diodoro Carrasco, during the first week of June.

Twenty kilometers north of Ocala, Florida, near the town of Zuber, there is a spectacular geologic feature that would, in the Yucatán, be referred to as a cenote, a water-filled pit that is undercut and bells out as one proceeds deeper. This particular sink, which reaches a depth of 80 meters at the bottom of a 120-meter-diameter truncated cone, offered sheer vertical descents evoking scenes from the movie *The Abyss*. It had been commercialized some years earlier by deep diving entrepreneur Hal Watts and renamed Forty Fathom Grotto. Hal and his staff served as the team's gracious hosts for the next two weeks.

Following a number of shallow familiarization dives on compressed air Scuba, which were important here since the visibility averaged less than 10 meters, the team began diving missions to depth on the rebreathers. The divers followed a permanently rigged line that led from a suspended platform at 10 meters to a sunken boat at 40 meters and finally to a car at 63 meters. These objects, which had accumulated throughout the history of the sinkhole when it was originally considered to be bottomless by the locals, provided convenient target points that were elevated above the silty bottom. This was a distinctly different diving scenario from Jackson Blue, because here buoyancy compensator and counterlung gas volumes continually changed during both descent and ascent. In addition to coping with this, team members rehearsed emergency procedures such as switching to open-circuit gas supplies and running the rigs manually during simulated computer crashes.

Once each team member had the 63-meter route mastered, free-fall descents were begun along the so-called Bonsai Line, which led straight to 80 meters depth. Open-circuit safety divers, breathing compressed air,

bailed out at the 60-meter level due to narcosis impairment and watched the rebreather divers, who were breathing heliox, disappear in the depths. By this time the onboard computer systems on the rebreathers, all six of them, were not only working solidly, but were being used to monitor decompression in real time. Dives were generally called when the safe ascent ceiling reached 30 meters, resulting in 90- to 105-minute dives. This proved to be a practical limit, because of chill induced by wetsuit compression at depth. Nearly all of the dives were done using wetsuits, because it was initially felt that the zippers used in drysuits would constitute a high risk, given the rugged conditions expected during transport at San Agustín.

All team members completed several descents along both the 63- and 80-meter-deep lines without operational problems, and without any decompression sickness (bends) symptoms. A total of forty-five missions had been logged at Forty Fathom Grotto when the operation was packed up on May 11. At this time the British portion of the team, Parker, Rolland, and the Dickinsons, returned home.

A total of 158 successful missions, representing more than two hundred fifty hours of underwater time, had now been logged on the MK-4s. What remained was to determine whether the team and the system could work together under conditions similar to those that would be encountered during the actual expedition to San Agustín. For this it was felt that a realistic simulation was needed at a remote site that involved rugged transport, vertical rope work, underground camping, and exploratory diving. Such a site existed at Cueva Infiernillo at the bottom of Sistema Purificación. I had originally dived the Main Sump there in 1978 with Rick Blevins. In the intervening fifteen years, no one had returned with dive gear, even though it was common knowledge that the Main Sump continued beyond our dive limit at 40 meters depth. I had approached Peter Sprouse at one time or another about the idea of using it as a test site for the rebreathers. Sprouse had always been enthusiastic about

this, since there was a common hunch among Proyecto Espeleológico Purificación members that a vast, untapped karst area lay to the west and that access to it had been stopped by a syncline, which had formed all the sumps in the Camp I and Moria areas. Get through the sump and you access this grand extension. My interest was slightly different. I still enjoy playing depth games. A 96-meter-deep dive in any of those sumps would boost Sistema Purificación to over a kilometer in depth. We had been diving daily in Florida to within 16 meters of that mark during the past month, so the idea of doing it in Infiernillo was not wishful thinking.

So it was that May 13, 1993 found us winding our way up the four-wheel-drive road to Infiernillo. The team consisted of Noel Sloan, Steve Porter, Jim Brown, Barbara am Ende, Kenny Broad, Peter Sprouse, and me. Sprouse had, on short notice, offered to guide us up to the cave and indicate survey tie-ins. That evening he, Barb, and Kenny went up to rig the cave, while the rest of us began sorting loads.

The following morning Peter left to catch a logging truck, leaving us to the business at hand. By late afternoon all the equipment, including two rebreathers and around a dozen small tanks, was at the plunge pool below the entrance. The pool was dry; the last time I had been here it had been a 30-meter-diameter lake. I climbed up first. It was a hell of an inspirational view. You could see a spectacular vista of the mountains, with an occasional virgin pine tree poking 20 meters above the rest of the growth. The road was there to harvest the big pines, but the canyon was so rugged that they had by no means gotten everything. On the topo maps this is called Cañon de Infiernillo, Hell Canyon, and I could easily see why loggers coming up here ninety years ago gave it that name. It was torturous. It was vertical, with great exposed walls of limestone, white streaked with vertical runners of black and orange, pushing up from the canyon floor like knives on three sides.

It was Kenny's first dry-cave trip, and he was overwhelmed. Like Steve, he was a cave diver first and was making the transition over to being a

Tom Morris prepares to dive with the MK-3 in Jackson Blue Spring, Florida. *Wes Skiles.*



vertical caver. Everyone at Jackson Blue had gotten together one evening and made up a list of things he needed to buy so that we could bring him up to speed as safely and quickly as possible on ropes. This was about as benign a place to learn as I could imagine, and he planned on yooyoing the entrance as many times as possible over the next week. When he climbed over the lip his eyes grew wide. "All caves aren't like this, are they?" he asked me. I laughed and looked behind me into the yawning black tunnel. No, they aren't.

We rigged a tyrolean and shortly had a system going. Jim Brown would attach duffels to the line and the remaining five, all up inside the entrance now, would heave-ho and pull the load up. Meanwhile, dusk was falling, Brown was in the midst of a near white-out, and it was raining hard. We, on the other hand, were all perfectly dry. It got to the point where there was nothing left but tanks and rebreathers, which could perfectly well stand the night in the rain, and we told Jim to quit and come on up. The way his clothes clung to him you could see he was absolutely soaked. I offered him a few candy bars and some water. He smiled his typical Jim Brown smile and said, "Somebody else can go down there in the morning."

At this point it was dark, and we scrambled around to find carbide lamps. We gathered minimal gear—sleeping bags, pads, camp clothes, two meals and the cook gear—and packed off to Camp I. We were all sweating profusely within 300 meters and stopped to take off a layer of clothing. There was a strong cool breeze blowing out the entrance, enough to blow Brown's bandana nearly horizontal, but in here, where the passage was much larger in places, you didn't notice it, and the heat began to build. By the time we had each chosen a camp site and had dinner it was 10 P.M. I was exhausted. It had taken slightly less than four days to get here from Forty Fathom Grotto.

It took until 2 P.M. the following afternoon to move all gear needed for the dive down to the Main Sump. There we dug out a prep platform in the sand bank some 6 meters above the sump and cut steps the rest of the way down to the water. The water level was down a full 20 meters from when I had been here in 1978. It was very bizarre to be walking through tunnel I had last been through with Scuba. By 8 P.M. it was clear that no one would be diving that day. But the rig was ready for use in the morning, by either Steve or Noel. Those were the only two who had exposure suits in the cave at this time, as arranged in discussions held Thursday evening at the truck. Brown was ill at the time, and of the three remaining I had the most experience, but I wanted someone else to make the first few dives, largely to give me independent feedback on the performance of the rig.

About the only hitch in the entire reassembly and check-out of the rig was when Noel discovered that we had a dead oxygen sensor. "No problem," I said, reaching for the official MK-4 Repair Kit. I had not had time to completely work up new sensors before leaving Florida, but had thrown in all the necessary stuff, including a special crimping tool for the gold-plated connectors used to hook the sensor to the computer. To my horror, when I opened the sensor package, I found that there had been a mix-up. These were old-style sensors that had gold pin contacts, as opposed to the

20-centimeter-wire leads needed to connect to our system. This now created a serious dilemma, since we had no fully equipped lab bench down there. Eventually we hit upon the idea of cannibalizing the leads, and the solder, off the dead sensor. We took these and the new sensor up to the stove, along with a large screw driver. By heating the screw driver in the stove until it glowed red, I was able to get a good solder joint between the old leads and the new sensor posts. I then sealed the sensor in its shell, and we put the rig back together. It worked perfectly.

There was a decidedly different atmosphere down there at the Main Sump the morning of May 16 than at the busy, yet relaxed social setting of a pre-dive kitup at Jackson Blue Spring. Everyone seemed a bit more business-like, with Porter being the icy cold, methodical technician. Of course, it started off being social, but the closer we got to the moment when Steve would actually have to swim off into that black 62°F pool, the more focused and withdrawn he became. Everyone was all caught up in the excitement of the moment: the first exploratory dive in this sump in fifteen years, with equipment that was light-years ahead of what had been used back then. So you had to stand back and analyze just what it was that made this feel, well, different. What it was, of course, was the stress, that this was the real thing, as opposed to Florida, where it was just "practice

for the real thing." It was something your gut knew straight off, but the mind hadn't quite connected with, unless of course you happened to be Steve Porter, who was getting grimmer and more determined by the minute. As he turned to set off down the surface pool, Noel said, "Scoop booty, brother." Porter said, in a kind of disconnected train of thought that indicated his mind was on other things than responding to Noel, "I'm gonna be taking this real slow," which of course meant, "Yeah, I've spent a month and a half now diving every day with this thing, but let's face it folks, this is still an experimental backpack and anything could go wrong at any time, and it's my hide on the line this time in a place where the vis looks like it will suck up a 20-watt primary beam in 5 meters flat, and it's cold as hell, and there will be no recompression chamber if I screw up." All that in the simple sentence, "I'm gonna be taking this real slow."

When the light finally disap-

peared—we could see a greenish glow flashing in the distance for the longest time—everyone settled in for "the watch." That became something of a ritual over the next few days. The conversations kept going in circles, and everyone would just blow out his light and sit there at the edge of the sump, watching the green light beam fade away. Then, around 30 minutes later, we saw it come back. When Porter finally surfaced after an hour or so down, the first thing he said was, "We're gonna need drysuits if this sump is the same temperature as San Agustín."

He had stripped his 100-meter line spool, ultimately reaching a depth of 34 meters. The tunnel had enlarged, and he was in a cold blue-white haze, heading down into what apparently was a huge canyon, of which he could see neither the floor nor the left wall. He was laboring all the way to find tie-offs for the line, which were few and were generally made of stiffened mud. There are a lot of things going

on during such a dive. You were constantly working with the buoyancy compensator while descending, as well as clearing your mask and equalizing both the mask and your ears. All of this in 5-meter visibility, while dealing with a line reel and a hand-held primary light. The poor vis was strange, since he hadn't really stirred up any silt. We later postulated that it was due to suspended minerals in the water. There were calcite rafts floating on the surface when we first reached the sump. We later found them over at the Left Hand Sump as well.

Around noon the following day, Noel was in the water. His plan was to hit -75 meters and survey out, since Porter's line from yesterday ended at -34 meters and was heading down sharply. Shortly after he entered the water, his main LCD display went

Jim Brown, Rob Parker, and Noel Sloan with MK-4s in Jackson Blue. *Nick Caloyianis.*



dead, a sure sign that the rest of the computer system was about to drop out due to exhausted batteries. So, while he knelt in the water at the sandy beach, I changed out his batteries, while Barb held tools and Steve held the fiberglass backpack shell. Soon he was off. Five minutes later Steve, in a wetsuit, swam a 72-cubic-foot bottle of pure oxygen out to the end of the air space. It was connected to our 5-gallon water jug for buoyancy. At the end, he unclipped a gap reel and dropped vertically to -9 meters, where he attached the O₂ bottle to the main dive line. He then did a free ascent.

Surprisingly, Noel was back in just 33 minutes, not having gone any further than the end of Steve's line. Porter had remarked on this tie-off yesterday. There was nothing solid down there, so he had just balled up a meter of line and stuffed it into the mud with his fist. Sloan eyed this with suspicion when he got there. It was a dicey operation. The shaft was near vertical, and the vis was bad already. When the line was pulled from that hole it would almost certainly go slack and be out there floating free, waiting to get wrapped around some projection on the rig, while he did the splice. During that time he would have to maintain rock-steady buoyancy control with no reference point or solid hold. He took this all in, grimaced, and decided to survey out.

We spoke to Noel about this, and since he had hardly used any gas we convinced him to go back and attempt it once again. Barb and I then left for the dome above the latrine. Sprouse had indicated that this was a promising lead and had loaned us a battery-operated Hitachi drill. Using this I set six bolts out on the overhang before rappelling off for lunch, leaving a fixed line hanging some 9 meters up in the middle of the passage. We were getting only about three bolts per battery pack, but when it worked you could set an 8-centimeter hole in a minute with one hand.

Noel's second dive was no better than the first, and he bailed out due to visibility concerns. We all had lunch back at camp and decided that while Noel and Steve prepped the rig for tomorrow, Brown, am Ende and I would go get our suits at the truck,

carry out trash, and bring back a few bottles of mixed gas and carbide. Brown reached the entrance first and yelled back, "There are people down there." I said, "Right, and pigs have wings." I thought he was joking, but sure enough there were three people down there with hard hats. I yelled down, "Who are you," and they responded, "It's OK man, we're cavers from Austin." They were all novices, sent by Terry Raines. They had come up to "find Sistema Purificación." I grimaced and stopped short of saying, "Well, you found it." I found this all a rather strange coincidence. They had been told by Raines that there was a 40-meter drop at the entrance to the cave, but he neglected to tell them that it was 40 meters straight *up*, not an entrance pit. They were about to give up, after failing in an attempt to climb above the entrance on the right-hand side and then rappel in, creating a large rockfall in the process. We let them use our rope, which Brown had pulled up after we had all our gear up on Friday, to ascend, and then they rigged their own. They spent a day touring the cave, then left as mysteriously as they had come.

The following day Noel suited up, with help from Kenny and Steve. Barb and I headed for the bolt climb and set another three bolts before the last battery pack died, within one bolt of the top. Barb lowered me down and we joined Steve at the sump vigil, waiting for Noel. He returned after about a 1-hour dive. He descended into a large tunnel from his last tieoff and reached a depth of 45 meters. He swam a ways, not using more than half his reel, before calling the dive due to cold. He surveyed out. Later in the afternoon Steve went back in. During a 1-hour dive he spooled out from the end of Noel's line another 60 meters, to where he entered a large junction chamber at 46 meters depth. The vis increased to around 12 meters, and he discovered a large breakdown pile leading steeply up to the right. He tied off at approximately 220 meters penetration on a solid boulder at -46 meters and surveyed out. During this time Barb and I went back to work on the dome climb. Between the two of us we had set eleven bolts, some with 2 meters reach between

them, on the extremely overhung roof before the last battery pack had given out on the drill. I went back up and finished the last bolt by hand and was finally able to stand on a ledge up in the top of the dome, 16 meters off the deck in free space. The wall was 12 meters away at the closest point. A much smaller fissure continued another 10 meters up, getting narrower as it went. It did not take air, nor did it look like it would link into anything, so we bailed out.

May 19 was my test of fire down at the main sump. The rig had not been serviced following Steve's dive yesterday, and so after breakfast he, Noel, and I headed down to begin changing out all the tanks and going through a pre-dive checkout. The oxygen sensors, the heart of the rig, were holding rock steady. By 11:40 A.M., I was kitted up and in the water and was going through that little emotional game that Sloan and Porter had been through before me. They had both insisted that I make this dive, even if I only followed their line for a look-see. They wanted me to feel all the different things they had felt, so as to know what the Intimidation Barrier felt like. No sooner had I gotten in the water, when I realized I was going to freeze my ass off and that any wishful thinking about stripping a reel beyond Porter's tieoff was just that, wishful thinking. I even left the Beauchat depth logger and gap reel that all the others had taken, with the idea that if you came out over a deep shaft you could drop the instrument down on the gap reel for close to 60 meters and get an official depth without having to rack up decompression. We had pretty much given up the notion that we could crack 1000 meters depth on this trip, given the lack of drysuits. Armed with a 50-watt spot-beam primary light (the others had used only the 20-watt Dive Rite light we wanted to standardize on for the expedition), my mission was to check out the end of Porter's line where it ended in the middle of what was apparently an immense junction room.

I floated off to the end of the air-space, a good 40-meter swim, and followed the line down to the oxygen bottle that Porter had stationed there on Monday. Up until this point I had only my helmet-mounted light on, a

The Infiernillo Sumps
 Cueva Infiernillo, Sistema Purificacion
 Tamaulipas, Mexico

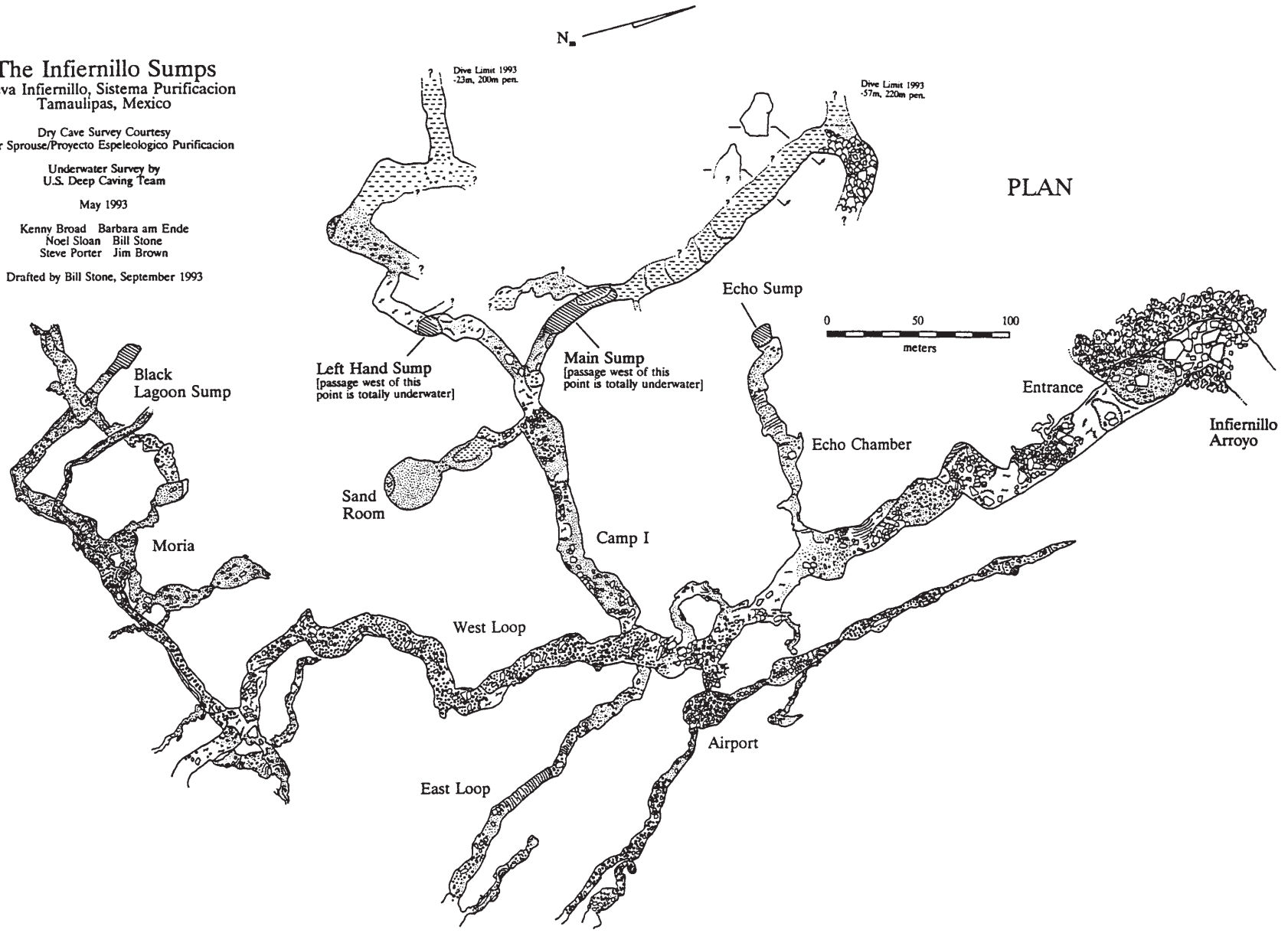
Dry Cave Survey Courtesy
 Peter Sprouse/Proyecto Espeleologico Purificacion

Underwater Survey by
 U.S. Deep Caving Team

May 1993

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Drafted by Bill Stone, September 1993

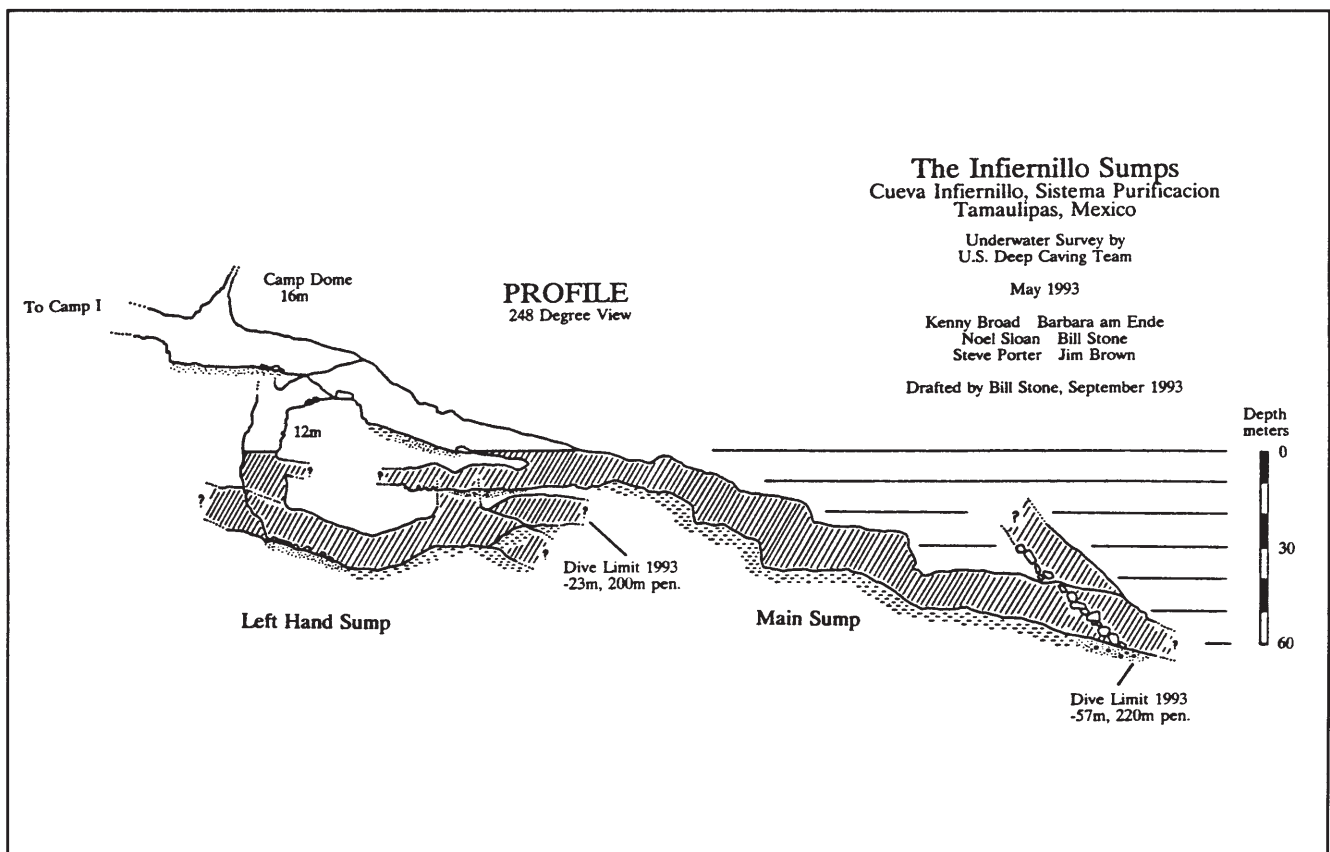


mini Q40 halogen beam. After spending a minute or so getting the oxygen concentration right and changing the setpoint to 1.0 atmospheres, I turned on the 50-watt handpiece and began coasting down the line. It was claustrophobic from the start, even though I knew from both Noel's and Steve's stories that the tunnel was huge. The vis was less than 4 meters, and it was biting cold. However, I was very busy, and the cold was not the primary, moment-to-moment concern. The real game was juggling the BC inflator, the counterlung diluent, and the mask and ear clears, all the while having the requirement of not touching the walls nor floor nor ceiling and keeping the guide line in sight. To stray off line here would be no picnic, even with a rebreather. We had no idea what was off to the left (north), and it could just as likely as not be some gaping railroad tunnel with bad visibility.

So I was intensely playing the game when I coasted through a rock arch in the right-hand side of the ceiling that both Noel and Steve had described, and within 20 meters the vis increased dramatically to something like 20

meters, and there in the distance was Porter's rock, the first really solid tie off he had come to since the beginning, and he had wrapped his line around it with a vengeance. It certainly wasn't coming off that one. So here I was at 220 meters penetration and 46 meters depth. With the big light I could see what Steve had not: the dimensions of the giant boulder pile sweeping up to the right (north) at a 45-degree angle in a passage measuring 20 meters wide by 15 meters tall. It was huge. I hung there for a while at the boulder, sweeping the light down the pile and up the pile, trying to figure out whether or not to unlimber the reel and spool out some line. I was cold as hell. Down below me, to the west, was what appeared to be a dark tunnel. The big boulder slope going up was much lighter colored. Odd. I kept an eye on the line going back to the entrance and slowly coasted down to the entrance of the dark tunnel. I equalized precisely at 1 meter off the floor, which in this particular spot happened to be gravel, and looked off into blackness. I could not see very far, since this was apparently where the bad vis began again.

But the tunnel was definitely continuing down and to the west. The depth on the LCD at this point read 57 meters, which later proved to be the deepest we got during our week at Infiernillo. I loaded the BC and coasted up to the guide line, 12 meters overhead. By this time I was convinced that it was time to leave. The cold was cutting through my wetsuit like it wasn't even there. Going back, I became aware of just how much of a vertical descent it had been, for it seemed like I was venting gas, managing the BC, clearing my mask, etc. for a long time, and then, finally, I came upon the oxygen bottle. It was only then, after looking at the LCD for the first time in quite a while, that I found that I had a 3-meter decompression ceiling. I chastised myself for not having looked at it sooner, but then again, I was running the dive on the head-up display, and had decompression been needed below 9 meters, the light would have come on red. After throwing in a little extra pure oxygen to be conservative (15 minutes at 9 meters), I slowly rose to 5 meters and began swimming back. I still had my primary on, and it was



then that something bizarre happened. Soon the floor fell away into a shaft, and I thought, "Damn, how did I get turned around?" But I hadn't turned around, and, after verifying the line position, found that, no more than 8 meters from where we put into the water, there was a large shaft going down. I could make out the clear outline of the roof of a tunnel heading south. At this point, having completed decompression and being quite cold, I left the lead for the following dive. There were now large unexplored tunnels going off in three directions.

Shortly after I de-kitted, we broke down the rig and prepared it for Jim Brown, minus the side-mounted diluent bottles. He then put it on and hiked over to the 12-meter shaft leading down to the Left Hand Sump. By this time I had changed into dry clothes, we had grabbed some lunch up in camp, and I had picked up my vertical gear. Brown had been very ambitious early in the day, had rigged this pit with four separate lines, and then carried all the heavy gear over. Sloane and I rappelled down to the water's edge and helped him kit up. Noel handed him his bailout bottle and the line reel, which had already been tied off, and off he went without so much as a goodbye wave. That was Jim Brown, impulsive. He was never guilty of not plunging into something

aggressively once he knew exactly what it was he wanted to do. Sloan and I sat down for the wait. During that time Barb came down and we surveyed from the dive line to the dry cave survey. Unlike the dive in 1978, meticulous efforts were undertaken to complete an accurate underwater survey. Around an hour later—an hour dive was becoming the standard around here—we could make out the familiar green light flashing in the distance. The interesting thing about this, which only Sloan and I recognized, having been on the Peña Colorada trip in 1984, was that there was no gurgling sound of bubbles breaking the surface, heralding the arrival of the diver, long before you could see him. In Sump III at the Peña Colorada, you could hear these bubbles coming up from depth several minutes before you even saw the lights, and it was one of those spooky things that you never got used to. Here, with rebreathers, there was nothing. Not a sound, not even a micro-gurgle.

When Brown surfaced, he proudly held up two empty reels. He had dumped 200 meters into the sump, and for most of his survey he was in very large tunnel, heading due west, where only one wall was visible. His vis had been similar to what I had in the big junction passage at the end of the Main Sump. He had hit -36 meters

on the way in, before the tunnel went back up and leveled out at -21 meters until he had run out of line. There was no sign of the main borehole ending, and he guessed that there were probably one or two major infeeders along the way. And so we had yet another lead. Near the entrance to this tunnel he had discovered a smaller, darker tunnel leading to the right, towards the Main Sump. And so we discussed whether or not that might be a good target for Kenny. Kenny was still a

bit of a novice on the MK-4, and so he ultimately decided to forgo diving in the Left Hand Sump in favor of tackling the new lead I had found within 8 meters of dive base in the Main Sump.

Within two hours we had moved all the gear back from the Left Hand Sump to the Main Sump. I had made the mistake of volunteering to bring the rebreather up that 12-meter shaft. It would not have been bad except for the two side-mounted diluent bottles and some other things, like lead, that were clipped to it. As it was, I could hear the words "heart attack test" being pronounced in my mind by Bill Steele, followed by his typical deep laugh. Normally we would have broken it down into modules for transport, but time was now short.

When Kenny kitted up at the Main Sump, he had one advantage that the rest of us did not. He had brought his drysuit. So we gave him the last reel of line and suggested he run as far as he could in the left-hand lead. Unlike Porter, Sloan, and the others going down the main sump, his light disappeared quickly, and the place went black as soon as he ducked into the side tunnel. About a half-hour later the light came back and, without surfacing, he headed down the main tunnel, and the light disappeared again. We figured he had gone on a little tourist mission, which proved to be the case. The left-hand tunnel had gone beyond the limit of his line at around 14 meters depth with increasingly bad vis. He had then surveyed this and took a run down to -30 meters before heading out. When this was finally plotted, it became apparent he had been within 10 meters of the head of the Left Hand Sump and at about the same level as the north-trending bad-vis tunnel reported by Brown. This being our last dive—with no injuries or problems—we broke everything down for transport and hauled it all back to camp.

