

AMCS
ACTIVITIES
NEWSLETTER
Number 29 June 2006





AMCS

ACTIVITIES NEWSLETTER

Number 29 June 2006

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

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

This issue was edited by Bill Mixon, with help from Katie Arens, Yvonne Droms, Rodolfo "Fofo" González, Orion Knox, Mark Minton, and John "Solo" White.

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

ASSOCIATION FOR
MEXICAN CAVE STUDIES
BOX 7672
AUSTIN, TEXAS 78713
www.amcs-pubs.org

© 2006 AMCS

All rights reserved.

Authors, photographers, and cartographers
retain copyrights to their individual contributions.

Printed in the United States of America.



Front cover

Robbie Warke on Nightmare Falls at -1300 meters in Cueva Cheve, Oaxaca, during the 2003 Cheve Expedition. Photo by Bill Stone.

Back cover

Passage in Cueva de la Mano, Guerrero. Photo by Gustavo Vela Turcott.

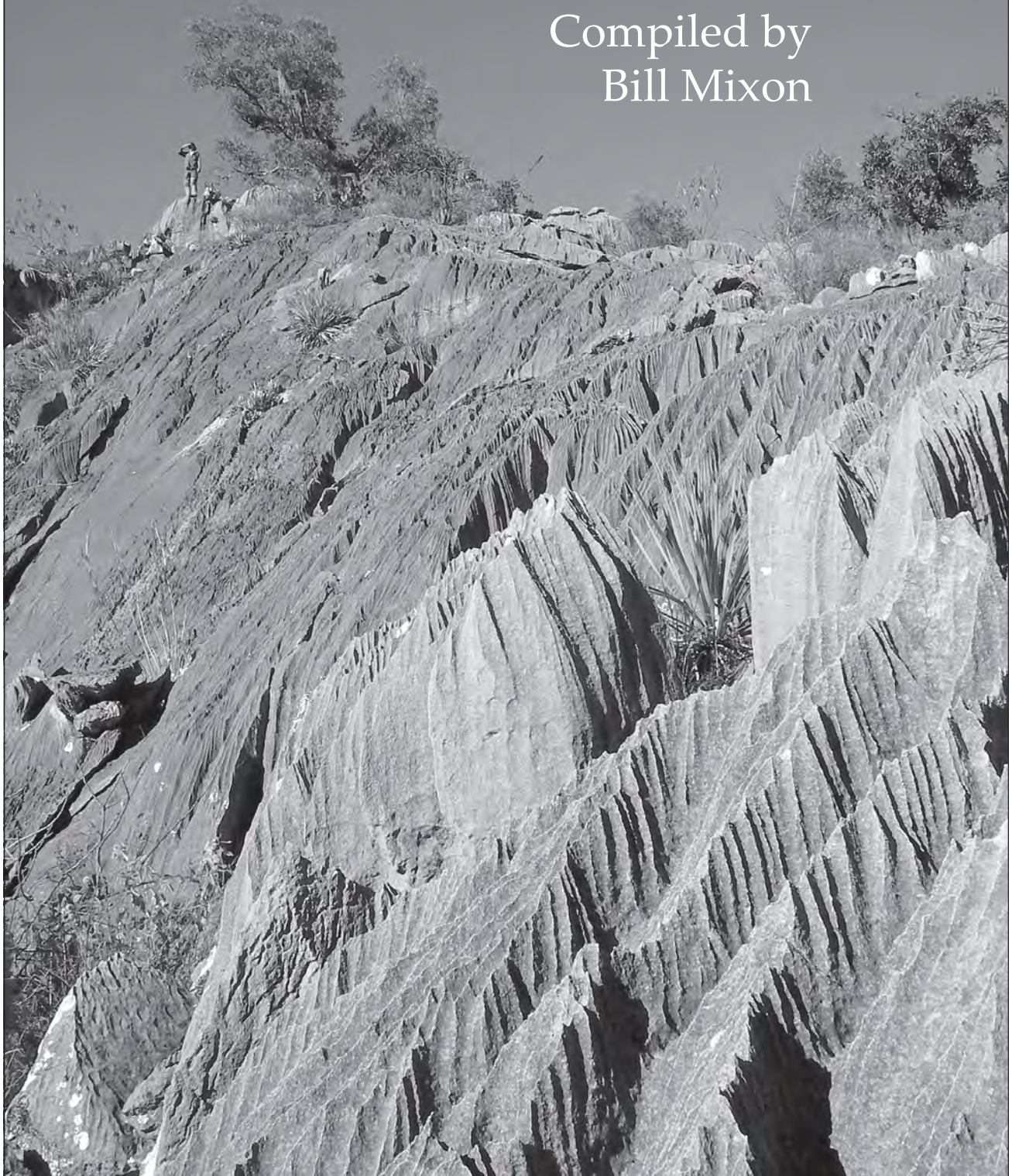


CONTENTS

- 4 Mexico News
- 21 deep pits list
- 22 long and deep caves lists
- 25 Summary of the 2005 J2 Expedition. *Bill Stone*
- 31 An Excursion to Sótano de la Culebra. *Terri Sprouse*
- 37 A Dream Fulfilled at Coyolatl. *Gustavo Vela Turcott*
- 42 Sótano de Los Hernández, Cave of Many Pitches. *Mark Crapelle*
- 45 Report on the Incident and Recovery Efforts at Resumidero Oztoquito, Puebla.
edited by Fanny Monreal
- 55 Booty and Solitude: Two Weeks in the Purificación Karst. *Mark Minton*
- 60 The Helicopter and the Bee: Cerro Rabón 2006. *Mike Frazier*
- 64 Evolutionary Biology and Cueva de Villa Lluz: Ichthyological Research in a
Sulfidic Cave In Tabasco. *Martin Plath, Michael Tobler, Rüdiger Riesch,
Francisco J. García de León, and Ingo Schlupp*
- 69 High Desert Caving. *Bev Shade and Peter Sprouse*
- 75 Gómez Farías Caving, November 2005. *Peter Sprouse*
- 82 First Through-Trip, Resumidero Izote–Pozas Azules. *Rodolfo Pertack E.*
- 85 Hydroleveling of Very Deep Caves, with an Example from Voronja (Kruber) Cave.
Alexander Degtjarev, Eugene Snetkov, and Alexey Gurjanov
- 93 The Juquila Canyon, Oaxaca. *Antonio De Vivo, Tullio Bernabei, and Leonardo
Piccini*
- 98 Some Pits in Northern Oaxaca. *Marion and Tony Akers*
- 104 Underground in Gómez Farías, Thanksgiving 2005. *Philip Rykwalder*
- 107 Jalisco Caving 2005. *John Pint*
- 111 Tabasco 2006. *Vickie Siegel and Chris Amidon*
- 115 A Nineteenth-Century Visit to Cacahuamilpa. *anon.* (historical reprint)
- 119 Los Amigos de la Gruta: Bustamante 2006. *Susan Souby*
- 123 The Return to J2. *Marcin Gala, Paweł Skoworodko, and Kasia Kędracka*
- 127 Proyecto Espeleológico Purificación: Car Capers in Chupaderos. *Bev Shade*
- 132 The Great Sierra de El Abra Caving Expedition. *Richard G. Albert* (history)
- 20 Obituary: Gregory Brown. *Jim Coke*

MEXICO NEWS

Compiled by
Bill Mixon



Mark Minton on a massive ridge of rillenkarren in the Purificación cave area. *Yvonne Droms.*