It was now around 10 P.M. We retired to camp for dinner, after which it was around 11:15, and people were making rumblings about taking a



Noel Sloan and Barb am Ende assembling a MK-4 rebreather on a platform carved into the sand bank above the Infiernillo main sump. *Bill Stone.*

backpack load out. Barb and Jim had already done one before dinner, while we had helped Kenny. So Noel, Barb, Steve, and I made a heavy haul, arriving at the entrance around midnight. It was an amazingly clear night, with stars outlining the entrance. We spent some time there talking, then hiked back in and hit the sack around 1 A.M. The following morning we packed out.

Processing of the survey data indicated that we had mapped 473 meters of underwater tunnels. These extended the length of Sistema Purificación to 79.1 kilometers and increased its depth to 954 meters. At least four large tunnels continue be-

yond what we explored, with one heading west to substantially deeper depths in the Main Sump at 220 meters penetration, and a major westward gallery at the end of the Left Hand Sump at 200 meters penetration. The rise from depth in the Left Hand Sump and the large ascending gallery in the Main Sump are encouraging evidence that perhaps the sump will in fact lead to air space within several hundred meters. Beyond that one can only hypothesize.

A total of eight dives were carried out during our five-day camp with average profiles of 1 hour duration and 50 meters maximum depth. Servicing of the rig to prepare it for the next dive was honed to less than 30 minutes.

During the entire operation only 20 cubic feet of oxygen, 40 cubic feet of compressed air (for buoyancy compensation), and 30 cubic feet of heliox were used, a total equivalent to about one standard sport diving Scuba tank. Thus the gamble on obtaining a quantum jump in logistical advantage by using rebreathers, the concept born nine years ago at the Peña Colorada, had paid off. Thoughts as we drove down the mountain were of course of San Agustín and of a few last-minute fixes that would be needed in light of what we had learned at Infiernillo. But there was other talk, of the PEP, the "Proyecto Espelco buceo Purificación." The underwater world of Infiernillo will be visited again.

El Sifón de la Cueva de Infiernillo

En 1981 Bill Stone buceó el sifón del Sótano de San Agustín en el Sistema Huautla, Oaxaca. Recorriendo así 285 metros desde la entrada del sifón. En 1984 exploración másiva se hizo en la Peña Colorada, donde se resurge el agua del Sistema Huautla, como resultado se exploró 4 kilómetros en pasajes subterráneos, incluyendo un kilómetro en sifones. Las dificultades para proveer a los buceadores con aire comprimido, despertó la necesidad de desarrollar equipo de buceo que pudiese reciclar el aire usada, removiendo el CO₂ y añadiendo oxígeno cuando se necesite. Diferentes generaciones de equipo se probaron en las cuevas sumergidas de la Florida desde 1987. La última versión MK-4 comprobó ser confiable y varios buceadores entrenaron para así aprender el uso de tal equipo. Para probar más a fondo el uso del MK-4, se bucearon dos sifones en la Cueva de Infiernillo del Sistema Purificación del estado de Tamaulipas. Ocho buceos de una hora de duración se hicieron, utilizado en toda la misma cantidad de aire contenido en un tanque scuba (80 cu. ft.). La profundidad máxima de estos buceos fue de 57 metros y 473 metros fueron añadidos a la longitud total del sistema. Actualmente se está planeando otro buceo en el sifón del Sótano de San Agustín con el sistema cerrado MK-4.

DIVING IN QUINTANA ROO, YUCATÁN PENINSULA THREE REPORTS

Steve Gerrard

Toucha Ha

This expedition began during the winter of 1991, when I sent out about twenty letters to people I had met through training classes I had taught, cave-diving trips to Mexico, or cave dives in my home state of Florida. I was hoping to find people interested in helping explore a new cave system near Akumal, which is located on the Caribbean coast of Mexico's Yucatán Peninsula, in the state of Quintana Roo.

I had heard about Toucha Ha (Monkey Water in Mayan) from Hilario Hiler. Hilario is a well known and very likable man. Originally from New Mexico, he has lived in the Tulum area for twenty years and speaks English, Spanish, and several Mayan dialects. An active diver and Scuba instructor for many years, Hilario had been a cave-diving student of mine in 1986. After that course, Hilario, Tony and Nancy DeRosa, and I found and explored the beginnings of the beautiful Maya Blue caves system, Quintana Roo. During subsequent correspondence, Hilario mentioned a new system near the famous Carwash Cenote, in which he and well-known cave diver Jim Coke had laid 700 feet of line during December 1990. Originally called Zapote Cenote, it had not been visited again, and Hilario felt that the system had plenty of potential. He offered to serve as a guide in its further exploration. This cenote is located on the property of Don Camillo, who had shown it to Hilario and gave us permission to explore it.

Five people were able to make the trip. They were Alton Hall of New Orleans, Louisiana, Keith Kinnard and Pat Watson of Montgomery, Ala-

bama, and George Irving and Paul Perk of Boca Raton, Florida. We all met on July 30, 1991, at Derosa Villas in Aventuras Akumal and spent the whole day preparing our equipment for the next week of cave diving.

Our plan for the following day was to divide into two teams and dive with double 80s. After we tossed a coin to see which team could have its pick of upstream, the direction of the original exploration, or downstream, into new territory, the winners, Pat, Keith, and Alton, chose downstream, and off they went. My team, which included Paul, George, and Hilario, geared up, entered the water, performed the ritual bubble checks and safety drills, reviewed our dive plan, and headed upstream. Following the line laid by Jim and Hilario, we swam a short distance, maneuvered our way through a slight restriction we eventually named The Teeth, and came into a gigantic room. Following the guideline, I couldn't help wondering why the original team never came back. As we approached the other side of this giant room at a depth of about 35 to 40 feet, I noticed to my left a dark, seemingly deep void that it appeared no one had explored yet. Tying off an exploration reel on a large stalagmite in the room, we started into this abyss. To our delight and tremendous excitement, we found a fabulous borehole 60 feet wide and 20 feet high at a depth of about 60 feet. It is extremely difficult to describe the feeling one gets when exploring and laying guideline in a new passage, especially one as large as this.

Now the big question was, how long would this passage last before it got smaller or, worse yet, pinch down

to nothing? But luck stayed with us, and the route began to wind its way through and around the beautiful columns in a room that we named Monster Canyon. After about 400 feet, the passage changed and went from 60 feet to 35 feet in depth, as we entered a dark-brown dome room containing hundreds of columns, stalactites, and stalagmites, which we called The Forest. At this point, we called the dive and surveyed our way out. Our penetration was 1200 feet. The downstream team was just as successful, having laid 800 feet of new line. What a day, and what a way to start an expedition.

As the week progressed, we quickly exceeded the range of our double 80s and had to add single and double stage bottles. It was a satisfying feeling to watch the bond of camaraderie and friendship grow stronger each day. We had unproductive dives, when little new line was laid or the cave did not cooperate, and we had dives when we laid hundreds of feet of guideline. This system is not the prettiest in the Tulum area, compared to Sac Actún or Nohoch Nah Chich, but it is spectacular because of the dramatic changes in scenery every three or four hundred feet. One room we called the Perk Room, because it was a big dome room with tannic-acid-stained, tea-colored water at the top.

We were very thorough with our surveying, plotting the data each day on graph paper, and we were proud as the cave grew on it. At the end of the week, we transferred all the information to the computer program SMAPS II, which allowed any loop closures to be adjusted. In all, we laid close to 9000 feet of guideline in this

new cave system.

Exploring virgin cave passage is a "high" that is wonderful to experience. It was fun to watch others go through the feelings I have had many times during my seven years of cave diving in the Akumal-Tulum area. Since that expedition, several cave divers have returned to add more line to Toucha Ha. It has grown to nearly 40,000 feet of explored and surveyed passage and ranks as the third longest underwater cave system in Mexico, behind Nohoch Nah Chich, which ranks as the world's longest at 70,000 feet, and the Naranjal cave system at 65,000 feet. For any cave diver, Mexico's Yucatán offers some of the best in the world.

Bacca Ha System

Allen Jonushaitis was standing in his wetsuit by the water-well dripping wet and with a grin from ear to ear. On Wednesday afternoon, July 1, 1992, we had just hiked out from further in the jungle, where a group of us were exploring a new cave system we named Tortuga (Turtle). Allen, who is from Jacksonville, Florida, was babbling like a child with a new toy. He and Cliff Keck, of Pittsburgh, had just finished their first exploration in this underwater cave, which offers a unique and challenging restriction, an opening constructed so it could be used to water cattle. Cliff was shaking his head while sitting on the edge of the well, still dressed in his cave-diving equipment. There was no doubt he was a very happy diver.

In early May, Tony DeRosa and I were shown this tiny hole by Don Camillo, who lives in the Pueblo Tulum and owns this defunct cattle ranch on the Coba road just one mile east of the famous Carwash Cenote. We were looking for a virgin cave system for a group trip we were putting together through Derosa Villas and the Cedam Dive Centers. We stared at the hole and shook our heads in disbelief. Don Camillo was insisting that this had an underwater cave, as he claimed to have seen a dead cow float to it from Tortuga, which had to be at least a kilometer away. We didn't buy that, but Tony did challenge me to check out the hole with a Scuba tank and proper equipment. Reluctantly, I donned my gear, climbed

over the short wall of the well, and slid into the tannic water. Tying off my guideline, I looked up at Tony and Don, whining that this was nuts and that only desperate people do desperate things. We were desperate, all right, to find a potential lead for the group we had booked for later in July.

The shaft dropped 10 feet into a small room. The visibility was 20 feet, and the floor consisted of dirt and decayed vegetation that probably was flushed in during rainstorms. Scanning my light around, I found the ceiling and decided which direction to pursue. Following the slope and being careful not to make a mess with the silt, it didn't take me long to emerge into crystal-clear fresh water, which was a hell of a good sign. Every direction I turned seemed to end at a wall or floor, but I found a small bedding plane perhaps 2 feet high and laid my guideline low and tight, praying that something good was going to happen. After 30 feet, my prayers were answered, as I entered a large passage decorated with many speleothems. Running line off my reel to the end of its 350-foot capacity, I was more than satisfied that this would work well for our later exploration team. Turning around, I retreated back to the entrance, reeling up all my line. My only concern was the exit, as it would require careful planning, particularly if there was an emergency. Surfacing, I announced to Tony and Don Camillo that it was a "goer" and began describing what I had experienced. Tony was quite pleased, as this would take the pressure off the planning for the group expedition.

Cliff was ecstatic. Allen couldn't stop talking. They finished adding up the survey data on their slates and proudly announced that they had laid 1800 feet of line. I was very proud of their accomplishment. Allen kept saying over and over that it had been his best cave dive and that all the expense and effort in participating in the trip had been justified. There is no better feeling than being the first into a virgin underwater passage.

There were three days left in the week-long trip. The Tortuga system was yielding excellent passage, but that is another story. The Bacca Ha system was beautiful, and its tiny opening for an entrance definitely

created a challenge. Besides Cliff and Allen, the other four members of the group were Don "the cave animal" Redinger, who was the quiet leader of the gang, Sam Terra, a confident, very humorous dry caver of seventeen years now having his first opportunity to explore virgin cave, Ivan Capelli, a vocal trouble-shooter and definitely the story and joke master of the group, and Randy Johnson, a very polite and considerate individual whose confidence level grew by leaps and bounds during the project. Ivan's very nice wife Mary, whom I had met when the group took one of my tourist trips in March and who is usually part of the group, was not along on this trip.

What really impressed me is the careful and methodical approach these divers took in surveying the system, despite the excitement inherent in being the first to witness its beauty. Each of the remaining days of the expedition saw the system grow. Thursday, Cliff and I did a stage dive and added another 600 feet of line. The system has two parts; the freshwater zone offers a vast display of formations, but then changes into a passage with obvious flow to the halocline and the salt-water zone. As the stick map grew, we did an overland survey along the path and road all the way to the Carwash Cenote. As we plotted the data from each dive, it was amazing to see this cave system growing along the road and heading straight for the downstream section of Carwash. We smelled connection.

Another interesting possibility is to the south, where the upstream leads of the Toucha Ha system have excellent possibilities of connecting to Bacca Ha. Time will tell.

On Friday, Allen and I made a dive to push a lead that paralleled the main passage. We found one small, decorated tunnel, taking water, that shot to the south and gave us a glimmer of hope. It was going to be a tight squeeze, but we felt it would open up again if the cave gods were on our side. Allen went first to lay the line, and I let him get ahead and have some room to work on the constriction. Obviously this stirred up silt, and within a few minutes it was getting quite nasty. After about ten minutes, Allen had turned around and met me, signaling

that he couldn't fit and was calling the dive. At least we tried.

Our plotted survey showed distinctly that our main passageway 2400 feet back was 200 feet from the downstream "Drain" in Carwash, and we were a mere 75 feet shy of a waterwell located on an abandoned Mayan ranch directly across the street from Carwash, at a depth of 70 feet. So close, but fate was not to be with us this time. Apparently, it is going to take someone like Roger Werner, of Orlando, Florida, whose unique talent is going through cave passage that only eels should fit through. Since this initial exploration, several others have tried, but no connection yet. Among those who have since visited this system are Steve and Judy Omeroid and Robert Thomas, of Columbus, Ohio, who were successful in collecting a few specimens of *Remipedia* for Jill Yager.

In total, over 3500 feet of underwater cave passage was explored and surveyed during our week-long expedition. The trip allowed everyone to gain valuable experience in underwater surveying and enjoy virgin exploration. The same group is planning to return in April 1993 to push the cave further.

The Blue Abyss

It was the second week of December 1992, and my dad and I had arrived in Aventuras Akumal a few days earlier, after a seven-day adventure driving my Toyota truck down from Tallahassee, Florida. I was moving to Mexico to manage the Cedam Dive Center of Aventuras Akumal, owned by Mike Madden. This was a golden opportunity to continue my pursuit of cave diving and exploration, as well as to live year-round in a warm tropical environment. Also here for the week were George Irving of Boca Raton, Florida, Bill Main of Alachua, Florida, and Bill Gavin of Panama City Beach, Florida. I have known George for almost two years. He was with me during the August 1991 exploration in the Toucha Ha system. I have known the two Bills for several years and have enjoyed immensely cave diving with them the few times I have had the opportunity. They're methodical in their approach to equipment. Simplicity and efficiency are

their keys to success.

Neither Bill had ever dived the Nohoch Nah Chich cave system, which has been explored continually since its discovery in November 1988. During Project Nohoch '92, the Cedam Cave Diving Team successfully pushed the cave system to 70,000 feet of surveyed passage, with another 20,000 feet very close to being connected to the main system.

Mike Madden invited both Bills and George on a double scooter dive with double 104s and stage bottles to tour this gigantic underwater cave and perhaps create an opportunity to do a little original exploration at the same time. Entering at the Nohoch Cenote entrance, the team motored upstream on the main trunk line and headed for a new area that I and Mexican cave diver Pablo Díaz had discovered and explored in September 1992. This section is beyond what is known as the Dinnerhole entrance and is off the "X" line. We had named our new line after Pablo Díaz.

The distance from the main entrance to the back area of this new section of cave is close to 10,000 feet. Using Tekna ponies and towing a second one behind allows one to view much of the cave and have fun motoring through the shallow depths, huge passages, and beautiful decorations that dominate the entire cave. Swapping to a fresh pony at the halfway mark insures that one can cover such a tremendous distance. This is exactly what the team did. Near the end, the team decided to stop and park the diver-propulsion vehicles and begin poking around for new leads. Mike and Bill Main led the way into a small passage that required negotiating a few restrictions, but they were able to work their way into a flowing passage, with George and Bill Gavin following. Having gone about 200 feet, Irving and Gavin turned their dive because of air supply. Madden and Main continued, and, after laying another 200 feet of line, entered what appeared to be a typical dome room, common in all cave systems in this region of the Yucatán. It featured a slight trace of tannic water at the ceiling, at a depth of 20 feet. As the divers swam into the room, their regulators nearly dropped out of their mouths. Below them was an apparently bot-

tomless pit. They could see with their lights approximately 100 feet down, and it was still going. In a cave with nearly 20 kilometers of passage that averages 25 feet deep, this was a surprising and unique feature. Sadly, they had hit their air turnaround levels and could only look down in amazement. Reluctantly, they cut the guideline, tied off, and headed home.

A few days later, Mike informed me of this find. I was excited by his discovery and begged him to take me there, so that we could descend into the huge hole and perhaps find the deeper cave system that we have suspected might lie beneath Nohoch. Because it was the busy season for the dive stores, it was difficult to schedule a day off to do this dive. Finally, in early February, the moment arrived. We hauled out to Nohoch on horses our two scooters, double 104s, and two stage bottles apiece. After two hours of equipment preparation, we hopped onto our pony saddles and motored up the line to the Dinnerhole Cenote. That was 5100 feet from the Nohoch entrance. We each dropped our first DPV and one stage bottle and switched to the second, fresh machine and the second stage bottle. It was the first time I'd used a pair of scooters, and I was pleased with my performance while towing a second DPV. Continuing onward, we motored another 1500 feet and jumped to the "X" line. After 1000 more feet, we jumped to the Pablo Díaz line, and we still had 2300 feet more to go before reaching the new line to the pit. Finally, we parked our ponies and dropped our second stage bottles. We now had plenty of air in our double 104s. I was getting mighty excited. After another 400 feet, I would get to see the amazing pit, and who knows what discoveries would come?

Mike had told me about the one very tight restriction halfway to this room. Yes, he was correct, and I had to slide through a vertical crack and be careful not to get stuck or damage the cave. Then suddenly I saw the end of the guideline at the same moment I could see the dimensions of the room. The lip of the drop was now visible, and the anticipation was torture. Cruising out over the edge, I panned my 50-watt light around the walls of the shaft until I saw a bottom. I saw at

least 150 feet of depth, below where I was at 30 feet. During my eighteen-year cave-diving career, I have seen only two other caves that sent the same chill of excitement through me. One was the fifth room in the Little Dismal Cave System, Leon County, Florida (my sentimental favorite cave dive), and the other is the balcony view in the Cube Room in the Sally Ward Cave System in Wakulla County, Florida.

Mike tied off his exploration reel where he had stopped before. He turned and looked at me, and I signaled, "Let's just do it." We began our descent like two kids feasting on candy. This was fun. I watched the depth increasing on my Aladin Pro computer as we dropped. When we reached 100 feet, it was quite obvious that this cylinder was going to go to 200 feet. In our pre-dive discussion, we had agreed that 190 to 200 feet would be our maximum, because we figured this would be a bounce dive that should be relatively safe from oxygen toxicity or nitrogen narcosis. We had no visions of being reckless heroes. At 120 feet, the great visibility gave a clear view of a bottom choked with huge boulders. As we approached the sloping floor, Mike made a lock wrap at the 185-foot depth, ready to cut the line and end it there. I flashed him my light and signaled to go ahead to 200 feet. He agreed.

The bottom was littered with gigantic rocks as big as cars or trucks.

While Mike was tying off the guideline, I could see more depth through the boulder maze. Mike glanced at me, and I motioned I was going down just a tad further to peek and see if a horizontal passage was evident. Carefully gliding down, I reached a depth of 214 feet, with another 15 feet below me. It looked like a passage going off was possible, but I thought I was pushing it far enough, so I backed off and returned to Mike. We were both satisfied with what we found and saw. The view looking upward was wonderful. The cobalt-blue, clear water allowed us to see faintly the top of the pit, which indicated that visibility exceeded 150 feet.

We began our ascent by spiraling along the walls, hoping to find a horizontal passage. Poking in holes and crevices, we found our hopes dimming as we neared the top. We found our first formations at 80 feet, which showed the cave was once dry to that depth. On the ceiling we could see a few very oddly shaped formations. They had a thin stalk with a ball at the end like a wasps' nest. I have never seen that before, and they were very beautiful. We had to be careful not to go too shallow, because of our decompression obligation. An amazing aspect of this dive is that during the long trip back to base you are decompressing at 20 to 25 feet most of the way.

During our brief decompression stop at 30 feet, Mike recorded survey data for the map. I was relaxed and

comfortable during the trip back to the main entrance, satisfied with what we had accomplished. This type of dive helped build confidence in and answer questions about long-range DPV diving. In Nohoch, it is relatively easy because of the shallow depths, and for part of the way it is especially safe because of escape routes to air. Scooter dives at depth have quite magnified hazards, and I admire the confidence of those who have done them.

We decided to call the pit the Blue Abyss. Four weeks later, Mike returned, with Bill Gavin and George Irving, to further check out the bottom of the Blue Abyss. To everyone's disappointment, the pit stopped at 230 feet maximum depth, with no horizontal passages. Both Bill and George were very impressed with the room. It is a shame it did not continue. This discovery, though, is quite impressive, especially in being so close to the ocean. Does this mean there could be more pits of this nature in Nohoch or other caves in the Akumal-Tulum area? The Angelita Cenote a few miles south of Pueblo Tulum was explored to 200 feet by Billy Young, Charles Bickleman, and Scotty Petrowski. Last summer, George Irving and Bill Mees reportedly found a deep cenote due west of Akumal, on a ranch 5 kilometers into the jungle. Well, that's what makes exploration so much fun. If you don't go, you won't know.

Espeleobuceo en la Peninsula del Yucatán, Quintana Roo

Tres reportes de exploraciones en las cuevas sumergidas de Quintana Roo. El primero es en el cenote de Toucha Ha, el cual ha sido explorado de 3000 metros a la nueva longitud de 12 kilómetros de pasajes topografiados. El segundo, conocido como el cenote del Bacca Ha, tiene 800 metros de pasajes topografiados y ya casi se conecta con el cenote llamado Carwash. El tercero es el Blue Abyss dentro del cenote de Nohoch Nah Chich, el cual es un tiro sumergido de 70 metros.

Historical Reprint

THE CAVE AT BOLONCHEN

John Lloyd Stephens

A short ride brought us to the suburbs of the village of Bolonchen, and we entered a long street, with a line of straggling houses or huts on each side. It was late in the afternoon. Indian children were playing in the road, and Indians, returned from their work, were swinging in hammocks within the huts. As we advanced, we saw a vecino, with a few neighbours around him, sitting in the doorway thrumming a guitar. It was, perhaps, a scene of indolence, but it was one of quiet and contentment, of comfort and even thrift. Often, in entering the disturbed villages of Central America, among intoxicated Indians and swaggering white men, all armed, we felt a degree of uneasiness. The faces that looked upon us seemed scowling and suspicious; we always apprehended insult, and frequently were not disappointed. Here all looked at us with curiosity, but without distrust; every face bore a welcome, and, as we rode through, all gave us a friendly greeting. At the head of the street the plaza opened upon us on a slight elevation, with groups of Indian women in the centre drawing water from the well, and relieved against a background of green hills rising above the tops of the houses, which under the reflection of the setting sun, gave a beauty and picturequeness of aspect that no other

village in the country had exhibited. On the left, on a raised platform, stood the church, and by its side the convent. In consideration of what the cura had already done for us, and that we had a large party—perceiving, also, that the casa real, a long stone building with a broad portico in front, was really inviting in its appearance, we resolved to spare the cura, and rode up to the casa real. Well-dressed Indians, with a portly, well-fed cacique, stood ready to take our horses. We dismounted and entered the principal apartment. On one side were the iron gratings of the prison, and on the other two long beams of wood with holes in them for stocks, and a caution to strangers arriving in the village to be on their good behaviour. Our carriers had arrived. We sent out to buy ramon and corn for the horses, had our hammocks swung, and sat down under the corridor.

We had hardly time to seat ourselves before the vecinos, in their clean afternoon clothes, and some with gold-headed canes, came over to "call upon us." All were profuse in offers of service; and as it was the hour for that refreshment, we had a perplexing number of invitations to go to their houses and take chocolate. Among our visitors was a young man with a fine black beard all over his face, well dressed, and the only one wearing a black hat, whom, as we knew they were about drilling companies in the villages to resist the apprehended invasion of Santa Ana, we supposed to belong to the army, but we afterward learned that he was a member of the church militant, being the ministro, or assistant, of the cura. The cura himself did not come, but one of our visitors, looking over to the convent,

and seeing the doors and windows closed, said he was still taking his siesta.

We had time to look at the only objects of interest in the village, and these were the wells, which after our straits at Chunchunu, were a refreshing spectacle, and of which our horses had already enjoyed the benefit by a bath.

Bolonchen derives its name from two Maya words: *Bolon*, which signifies nine, and *chen*, wells, and it means the nine wells. From time immemorial, nine wells formed at this place the centre of a population, and these nine wells are now in the plaza of the village. Their origin is as obscure and unknown as that of the ruined cities which strew the land, and as little thought of.

These wells were circular openings cut through a stratum of rock. The water was at that time ten or twelve feet from the surface, and in all it was at the same level. The source of this water is a mystery to the inhabitants, but there are some facts which seem to make the solution simple. The wells are mere perforations through an irregular stratum of rock, all communicate, and in the dry season a man may descend in one and come out by another at the extreme end of the plaza; it is manifest, therefore, that the water does not proceed from springs. Besides, the wells are all full during the rainy season; when this is over the water begins to disappear, and in the heat of the dry season it fails altogether; from which it would appear that under the surface there is a great rocky cavern, into which the flood of the rainy season find a way by crevices or other openings, which cannot be known without a survey of

Reprinted from *Incidents of Travel in Yucatán*, by John Lloyd Stephens, with illustrations by Frederick Catherwood, published in New York in 1843. This book, along with his similar book *Incidents of Travel in Central America, Chiapas, and Yucatán*, first brought the ruined Mayan cities to the attention of the world.

the country, and, having little or no escape, are retained, and furnish a supply so long as they are augmented by the rains.

The custody and preservation of these wells form a principal part of the business of the village authorities, but, with all their care, the supply lasts but seven or eight months in the year. This year, on account of the long continuance of the rainy season, it had lasted longer than usual, and was still abundant. The time was approaching, however, when these wells would fail, and the inhabitants be driven to an extraordinary cueva at half a league from the village.

At about dark Mr. Catherwood arrived, and we returned to the casa real. In a room fifty feet long, free from fleas, servants, and Indian carriers, and with a full swing for our hammocks, we had a happy change from the hut at Chunhuhu.

During the evening the cura came over to see us, but, finding we had retired, did not disturb us; early in the morning he was rapping at our door, and would not leave us till we promised to come over and take chocolate with him.

As we crossed the plaza, he came out to meet us, in black gown and cape, bare-headed, with white hair streaming, and both arms extended; embraced us all, and, with the tone of a man who considered that he had not been treated well, reproached us for not coming directly to the convent; then led us in, showed us its comforts and conveniences, insisted upon sending for our luggage, and only consented to postpone doing so while we consulted on our plans.

These were, to leave Bolonchen in the afternoon for the ruins of San Antonio, four leagues distant. The

cura had never heard of such ruins, and did not believe that any existed, but he knew the hacienda, and sent out to procure information. In the mean time it was arranged that we should employ the morning in a visit to the cueva, and return to dine with him. He reminded us that it was Friday, and, consequently, fast day; but, knowing the padres as we did, we had no apprehension.

There was one great difficulty in the way of our visiting the cueva at this time. Since the commencement of the rainy season it had not been used; and every year, before having recourse to it, there was a work of several days to be done in repairing the ladders. As this, however, was our only opportunity, we determined to make the attempt.

The cura undertook to make the arrangements, and after breakfast we set out, a large party, including both Indians and vecinos.

At the distance of half a league from the village, on the Campeachy road, we turned off by a well-beaten path, following which we fell into a winding lane, and, descending gradually, reached the foot of a rude, lofty, and abrupt opening, under a bold ledge of overhanging rock, seeming a magnificent entrance to a great temple for the worship of the God of Nature. Figure 6 represents this aperture, an Indian with a lighted torch being seen just entering.

We disencumbered ourselves of superfluous apparel, and, following the Indian, each with a torch in hand, entered a wild cavern, which as we advanced, became darker. At the distance of sixty paces the descent was precipitous, and we went down by a ladder about twenty feet. Here all light from the mouth of the cavern was lost, but we soon reached the brink of a great perpendicular descent, to the very bottom of which a strong body of light was thrown from a hole in the surface, a perpendicular depth, as we after learned by measurement, of two hundred and ten feet. As we stood on the brink of the precipice, under the shelving of an immense mass of rock, seeming darker from the stream of light thrown down the hole, gigantic stalactites and huge blocks of stone assumed all manner of fantastic shapes, and



FIG. 6

seemed like monstrous animals or deities of a subterranean world.

From the brink on which we stood an enormous ladder, of the rudest possible construction, led to the bottom of the hole. It was between seventy and eighty feet long, and about twelve feet wide, made of the rough trunks of saplings lashed together lengthwise, and supported all the way down by horizontal trunks braced against the face of the precipitous rock. The ladder was double, having two sets or flights of rounds, divided by a middle partition, and the whole fabric was lashed together by withes. It was very steep, seemed precarious and insecure, and confirmed the worst accounts we had heard of the descent into this remarkable well.

Our Indians began the descent, but the foremost had scarcely got his head below the surface before one of the rounds slipped, and he only saved himself by clinging to another. The ladder having been made when the withes were green, these were now dry, cracked, and some of them broken. We attempted a descent with some little misgivings, but, by keeping each hand and foot on a different round, with an occasional crash and slide, we all reached the foot of the ladder; that is, our own party, our Indians, and some three or four of our escort, the rest having disappeared.

Plate XVIII represents the scene at the foot of this ladder. Looking up, the view of its broken sides, with the light thrown down from the orifice above, was the wildest that can be conceived. As yet the reader is only at the mouth of this well; but to explain to him briefly its extraordinary character, I give its name, which is Xtacumbi Xunan. The Indians understand by this La Señora escondida, or the lady hidden away; and it is derived from a fanciful Indian story that a lady stolen from her mother was concealed by her lover in this cave.

Every year, when the wells in the plaza are about to fail, the ladders are put into a thorough state of repair. A day is appointed by the municipality for closing the wells in the plaza, and repairing to the cueva; and on that day a great village fête is held in the cavern at the foot of this ladder. On the side leading to the wells is a rugged chamber, with a lofty overhang-

Plate XVIII



F. Gutherwood.

S. H. Gilbert

BOLONCHEN

Cueva or Well.

ing roof and a level platform; the walls of this rocky chamber are dressed with branches and hung with lights, and the whole village comes out with refreshments and music. The cura is with them, a leader in the mirth; and the day is passed in dancing in the cavern, and rejoicing that when one source of supply fails another is opened to their need.

Figure 7 will give some imperfect idea of a section of this cave from the entrance to the foot of the great ladder, with the orifice through which

the light descends from above, and the wild path that leads deeper into the bowels of the rock and down to the water.

On one side of the cavern is an opening in the rock, as shown in the engraving, entering by which, we soon came to an abrupt descent, down which was another long and trying ladder. It was laid against the broken face of the rock, not so steep as the first, but in a much more rickety condition; the rounds were loose, and the upper ones gave way

on the first attempt to descend. The cave was damp, and the rock and the ladder were wet and slippery. At this place the rest of our attendants left us, the ministro being the last deserter. It was evident that the labour of exploring this cave was to be greatly increased by the state of the ladders, and there might be some danger attending it, but, even after all that we had seen of caves, there was something so wild and grand in this that we could not bring ourselves to give up the attempt. Fortunately, the cura had taken care to provide us with rope, and, fastening one end round a large stone, an Indian carried the other down to the foot of the ladder. We followed, one at a time; holding the rope with one hand, and with the other grasping the side of the ladder, it was impossible to carry a torch, and we were obliged to feel our way in the dark, or with only such light as could

reach us from the torches above and below. At the foot of this ladder was a large cavernous chamber, from which irregular passages led off in different directions to deposits or sources of water. Doctor Cabot and myself, attended by Albino, took one of the passages indicated by the Indians, of which some imperfect idea is given in the section.

Moving on by a slight ascent over the rocks, at the distance of about seventy-five feet we came to the foot of a third ladder nine feet long, two or three steps beyond another five feet high, both which we had to go up, and six paces farther a fifth, descending, and eighteen feet in length. A little beyond we descended another ladder eleven feet long, and yet a little farther on we came to one—the seventh—the length and general appearance of which induced us to pause and consider. By this time Albino was

the only attendant left. This long ladder was laid on a narrow, sloping face of rock, protected on one side by a perpendicular wall, but at the other open and precipitous. Its aspect was unpropitious, but we determined to go on. Holding by the side of the ladder next the rock, we descended, crashing and carrying down the loose rounds, so that when we got to the bottom we had cut off all communication with Albino; he could not descend, and, what was quite as inconvenient, we could not get back. It was now too late to reflect. We told Albino to throw down our torches, and go back for Indians and a rope to haul us out. In the mean time we moved on by a broken, winding passage, and, at the distance of about two hundred feet, came to the top of a ladder eight feet long, at the foot of which we entered a low and stifling passage; and crawling along this on our hands and feet, at the distance of about three hundred feet we came to a rocky basin full of water. Before reaching it one of our torches had gone out, and the other was expiring. From the best calculation I can make, which is not far out of the way, we were then fourteen hundred feet from the mouth of the cave, and at a perpendicular depth of four hundred and fifty feet. As may be supposed from what the reader already knows of these wells, we were black with smoke, grimed with dirt, and dripping with perspiration. Water was the most pleasant spectacle that could greet our eyes; but it did not satisfy us to drink it only, we wanted a more thorough benefit. Our expiring torch warned us to forbear, for in the dark we might never be able to find our way back to upper earth; but, trusting that if we did not reappear in the course of the week Mr. Catherwood would come to the rescue, we whipped off our scanty covering, and stepped into the pool. It was just large enough to prevent us from interfering with each other, and we achieved a bath which, perhaps, no white man ever before took at that depth under ground.

The Indians call this basin Chacka, which means *agua colorada*, or red water; but this we did not know at the time, and we did not discover it, for to economize our torch we avoided flaring it, and it lay on the rock like an

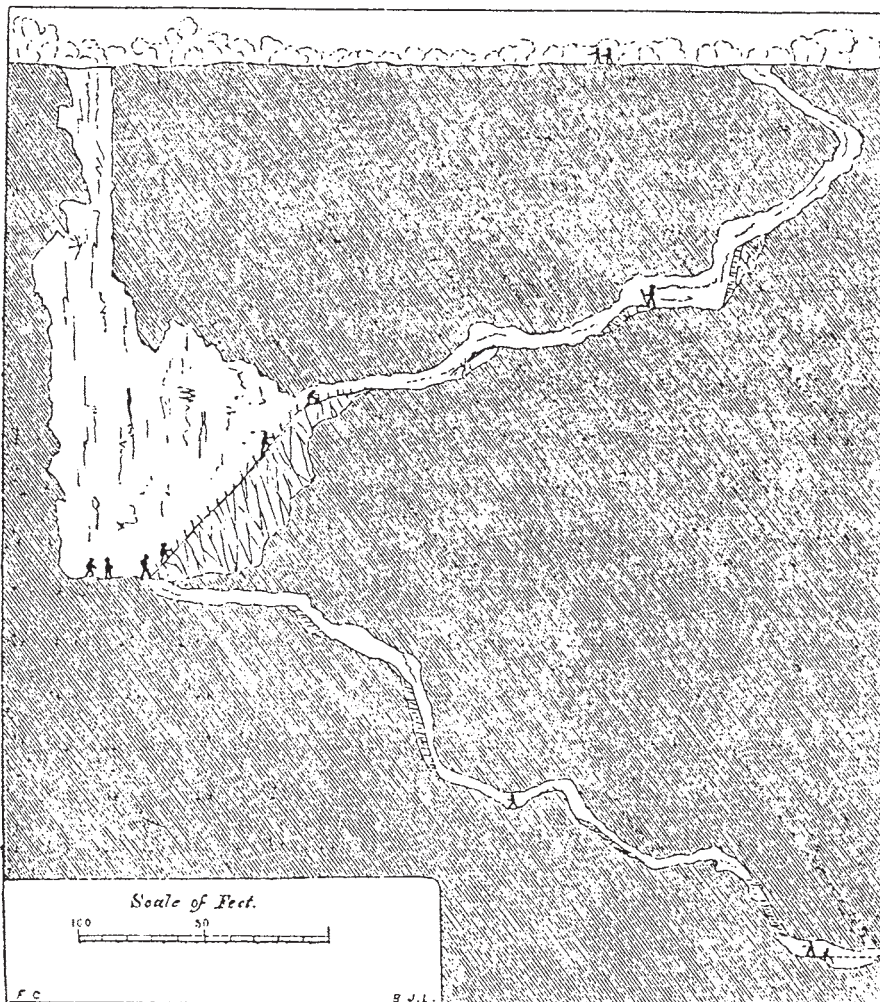


FIG. 7

expiring brand, admonishing us that it was better not to rely wholly upon our friends in the world above, and that it would be safer to look out for ourselves. Hurrying out, we made a rapid toilet, and, groping our way back, with our torch just bidding us farewell, we reached the foot of the broken ladder, and could go no farther. Albino returned with Indians and ropes. We hauled ourselves up, and got back to the open chamber from which the passages diverged; and here the Indians pointed out another, which we followed till it became lower than any we had yet explored; and, according to Doctor Cabot's measurement, at the distance of four hundred and one paces, by mine, three hundred and ninety-seven, we came to another basin of water. This, as we afterward learned, is called Pucuelha, meaning that it ebbs and flows like the sea. The Indians say that it recedes with the south wind, and increases with the north-west; and they add that when they go to it silently they find water; but when they talk or make a noise the water disappears. Perhaps it is not so capricious with white men, for we found water, and did not approach it with sealed lips. The Indians say, besides, that forty women once fainted in this passage, and that now they do not allow the women to go to it alone. In returning we turned off twice by branching passages, and reached two other basins of water; and when we got back to the foot of the great staircase, exhausted and almost worn out, we had the satisfaction of learning, from friends who were waiting to hear our report, that there were seven in all, and we had missed three. All have names given them by the Indians, two of which I have already mentioned.

The third is called Sallab, which means a spring; the fourth Akahba, on account of its darkness; the fifth Chocohá, from the circumstance of its being always warm, the sixth Ociha, from being of a milky colour; and the seventh Chimaisha, because it has insects called ais.

It is a matter of some regret that we were not able to mark such peculiarities or differences as might exist in these waters, and particularly that we were not provided with barometer and thermometer to ascertain the relative heights and temperatures. If we had been at all advised beforehand, we should at least have carried the latter with us, but always in utter ignorance of what we were to encounter, our great object was to be as free as possible from all encumbrances; besides which, to tell the truth, we did some things in that country, among which was the exploring of these caves, for our own satisfaction, and without much regard to the claims of science. The surface of the country is of transition or mountain limestone; and though almost invariably the case in this formation, perhaps here to a greater extent than anywhere else, it abounds in fissures and caverns, in which springs burst forth suddenly, and streams pursue a subterranean course. But the sources of the water and the geological formation of the country were, at the moment, matters of secondary interest to us. The great point was the fact, that from the moment when the wells in the plaza fail, the whole village turns to this cave, and four or five months in the year derives from this source its only supply. It was not, as at Xcoch, the resort of a straggling Indian, nor, as at Chack, of a small and inconsiderable rancho. It was the sole and only watering place of one of the

most thriving villages in Yucatan, containing a population of seven thousand souls; and perhaps even this was surpassed in wonder by the fact that, though for an unknown length of time, and through a great portion of the year, files of Indians, men and women, are going out every day with cantaros on their backs, and returning with water, and though the fame of the Cueva of Bolonchen extends throughout Yucatan, from the best information we could procure, not a white man in the village had ever explored it.

We returned to the casa real, made a lavation, which we much needed, and went over to the cura's to dine. If he had not reminded us beforehand that it was Friday and Lent, we should not have discovered it. In fact, we were not used to dainties, and perhaps the good cura thought we had never dined before. It was not in nature to think of moving that afternoon, and, besides, we were somewhat at a loss what to do. The cura had unsettled our plans. He had made inquiries, and been informed that there were no ruins at San Antonio, but only a cueva, and we had had enough of these to last us for some time; moreover, he advised us of other ruins, of which we had not heard before. These were on the rancho of Santa Ana, belonging to his friend Don Antonio Cerbera, the alcalde. Don Antonio had never seen them, but both he and the cura said they intended to visit them; and they spoke particularly of a casa cerrada, or closed house, which, as soon as the dry season came on, they intended to visit con bombas, to blow it up! The cura was so bent upon our visiting this place, that almost in spite of ourselves we were turned in that direction.

La Cueva en Bolonchen

Este es un folleto reimpresso sobre la visita a una cueva en Bolonchen en la península del Yucatán, publicada originalmente en *Incidents of Travel in Yucatán*, por John Stephens, 1843.

SEARCHING FOR THE BIG ONE AT XILITLA

Gerald Moni

For the last three years, a group of cavers from the Tennessee, Alabama, Georgia area (TAG), with help from several Mexican cavers, has been searching the Xilitla Plateau for caves. The Xilitla Plateau is located in the Mexican states of San Luis Potosí and Querétaro. This mountain range contains some of the deepest and best pits in the world, including Sótano de las Golondrinas. So far, we have found or rediscovered 112 caves and pits in the area from the city of Xilitla westward towards Jalpan, on the left (south) side of Highway 120. From Highway 120, several good dirt roads lead off into the surrounding mountains. Our procedure is to camp next to a road and do day hikes to find and explore the nearby caves. Since the cave entrances are nearly impossible to find without help, we use local guides to lead us to the caves.

Our Xilitla project started during a 1990 Christmas trip by Thany Mann and me. We had planned to visit several of the lesser-known caves in northern Mexico, but once in Mexico we decided to also search for new caves. From the city of Xilitla, we followed a dirt road several kilometers to Sumidero de Tlaetla. After bouncing this 125-meter pit, we drove further down the dirt road to Puerto de Amayo. For the next several days, we found and explored nearby caves. Our best discovery was Sótano de Lamoras, a 90-meter pit. On the following year's Thanksgiving trip, this cave was pushed down three additional pitches for an estimated total depth of 170 meters.

The next trip was Easter 1991. Jack Thomison and I visited Mexico for two weeks. Most of the trip was searching for new caves. In Xilitla, we met Fausto Gómez, a resident who had done some caving, but had quit when a friend died in Sótano de Peña

Blanca, a very large and impressive cave. After leaving Xilitla, Jack and I looked for caves from Xilitla to Puerto de Amayo. At Puerto de Amayo, we found several significant caves. The best was Sótano de Lutevio, a 58-meter pit with a second, undescended pit and strong air flow.

Over Thanksgiving 1991, a large group of TAG cavers and Vico Jones, from San Luis Potosí, Mexico, returned to Puerto de Amayo. The next week we checked known leads and searched for new caves. Sótano de Lutevio was pushed down twenty-two pits to an estimated depth of 460 meters. [See article in *AMCS Activities Newsletter* 19.] Three other caves were explored down to depths between one hundred and two hundred meters. Ten new caves, all duds, were found.

Our Easter 1992 trip started out as a disaster. Five members of the expedition were not able to enter Mexico because of a change in the requirements for taking vehicles into the country. However, four cavers did get into Mexico. We started at the town of Ahuacatlán, 20 kilometers west of Xilitla, and searched along the foot trail to La Victoria. During the following week we found eighteen caves. Our three best caves were next to the La Victoria trail 4 kilometers from Ahuacatlán. Sótano Rubio, at 82 meters, was the deepest pit discovered. Sótano La Laja is located only 10 meters to the right of the trail. This blind pit is 46 meters deep. Sótano Chabello Montoya was our best discovery. The cave was explored down to the top of the sixth pit. The following Thanksgiving, TAG cavers were stopped at the bottom of the sixth pit by a tight crack at a total depth of 165 meters.

The 1992 Thanksgiving trip in-

cluded eighteen cavers, three from San Luis Potosí. We went 30 kilometers west of Xilitla to the town of El Lobo on Highway 120. A dirt road ran south for over 50 kilometers. One group of cavers searched without luck for caves northeast of Ahuacatlán. The rest looked 1 to 8 kilometers south of El Lobo. We found thirty-four caves and pits. Chris Hudson and I found Sótano de Alfredo. Chris did the entrance pit, leaving a second pit undescended.

The Easter 1993 trip had four TAG cavers. We were joined by three cavers from Mexico City. We continued searching south-southeast of El Lobo along the dirt road to the village of Neblinas. South of Neblinas, we found our deepest pit, Pozo Demado, which is 155 meters deep. Sótano de Alfredo was explored down twenty-two pits to a depth of about 300 meters by Peter Hall, Paul Aughey, Carlos González, and Bernardo Morales. A total of twelve new caves were found. The main areas searched were around the villages of Neblinas and Puerto de Sabino.

We plan to continue in the future our systematic search for new caves on the Xilitla Plateau, always hoping to find the Big One.

En Busca del Más Profundo

Desde hace tres años espeleólogos de Tennessee, Alabama, y Georgia, con la ayuda de espeleólogos mexicanos, han localizado 112 cavernas en los estados de San Luis Potosí y Querétaro. En las cercanías de Xilitla se encontró el Sótano de Lamoras (Las Moras) el cual contiene un tiro de 90 metros y con una profundidad total de 170 metros, el Sótano de Lutevio con 22 tiros, y una profundidad estimada de 460 metros, Pozo Demado (de Amado) con 155 metros de profundidad, y el Sótano de Alfredo con 22 tiros y una profundidad de 300 metros.

Xilitla Area Caves, Found December 1990 to April 1993
Gerald Moni

	location map	length (m)	vertical extent (m)	deepest pit (m)	number of pits	
<u>Caves in San Luis Potosí</u>						
1.	Sótano de Peña Blanca	1	700	110	27	1
2.	Cueva de Sapo	2	20	6		
3.	Cueva del Laberinto	2	150	30	20	1
4.	Cueva Fausto	2	150	40	20	1
5.	Cueva del Tejón	2	25	15	10	1
6.	Cueva del Harador	2	60	5		
7.	Sótano la Planada	2	10	27	25	1
8.	Sótano de Palomas	2	15	30	20	1
9.	Cueva de Lencho	3	30	15	8	1
10.	Sótano Encarnación	3	20	30	23	1
11.	Sótano de Cilantro	3	20	63	57	1
12.	Sótano de Liboria	3	15	17	15	1
13.	Sótano de Lamoras	3	100	170	90	4
14.	Cueva de Raymundo	3	75	15		
15.	Sótano de Daniel	3	6	20	16	1
16.	Cueva de Daniel	3	350	50		
17.	Sótano de Quireno	3	60	67	67	1
18.	Sótano Terrezu de Herrera	3	350	80	55	1
19.	Sótano de Bajada	3	15	15	9	1
20.	Cueva de Encarnación	3	25	3		
21.	Cueva de Luisito	3	65	60	5	2
22.	Cueva de Sierra Teran	3	65	40	15	1
23.	Cueva de Teran	3	30	7		
24.	Cueva del Cantil	4	70	50	38	1
25.	Sótano del Cotorro	4	2	22	21	1
26.	Sótano del Puerco	4	25	32	27	1
27.	Sótano de Uhuaxuco	5	25	49	29	1
28.	Cueva de Huaxuco	5	250	70	11	3
29.	Sótano de las Ropas Perdidos	5	200	85	25	6
30.	Sótano de Zaragoza	5	15	30	27	1
31.	Sótano de Toribio	5	15	27	23	1
32.	Cueva de Sirenio Muñoz	5	20	30		
33.	Sótano del Chapulín	5	6	30	29	1
34.	Sótano de los Jarros	5	25	16	14	1
35.	Cueva de los Jarros	5	25	30	8	1
36.	Sótano de Lutevio	5	600	460	58	22
37.	Sótano de Alicia	5	120	115	38	5
38.	Sótano de Barrio Huaxuco	5	15	30	14	1
39.	Cueva del Vidro Roto	5	20	25	5	1
40.	Cueva de Agua Fría	5	100	75	56	1
41.	Sótano de Mucho Machete	5	6	16	13	1
42.	Sótano de Huexco	5	30	39	36	1
43.	Sótano de Mojada	5	6	18	16	1
44.	Sótano Cabeza de Pollo	5	12	25	23	1
45.	Cueva de Mojada	5	50	45	13	3
46.	Sótano de Trelestino	5	10	40	40	1
47.	Cueva de Cerrano	5	60	8	20	2
48.	Cueva de Vicente Cerrano	5	60	20		
49.	Sótano de Cesar	5	12	27	22	1
50.	Cueva de Odon	5	6	20	17	1
51.	Cueva de las Joyas de Mojada	5	120	50	11	2
52.	Cueva de Joyas Chica	5	15	12		
53.	Cueva de Esu	5	100	25		
54.	Sótano de Jonas Trejo	5	6	17	17	1
55.	Sótano de Serrano	5	24	34	25	1

	location map	length (m)	vertical extent (m)	deepest pit (m)	number of pits	
56.	Sótano Coate	5	10	45	40	1
57.	Bordo del Mundo	5	10	24	16	1
58.	Cueva de Risco	5	70	6		
59.	Sótano la Laja	5	70	58	46	1
60.	Sótano Rubio	5	35	110	82	1
61.	Sótano Chabello Montoya	5	260	165	51	6
62.	Hoyo de Lopez	6	6	17	13	1
63.	Hoyo de Minita	6	24	21	21	1
64.	Cueva de la Agua Nueva	6	100	25	7	1
65.	Cueva de las Cruces	6	60	10		
66.	Sótano Necio	6	3	15	14	1

Caves in Querétaro

67.	Cueva de Ezequiel Rubio	6	110	10		
68.	Sótano de Colibrí	8	43	41	31	2
69.	Cueva de Emigdio	8	25	24		
70.	Sótano de Emigdio	8	24	28	27	1
71.	Sótano de Caña Azúcar	8	15	37	30	1
72.	Sótano de Hombre Muerto	8	100	52	41	2
73.	Sótano de Manquez	8	14	37	21	2
74.	Cueva de Llano	8	15	13	7	1
75.	Sótano de Buhonero	8	10	19	12	1
76.	Sótano de Eladio	8	60	30	11	1
77.	Hoyo de Burros Peliando	8	12	19	13	1
78.	Sótano de las Sotonas	8	24	24	13	1
79.	Gruta de Mario	8	30	18		
80.	Gruta de Sheriff	8	45	18		
81.	Sótano de la Yerbabuena	8	20	41	35	1
82.	Sótano de Naranja	8	30	68	65	1
83.	Sótano de Pierna Larga	7	6	15	14	1
84.	Gruta de Arana Negra	7	175	5		
85.	Sótano de las Ciénegas	8	7	60	56	1
86.	Sótano de Luiz	8	12	29	29	1
87.	Sótano de Nido	8	12	70	64	1
88.	Hoyo del Rotannes	8	15	32	16	2
89.	Sótano de Dos Vacas	8	38	48	14	2
90.	Cueva de Imontrejo	8	20	12		
91.	Gruta de Guadalupe	8	15	15		
92.	Sótano de Gracia	9	15	16	13	1
93.	Cueva Demado	9	20	6		
94.	Pozo Demado	9	40	161	155	1
95.	Sótano el Querreque	9	10	21	18	1
96.	Sótano de Izac	9	5	16	12	1
97.	Sótano la Huerta	10	10	25	25	1
98.	Sótano de los Pinos	10	4	20	16	1
99.	Cueva de Norborto	10	30	7		
100.	Sótano de Mayorga	10	13	19	15	1
101.	Cueva de Gelasio	10	25	12		
102.	Sótano de Río Verdito	10	15	32	26	1
103.	Cueva de Río Verdito	10	50	20		
104.	Cueva de Frutoso	10	25	6		
105.	Sótano de Alfredo	10	400	300	38	22
106.	Sótano de Reynaldo	10	25	21	14	1
107.	Sótano Pequeño Grande	10	12	17	12	1
108.	Gruta del Encino	11	200	18		
109.	Sótano de Gráfico	11	30	62	58	1
110.	Sótano de Juan	11	12	38	37	1
111.	Sótano de Romeo	11	8	41	40	1
112.	Cueva de la Mesa de la Seiba	12	27	6		

CAVE DESCRIPTIONS

1. **Sótano de Peña Blanca**, SLP. Four hundred meters northwest of cementerio shown on the topo. A dirt road goes west 1.5 kilometers to the cementerio from the old Xilitla road. Pass to the right of the cementerio through a gap and follow trail down about 50 meters. The pit entrance is about 40 meters to the left (west).

The large pit entrance is 20 meters long and 10 meters wide. The 27-meter pit leads to a room more than 30 meters across that slopes downward to the left and right. The left passage is 350 meters long. A 60-meter-deep slope goes to a 20-meter-wide, 15-meter-high passage that ends after 250 meters. The right passage slopes downward to a 60-meter-high and 40-meter-wide passage that goes 350 meters and gets smaller (20 by 20 meters) near its end. A very large cave with nice formations. Pits in the floor were probably dug for phosphate.

2. **Cueva de Sapo**, SLP. Thirty meters north of Cueva de Laberinto (number 3) and 80 meters vertically above the paved Xilitla highway, 0.5 kilometer southwest of town. In a coffee plantation.

The entrance is 5 meters high and 2 meters wide. The canyon passage goes 20 meters, 5 meters high, with some formations.

3. **Cueva de Laberinto**, SLP. Thirty meters south of Cueva de Sapo (number 2).

The entrance is 2 meters wide and 1.5 meters high. The stoop entrance goes 12 meters to a junction. The left passage goes 65 meters in interconnecting maze passages. A log across a 10-meter-deep pit goes to the end. The right passage goes 25 meters to a room, from which a short, tight crawl leads to a 20-meter pit that was not descended.

4. **Cueva Fausto**, SLP. Thirty meters east of the Xilitla—Plan de Juarez trail and 400 meters southeast of the paved Xilitla highway (route 120). The entrance, 6 meters wide and high, leads to a large room that slopes down to the left to a junction. The left passage goes 80 meters. The right passage goes to a maze of rooms and finally to a 20-meter pit that

was not descended.

5. **Cueva del Tejón**, SLP. Two hundred meters northwest of Cueva del Harador (number 6), at the top of a hill 0.9 kilometers south of paved highway 120.

The entrance is a 7-meter-deep crack. A 1.5-meter-square hole goes to a 2-meter climb down into a room. A sloping pit goes 15 meters (10 meters vertically) to the bottom, where a passage goes 10 meters to the end of the cave. The pit has two major ledges, the first of which is 5 meters down.

6. **Cueva del Harador**, SLP. Two hundred meters southeast of Cueva del Tejón (number 5), 15 meters lower, on the southeast side of the hill.

The entrance is 2 meters long and 1

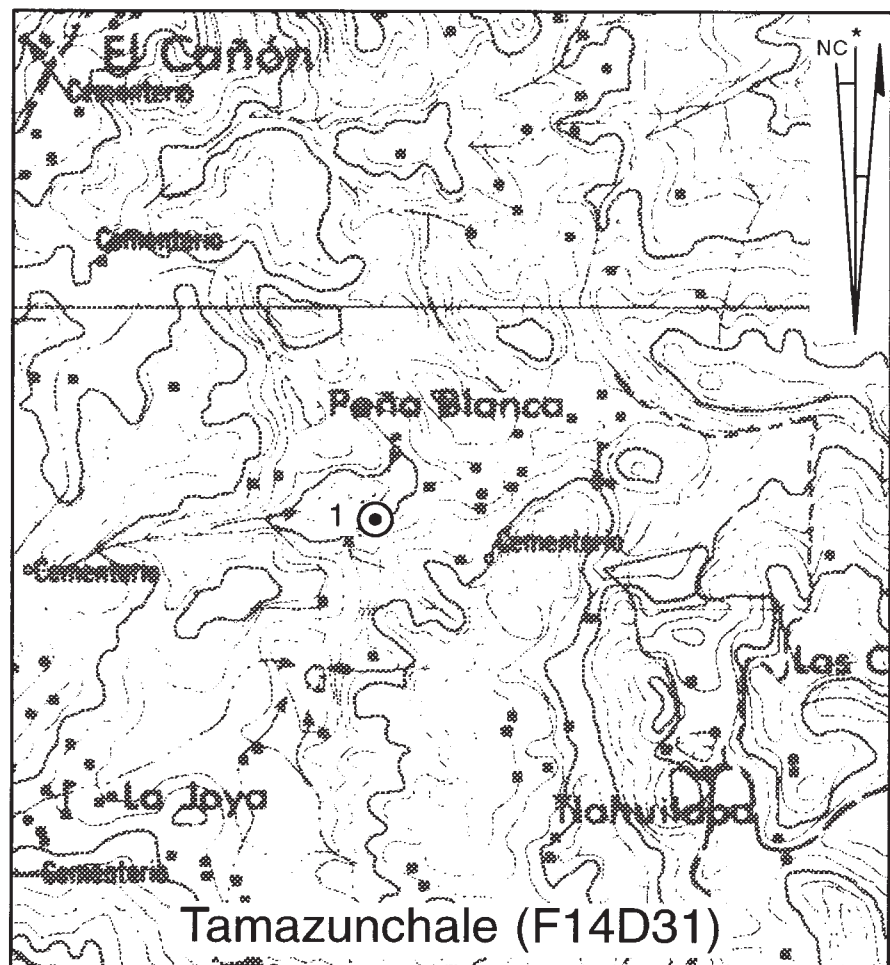
meter wide in a bluff 4 meters high. A 3-meter slope leads to a 10-meter-diameter room. From this room a passage 1 meter high goes as a muddy crawl for 50 meters.

7. **Sótano la Planada**, SLP. Fifty meters east of the main Xilitla—Plan de Juarez trail, 1.5 kilometers south of Xilitla. Ten meters west of a minor side trail.

The pit entrance is 5 meters long and 5 meters wide, and the pit is 25 meters deep. At the bottom is a room 10 meters long and 6 meters wide, with no leads.

8. **Sótano de Palomas**, SLP. Thirty meters below and on the west side of Cerro de Jobo, 2 kilometers south of Xilitla.

The pit entrance is 8 meters long and 3 meters wide. The depth of the pit is 20



Map 1



These descriptions have been written by the editor based on information in cave-report forms supplied by Gerald Moni.

meters, and the cave slopes downward 6 more meters to a bottom with no leads.

9. **Cueva de Lencho**, SLP. The cave is 1400 meters east-southeast of Puerto de Amayo.

The entrances are in a sink 10 meters in diameter. Entrance 1 is 3 meters wide and 2 meters high; entrance 2 is 5 meters wide and 1.5 meters high. Entrance 1 slopes down 15 meters to a room from which a passage with an 8-meter pit to right to entrance 2. Entrance 2 slopes downward 8 meters to a 10-meter pit. Half way down the slope is the passage to entrance 1. The room at the bottom of the pit ends after 7 meters.

10. **Sótano Encarnación**, SLP. West of Xilitla, turn downhill to the left on first dirt road. Follow it 6.5 miles to Amayo de Zaragoza, turn left and continue 0.5 mile to Encinal. The pit is 8 meters left (east) of and 3 meters above the road.

The entrance to the sloping 23-meter

pit is 4 meters across. The pit has two major ledges. The bottom is a room 8 meters across with trash, many bones, and no leads.

11. **Sótano de Cilantro**, SLP. The entrance is 10 meters uphill and 350 meters south of the school in Amayo de Zaragoza (see number 10). It is 25 meters south of an arroyo.

The pit is 2 meters square at the top and 57 meters deep. It is 7 meters across at the bottom, where a 6-meter climb down leads to the end.

12. **Sótano de Liboria**, SLP. Entrance is 1100 meters south-southeast of village school, 150 meters southwest of Sótano de Lamoras (number 13). It is on a hillside in jungle overlooking a "flat" pasture.

The entrance is 7 meters long by 5 meters wide, and the blind, sloping pit is 15 meters deep on the low side and 15 meters long at the bottom.

13. **Sótano de Lamoras**, SLP. One thousand meters south-southeast of school in Amayo de Zaragoza (see number 10), and 150 meters northeast of Sótano de Liboria, on a hillside in jungle overlooking a "flat" pasture.

The entrance is 8 meters square and 90 meters deep. At the bottom, 10 by 15 meters, a 6-meter climb up leads to a 57-meter pit. At its bottom, another climb up leads to a 6-meter pit, from the bottom of which a climb down and tight squeeze lead to the fourth pit, 17 meters deep. Some small crawls at the bottom go 60 meters before pinching out with no air flow.

14. **Cueva de Raymundo**, SLP. Entrance 2 is 40 meters north of Cueva de Daniel (number 15).