CHIAPAS

A joint Croatian-Italian-Mexican expedition took place from March 3–23, 2005, in an area near Tuxtla Gutiérrez. The team composed of eight Croats, one Italian, and local Mexican Paco Mendez, divided into groups with various objectives. A traverse of **Chorreadero**, a 4-kilometer trip with almost 400 meters of depth gain, was again completed, as well as a descent of the **Cañon del Río La Venta**, a tiring journey due to the lack of rain in the two previous years. A number of leads, probably new, were noticed along the walls of the canyon, but were not checked.

In an area adjoining the forest of El Ocote, three Croatian team members explored and mapped **Cueva Esperanza**, 1200 meters long and 119 meters deep. This cave could connect to nearby **Los Bordos** or **La Conciuda**, 5 kilometers of large stream passages that sump upstream. Exploration in Cueva Esperanza was halted by a large lake, but the cave continues and is the objective of a future expedition.

Cueva Dos Leones, discovered by Paco Méndez and Tullio Bernabei many years ago but never fully explored, was another objective of the 2005 expedition. During the 2000 and 2001 expeditions, about 1500 meters of passage had been mapped in galleries filled with large lakes, some over 200 meters long, that forced the cavers to swim or stay in water for extended periods of time. Beyond the 1500 meters previously surveyed, the first of two alternating teams of Croats found and mapped an additional 1000 meters of cave, turning around in going passage.

The second group, back from the descent of the canyon, enjoyed a last push into the cave. After 3 kilometers of lakes interspersed with more-or-less fossil passages, the stream disappears in a collapsed area, but the passage continues for another 2 kilometers of spectacularly decorated fossil galleries. The cave ends in a large room completely filled with mud. The water level was 2 meters lower in 2005 than in previous years, and so instead of swimming the lakes, it was necessary to wade through knee-deep water and thick mud, which made progress difficult.

A couple of side passages, a few

hundred meters long, were also surveyed and led toward the surface. Mapping them was difficult, because tree roots robbed the air of oxygen. A bypass was found around the collapsed area where the stream disappears. After a few hundred meters with more lakes, the passage turns into a canyon that narrows and becomes steeper. Finally a 7- or 8-meter drop was encountered, which halted exploration due to lack of rope. Since there was no airflow, it was speculated that a sump could be ahead.

The last two days of the expedition were spent surveying almost 2 kilometers of passage in **Cueva de Ocuilapa**. Its main branch is over 900 meters long, and three other branches contain interesting archaeological remains, including human bones and pottery.