Entrance 1 is 5 meters wide and 10 meters high. Entrance 2 is 4 meters wide and 3 meters high. From entrance 1, the passage, 15 meters high and 6 meters wide, goes south 70 meters to entrance 2. Twenty meters inside the cave, a short slope down to the right ends after 12 meters.

15. **Sótano de Daniel**, SLP. Twelve hundred meters south-southeast of the school in Amayo de Zaragoza (see number 10), in pasture, 30 meters uphill (north) from the upper entrance 2 to Cueva de Daniel (number 16).

The pit entrance is 1.5 meters across and 16 meters deep. A 5-meter slope leads to the end.

16. **Cueva de Daniel**, SLP. Twelve hundred meters south-southeast of school in Amayo de Zaragoza (see number 10). One hundred fifty meters north and slightly east of Sótano de Quireno in the first sinkhole valley. Forty meters south is entrance 2 to Cueva de Raymundo (number 14).

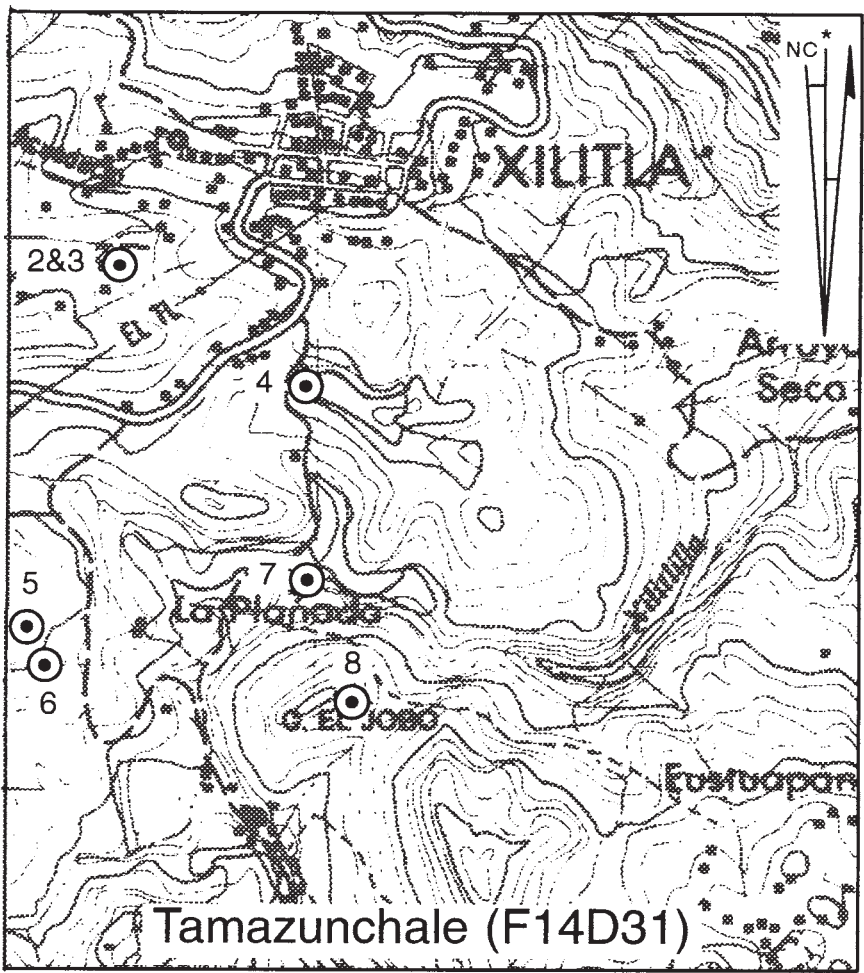
There are three entrances. The first two are separated by a natural bridge, and both are 20 meters high and 10 meters wide. The third is a pit 30 meters deep and 7 meters wide.

From the first two entrances, the passage goes 300 meters, 15 meters high and 10 meters wide. Two passages to the right loop around to the bottom of the pit entrance. A nice, large cave.

17. **Sótano de Quireno**, SLP. On top of a ridge between two sinkhole valleys, 1400 meters south-southeast of Amayo de Zaragoza (see number 10).

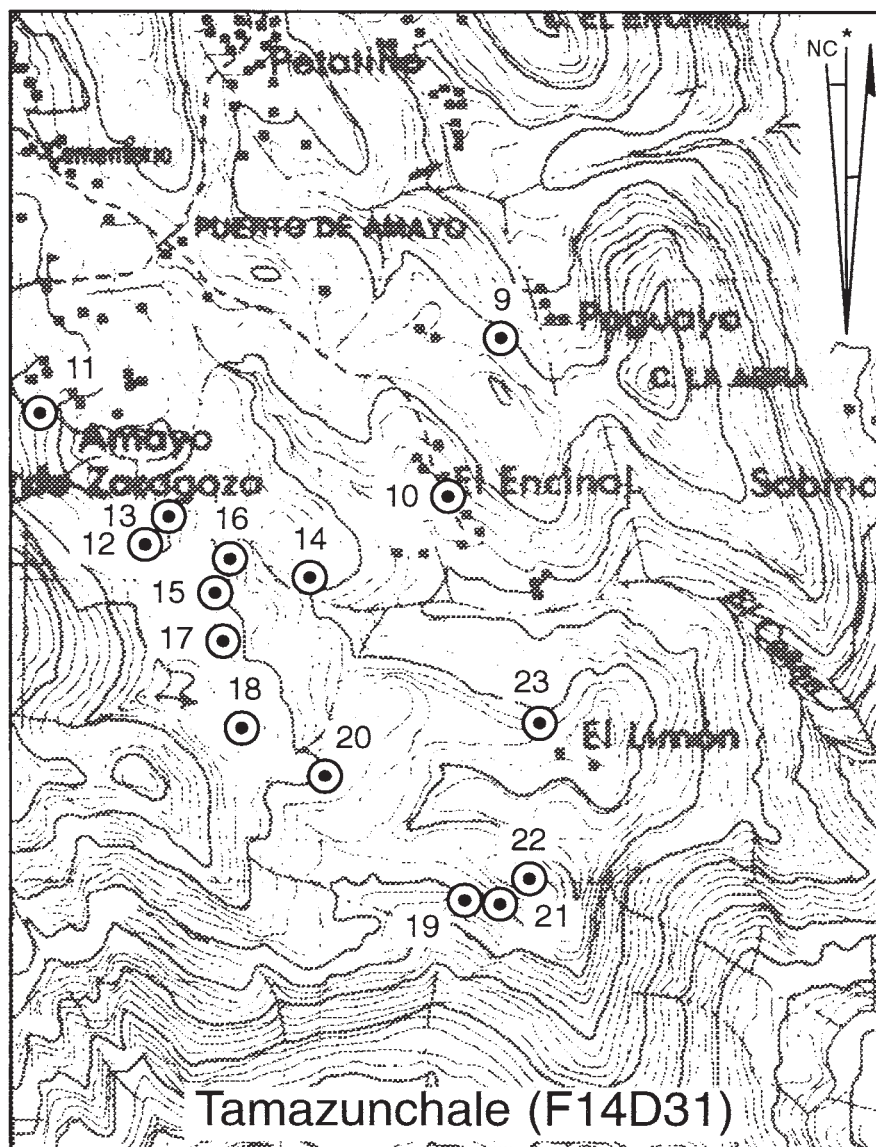
The entrance pit is 10 meters wide and about 67 meters deep. A very nice, free drop. Rope did not reach the bottom, where two possible passages were seen.

18. **Sótano Terrezu de Herrera**, SLP. On top of a ridge, 500 meters south of



Map 2





Map 3



Sótano de Quireno (number 17) and 150 meters south of a major arroyo.

The entrance pit is 55 meters deep. It is 12 meters across at the top and 30 meters at the bottom. At the bottom one can go right into a parallel dome 20 meters long, 12 meters wide, and 30 meters high. On the far side of this room a 6-meter climb leads to a passage that was not explored. Below the climb, the cave descends 20 meters to a dirt sump.

On the other (left) side of the entrance pit is a climb up to a passage 12 meters high and 10 meters wide with huge flowstone formations. There are about 250 meters of passage here, and the total passage at the bottom of the pit is at least

350 meters.

19. **Sótano de Bajada**, SLP. On the north side of Río Tancuilín, 0.5 kilometers south-southwest of El Limon. Twenty meters below and 100 meters west of Luisito (number 21); 65 meters vertically below the top of the ridge.

The slit entrance is 10 meters long and 3 meters wide. The high side is a climb down to a 5-meter pit. The low side is a 9-meter pit. At the bottom, the cave goes down 6 more meters and is 15 meters long, with no leads.

20. **Cueva de Encarnación**, SLP. On top of a hill that doesn't show on the topo map. One kilometer west and slightly south of El Limon, 1.1 kilometer

southeast of Amayo de Zaragoza.

Entrance 1 is 8 meters wide and 4 meters high. The borehole slopes downward 10 vertical meters, then goes upward to entrance 2, a tight crawl 1.25 meters wide and 0.3 meters high.

21. **Cueva de Luisito**, SLP. One-half kilometer south-southwest of El Limon; 20 meters above and 100 meters to the right of Sótano de Bajada (number 19). At the base of a 10-meter cliff 40 vertical meters below the top of the ridge. A fissure-like arroyo goes from Bajada up the mountain to Luisito, angling to the right. Several cave-like karst features were noted within this arroyo.

The entrance is 2 meters wide and 1.8 meters high and slopes downward. The passage goes 50 meters to a 3-meter pit, 10 meters further to a 5-meter pit, and then ends. The passage is a rift that slopes downward until it finally gets too narrow.

22. **Cueva de Sierra Teran**, SLP. On the top of a ridge overlooking the Río Tancuilín, 0.4 kilometer south-southwest of El Limon.

The entrance is in the bottom of a 5-meter-deep sink 2 meters square. The 1-by-2-meter rift slopes steeply downward for 40 meters to a 5-meter pit, which wasn't descended but doesn't look as if it goes.

23. **Cueva de Teran**, SLP. On the north slope of a ridge 25 meters below the top. Three hundred meters west of El Limon and 1.8 kilometers southeast of Puerto de Amayo.

The entrance is 1.9 meters wide and 0.8 meters high. The cave is 30 meters long, with small formations. The passage is mainly walking, very muddy, and ends in a mud sump with no leads.

24. **Cueva del Cantil**, SLP. Three hundred meters southeast of highway 120, 60 meters below it and 10 meters above a valley floor, level with some power lines.

The entrance is 8 meters long and 2.25 meters wide. A 5-meter climb down leads to a room, from which a passage goes 10 meters to a 38-meter-deep pit. At its bottom are 30 meters of passage.

25. **Sótano del Cotorro**, SLP. On the northeast side of a major arroyo, 60 meters from the stream bed. Six meters west of sótano el Puerco (number 26). Due south 0.5 kilometers from Sótano de San Antonio. Two hundred fifty meters south-southeast of highway 120.

A blind pit 21 meters deep and 1.5 meters in diameter at the top.

26. **Sótano del Puerco**, SLP. On the northeast side of a major arroyo, 60 meters from the stream bed and 5 meters

down from the top of a gap. Six meters east of Sótano el Cotorro, and 0.5 kilometer south of Sótano de San Antonio. Two hundred fifty meters south-south-east of highway 120.

The pit entrance is 10 by 7 meters, and the pit is 27 meters deep. At the bottom, a passage slopes downward 5 vertical meters to the end. There are no leads.

27. **Sótano de Uhuaxuco, SLP.** One hundred meters vertically above and 500 meters north-northwest of the village of Huaxuco (spelled Uhuaxuco on the topo map). The pit is 30 meters below the top of the mountain, above and to the left of a school. It is 1.4 kilometers north-northwest of Ahuayo Zaragoza.

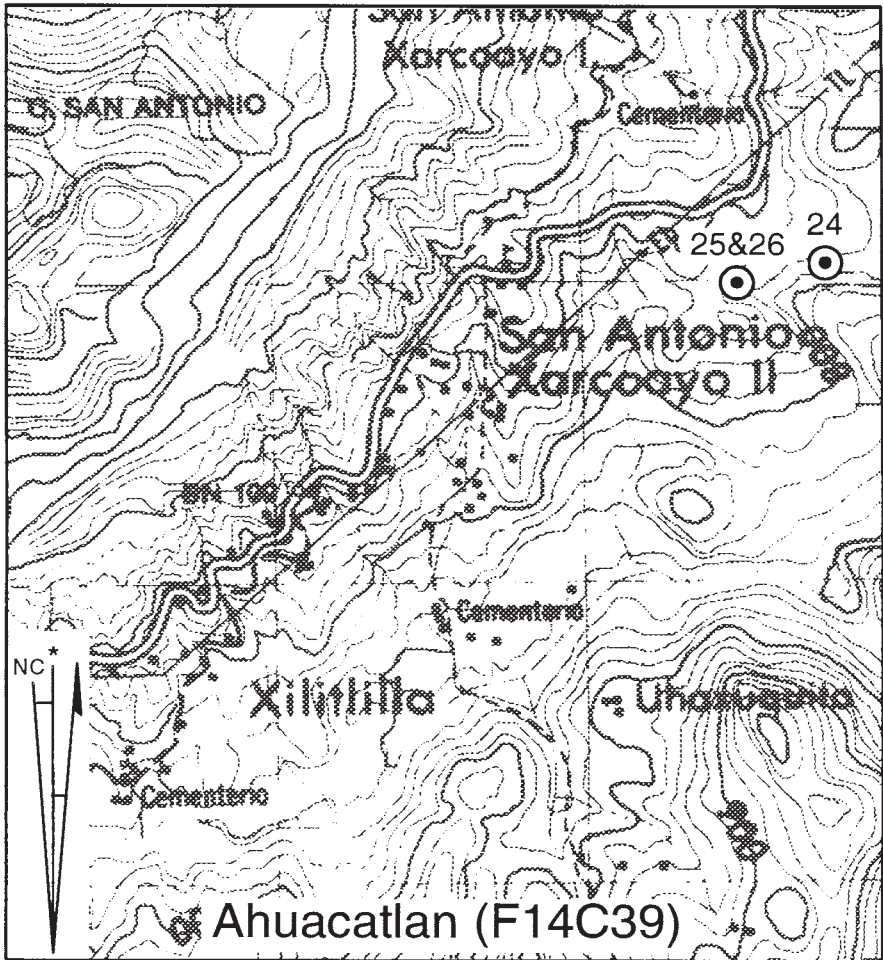
The entrance pit is 29 meters deep and 3 meters in diameter at the top. The bottom slopes down climbs 20 meters to a couple of small rooms. A 30-degree downward slope ends at a too-tight hole.

28. **Cueva de Huaxuco, SLP.** Located in a large sink at the valley floor, 50 meters northeast of a main trail, in the village of Huaxuco (spelled Uhuaxuco on map). One kilometer north-northwest of Ahuayo Zaragoza.

The entrance is 3 meters square. Sixty meters from the entrance is an 8-meter pit. Fifty meters of stooping and walking passage leads to an 11-meter pit. At its bottom is a 4-meter climb down. The next 50 meters is crawl and stoop and leads to the last pit, 5 meters deep. About 80 meters of passage leads from there to a flowstone plug with some air flow. A stream, which goes to the end of the cave, is first met 15 meters from the entrance.

29. **Sótano de las Ropas Perdidos, SLP.** At the southwest corner of a field, in an outcrop 3 meters from fence, 600 meters northwest of the school at Zaragoza; 1.2 kilometers northeast of the village of Las Joyas and 1.3 kilometers southeast of the village of Agua Fria.

The entrance is 2 meters by 1 meter and has a very strong air flow. The first pit is 12 meters deep. The last half of the pit is on a slope that leads to a 24-meter pit with one major ledge. At the bottom is a large room with 30 meters of passages. A 6-meter climb up leads to 15 meters of nice walking passage to a 9-meter pit. At the bottom is a 25-meter pit, from the bottom of which 30 meters of passage goes down two more pits of 5 and 4 meters and gets too tight. The 25-meter pit has a waterfall running down one side. At the top of the 25-meter pit, a 60-meter passage goes to a parallel 24-meter pit, where the cave ends in a mud sump. Footprints and carbide dumps



Map 4



were seen throughout the cave.

30. **Sótano de Zaragoza, SLP.** The entrance pit is 200 meters northwest of and 20 meters above the school at Amayo de Zaragoza (see number 10). It is 7 meters long, 3 meters wide, and 27 meters deep and leads to a room 8 by 5 meters. A sloping passage goes 10 meters to a 1-meter climb down to a drain too tight to follow.

31. **Sótano de Toribio, SLP.** One kilometer northeast of Cerro los Jarros, 200 meters northwest of main trail on the east side of a knob.

The pit entrance is 2 by 1.25 meters and 23 meters deep. There is a ledge 11 meters down, and at the bottom a 3-meter climb down leads to a short fissure passage.

32. **Cueva de Sirenio Muñoz, SLP.** On the west side of a 25-meter-high hill not shown on topo. The entrance is half-way up the hill and 500 meters south-east of the village of Los Jarros.

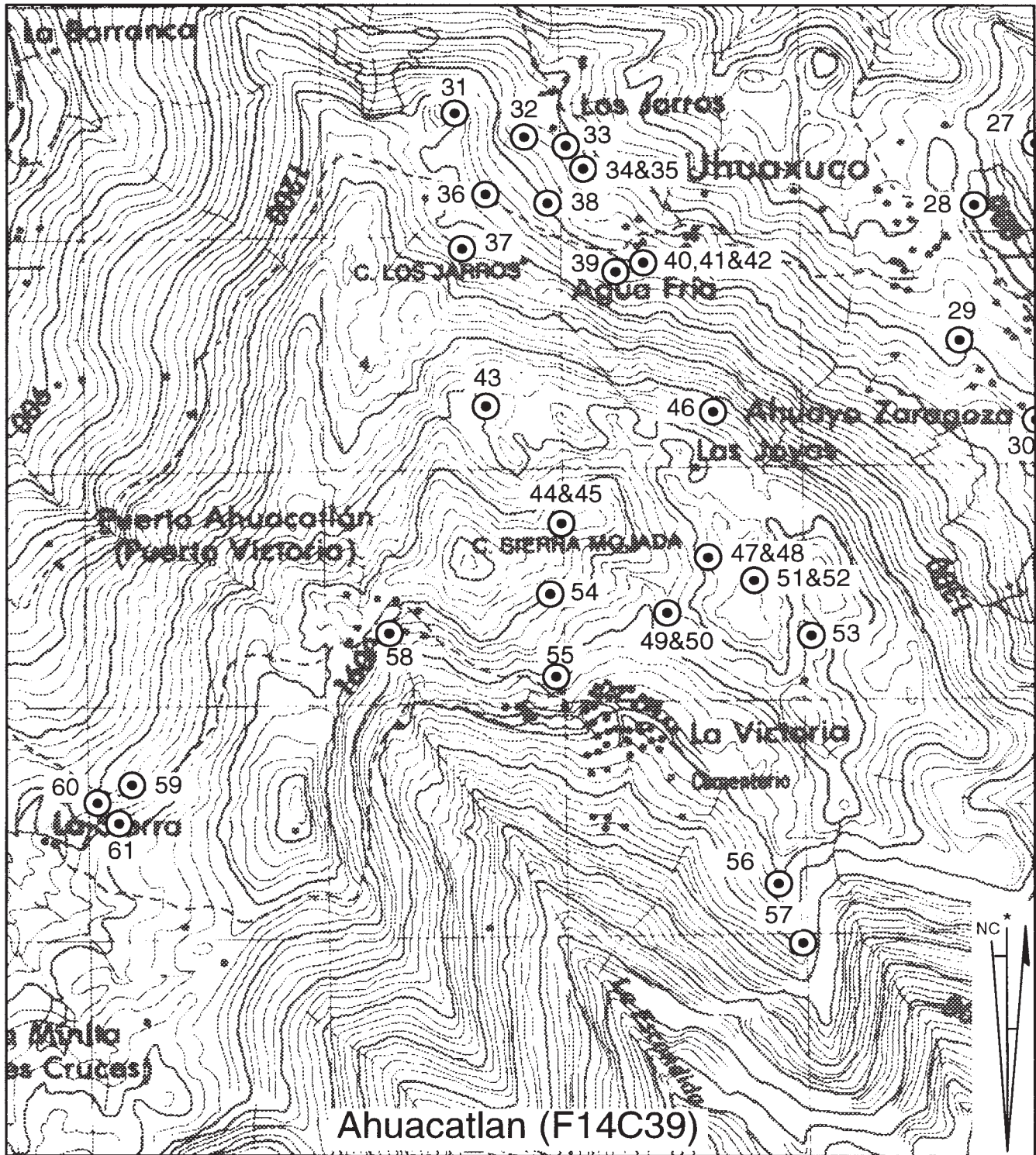
The entrance is 7 meters square. The passage slopes downward at 45 degrees for 20 meters, with some climbs. The passage stays 7 meters square to the end.

33. **Sótano de Chapulín, SLP.** Four hundred meters south of the village of Los Jarros, 100 meters north of Cueva de los Jarros (number 35), and 10 meters southwest of the main Huaxuco—Los Jarros trail.

The blind pit is 29 meters deep, 7 by 3 meters at the top, and 6 by 6 meters at the bottom.

34. **Sótano de los Jarros, SLP.** Five hundred meters south of the village of Los Jarros, 100 meters southeast of the main Huaxuco—Los Jarros trail. Thirty meters east of Cueva de los Jarros.

The pit entrance has a diameter of 15 meters and a depth of 14 meters. The bottom slopes to a choke. Two short passages in the side of the pit connect to a parallel dome.



Map 5



35. **Cueva de los Jarros**, SLP. Thirty meters west of Sótano de los Jarros (number 34).

The entrance is 7 meters wide and 3 meters high. A downward-sloping passage 25 meters long goes 20 vertical meters to the top of an undescended 8-meter pit.

36. **Sótano de Lutevio**, SLP. Seven meters downhill (northeast) of a main trail and 40 meters northwest of a school with ball court. Seven hundred meters northeast of Cerro Los Jarros.

Eight meters down the sinkhole entrance is a 58-meter pit, which leads to passage and pits with estimated length of 600 meters and depth of 460 meters. See *AMCS Activities Newsletter* number 19 for an article describing this cave.

37. **Sótano de Alicia**, SLP. Sixty vertical meters above and west of a school with ball court on a main trail. Thirty meters above a barbed-wire fence. One kilometer northwest of Agua Fría and 600 meters northeast of Cerro los Jarros.

The sink entrance is 20 meters long and 10 meters wide. The entrance pit is 38 meters deep, and at the bottom is a 4-meter pit. Then 10 meters across a room is a 6-meter climb down to the third pit, 9 meters deep. (The second and third pits may be climbable.) Then a 5-meter, sloping pit leads to a series of climbs down a fissure that add up to 75 meters vertically and lead to a tight crawl to the last pit, 12 meters deep. At its bottom is a 3-meter climb down to 25 meters of tight crawlway that could go further. There is very little air flow.

38. **Sótano de Barrio Huaxuco**, SLP. Fifty meters vertically below the main trail, 800 meters east-northeast of Cerro los Jarros and 400 meters northwest of Agua Fría.

The pit entrance is 2 by 1.25 meters and goes down 14 meters, with a ledge 6 meters down. At the bottom, an 18-meter sloping passage 5 meters wide and 8 meters high leads to the end.

39. **Cueva del Vidro Roto**, SLP. Two hundred meters west-southwest of the village of Agua Fría, 25 meters vertically above the village. Fifty meters vertically above and to the south-southwest of Sótano de Agua Fría, and 1.9 kilometers northwest of Ahuayo Zaragoza.

The entrance is 3 meters in diameter. A 14-meter slope leads to a nasty 5-meter pit with a slope of talus and broken glass at the bottom.

40. **Cueva de Agua Fría**, SLP. Thirty meters southwest of and 10 meters lower than a major trail. Thirty meters to the northwest is a smaller, 10-meter pit not descended. Seventy-five meters north-

west of the village of Agua Fría, 1.9 kilometers northwest of Ahuayo Zaragoza.

The entrance is 8 meters high and wide. A passage to the right slopes downward to 12 meters and ends. The main passage slopes downward at 45 degrees for 20 meters to a very difficult 8-meter climb down to a 56-meter pit with a major ledge 29 meters down. A passage at the bottom goes 80 meters before it becomes too tight.

41. **Sótano de Mucho Machete**, SLP. Thirty meters west of village of Agua Fría and 80 meters south of Sótano de Agua Fría, on southwest side of 10-meter-deep valley; 1.9 kilometers northwest of Ahuayo Zaragoza.

The pit entrance is 2 by 1.5 meters and 13 meters deep. At the bottom, a passage slopes downward 3 meters to the end.

42. **Sótano de Huexco**, SLP. One hundred meters northwest of the village of Agua Fría and 28 meters vertically below it. On northeast side of pasture, within a row of limestone outcrops.

The top of the pit is 2 by 1.5 meters. The pit goes down 36 meters, past ledges as 7 meters and 23 meters. At the bottom is a 12-meter-diameter room with a couple of short, small passages leading off.

43. **Sótano de Mojada**, SLP. Six hundred meters north of Cerro Sierra Mojada, on southeast side, 10 meters above bottom, of 125-meter-diameter sink; 1.2 kilometers northeast of Puerto Victoria.

A blind pit 16 meters deep and 1.5 by 1.25 meters at the top.

44. **Sótano Cabeza de Pollo**, SLP. One kilometer north of La Victoria, on top of a ridge projecting east from C. Sierra Mojada. Fifteen meters southeast of number 44 is a blind 12-meter pit; 40 meters northeast is Cueva de Mojada (number 45).

The 23-meter pit is 5 by 10 meters at the top and 8 meters in diameter at the bottom. A short crawl leads to a small room and a too-tight crawl.

45. **Cueva de Mojada**, SLP. Forty meters northeast of Cabezo de Pollo (number 44).

The large, sloping entrance is 6 meters wide and 3 meters high. Passage slopes down a vertical distance of 12 meters to the top of a 2-meter pit. The 5-meter-diameter room at the bottom has a tight crawl leading to a 13-meter pit. At its bottom is a 12-by-12-meter room, where a pit drops an estimated 10 meters through dangerous breakdown. The cave has air flow and could go deep.

46. **Sótano de Trelestino**, SLP. Fifty meters vertically below and 150 meters north-northeast of the houses at Las Joyas; 1.3 kilometers northeast of Cerro Sierra Majada.

The pit entrance is 2 by 1 meters and drops 40 meters. No leads or air flow.

47. **Cueva de Cerrano**, SLP. Ten meters higher and 25 meters south-southwest of Cueva de Vicente Cerrano (number 48). On east slope of Cerro Sierra Mojada, 350 meters south of Las Joyas.

The entrance is 2 meters wide and 1.8 meters high. The entrance passage slopes down 6 meters to a 4-meter pit. At the bottom, a short climb up leads to a 20-meter pit with a terminal breakdown room, 1.8 by 2 meters, at the bottom.

48. **Cueva de Vicente Cerrano**, SLP. See number 47. The entrance is 3 meters wide and 2 meters high, and the walking passage slopes downward for 45 meters to 15 meters of crawlway.

49. **Sótano de Cesar**, SLP. On the northeast side of a flat ridge 400 meters northeast of La Victoria. The entrance is 30 meters southeast of Cueva de Odon (number 50).

The entrance is a 22-meter free drop from an opening 2 by 2 meters to a floor 12 by 12 meters. A couple of crawlway leads could be dug, but don't look promising.

50. **Cueva de Odon**, SLP. Thirty meters northwest of Sótano de Cesar (number 49).

The small entrance passage is 0.5 meter high, 0.7 meters wide, and goes 3 meters to a 17-meter pit with four major ledges, the first of which is 3 meters down. From the bottom, a passage 0.8 meters wide goes 12 meters.

51. **Cueva de las Joyas de Mojada**, SLP. On the northwest side of a large sink shown on the topo map, and 50 meters downhill from a spring and pool. Nine-tenths of a kilometer east-southeast of the village of Las Joyas, and 1.2 kilometers east and slightly south of Cerro Sierra Mojada.

The large entrance is 8 meters square. A 20-meter entrance passage goes to a climb down through breakdown to an 11-meter pit. Fifteen meters across a large room, a crawl leads to 6 meters of stooping passage and a 3-meter climb down to another one of 5 meters. At the bottom is a 10-meter room, from which a fissure goes 20 meters to a too-tight crack with strong air flow. A very good blasting lead. From the room at the bottom of the 11-meter pit, a second passage goes 20 meters to an 8-meter pit, below which the passage becomes too tight in breakdown with some air.

52. **Cueva de Joyas Chica, SLP.** Twelve meters west of and 8 meters higher than Joyas de Majada (number 51).

The crawl entrance is 1 by 1.5 meters, located in a bluff. The passage slopes down at a steep angle for 15 meters to a too-tight end, with some air flow.

53. **Cueva de Esu, SLP.** One kilometer northeast of La Victoria, on the east side of a ridge.

The entrance is 6 meters wide and 1 meter high, and the passage slopes downward a distance of 100 meters to a depth of 25 meters. The passage averages 8 meters wide and 3 meters high and is floored with loose rocks. There is a small pool of water at the end.

54. **Sótano de Jonas Trejo, SLP.** Five hundred meters north of La Victoria, in a field of limestone boulders; 3.5 kilometers east of the town of Ahuacatlan.

The blind pit is 17 meters deep, 1.8 by 0.7 meters at the top and 3 by 6 meters at the bottom.

55. **Sótano de Serrano, SLP.** Two hundred meters northwest of La Victoria and 15 meters above the Ahuacatlan—La Victoria trail. Twenty meters south-east of a major gully.

The entrance to the pit is 10 by 5 meters. The pit drops 25 meters to a 6-by-24-meter room with a 10-meter slope down to a very tight crawl with no air flow. The floor is covered with black-and-white-banded breakdown.

56. **Sótano Coate, SLP.** One kilometer southeast of La Victoria, on the east side of a point overlooking Río Tancuilín.

Blind pit 40 meters deep, 6 by 5 meters at the top and 10 by 3 meters at the bottom.

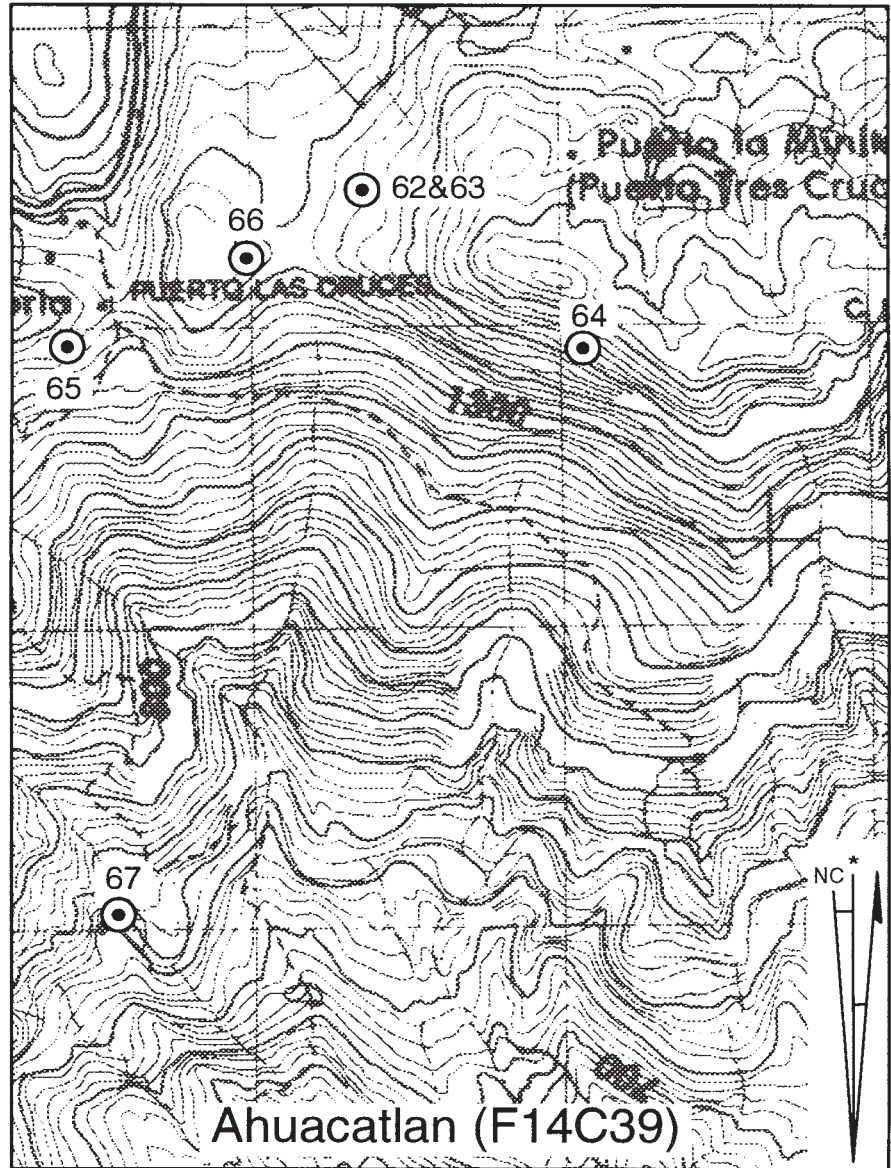
57. **Borde del Mundo, SLP.** One and one half kilometers southeast of La Victoria, in a cliff face 300 meters south of a major gully and 30 meters east of the trail from La Victoria to the Río Tancuilín.

The 16-meter pit has a cliff entrance 5 meters in diameter. The bottom is 10 by 6 meters, with no leads. The pit continues up the cliff face for another 8 meters.

58. **Cueva de Risco, SLP.** At the base of a cliff, 150 meters west of a major stream bed and 200 meters southwest of Puerto Ahuacatlan.

Two entrances are under a 12-by-6-meter overhang. Entrance 1 is on the left and is 0.5 meter wide and 0.5 meter high. The crawl goes 50 meters with good air flow, but wasn't pushed. Some of the distance is walking. Entrance 2 is 0.7 meter wide and 0.8 meter long. Twenty-five meters of passage goes to a junction; neither passage from there was checked.

59. **Sótano la Laja, SLP.** Ten meters to



Map 6



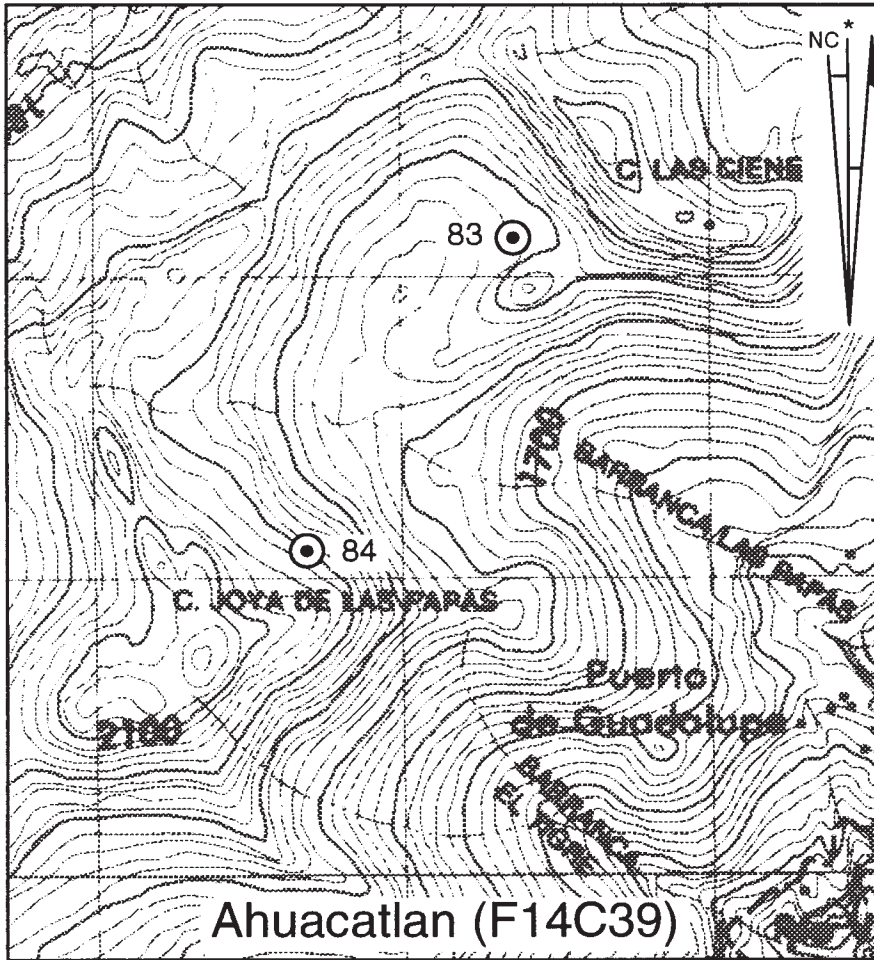
the right (south) side of the trail going from Ahuacatlan to La Victoria, 1900 meters east-southeast of Ahuacatlan. Forty meters lower than and 150 meters northeast of Sótano Rubio (number 60) and 100 meters northeast of and 10 meters lower than Sótano Chabello Montoya (number 61).

The entrance to the 46-meter free drop is 5 meters in diameter and goes down a 70-meter-long fissure. The passage at the bottom slopes down another 12 meters. A nice pit.

60. **Sótano Rubio, SLP.** See number 59. The entrance is 7 by 14 meters and drops 82 meters. On the low side, a 15-meter slope goes to a ledge, but the right

side (facing uphill) can be rigged as a free 82-meter pitch. The pit is 12 meters across, and the bottom slopes downward for 35 meters to a dome 40 or more meters high. The water in the cave goes down a small drain.

61. **Sótano Chabello Montoya, SLP.** See number 59. The entrance is 6 by 5 meters. The entrance pit is 28 meters to a ledge. The second pit is 23 meters to a sloping room. The third pit is 51 meters deep. Fifty meters of passage leads to a 19-meter pit, from the bottom of which a 30-meter crawl leads to a 4-meter pit. A hundred meters of passage slopes downward 30 vertical meters to a sixth pit 11 meters deep. At the bottom, the



Map 7



passage goes 30 meters and becomes too tight. A crack in the floor, also too tight, drops down to a flowing stream. The cave has good air flow.

62. **Hoyo de Lopez**, SLP. Slightly north of and 0.9 kilometer east of La Gloria, in a "flat" field. Thirty meters south of Hoyo de Minita.

The pit entrance is 0.7 by 0.5 meters, and it drops 13 meters to a room 6 by 3 meters. The bottom slopes down 4 more meters, with no leads.

63. **Hoyo de Minita**, SLP. See number 62. A 21-meter pit with a natural bridge 9.5 meters down. It is 4 by 2 meters at the top and 2 by 6 meters at the bottom, with no leads.

64. **Cueva de la Agua Nueva**, SLP. Located in jungle 1.7 kilometers east-southeast of Puerto las Cruces.

A crawlway entrance 0.7 meters wide and 0.5 meters high slopes downward to 30 meters to a 7-meter pit. A climb up leads to the rest of the cave, on the other

side of the pit. Average passage is 6 meters wide and 12 meters high, with a maximum height of 20 meters. From the pit, the passage slopes upward to a flowstone end. There are no leads.

65. **Cueva de las Cruces**, SLP. Thirty meters northwest of a trail; 200 meters southwest of Puerto las Cruces.

Entrance 0.3 meters wide and 1 meter long slopes to a short passage containing many bats. Average passage size is 1.8 meters high and 5 meters wide. No leads.

66. **Sótano Necio**, SLP. Near the top of a level ridge and 0.4 kilometers east of Puerto las Cruces. The ridge holds two large 2.5-meter-high piles of rocks that the locals claim are Aztec ruins.

Blind pit 14 meters deep, 0.2 by 1.8 meters at the top and 0.5 by 1.8 meters at the bottom.

67. **Cueva de Ezequiel Rubio**, Qto. On the north side of Río Tancuilín, 50 meters from the river and 15 meters

vertically above it. A travertine-covered gully goes from the river to the entrance, which is 1.5 kilometers northwest of Neblinas.

The bluff entrance is 1.5 meters high and 1.5 meters wide. To the left, a small crawl goes to a high-water sump and then ties back into the main passage, which leads to a 1-meter-wide and 3-meter-high trunk passage with a stream. Fifteen meters upstream is a sump. Ten meters downstream is a 1.8-meter climb down to another sump. The cave is upstream of and directly above a large spring that flows into the Río Tancuilín.

68. **Sótano de Colibrí**, Qto. In the southeast-facing side of a hill, in trees, 1.2 kilometers northeast of Potrero del Llano, above Cueva and Sótano de Emigdio.

The entrance is a 5-by-6-meter 10-meter drop to a ledge with a large pile of logs. Twenty-one meters further down, on the bottom to the left is a 12-meter long canyon. A 10-meter drop down the canyon leads to a room 20 by 2.4 meters.

69. **Cueva de Emigdio**, Qto. Five meters east of uphill trail 1.1 kilometers east-northeast of Potrero del Llano, and 30 meters above and slightly west of Sótano de Cana Azúcar (number 71). On the lower right side of the sink entrance is the small entrance to Sótano de Emigdio (number 70).

The sink entrance is 10 meters by 6 meters. A difficult 8-meter climb leads down to a sloping room, from which a passage goes right to a couple of small rooms. No leads.

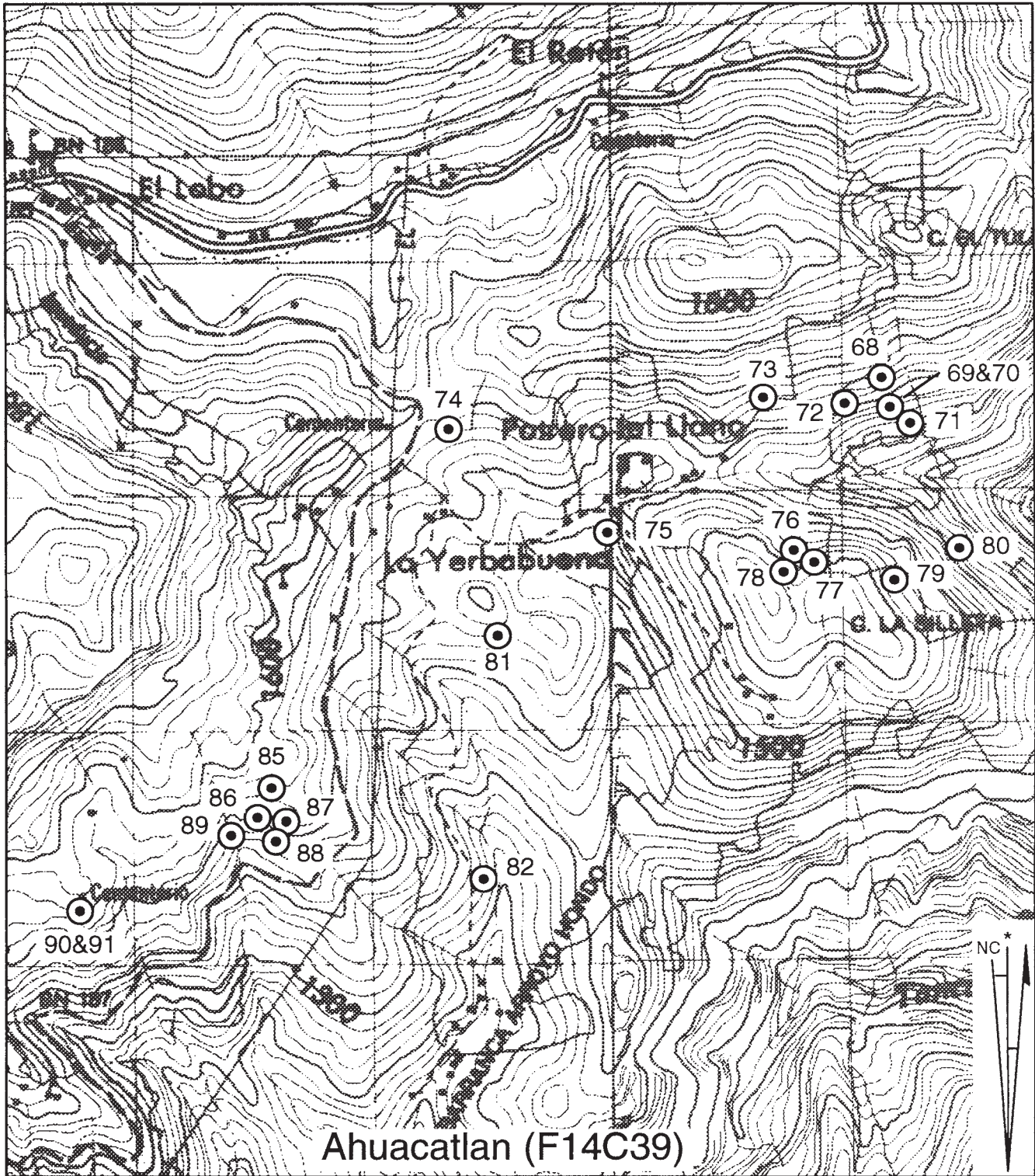
70. **Sótano de Emigdio**, Qto. See number 69. The pit drops 27 meters, past a ledge 5.5 meters down. It is 0.6 meters square at the top and 20 by 3 meters at the bottom. No leads.

71. **Sótano de Caña Azúcar**, Qto. See number 69. The pit, 6 by 3 meters at the top, is offset 6 meters down to a slope to 30 meters depth. The bottom slopes to a 6-meter dome. No leads.

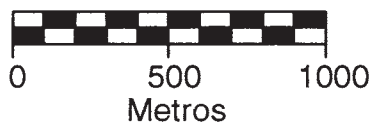
72. **Sótano de Hombre Muerto**, Qto. Entrance is on a hillside facing south-east, 200 meters east of Sótano de Manquez (number 73) and 0.8 kilometers northeast of Potrero del Llano.

The 41-meter entrance pit is 3 by 6 meters at the top and goes to a room with a mud and flowstone slope downward. There is a tight climb up in popcorn and flowstone for 12 meters to where a dome drips water into a rimstone pool 0.7 meters deep. A second pit, 12 meters deep, goes to two passages that soon pinch.

73. **Sótano de Manquez**, Qto. In a hillside jungle facing southeast; see num-



Map 8



ber 72.

The 3-by-4-meter entrance opens into an overhang. The 21-meter drop goes to a ledge from which a small passage goes 11 meters. The drop below the ledge is 15 meters deep, to a bottom that slopes downward another 0.7 meters. The bottom of the cave is also 3 by 4 meters.

74. **Cueva de Llano**, Qto. Two hundred meters east of a main dirt road, on open slope above and 0.6 kilometers northwest of Potrero del Llano.

The entrance is 1.5 meters high and 5 meters wide. Immediately inside, a pit drops 13 meters. It can be climbed to a mud slope leading to a room at the end of the cave.

75. **Sótano de Buhonero**, Qto. Located facing town in a corn field south of Potrero del Llano.

The pit entrance is 1.5 by 1 meters and 12 meters deep. A 7-meter climb leads down to the end. No leads.

76. **Sótano de Eladio**, Qto. One kilometer east of Potrero del Llano, on the north slope of Cerro la Silleta. One hundred meters northwest of and 40 meters below Hoyo de Burros Peliando (number 77).

The 10-by-10-meter pit is 11 meters deep, mostly sloping. At the bottom of a 1.2-meter-deep hole, a 6-meter crawl goes to a room 20 by 6 meters. Going down a further 2.1 meters leads to a chamber 4 meters by 2.4 meters by 2.2 meters high. Up dip 20 meters is another room, 4 by 4 meters. Nice formations.

77. **Hoyo de Burros Peliando**, Qto. See number 76. A pit 3 by 3 meters at the top and 13 meters deep goes to a 6-meter slope with no leads.

78. **Sótano de las Sotonas**, Qto. Twenty meters below top of hill on north slope of Cerro la Silleta and 75 meters northwest of communication tower; 0.9 kilometers southeast of Potrero del Llano.

The pit is 8 by 8 meters at the top and drops 13 meters to a 12-by-4-meter bottom that slopes in two directions. There is a 6-meter climb down on one side and a small grotto on the other. No leads.

79. **Gruta de Mario**, Qto. One hundred fifty meters east of communications tower; see number 78.

A 2.4-meter climb down inside the 4-meter-wide and 1.2-meter-high entrance goes into a 20-by-6-meter room. A side passage on the left quickly ends. At the end of the room is a 2-meter climb down that also ends. The whole cave slopes steeply downward.

80. **Gruta de Sheriff**, Qto. On the northeast slope of Cerro la Silleta 1.2 kilometers southeast of Potrero del

Llano.

The entrance is 5 meters high and 1.5 meters high. The passage slopes downward 30 meters to a crawl 15 meters long. The 11-meter climb up flowstone at the start of the crawl leads to a dead end.

81. **Sótano de la Yerbabuena**, Qto. Open-air pit in some karst on a hillside facing southeast 0.5 kilometer south of La Yerbabuena.

The entrance is 10 meters across, and the 35-meter pit drops to a mud slope 21 meters long and 15 meters wide.

82. **Sótano de Naranjo**, Qto. Near the trail 0.5 kilometers north of the village of Barranca Arroyo Hondo. Forty meters above and 30 meters west of a large arroyo.

Blind pit 65 meters deep and 6 by 4 meters at the top. The bottom is 30 by 20 meters and slopes down another 3 meters.

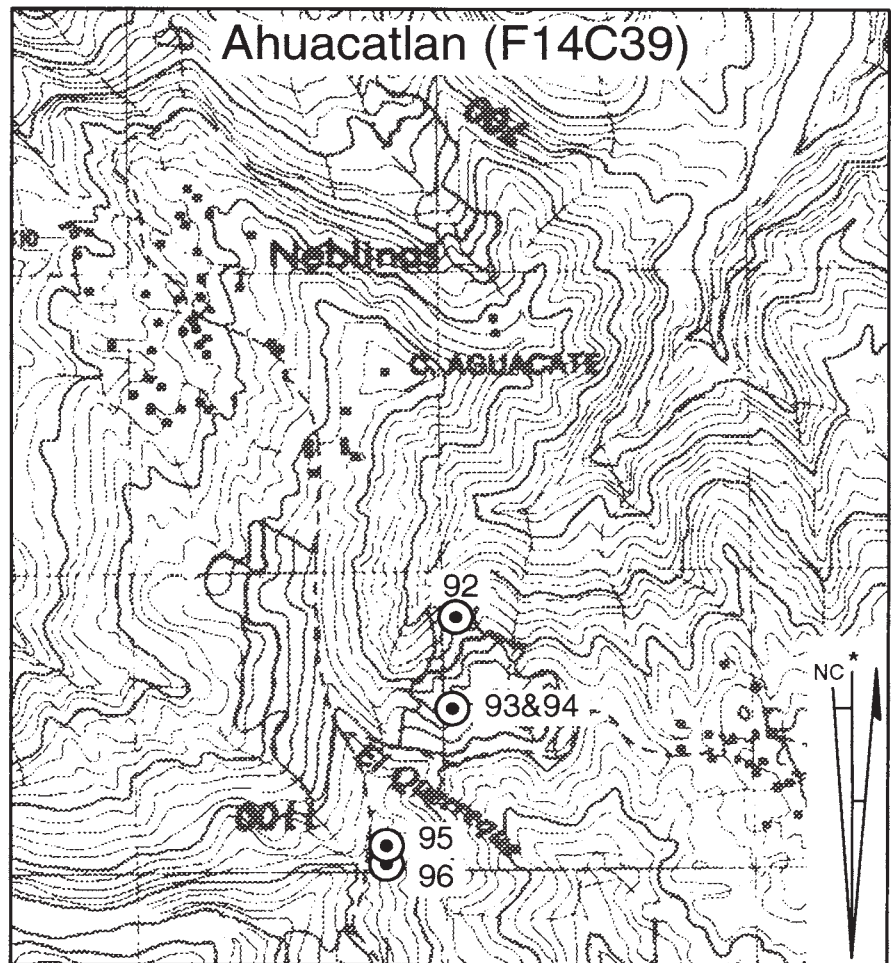
83. **Sótano de Pierna Larga**, Qto. Near a large sinkhole on the east top of Cerro las Ciénegas, 2.1 kilometers northwest of Puerto de Guadalupe.

There are two holes in a dirt sink. One hole is 2 by 3 meters and 14 meters deep. At its bottom is a small chamber.

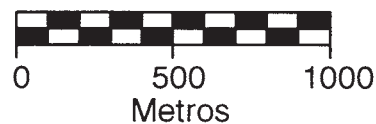
84. **Gruta de Arana Negra**, Qto. On east-northeast slope of Cerro Joya de las Papas, 2 kilometers north west of Puerto de Guadalupe.

From the entrance, 12 meters wide and 2.5 meters high, the cave extends back 6 meters deep by 12 meters wide. In the middle is a 2.5-meter-deep hole. To the right, a 10-meter crawl leads to a formation room 15 meters long, 6 meters wide, and 1.8 meters high. To the left is a crawl that leads into a small room from which a tight, dug crawl goes to three different passages with some air flow.

85. **Sótano de las Ciénegas**, Qto. In a large sink in a pasture ringed with trees,



Map 9



250 meters west of a road and 75 meters above it; 1.9 kilometers northeast of Puerto de Guadalupe.

The pit is 56 meters deep from its 10-by-15-meter entrance. There is an offset 30 meters from the floor. The floor slopes downward another 4 meters.

86. **Sótano de Luiz, Qto.** One hundred meters above and 300 meters west of the main dirt road 1.7 kilometers northeast of Puerto de Guadalupe. Sixty meters at 60 degrees and 20 meters

higher than Sótano de Dos Vacas (number 89).

A 29-meter blind pit 8 meters in diameter at the top. The bottom is 12 by 6 meters.

87. **Sótano de Nido, Qto.** In the middle of a corn field, 20 meters above and southeast (110 degrees) of Sótano de Luiz (number 86).

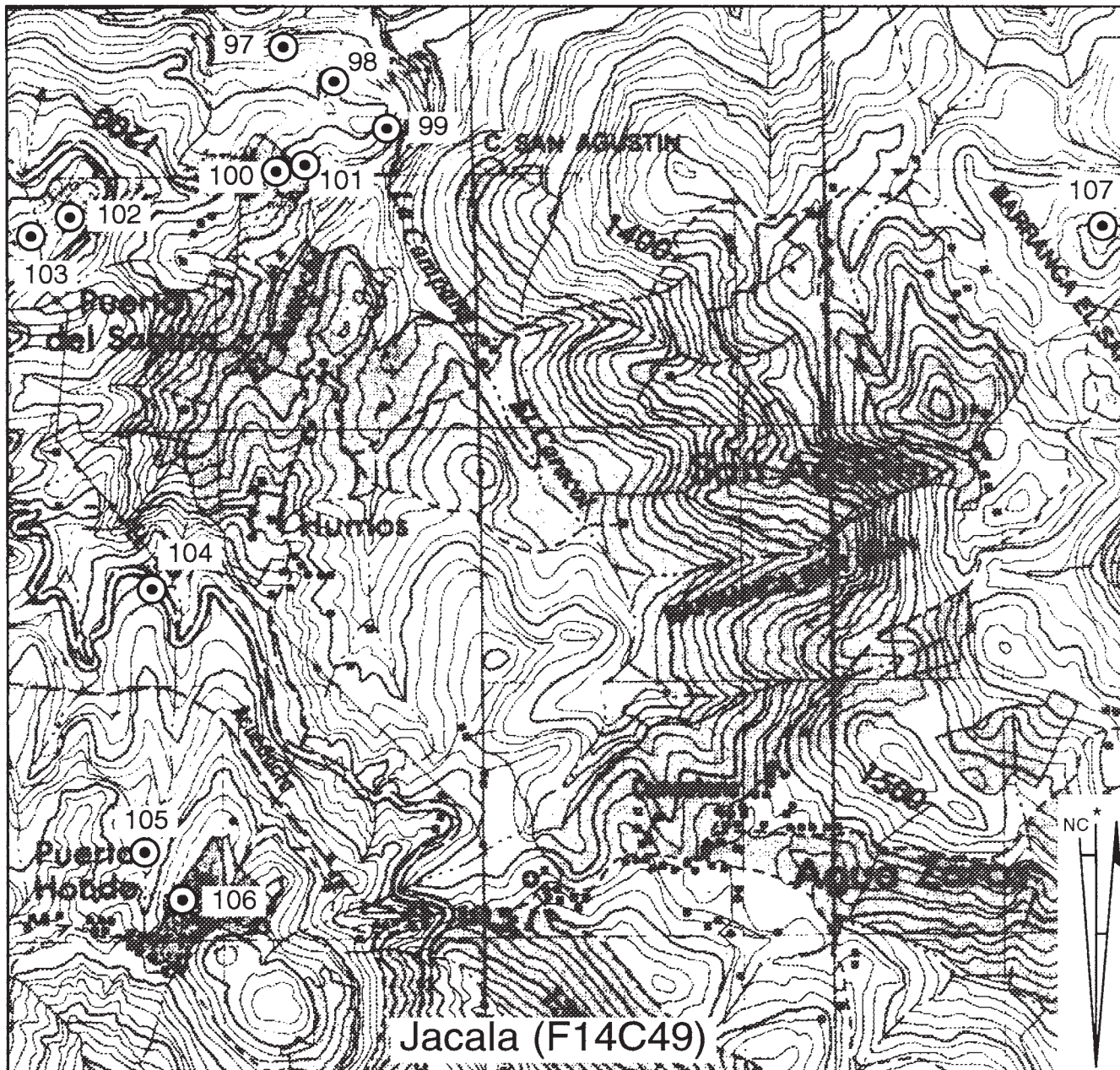
Blind pit 64 meters deep from 3-meter-diameter entrance.

88. **Hoyas del Rotannes, Qto.** Fifty

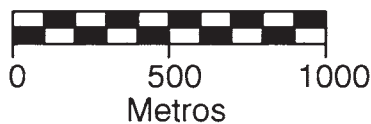
meters at 245 degrees from Sótano de Nido (number 87) and slightly downhill.

The pit entrance is 2 meters in diameter. The pit drops 16 meters to an 8-meter slope to a pit 6 meters deep. The bottom is 3 by 1.5 meters and slopes down another 3 meters.

89. **Sótano de Dos Vacas, Qto.** See number 86. The 5-meter-diameter entrance is in a 20-meter sink. The 14-meter entrance pit goes to a slope 21



Map 10



meters long (15 meters vertically) to the second pit, 3 meters deep. Another slope 21 meters long goes down another 15 meters to the end.

90. **Cueva de Imontrejo, Qto.** One hundred meters south of cementerio shown on topo map 0.8 kilometers north-northeast of Puerto de Guadalupe. Fifty meters south of Gruta de Guadalupe (number 91).

The entrance is 8 meters long and 2.5 meters wide. A difficult 4-meter climb leads down to a slope into a large room with formations.

91. **Gruta de Guadalupe, Qto.** Fifty meters north of Cueva de Imontrejo (number 90).

The walk-in entrance is 6 meters wide and 5 meters high and leads to a 5-meter climb down to a breakdown room. Continuing passage has good air flow, but is too small.

92. **Sótano de Gracia, Qto.** Five hundred meters north of Pozo Demado (number 94); 1.3 kilometers southeast of Neblinas.

Small 13-meter pit with entrance 0.9 by 0.7 meters. The bottom is 3 meters across and slopes down another 0.8 meters.

93. **Cueva Demado, Qto.** Three meters west of Pozo Demado (number 94); 1.8 kilometers southeast of Neblinas. Four hundred meters east of a main trail, on east bank of major arroyo.

The crawlway entrance is 0.6 meters wide and 0.3 meters high. A short crawl leads to a room 20 meters long, 12 meters wide, and 6 meters high. It slopes downward to the end.

94. **Pozo Demado, Qto.** Three meters east of Cueva Demado (number 93). The top of the 155-meter pit is 6 meters in diameter. At the bottom, a climb down through breakdown leads to a room 3 by 1 meters, which slopes down 5 meters to the end.

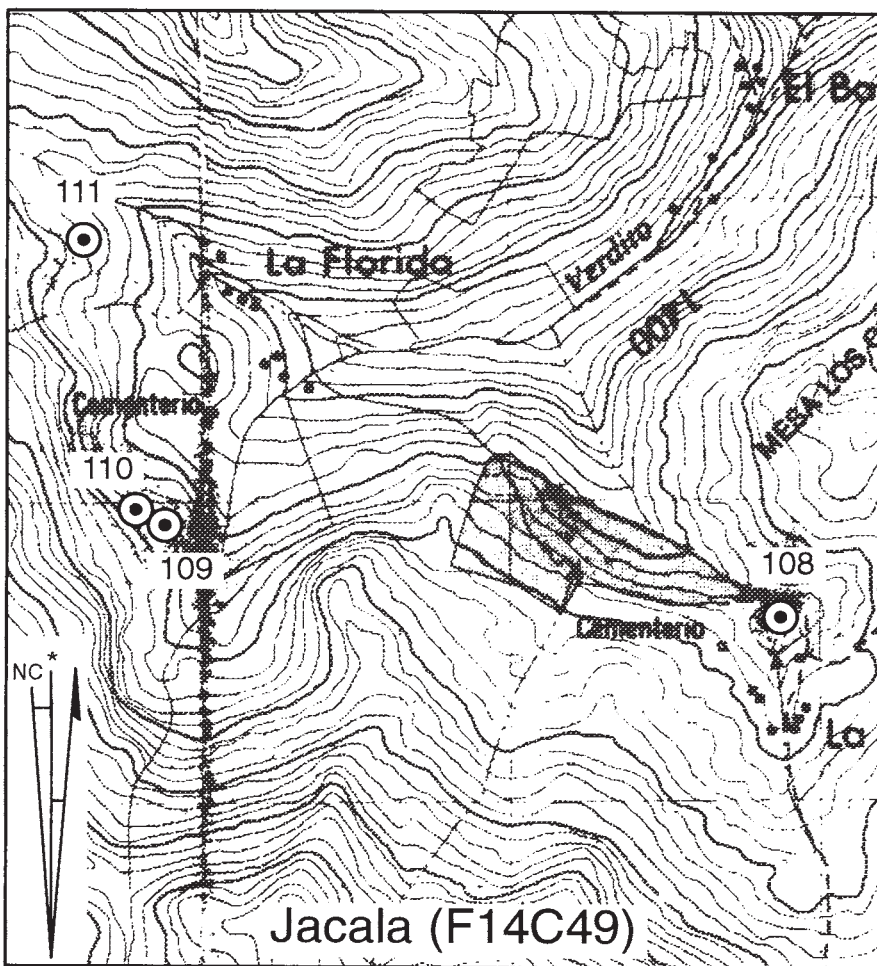
95. **Sótano el Querreque, Qto.** Fifty meters north of Sótano de Izac; 1.6 kilometers west and slightly south of San Rafael.

The pit entrance is 4 by 2.7 meters. The pit descends 18 meters to a 10-by-5-meter bottom, which slopes on down 2.8 meters more to a choke.

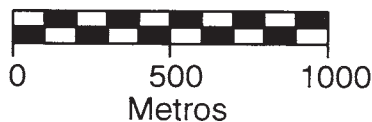
96. **Sótano de Izac, Qto.** Fifty meters south of Sótano de Querreque (number 95). Sixteen-meter pit 0.8 by 1.1 meters at the top and 5 meters in diameter at the bottom, which slopes downward 4 meters to the end.

97. **Sótano la Huerta, Qto.** North-northeast 1.5 kilometers from Puerto del Sabino.

Twenty-five-meter pit 1.2 by 1 meters



Map 11



at the top and 3 by 1 meters at the bottom, which slopes upward to a dome that almost reached the surface.

98. **Sótano de los Pinos, Qto.** Fifty meters north of the Puerto del Sabino—El Lobo trail, 1.5 kilometers northeast of Puerto del Sabino.

The 1-by-1-meter pit entrance is in a sink 3 by 5 meters by 2 meters deep. The bottom of the 16-meter pit is 4 by 2 meters and slopes downward an additional 2 meters.

99. **Cueva de Norborto, Qto.** In open field 150 meters north of Puerto del Sabino—El Lobo trail, 1.2 kilometers northeast of Puerto del Sabino.

The entrance is 3 meters wide and 2 meters high. After a short crawl 3 meters in, the cave opens into a passage 2 meters high and wide and 15 meters long, after which a tight crawl goes another 10 meters.

100. **Sótano de Mayorga, Qto.** Near top of hill, on the east side, 0.6 kilome-

ters northeast of Puerto del Sabino.

The 15-meter pit has three ledges and is 2 by 1.8 meters at the top and 7 by 5 meters at the bottom. At the bottom, a short climb down leads to a small room.

101. **Cueva de Gelasio, Qto.** North-west side of Arroyo el Pemoche, 0.5 kilometer northeast of Puerto del Sabino. Five meters east of and below main trail to El Lobo.

The entrance is 1 by 1 meters. A steep slope leads to a 3-meter climb, at the bottom of which are a slope to the left and another short climb down to the right. Both ways end soon.

102. **Sótano de Río Verdito, Qto.** One hundred ten meters above the road 1.2 kilometers east-southeast of the town of Río Verdito. Walk three-quarters of the way to top of a pasture and turn east-northeast to follow a cow trail 200 meters to the pit entrance, which is covered with logs in a shallow sink. Ten meters lower and 95 meters north-northeast of

Cueva de Río Verdito.

The 26-meter pit is 2 by 3 meters at the top and lands on a muddy slope to a small room with some formations.

103. **Cueva de Río Verdito, Qto.** See number 102. Walk down a breakdown slope from the horizontal entrance. At the bottom is a 5-meter pit, with a dome room behind it and to the left. There is a skylight entrance 10 meters from the walk-in entrance, and behind where that rappel ends is a small room.

104. **Cueva de Frutoso, Qto.** In a road-cut for the main dirt road, on the west side, 200 meters downhill (northwest) of a "blue line" arroyo. The arroyo contains Sótano de Alfredo (number 105).

Entrance is 1.2 meters wide by 0.6 meters high. There is a 2.4 meter climb 15 meters from the entrance, and the cave ends 8 meters further. No air.

105. **Sótano de Alfredo, Qto.** Four hundred meters up an arroyo with an

elevation gain of 100 meters above the main dirt road, 0.3 kilometers north-northeast of Puerto Hondo. Entrance is in the middle of the arroyo. A small cave is seen on the left 150 meters before reaching the pit.

The entrance is 8 by 6 meters. There is a 28-meter drop to a ledge, followed by a 10-meter drop down to the left. A 3-meter climb down goes to a room with an adjoining room from which one can see out into the pit. A small hole 6 meters from the climb down drops a climbable 7 meters into a canyon, which drops into a second pit of about 12 meters. Then a short crawl leads to a series of twenty-one pits and many climb-downs to a total estimated depth of 300 meters.

106. **Sótano de Reynaldo, Qto.** On southeast slope of valley containing Sótano de Alfredo, 0.3 kilometers east of Puerto Hondo. Twenty meters vertically below the Puerto Hondo—Agua Zarca

trail.

The entrance is 6 by 3 meters, and the pit is 14 meters deep. A dirt floor slopes downward through a small passage 10 meters into a dome room.

107. **Sótano Pequeño Grande, Qto.** North side of ridge top northeast of Barranca el Sarro, 1.8 kilometers north-west of Tlacuilola.

Twelve-meter pit from a 6-by-5-meter top to a 6-meter-diameter bottom that slopes downward another 5 meters to the end.

108. **Gruta del Encino, Qto.** Just north of the village of La Yesca and 2.3 kilometers south of the town of Río Verdito, in a small bluff on the northwest side of a large sink shown on the topo. A house and the trail are just above the entrance.

A small crawl leads down 3 meters to a room, from which a walking passage goes 12 meters west-northwest to a Y. The left route goes 30 meters. To the right, the cave goes southwest down a slope and then turns west-southwest, going 60 meters and gaining 18 meters in depth. It ends in a too-tight crawl.

109. **Sótano de Gráfico, Qto.** Southwest 3.2 kilometers from the town of Río Verdito; 0.7 kilometers southwest of La Florida. One hundred meters east of Sótano de Juan (number 110), and 5 or 10 meters below it.

The large pit entrance is 4 meters by 6 meters. The 58-meter drop is dry and lands on a large talus slope that goes downward 5 vertical meters to a flat, rocky floor in a room with some nice formations. The pit has a ledge 3 meters down.

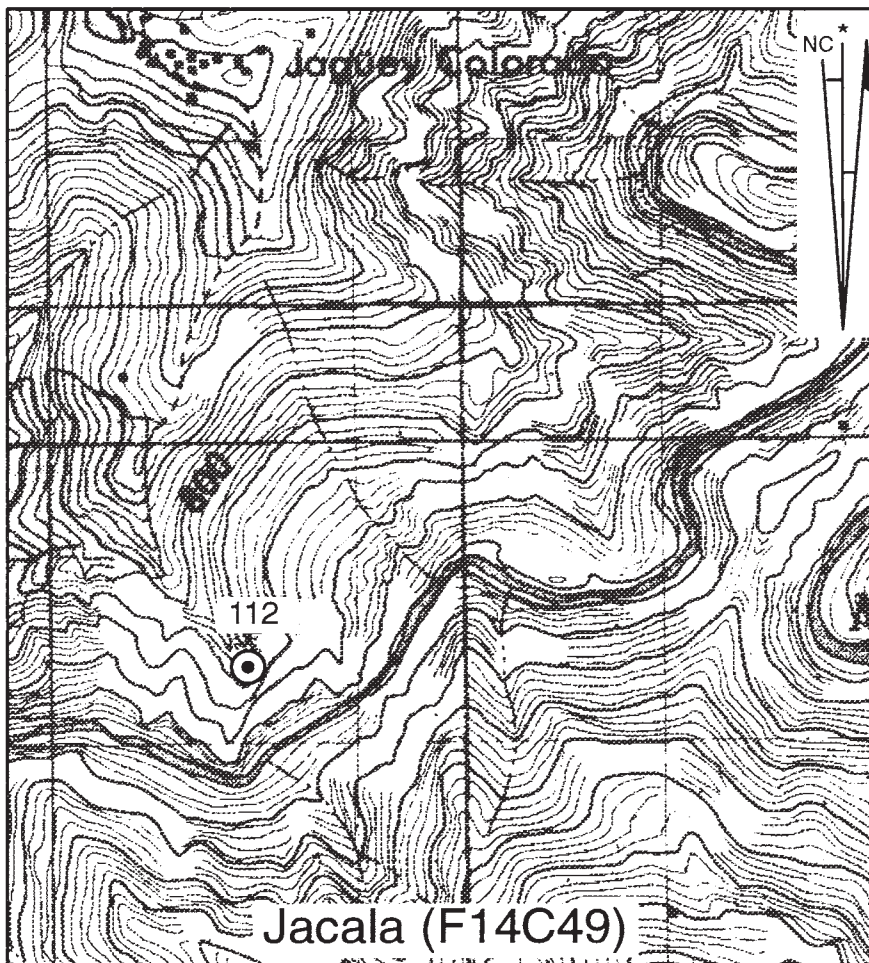
110. **Sótano de Juan, Qto.** See number 109. A blind 37-meter pit, 4 by 7 meters at the top and 6 by 12 meters at the bottom.

111. **Sótano de Romeo, Qto.** A thirty-minute walk (0.6 kilometers west) from La Florida; 2.8 kilometers southwest of Río Verdito.

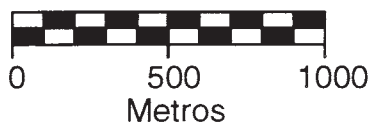
Blind "horror hole". Heavily overgrown entrance is 1.5 by 3 meters. The pit is 40 meters deep with ledges at 16 and 23 meters. The bottom is 8 by 1.5 meters.

112. **Cueva de la Mesa de la Sieba, Qto.** In a 12-meter-high stair-stepping bluff on the north slope of Río Motezuma, 2.2 kilometers south of Jagüey Colorada.

Entrance is 2 meters wide and 1.2 meters high, going into a down-sloping entrance room 2.4 meters wide, 3.7 meters long, and 3 meters high, beyond which the cave continues sloping down 1 meter wide and 2 meters high. After 6 meters, the passage turns right, then left, and ends.



Map 12



Grupo Espeleológico Universitario PROYECTO IZTAXOCHITLA

Francisco Ruiz

We discovered this area in September 1989, when Sergio Lozada, Gerardo Galindo, and Javier Vargas went on a prospecting walk from Zoquitlán to Tlacotepec, in the state of Puebla. The towns of Los Duraznos, Xaltepec, Atlancolaquia, Acticpac, Metzontla, and Iztaxochitla were visited. The community of Iztaxochitla was hospitable and cooperative, due to the good disposition of and wonderful help from Alejandro Martínez, the director of the elementary school there. The people became enthusiastic about our work, and since there were more than ten cave entrances in less than one square kilometer, we decided to begin serious exploration in that area.

Iztaxochitla's ejido belongs to the municipio of Coyomeapan, Puebla. It is at 18°23' north latitude and 96°54' east longitude, and its elevation is 1350 meters. The best way to get there is via Córdoba, Tezonapa, and Tlacotepec, then a five-hour trek over dry terrain.

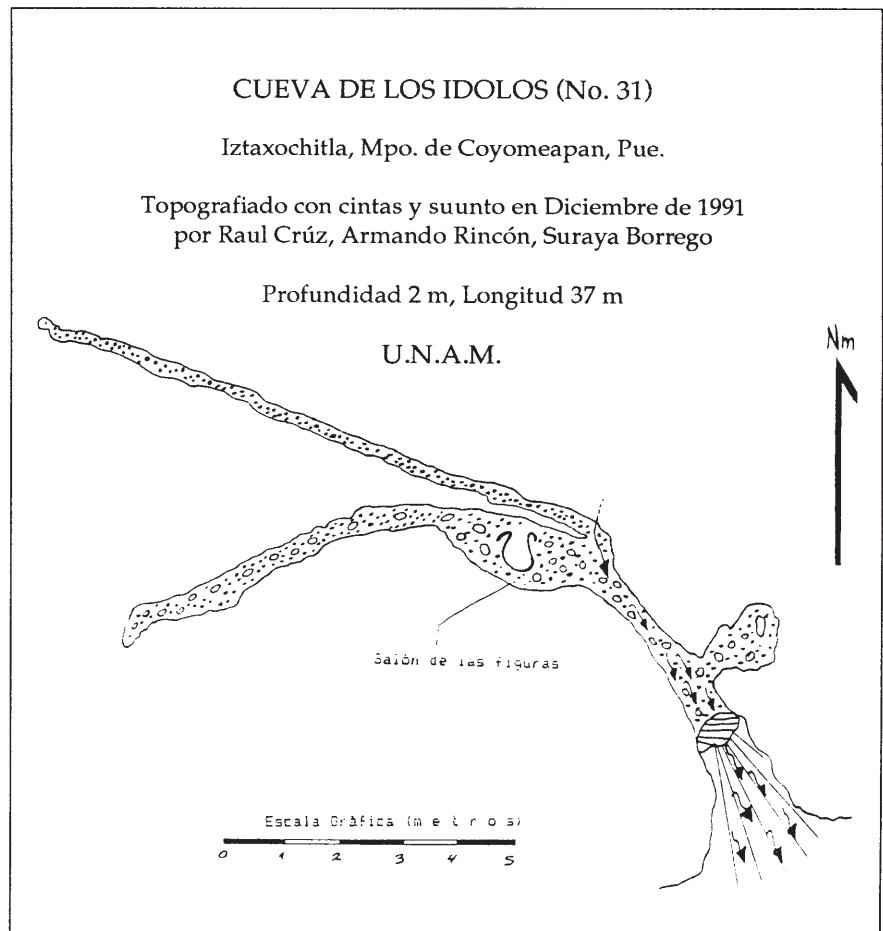
In December 1989, we began our project with two weeks of caving by ten cavers, A. Calderón, A. Chavarría, O. Chavarría, G. Jiménez, J.A. Jiménez, S. Lozada, R.D. Pérez, E. Tobón, and J. Vargas. The water was a near-freezing 4°C. We surveyed a total of 2721 meters of new cave, reaching a maximum depth of 218 meters. Three caves (numbers 3, 5, and 7) were completely explored and surveyed. Another five (numbers 1, 2, 4, 6, and 8) were partly surveyed. All of these entrances are located inside the village, and two of them (1 and 2) were connected.

We had only three cavers, Lozada, Tobón, and Vargas, in December 1990, but this was a successful expedition, because in two weeks we explored and surveyed more than one kilome-

ter of new caves. We decided to begin by continuing the exploration of entrances 4, 6, and 8. This resulted in connecting them all into a very interesting system. Also, with ants still in our clothes, after rappelling inside a waterfall and climbing down a couple of drops, we made connections from entrances 9, 10, and 11, called *hormigas* because of the great number of insects that live there, into a borehole. This was later found to be part of the same system as 4, 6, and 8. We decided to name this Sistema Iztaxochitla in

honor of the village above. Because of its 1830-meter length and 171-meter depth, the Sistema Iztaxochitla is one of our most important finds in the area. A connection between it and Sistema Platanitos (entrances 1 and 2) may be found soon.

In April 1991, in the hope of finding caves that were more vertical, we spent five days visiting two very interesting areas, one to the east and one to the south, with the help of Gregorio "Goyo" Cacho, *comisario ejidal* and





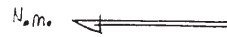
EL CAÑON

Iztaxochitla,
Mpo. de Coyomeapan, Pue.

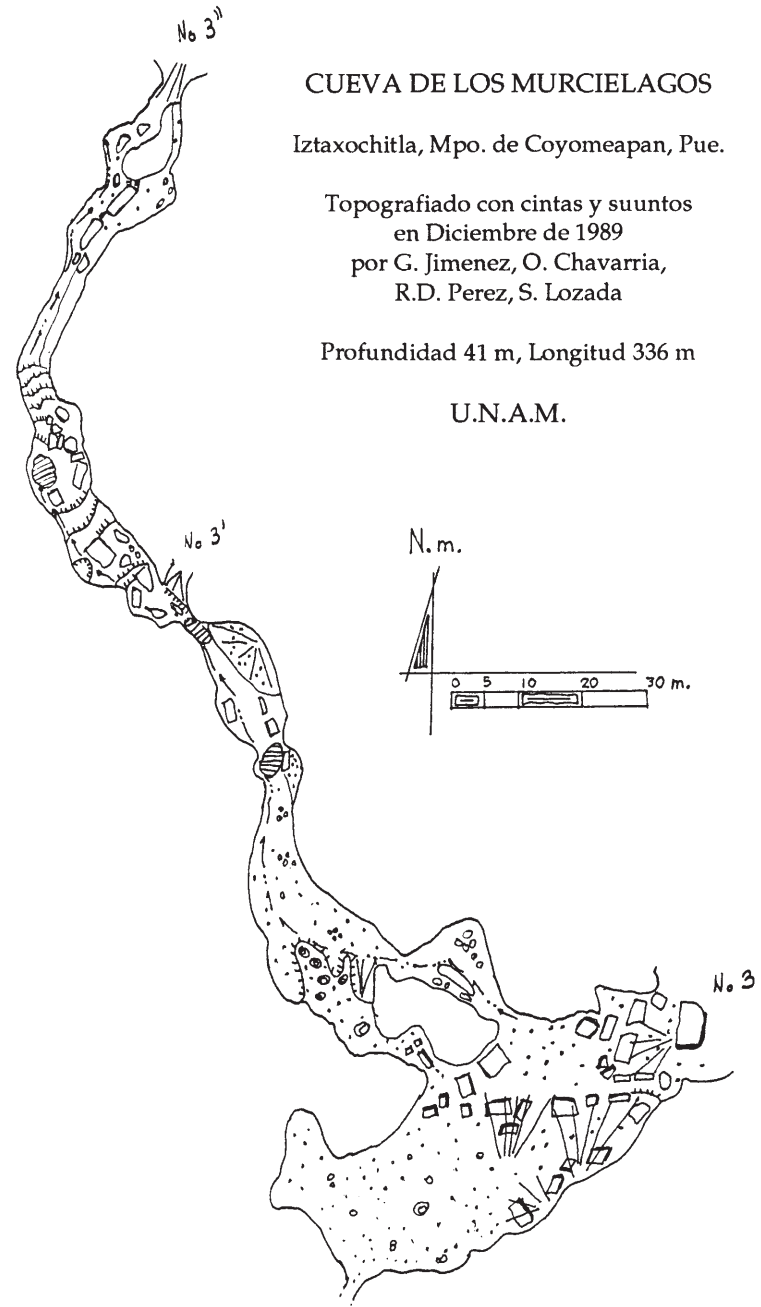
Topografiado con cintas y suuntos
en Diciembre de 1989
por G. Jimenez, J.A. Jimenez,
O. Chavarria, A. Chavarria,
R.D. Pérez, A. Calderón,
J. Vargas, S. Lozada

Profundidad 146 m, Longitud 706 m

U.N.A.M.



ESCALA GRAFICA



CUEVA DE LOS MURCIELAGOS

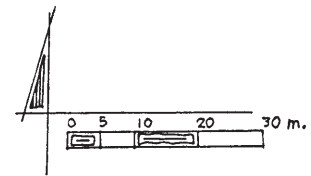
Iztaxochitla, Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suuntos
en Diciembre de 1989
por G. Jimenez, O. Chavarria,
R.D. Perez, S. Lozada

Profundidad 41 m, Longitud 336 m

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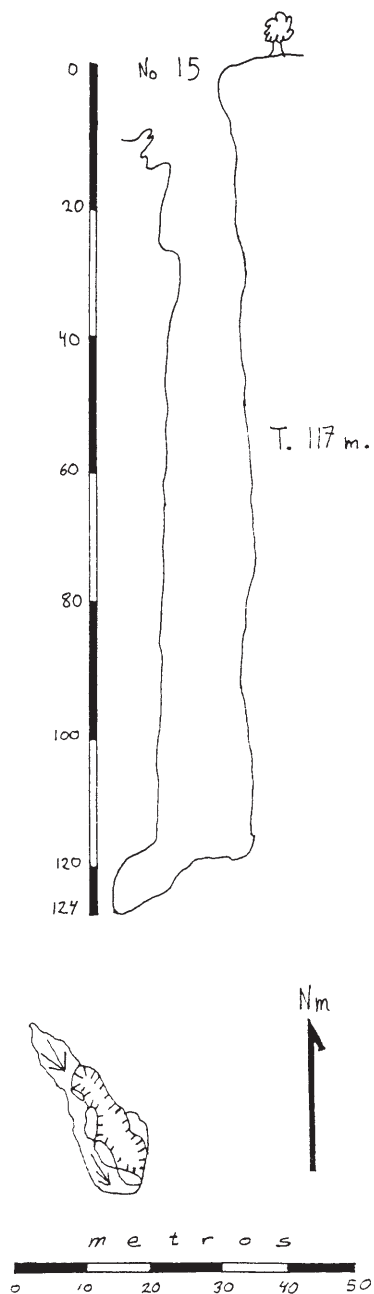


**SÓTANO DE LOS
10 MINUTOS**

Iztaxochitla,
Mpo. de Coyomeapan, Pue.

Topografía con cintas y suunto
en Abril de 1990
por J. Vargas y E. Tobón

U.N.A.M.



our best guide. Our visit to the eastern area provided plenty of excitement. Four caves (12, 13, 15, and 16) were explored. The survey of Sótano de los 10 Minutos (Goyo said a stone dropped in will take 10 minutes to reach the bottom) was done by Javier and Emilio. While they were descending the initial drop of 117 meters, we were making plans to return with five hundred meters of rope. When Javier reported that the sótano ended after a down-climb, we were a little disappointed, and we turned to Cueva de la Fantasía, where we found the most beautiful cave at Iztaxochitla. At the entrance one sees a magnificent room lit by sunlight from above that gives the sensation of being inside a cathedral. This is the first of several galleries, some only a few meters long, but two larger. A large ascending room has several beautiful columns among stalagmites and cave pearls. A large descending room is more difficult to explore, and cavers must be very cautious. The walls are smooth and white, and a great number of bats are hanging from the roof.

To the south, in the Chantoro area, we explored the cave system with that name (entrances 19 and 20) and Sótano de las Espinas (21), and found, but did not descend, entrances 17 and 18.

Back in the village, we partially explored the caves with entrances 22 and 23, which probably connect to Sistema Iztaxochitla. A total of 470 meters of new caves were explored in five days. The April 1991 group consisted of R. Cruz, S. Lozada, E. Tobón, and F. Ruiz.

In December 1991, we decided to investigate the Chantoro area more thoroughly, so we camped in a little cave an hour away from Iztaxochitla. This time thirteen cavers participated in the exploration, and we found thirteen new caves in three weeks. As an appetizer, we explored the Sistema de Mi Carnal, but this was a very short survey. For a bigger challenge, we decided to push the pit entrances 17 and 18 that we had found in April. Number 18, Del Bejuco Roto, ended after the first drop. Because of an error in directions, the group charged with the exploration of 17 found instead the new and marvelous La Cueva de los Ídolos (31) and El Sótano del

SIN NOMBRE

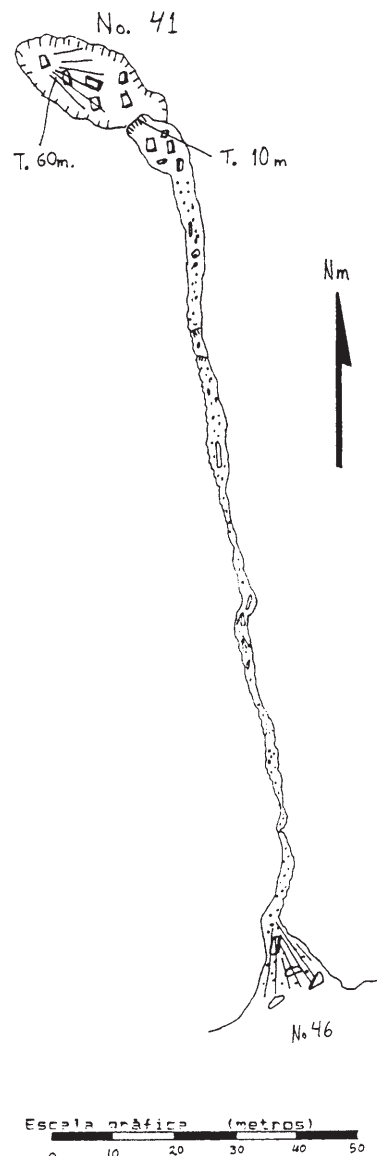
Iztaxochitla,
Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suunto
en Abril de 1992

J. Vargas, L. Ma. Calzada,
J.a. Soriano, E. Marton, S. Borrego

Profundidad 74 m
Longitud 165 m

U.N.A.M.

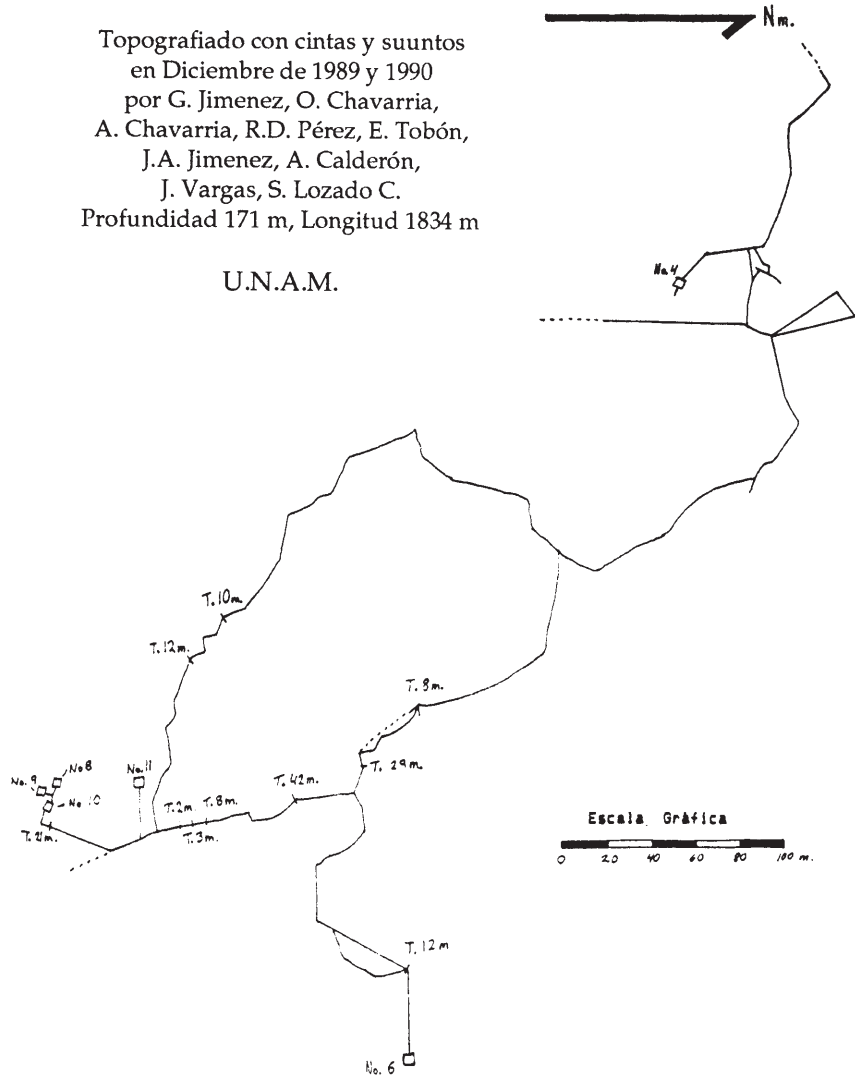


SISTEMA IZTAXOCHITLA

Iztaxochitla, Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suuntos
 en Diciembre de 1989 y 1990
 por G. Jimenez, O. Chavarria,
 A. Chavarria, R.D. Pérez, E. Tobón,
 J.A. Jimenez, A. Calderón,
 J. Vargas, S. Lozado C.
 Profundidad 171 m, Longitud 1834 m

U.N.A.M.



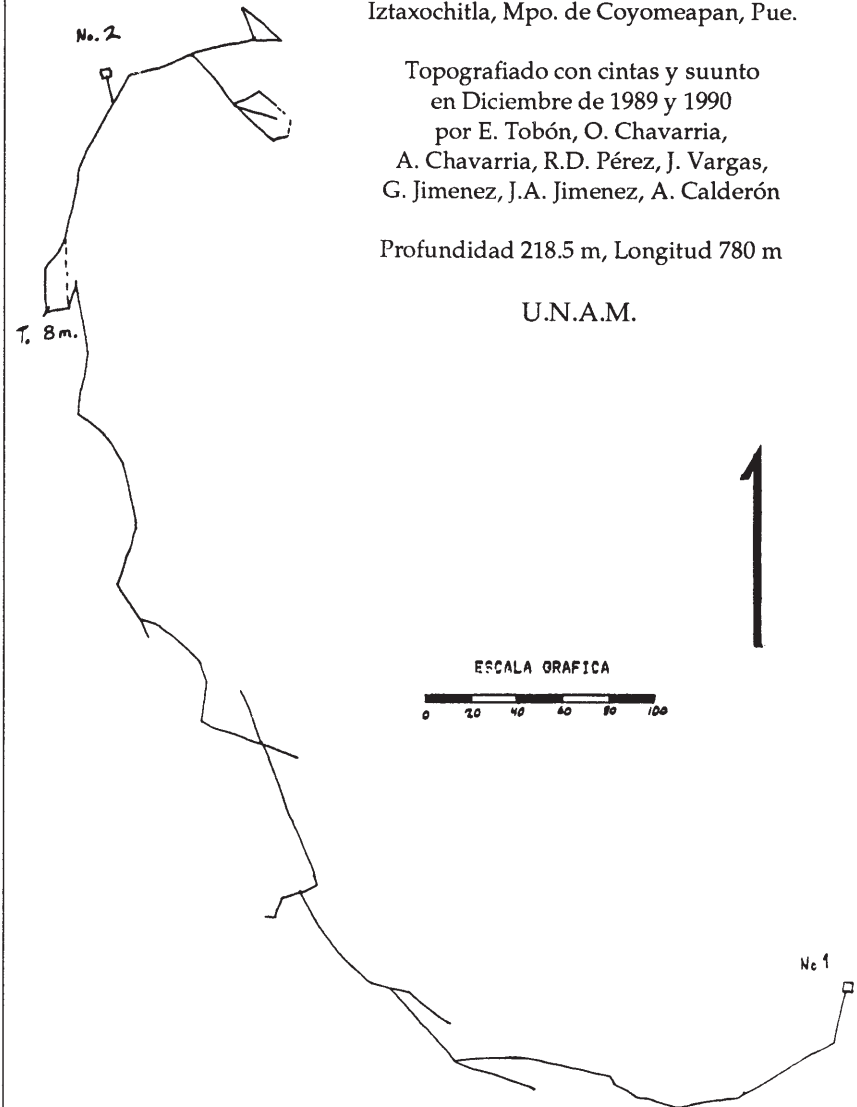
SISTEMA PLATANITOS

Iztaxochitla, Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suunto
 en Diciembre de 1989 y 1990
 por E. Tobón, O. Chavarria,
 A. Chavarria, R.D. Pérez, J. Vargas,
 G. Jimenez, J.A. Jimenez, A. Calderón

Profundidad 218.5 m, Longitud 780 m

U.N.A.M.



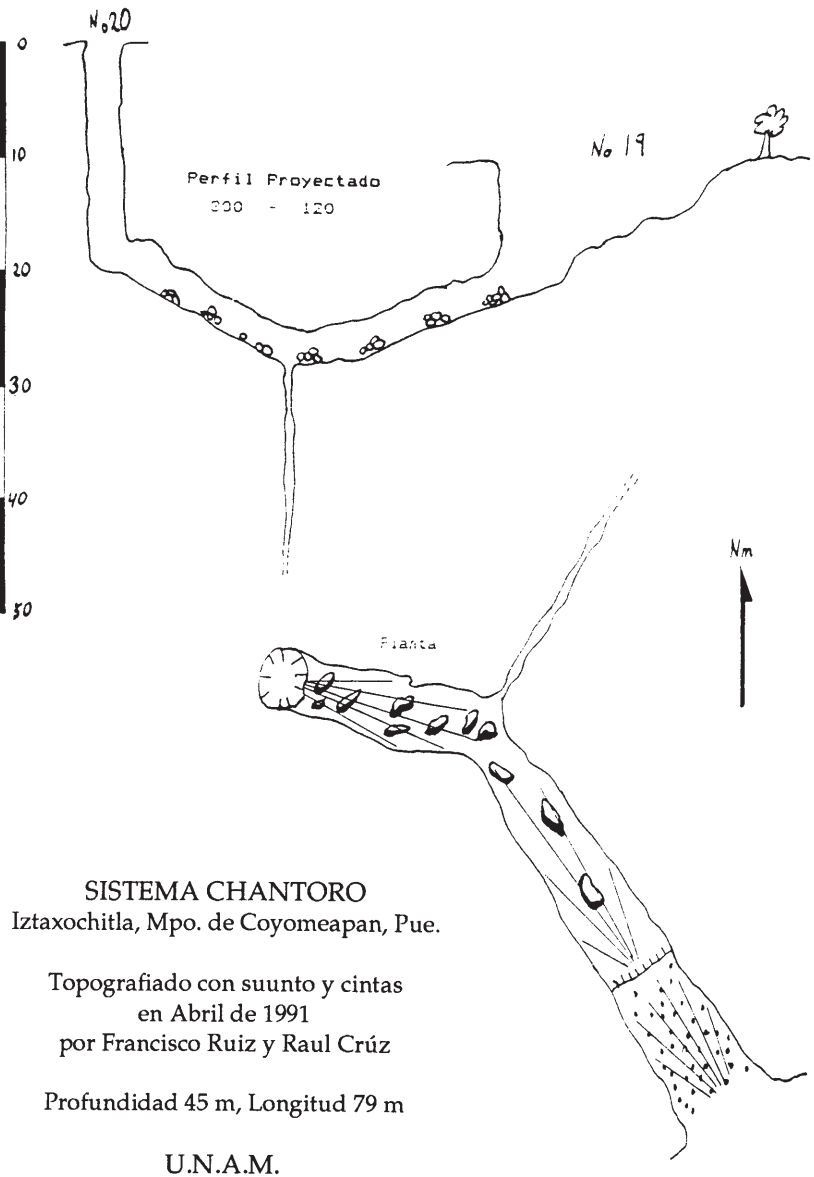
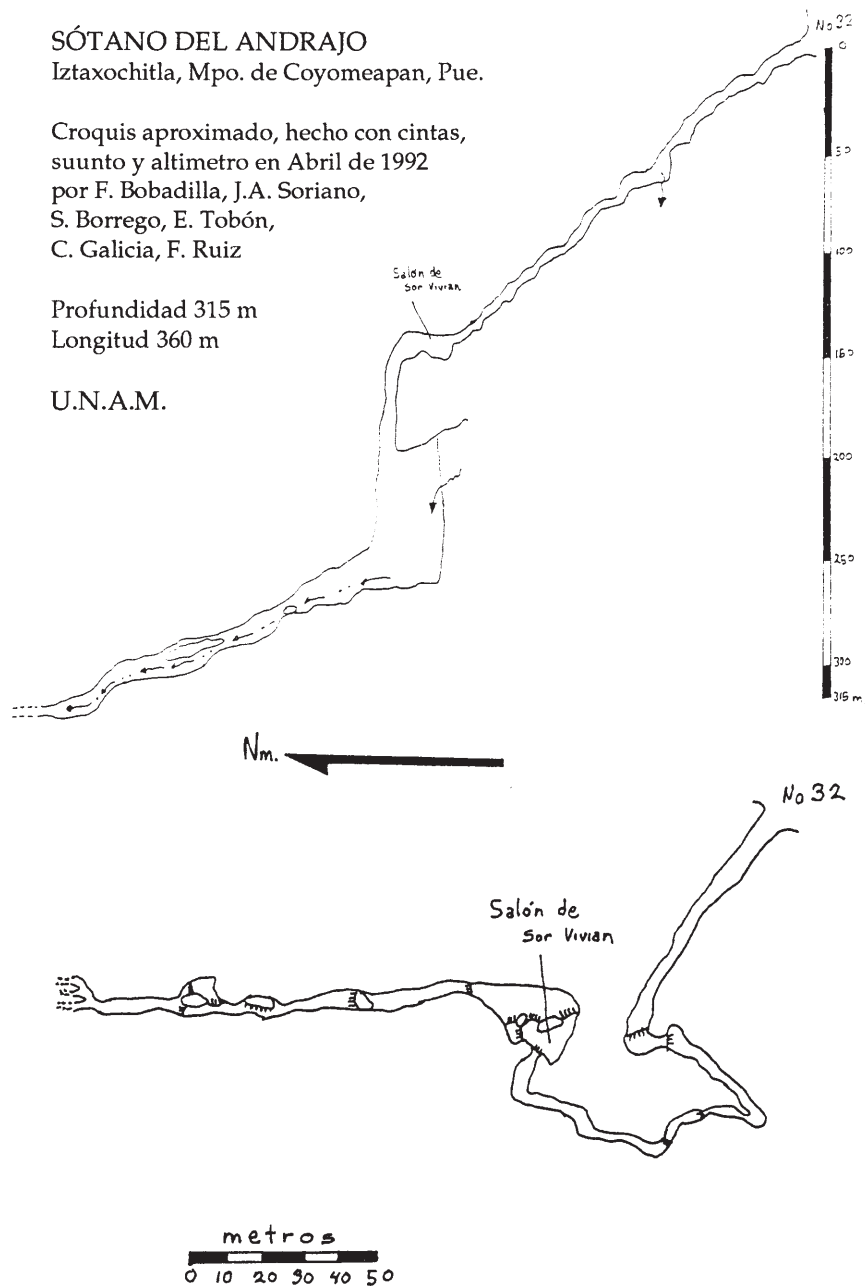
SÓTANO DEL ANDRAJO

Iztaxochitla, Mpo. de Coyomeapan, Pue.

Croquis aproximado, hecho con cintas, suunto y altimetro en Abril de 1992 por F. Bobadilla, J.A. Soriano, S. Borrego, E. Tobón, C. Galicia, F. Ruiz

Profundidad 315 m
Longitud 360 m

U.N.A.M.



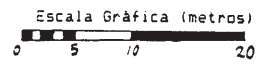
SISTEMA CHANTORO

Iztaxochitla, Mpo. de Coyomeapan, Pue.

Topografiado con suunto y cintas en Abril de 1991 por Francisco Ruiz y Raul Cruz

Profundidad 45 m, Longitud 79 m

U.N.A.M.



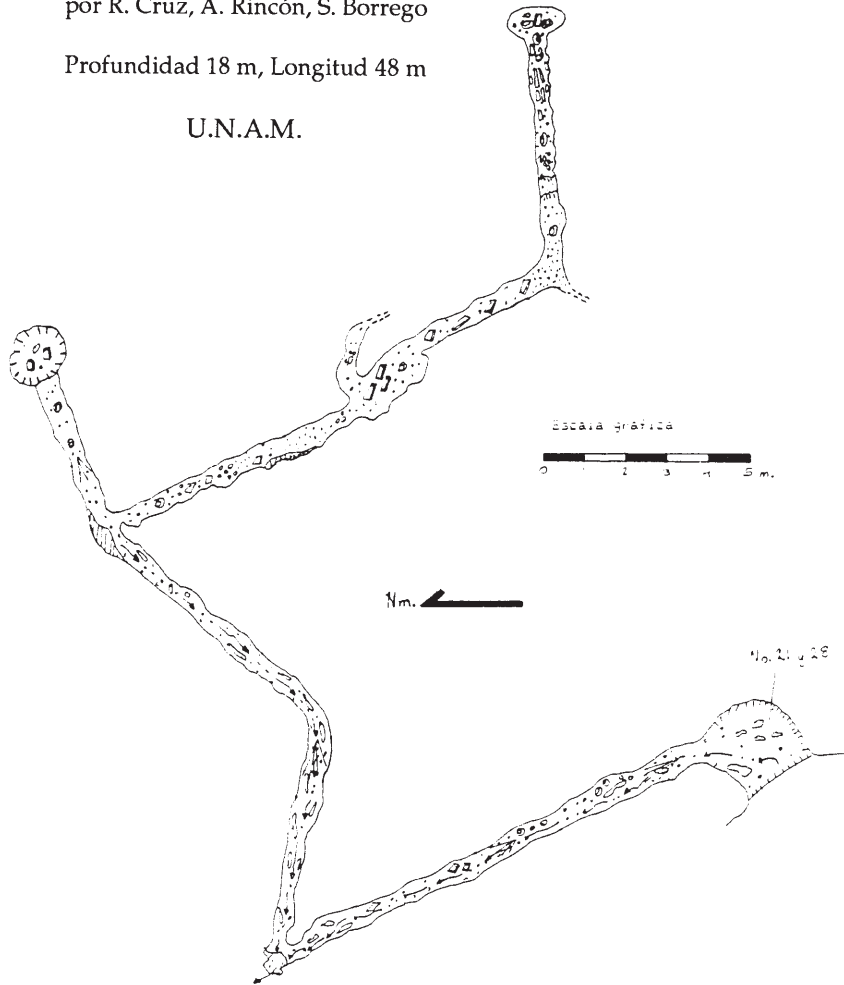
SÓTANO DE LAS ESPINAS

Iztaxochitla,
Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suuntos
por R. Cruz, A. Rincón, S. Borrego

Profundidad 18 m, Longitud 48 m

U.N.A.M.



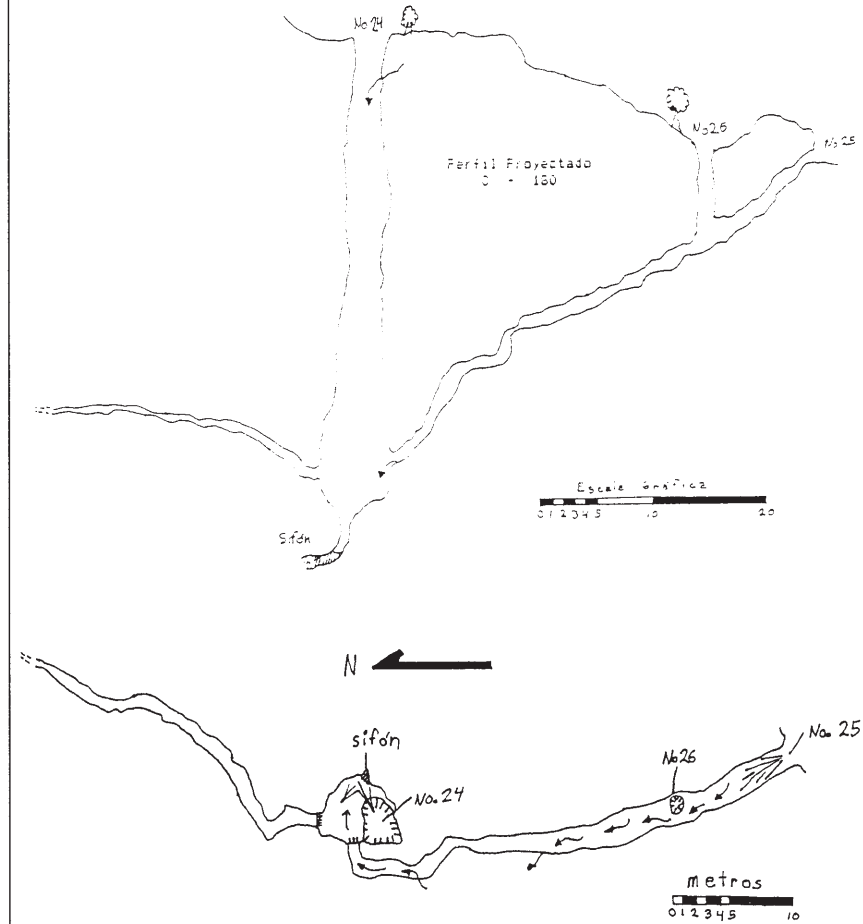
SÓTANO DE MI CARNAL

Iztaxochitla, Mpo. de Coyomeapan, Pue.

Topografiado con cintas y suuntos en Diciembre de 1991 por
J. Vargas, V. Bénard, F. Bobadilla, V. Reinoso,
C. Galicia, F. Ruiz, G. Avila S.

Profundidad 46 m, Longitud 79 m

U.N.A.M.





Emilio Tobón at the top of 117-meter Sótano de los 10 Minutos. *Sergio Lozada.*

Andrajo (32). Four meters from the entrance in 31 was found a carved Tlaloc face, which gave the name for the cave.

Some cavers thought the idol was a bad luck symbol. I don't know if it was or not, but the survey of the next cave, El Sótano del Andrajo, was full of incidents. The first was when I found myself climbing down a very dangerous drop due to an error in communication. But the worst occurred when we tried to derig an 80-meter drop and the rope got caught. We wasted a

whole day recovering it. Raúl, who was taking some equipment back to camp, suddenly heard strange and unknown voices. The sounds seemed to come from a drop in the trail and then from behind him, so he returned to camp in record time. Paco had a problem climbing one drop when a handhold broke, dropping him four meters. Fortunately, the only consequence was a pain in a rib whenever he laughed. A bit disappointed, we ended up with a depth of 300 meters and hopes to return in April. The cavers were G. Avila, F. Bobadilla, S. Borrego, R. Cruz, E. Duarte, C. Galicia, C. Gomez, V. Reinoso, A. Ricón, E. Tobón, J. Vargas, V. Vénard, and F. Ruiz.

In April 1992, when we returned to



PIEZAS ARQUEOLÓGICAS

Cueva de los Idolos

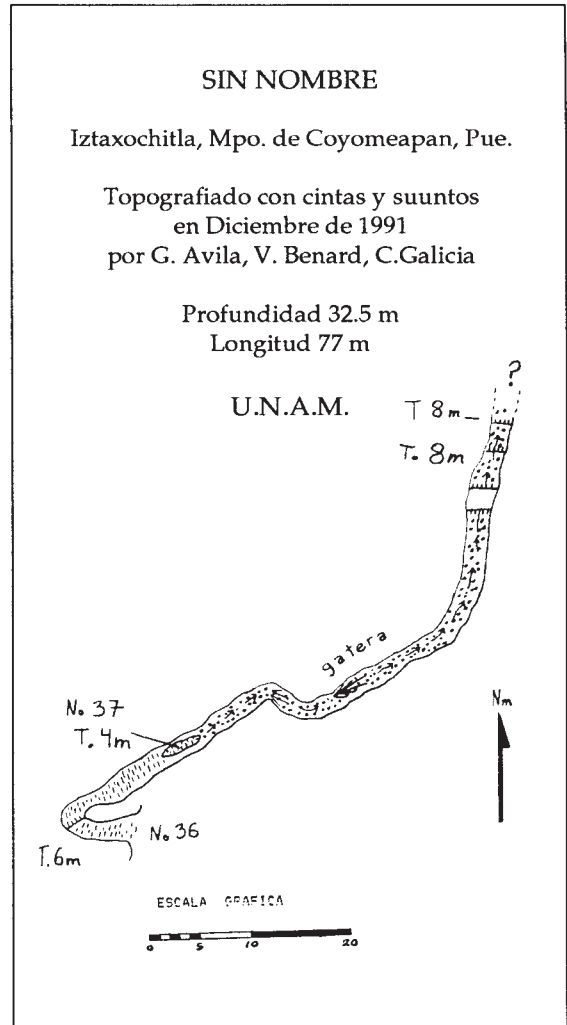
drawing by Armando Rincón



Javier Vargas in the pit series in Los Gours (number 6) entrance. Sergio Lozada.

entrance 17 one year after we had found it, the trail to the entrance had been completely overgrown by the jungle. It took a whole day to find it. We made three drops here, of 15, 20, and 30 meters, and reached some galleries that we could not explore because we put most of our effort into our bad-luck cave number 32, Andrajo, which we had not finished in December. This time we mapped down to the depth of 300 meters, but we can not say that it is finished, because there are still several unexplored branches. We also surveyed five new holes, including a 60-meter pit (number 41). Then the bad luck struck again. On the way back to Mexico City, we lost the notes for caves 16, 17, and half of 32. This was our most recent trip to the area, where we have found forty-six entrances and have a lot more work to do. Cavers on this last trip were B. Alvarez, G. Atamoros, F. Bobadilla, G. Bobadilla, S. Borrego, L.M. Calzada, J.M. Casanova, C. Galicia, E. Martos, A. Morales, L.M. Rojano, D. Sanchez, J.A. Soriano, E. Tobón, J. Vargas, and F. Ruiz.

Throughout our explorations, we have found some factors that are constant throughout these areas. Almost all the caves are very wet, even in the dry season, there is a lot of breakdown, and all the water disappears into small holes in the walls or floors. In the Chantoro area we



reached a depth of 300 meters, but the area has not been completely explored, and we hope to find a main stream passage. Another large expedition to the area is being

planned for the near future.

We want to thank De Sann Cacao S.A. de C.V.; without their financial support and help we could not have done a large part of this project.

Proyecto Iztaxochitla

Espeleólogos de U.N.A.M. han estado explorando cuevas cerca del poblado de Iztaxochitla, en el Municipio de Coyomeapan, en el estado de Puebla. El Sistema Iztaxochitla tiene actualmente seis entradas, con una longitud de 1830 metros y 171 metros de profundidad. Sótano de los 10 Minutos tiene un tiro de entrada de 117 metros y el cual se localiza en el area de Chantoro. Por ultimo el Sótano del Andrajo alcanza una profundidad total de 300 metros.

MORE DISCOVERIES IN THE CUETZALAN AREA

Jim Pisarowicz

It did not start out as a very good day, back in 1981, for Doug Wilson. The sun was out early that morning, a rarity for Cuetzalan, and we got an early start driving Bill Liebman's and my trucks down toward Nauzontla, where, the year before, Doug, accompanied by Scott Trossen, had spent some time poking around the road to Nauzontla and had been told of a cave high up on a hillside. Doug was climbing up that hillside, when suddenly the slippery earth gave way beneath his feet. Down the hillside he slid, and he was only able to stop his tumble by grabbing onto the only plants growing along his route, *mala mujer*. Although the stinging nettles stopped his fall, his hands, arms, chest, and back were rapidly swelling. At that moment he was not a happy caver.

While Doug had been checking out his side of the canyon and having a close encounter of the nasty kind with the local vegetation, Bill and I had noted a man riding toward us on a horse. Asked about caves in the area, he pointed up a small valley and said that there was a cave in that direction called Cueva de Atecarla. We thanked him, grabbed our caving kit, and began searching the sides of the valley for an entrance.

Louise Hose, Tom Strong, and I quickly found the entrance. I grabbed a flashlight to see whether it went. Tom and Louise quickly followed, but we were immediately confronted by a lake that filled the passage from wall to wall. While Tom and Louise looked on, I stripped off my clothes and, wearing only my boots and carrying my flashlight, I proceeded into the water. After only a short wade, I was across the entrance lake. As I ran naked down the passage, it became

clear that we had a going cave, for I encountered several side leads and then a major stream passage. Leaving the cave, I told Tom and Louise what I had found. While I threw on some clothes, they shouted down to the others that the cave went, to bring up caving and surveying gear, and to be prepared for a short wet section near the entrance.

Mark Maslyn, Randy Spahl, and Doug Wilson would begin at the first major junction and survey what appeared to be the main passage. Alan Williams, Jerry Hassemer, and Tom Strong would head down the main passage until a side passage was encountered, set an obvious station, and

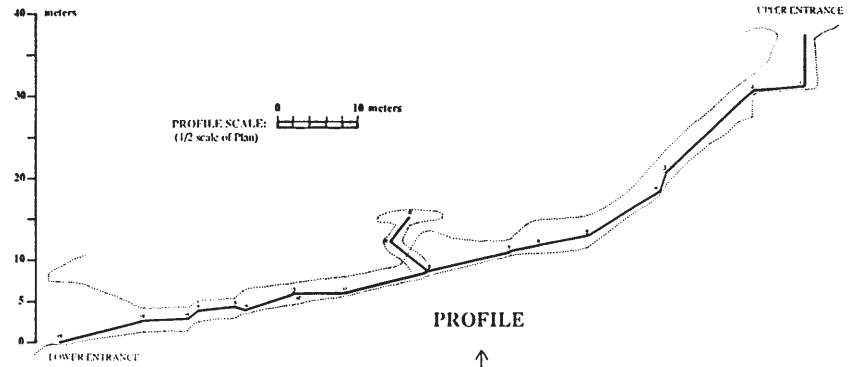
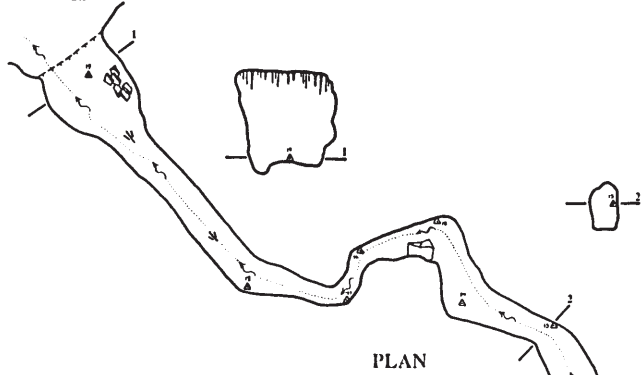
begin surveying. In case a side passage was not encountered, they would go what they thought was a reasonable distance for the other team to survey in one day, set an obvious station, and begin surveying there. Despite the potential problems with such a hastily thrown-together plan, everything progressed like clockwork.

The entrance-passage survey that Louise and I did got us wet, but once past the entrance lake, we put our clothes back on and stayed mostly dry. Side passages in the entrance area were not extensive, but they took a fair amount of time to survey, as there were stoop passages and crawlways.

Doug Wilson at the entrance to Atecarla.
Alan Williams.



LOWER ENTRANCE



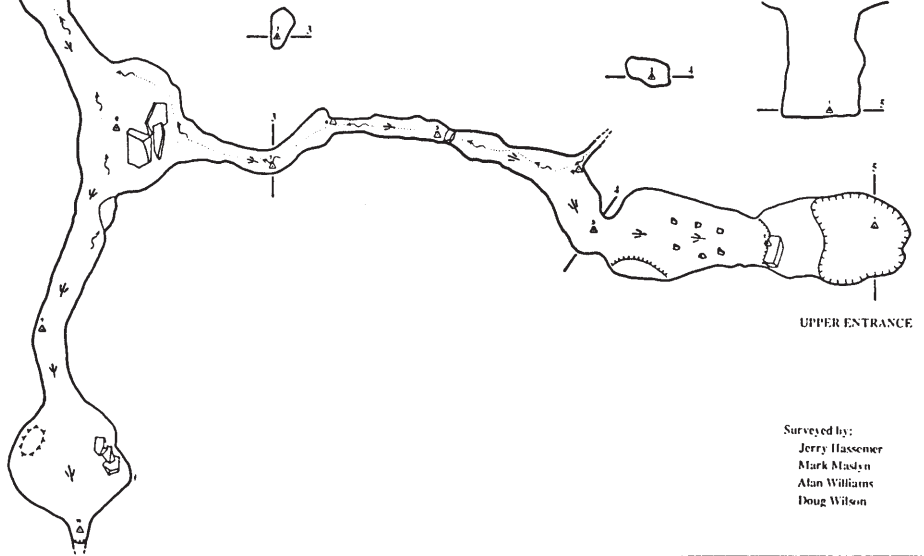
UPPER ENTRANCE

CUEVA del PASEO de la BORITA

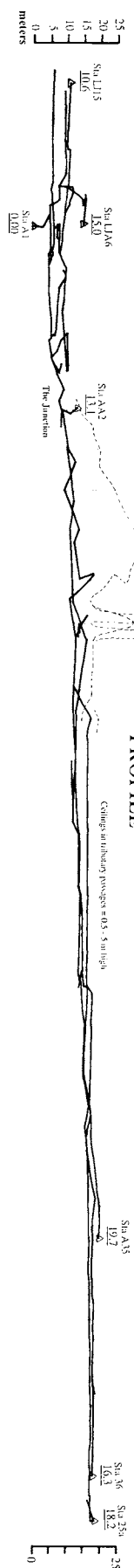
Near Cuetzalan, Puebla, Mexico

Sumto & FG tape survey of 20 December 1981
Plot and Draft by Alan Williams © 1992

Traverse Distance: 163 meters
Vertical Extent: 37 meters



Surveyed by:
Jerry Hassener
Mark Maslyn
Alan Williams
Doug Wilson



PROFILE

Profile view angle (90° angle)

Main cave stream passage

Stalactites & Black Forest Drip

The Junction

Sta. LJA6 13.0

Sta. LJA5 14.0

Sta. LJA4 15.0

Sta. LJA3 16.0

Sta. LJA2 17.0

Sta. A36 16.3

Sta. A35 18.2

Sta. A34 19.7

Sta. A33 19.7

Sta. A32 19.7

Sta. A31 19.7

Sta. A30 19.7

Sta. A29 19.7

Sta. A28 19.7

Sta. A27 19.7

Sta. A26 19.7

Sta. A25 19.7

Sta. A24 19.7

Sta. A23 19.7

Sta. A22 19.7

Sta. A21 19.7

Sta. A20 19.7

Sta. A19 19.7

Sta. A18 19.7

Sta. A17 19.7

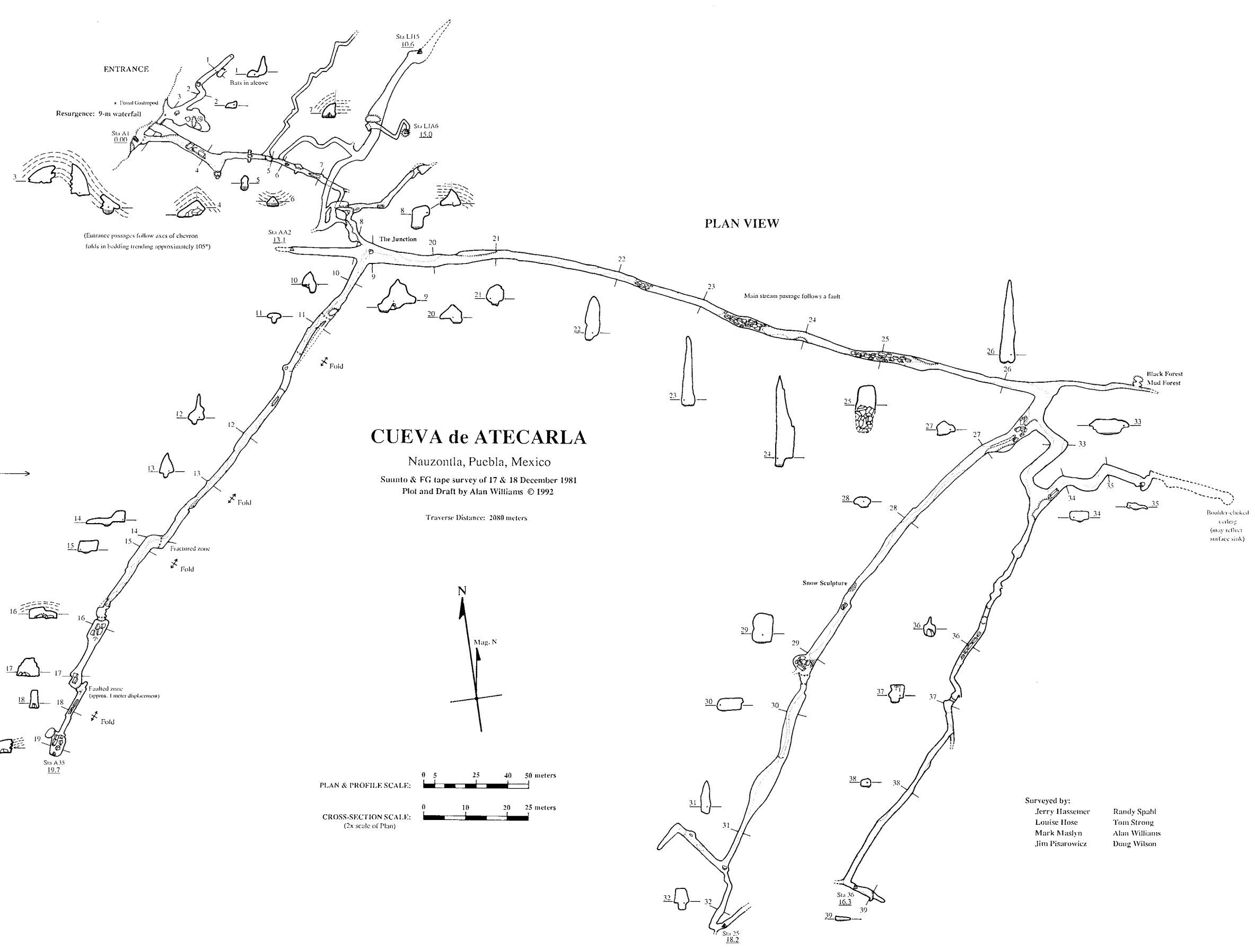
Sta. A16 19.7

Sta. A15 19.7

Sta. A14 19.7

Sta. A13 19.7

Sta. A12 19.7



CUEVA de ATECARLA
 Nauzontla, Puebla, Mexico

Suunto & FG tape survey of 17 & 18 December 1981
 Plot and Draft by Alan Williams © 1992

Traverse Distance: 2080 meters

Surveyed by:
 Jerry Hassemer
 Louise Hose
 Mark Maslyn
 Jim Pizarowicz
 Randy Spahl
 Tom Strong
 Alan Williams
 Doug Wilson

The team of Mark, Randy, and Doug took off like a rocket. The passage tended to be very straight, with little side development. They, like all our teams, eventually got wet, as the going involved wading through the water and encounters with small waterfalls. Despite such wettings, most of their survey was walking passage. Twenty- and thirty-meter shots were common. By the end of the day, this team had surveyed 1001 meters.

The third team had almost as much luck. The side passages beyond the main entrance junction were walking-sized passages. Survey shots using all or nearly all of the length of the tape were common. By the time all the parties had been reunited, we had surveyed the entire cave in one day.

The surveyed length was 2080 meters. Doug had even forgotten about his encounter with the *mala mujer* earlier in the day. What great medicine a good cave can provide.

Medicine such as Atecarla does not last forever, and Doug was still itching from *mala-mujer* welts several days after we did that cave. The only cure is another cave, and so, three days after we mapped Atecarla, Cueva del Paseo de la Borita was entered and mapped.

Approximately 13 kilometers south of Cuetzalan, a divide is encountered on the main road to Zacapoaxtla. South of this divide, there is a large doline on the east side of the road. The bottom of the doline is a corn field. A cave entrance is located just within

the jungle on the east edge of the field. This cave was mapped by Jerry Hassemer, Mark Maslyn, Alan Williams, and Doug Wilson. They entered the cave from the bottom of the doline and traversed 163 meters, rising 37 meters from this lower entrance near the corn field to an upper, pit entrance deeper in the jungle. Water trickles through the cave in small streams, apparently from local infiltration, and runs out into the doline through the lower entrance.

By the time Doug finished helping map Paseo de la Borita, he had almost forgotten about his welts. It was time for more caving, in Sistema Cuetzalan and other caves, but those are other tales to be told at other times.

Mas Cuevas en el Area de Cuetzalan

Dos cuevas en Cuetzalan, Puebla fueron mapeadas en 1981: Cueva de Atecarla, con 2080 metros de longitud, y Cueva del Paseo de la Borita, con 163 metros de longitud.

CUEVA DE LAS ABEJAS AFRICANAS ACATITÁN, COLIMA

John J. Pint

Once again our enterprising friends in Colima had located a promising cave. "It's a pit," explained Manuel, "but there's also a hive of African bees right at the entrance, so you'd better be careful." We were so careful that we let a year go by before we even took a look at this pit. We knew that recently five people had been stung to death *inside* Colima City, a fact that has inspired us to always carry face netting whenever we go tromping off the beaten trail.

We figured the bees might be gone a year later, so, in March of 1993, we finally followed Manuel's directions out to a bone-dry hill near the *pueblito* of Acatitán, a few kilometers south of Colima City. There was more exposed limestone than dirt on that hill, which gave us hopes of finding something worthwhile. After a ten-minute walk we found the cave entrance, or, rather, entrances; there were two holes side by side, one a couple of meters in diameter and the other a slot that we didn't even approach. That's where the bees were hanging out, apparently still enjoying great prosperity and health.

The no-bee entrance was only about 12 meters deep. I rappelled and found myself in a roomy cave with an opening on one side that led to an equally large room with a floor about three meters below me. Above one end of the room you could get a great worm's-eye view of the dreaded bees.

I asked for another hunk of rope from the folks on top and did an aid climb down into the second room. High at one end I could see a small passage full of bats and possibly leading somewhere. At the other end, to my surprise, I found a hole in the wall,

very much like a small window and plenty big enough to crawl through. Beyond this hole I could see into a third room, at least as big as the first two, but again there was a several-meter drop on the other side of the wall, a drop that appeared to require a rope or cable ladder. Since I was unable to lean very far into this window, I stuck my Pentax Zoom 90-WR autofocus through it, which resulted in a wide-angle shot showing several bats and a down-sloping floor. What might lie beyond?

Believe it or not, we didn't find out. I went back to the first room and shouted up to Susy and Chema those words so welcome in any language: "It goes!" Chema was already geared up and ready to put rack on rope. Meanwhile, I made the mistake of wandering over to that spot at the bottom of Slot Bee to try to get a picture of the hive way up above me. As I was adjusting the zoom, I felt a prick on my little finger. Apparently not all the bees were up there by the hive. I had been stung by Outpost Sentry Number One and did not intend to get to know Number Two nor any other members of the organization. "Chema! Abort! Get off rope, I'm heading up."

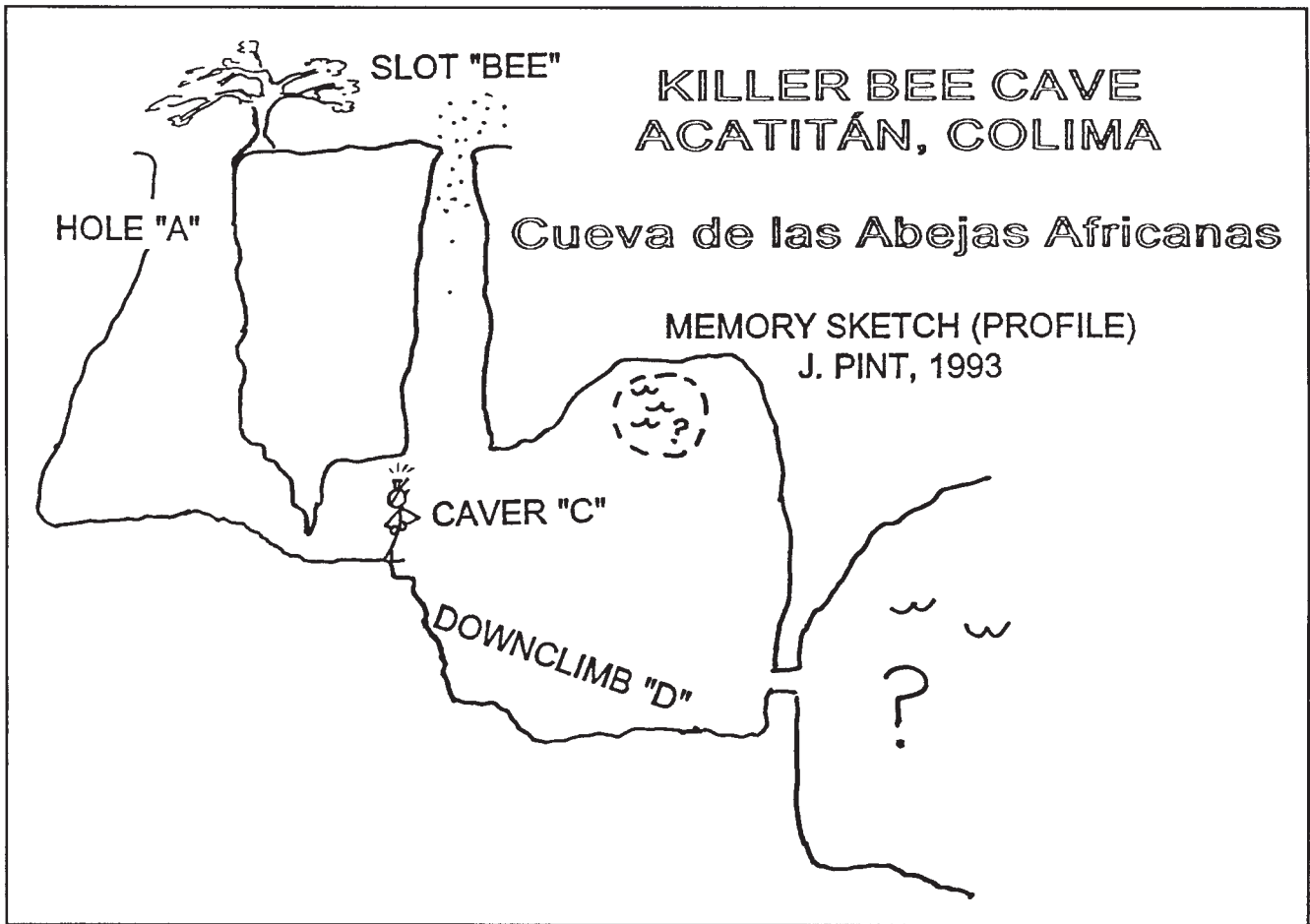
That was the end of it, but later I had fantasies of what prusiking might be like to the tune of hundreds of little buzzing

stingers, and it wasn't a pleasant thought. Still, I believe this cave could be safely explored by staying in the dark areas, far away from the Slot Bee side.

We are beginning to wonder whether smoke pots will someday become standard gear for caving in Colima. Manuel tells us he has two more pits lined up for us at a place called San Gabriel, both of them guarded by more of those good old neighborhood African Killer Bees.

The friendlier entrance to the Killer Bee Cave. *John Pint.*





Cueva de las Abejas Africanizadas
Acatitán, Colima

Esta cueva pequeña contiene un panal de abejas africanizadas en uno de los tiros de la entrada, sin embargo ha sido explorado por las otras entradas.

RECONNAISSANCE IN CHIHUAHUA

Jim Pisarowicz

Searching for caves in Mexico has become much easier in recent years. With the publication of topographic maps covering the entire country, wandering cavers with some knowledge of what topographic features are usually associated with caves can more easily zero in on new caving areas. Although certainly not as detailed as the topographic maps, PEMEX has for many years published a series of road atlases. The most valuable of these for general travel throughout Mexico is the *Atlas de Carreteras y Ciudades Turísticas*. This compact booklet of maps shows all major and many minor Mexican roads. The maps also contain such invaluable information, such as which towns have gas stations and whether the stations are set up to carry unleaded gasoline. The maps also show various tourist attractions, including, surprisingly enough, caves.

When I received the latest *Atlas de Carreteras*, I happened to note that

several towns in Chihuahua were depicted with an adjacent "grutas o cuevas" symbol. As one does not usually see many, or any, reports on caves in Chihuahua, I contacted Peter Sprouse to see if the AMCS had any reports on caves in or near the Chihuahuan villages of Basaseachic, Yepachic, Ocampo, and Guaynopa. When Peter indicated that he did not have any cave reports about these areas, a trip was quickly planned.

Weekend caving trips from Colorado to Mexico are not within the normal realm of caving activity, but then normal caving trips are, well, just too normal. I contacted Louise Hose in Colorado Springs to see if she was already committed to anything for the 1993 Memorial Day weekend, and she was not. Several more calls did not yield additional cavers, although Louise convinced John Campbell, another Colorado Springs caver, that a weekend cave-reconnaissance trip to Mexico was the thing to do.

The trip plan was simple. I would leave Montrose Thursday night after work. Louise and John would meet me at Glenda Rhodes's home in Albuquerque. There they would leave John's vehicle, and we would use my Jeep for the remainder of the trip to Mexico. Everything worked like clockwork, except for the three-hour detour around Red Mountain Pass because of a snow slide blocking the road. Despite this delay, we crossed into Mexico around 5:00 A.M. on Friday, just ahead of the usual morning border rush at El Paso-Juárez. Continuing south on highway 46, we skirted Chihuahua, then went west on highway 16 to Cuauhtemoc, and finally started the climb into the Sierra Madre Occidental. When the pavement ended, we were on a fairly typical Mexican gravel road, winding our way toward the first town with a cave symbol, Basaseachic.

We rambled into Basaseachic late Friday afternoon. We were all very tired after driving for nearly twenty-four hours. Along the route into the mountains we had seen precious little limestone, as much of the area seems to be rhyolite. Of course, this did not bode well for finding large caves, but in our excited state of tiredness we just wanted to get there.

Basaseachic is situated on the northern end of the Parque Natural Cascada de Basaseachic and contains a truly spectacular 300-meter waterfall. Being the only gringos in town, we were quickly directed toward the *cascada*, but we soon discovered that there was a cave along the trail to the waterfall. Enlisting a local guide, we found



Pictographs in Cueva Pintura.
Jim Pisarowicz.

ourselves scrambling down a small canyon into a nice shelter cave containing several cave paintings and some artifacts, such as metates. Standing in the shelter cave, it was obvious to us why the Indians has used this site. The cave provided shelter, there was a beautiful stream with large plunge pools just outside the cave, and only a couple hundred meters to the south was the magnificent cascade.

After spending time photographing the waterfall and watching the updrafts carry the water back up the falls into our faces, we were again on the road, heading toward Yepachic. Limited outcrops of limestone were encountered, but again rhyolite seemed to predominate along the road.

Around dinner time we pulled into Yepachic. The owner of a small tienda told us that there were several caves in the area, but the most interesting one was many kilometers away. After several minutes of negotiation, we had acquired a guide for the next morning, and we headed off into a field for a much-needed night's sleep.

Early Saturday morning we picked up our guide, shifted into four-wheel-drive, and headed into a remote area of the Sierra Madre Occidental north of Yepachic. Without the guide, we would never have found our way. The road quickly deteriorated into a path, then a cow track. The guide, led by some unknown sense, kept pointing his finger one way and then another, as all four wheels, driving and pulling, took us further afield. As we entered a small clearing, he motioned us to stop. He pointed up at a cliff, and there was a large shelter cave.

The hike to the cave was short, and before we knew it, we were staring at a wall covered with pictographs. Protected by the sheltering overhang, the walls were completely covered for many meters by cave rock art created by local Indians in the long-forgotten past. After admiring and photographing the pictographs, we continued along the lower part of the cave shelter until we encountered a wall. This wall had obviously been used by the inhabitants to grind their corn, as it

had been constructed to function as a large, multi-place metate. As in all the shelters we visited, metates were very much in evidence, but we saw no obvious manos.

Climbing to an upper level, we traversed a long, overhung ledge on the cliff. This eventually led to another, larger shelter cave. Constructed in one corner of this cave was a small structure apparently used as a granary. Many cobs of corn were found in the structure, several of which were small, old-fashioned hybrids, probably grown by Indians in the area many centuries ago. Our guide told us that the cave was called Cueva Pintura. Although not the sort of find typically sought by cavers, it was an exciting discovery that I am sure is seldom visited by people from anywhere except the immediate vicinity of Yepachic.

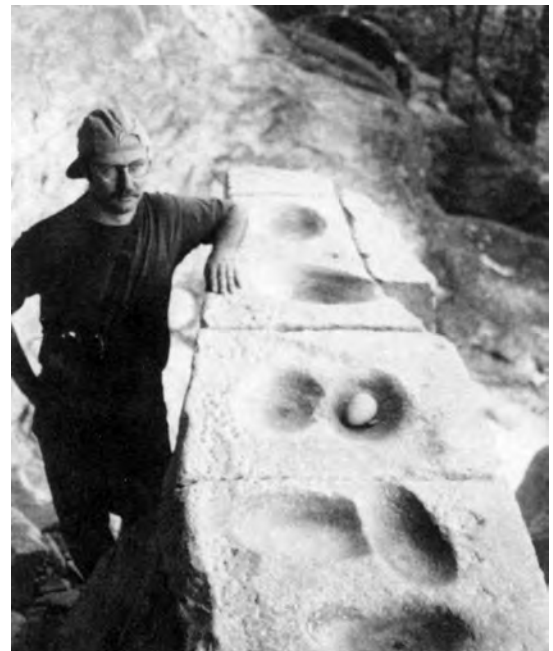
Although that was the only cave visited near Yepachic, our trip back to the main road held another discovery. About half-way back to town, our guide stopped us. Walking across a large field, we were soon at the base of a lava flow that was covered with large bird tracks and many petroglyphs. We traveled quite a distance up a drainage, and it seemed that everywhere we looked we saw evidence that some ancient Indian group had left their marks in the stone. After photographing several examples of the fossil footprints and pecked drawings, Louise asked our guide if any scientists or other people from any universities had ever visited these sites. The guide said that to his knowledge none had ever been in the area at all. A later conversation with the owner of the tienda back in town supported our guide's story. The store owner said that he was sixty-seven years old, and he knew of no scientist ever seeing what we had seen.

John Campbell beside
the metate wall in
Cueva Pintura.
Jim Pisarowicz.

From Yepachic, we retraced our route back to Basaseachic and then pushed on to Ocampo. Ocampo is situated at the bottom of a steep canyon, where the road descends with tight switchbacks. From the top of the canyon, the town looked like a mining village, which is what it turned out to be. Partway down the canyon, we spied a large cave entrance, but we continued down into town to gather more information. After passing several mine entrances, we found ourselves wandering the streets of Ocampo. At a shop packed with people, we asked about caves in the area. The owner said that the cave we had seen coming into town was only a large shelter. He also said that there was a larger cave, also a shelter, about eighteen hours' walk from town. This cave supposedly contains spectacular pictographs. As our time was limited, we did not visit this cave.

Further questioning revealed that most of the mines in the valley were gold mines. The owner went into his back room and pulled out a large cloth sack containing pieces of melted-down gold. He said that there were several company mines in the area, plus numerous small family mines.

On the way back to the Jeep, we went over to one mine entrance, and, after a brief period of introductions, we were invited underground for a tour. This mine had just recently been reopened. As we started into the





Louise Hose and petroglyphs in lava flow. *Jim Pisarowicz.*

entrance, the cool breeze attested to the size of the mine. The foreman said that the workers were removing fill that had clogged the entrance area. Pumps were in operation to remove water that had filled some of the levels of the mine. Although it was not a cave, this would be the closest we would get to really being underground on this trip.

Although we had been told that the shelter cave we had seen coming down the canyon was *feo* (ugly), we made the traverse across the canyon

to check it out. It contained evidence of human habitation.

There was now only one more place to check out before heading home. We backtracked toward Cuauhtemoc, and at Mateos turned north. The village of Guaynopa, near the Chihuahua-Sonora border, was shown in the PEMEX atlas as having a cave nearby. Halfway between Mateos and Guaynopa, we bedded down for another night's well-deserved rest. The next morning, we got directions at La Mesa del Huracán

and turned west toward the state border. La Mesa was the last place where we really knew where we were for most of the day. We wandered up, down, and all around the countryside for hours, trying to find our way to Guaynopa, but we could not locate it. In fact, for several hours we did not see a single person, truly unusual for Mexico. Soon it was starting to get late, we were running low on fuel, and it was still a long way back to Colorado. It was time to call off the Chihuahuan cave reconnaissance.

We found our way back to Chihuahua, where John and I dropped off Louise at the airport. She had to catch a plane to Oaxaca to begin working on a geology project at Monte Albán. John and I then blasted back to the border and then north to Colorado. Although no large cave systems were discovered, the caves visited were truly interesting. From what we had seen on our short trip into the Sierra Madre Occidental in Chihuahua, I am sure that numerous other shelter caves with extensive evidence of human use will eventually be rediscovered and cataloged by archaeologists. Although not the sort of caves usually sought by cavers, these caves are definitely valuable cave resources.

Explorando Chihuahua

Espeleólogos de Colorado hicieron una corta visita a dicho estado para así investigar algunas cuevas que observaron en el atlas de PEMEX. Una cueva encontrada cerca de Basaseachic contiene pinturas rupestres. Cueva de la Pintura es una cueva cerca de Yepachic, contiene pinturas rupestres y metates, y cerca de ahí se encontraron petroglifos en lava. Otra cueva localizada en el cañada cerca de Ocampo se observó vestigios humanos. Cuevas de origen calcáreo no se encontraron, sin embargo las otras cuevas fueron bastante interesante.

THE CAVE THAT RUNS THROUGH THE MOUNTAIN

John J. Pint

“I know a cave up in the hills and there’s gold inside it, *seguro*,” exclaimed Paulo, a one-armed man with a dazzling smile and an unwavering belief that all Mexican caves are loaded with treasure buried by the savings-conscious *bandidos* of yesteryear.

When my wife Susy and I first arrived in El Ojo de Agua in the state of Jalisco, Paulo had immediately offered us accommodations in the hacienda guest house, followed by an invitation to enjoy a swim in the spring-fed pool and a delicious *tatemada* meal. Now, I can think of certain other places in the world where two total strangers might have been welcomed with a shotgun and an ominous “Git off o’ my land you varmits!” Instead, Paulo immediately took us on a tour of shelter caves in the cliff below the ranch, and this convinced us there was some fine karst in those hills.

A few weeks later, accompanied by Claudio Chilomen, Chema Méndez, and Juan Blake, we followed Paulo up the steep mountain trail for about four hours. This is easier said than done when the temperature is in the 90s. However, Paulo’s frequent reminders that “this cave goes all the way through the mountain” kept us moving at a good speed, even though we had heard such claims before, only to have the caves always manage to end 5 meters beyond the entrance. At the edge of a newly planted field high in the hills, Paulo stopped to talk to several men with tanks strapped to their backs. We newcomers got a few quizzical looks, but Paulo generously offered to include one and all in the booty we’d soon be extracting from the bowels of the earth.

Finally we came to the cave entrance, at the bottom of a bushy fold in

the hills. To our surprise, the opening was completely covered by a patchwork of mesh held tightly in place by barbed wire and a framework of stout branches. “What’s this all about?” we asked Paulo. He explained that the cave had been filled with dreaded vampires, but, luckily, the men we had met along the way had “taken care of the problem.” With the help of Leatherman pliers, we made a slit in one side of the formidable barricade and climbed inside.

We were in a passage about six feet high strewn with large chunks of breakdown. We followed it slowly for about half an hour, checking for side passages and photographing several large stalactites. Then we saw light. “Maybe we’ve finally found a cave that *does* go straight through the mountain,” we quipped. But as we entered a wide room with a high ceiling, we saw that this second entrance was sealed by another bat barricade.

We backtracked, and, as we approached our starting point, Susy spotted a very low crawlway. A few minutes later we heard a tiny voice calling from afar, “I’m in another trunk passage, a real beauty.” This branch of the cave turned out to have its own entrance, also bat-proofed, next to the one we had opened. The floor of this new section of the cave was covered with a thick, spongy layer of guano. The further we walked, the more we were convinced that many thousands of bats had once lived here. Now there was not a one to be seen.

The texture and reddish color of the walls brought a special beauty to this passage. Soon we were threading our way among giant breakdown blocks. We did plenty of climbing both up and down, but never needed a rope. This challenging and enjoy-

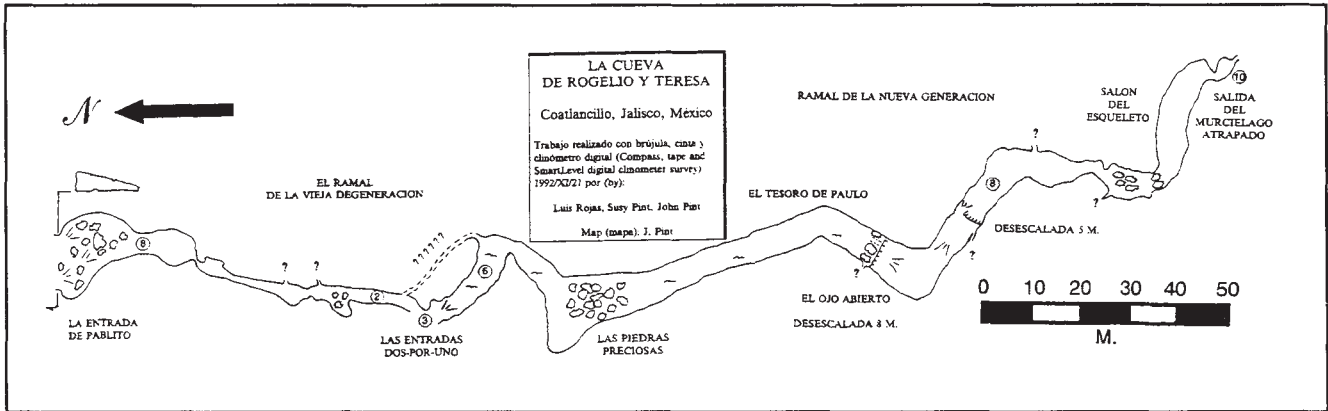
able passage finally came to an end, and, yes, there in front of us was light—and the ominous silhouette of chicken wire and branches. At this moment we could almost feel the panic that all those bats must have felt. Had they been caught on the inside like us, trapped, flying desperately from one entrance to another in a futile attempt to find a way out?

When we left the cave, we removed as much of the first barrier as we could (with Paulo’s permission), but we suspected that it would soon be put back in place. Since the cave had no name, we baptized it Rogelio and Teresa’s Cave, after the humble couple living in a little cabin nearby, who treated us to incredibly delicious hot tacos made with hand-patted tortillas.

That night we sat in the plaza of Coatlanillo, the small town below the hacienda, downing cold Dos Equis Negras and talking, to whoever would listen, about the cave. “We checked every inch of that cave and never found the slightest sign of vampire guano. Those were insect-eating bats in there, and now you people have to spray your crops with poison to keep down the bugs. If there’s treasure in that cave (a glance in Paulo’s direction), it’s the tons of good fertilizer lying on the floor. But somebody has killed off the bats that make the fertilizer.”

“*Caray, señor*,” said an old-timer. “Don’t you know there is *malo aire* in the cave? It has made a lot of people very sick.” Apparently, in his enthusiasm to tell us about the gold, Paulo had “forgotten” to mention this little detail.

“Well, then, don’t go inside. But why put up a barrier against bats that eat bugs and pollinate plants?”



The allusion to histoplasmosis proved true. Chema, the only novice caver in our group, got a nasty case of it exactly eleven days later. The rest of us figured we were immune and decided to go back and map the cave several months later.

Once again we were heading up the steep, narrow trail, but this time riding horses and mules, which “might come in handy for carrying back the treasure,” according to Paulo, the eternal optimist. Equestrian caving is definitely for me. Instead of arriving pooped out, we reached the entrance in high form, raring to go. But as soon as we had dismounted, Paulo, who had brought along his family, announced, “OK amigos, let’s make a fire and start cooking.”

Fortunately, a tin of oysters doesn’t require much cooking, and I was able to escape from the picnic with the pretext that I wanted to take a few pictures before starting the survey. Later, in the course of a rushed map-

ping job, we received two wonderful surprises. First, the local people had apparently believed us city slickers and had actually ripped aside three of the four chicken-wire barriers. Second, we walked into the guano passage and were greeted by hundreds and hundreds of flying creatures. There were so many swirling around us and bumping into us that we had to crouch on the ground and wait several minutes for them to get used to our presence. The bats were back!

On another occasion, Paulo took us to a vertical hole that was supposed to lead to a long, horizontal tunnel whose end has never been reached. “There are rumors that the Devil himself lives in this cave,” exclaimed Paulo. “So, of course, we brought a priest up here to perform an exorcism. The priest actually went down into the hole and came right back out. He said he’d seen writing on the wall in Latin, indicating it’s the Devil’s pad, all right. ¡Chihuahua!

Did he even leave in a hurry, and with all the people behind.”

We climbed down into the shallow first pit and proceeded to clear away the bones and rotting flesh of a smelly, disgusting dead cow blocking the narrow entrance to a second room. This led to a very tight passage that brought us down to a small room maybe 8 meters below the surface. Here, Luis Rojas squeezed into a slippery, narrow crack (“Devilishly tight,” he quipped) that went down another 10 meters before it became impassable.

I spent eight years of my life studying Latin and had high hopes of finally putting it to some practical use. However, we didn’t see a sign of handwriting on the wall, not even in Pig Latin. All we found in La Cueva de la Vaca Muerta (Dead Cow Cave) was an empty bucket, no doubt left there by someone who, like Paulo, hoped to find treasure and ended up getting the Devil scared out of him.

La Cueva Que Atraviesa el Monte

Espeleólogos del Grupo Zotz visitaron una cueva en el estado de Jalisco, la cual se topografió y fue llamada la Cueva de Teresa y Rogelio. Esta contiene varias entradas, las cuales han sido bloqueadas por los pobladores de la región ya que ellos pensaban que el tipo de murciélago que habita esta caverna son del tipo vampiro. Afortunadamente los espeleólogos explicaron el tipo murciélago y los beneficios de estos. Un miembro del grupo contrajo histoplasmosis en esta cueva.