The expedition was documented with footage that will be used to produce a video for Croatian Television. *Source:* Luca Tanfoglio in *Speleologia* 51, translated by Yvonne Droms.

COAHUILA

EspeleoCoahuila 2005, sponsored by the Asociación Coahuilense de Espeleología, AC (ACEAC) in collaboration with the Association for Mexican Cave Studies, was held at Los Oyameles in the foothills of the Sierra Potrero de Abrego on July 1–4, 2005. The main objectives of the project were to increase ties between caving groups, survey known caves in the area that lack maps, and locate and map new caves.

Attendees included cavers from Saltillo, Monterrey, Mexico City, and various parts of Texas.

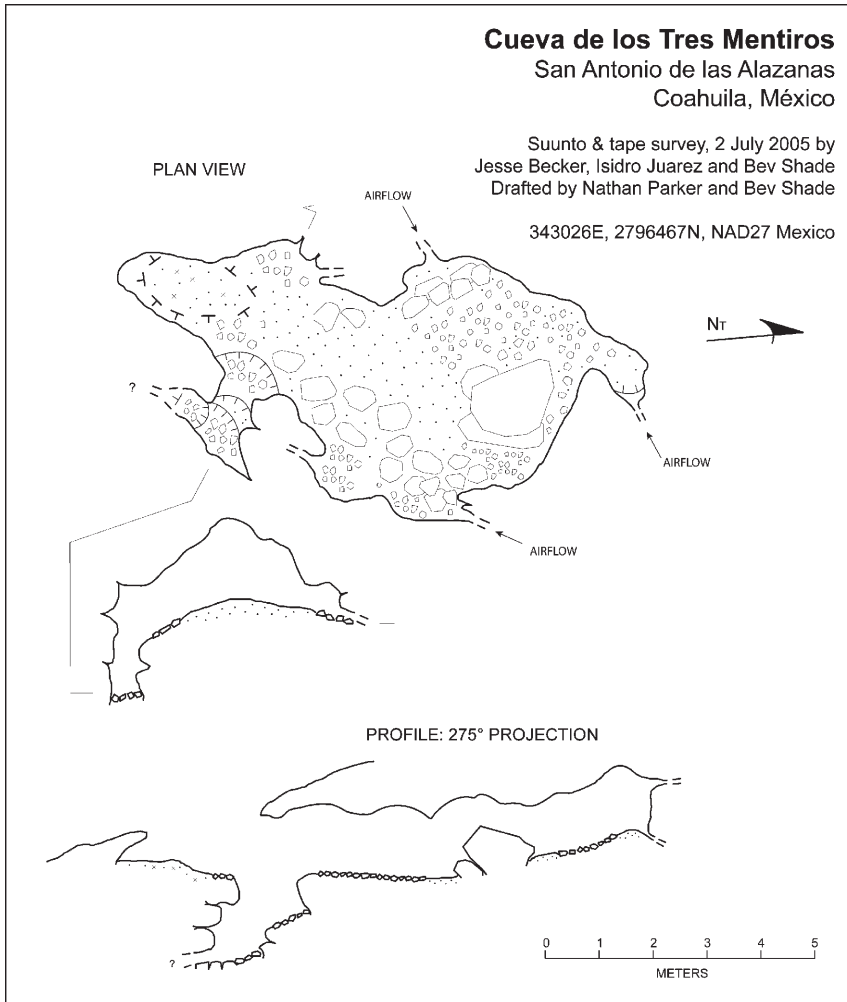
Activities included a reconnaissance project to **El Volcán**, the deepest cave in the state, at a depth of 372 meters. [See *AMCS Activities Newsletter 22*, page 148.] In recent years, parts of El Volcán had become plugged with debris from storms, and work focused on reopening the constriction by digging. Much progress was made, but the cave remains plugged.

Other groups focused on ridge walking in the high karst of the Mesa de Tablas, identifying and mapping numerous small caves with the assistance of helpful forestry guides from San Antonio de las Alazanas. Many of the small caves appeared to be modified by shoring or partially filled with rocks, indicating they had been mined. Side-trips included visits to the gypsum caves in the area of San Antonio de las Alazanas. Most of the gypsum caves found were small man-sized pits, but **Cueva los Hundidos** is horizontal, with street-sized walking passages.

The charming cabins at Los Oyameles, at an elevation of 7,500 feet, offered a comfortable respite from the searing July heat at lower elevations. Thanks to the laptop of Peter Sprouse and a projector, evenings were spent watching up-to-the-minute slide shows of the day's activities. A banquet was provided by ACEAC on the last night of the project. *Source:* Aimee Beveridge.

CUEVAS ENCONTRADAS EN ESPELEOCOAHUILA 2005

<i>Cueva</i>	<i>Lat. NAD27 CONUS</i>	<i>Long. NAD27 CONUS</i>	<i>Altitud</i>	<i>Localidad</i>	<i>Municipio</i>
Cueva del Cañon de los Lobos	25.23854	100.4119	2668	Mesa de las Tablas	Arteaga
Cueva del Perrito	25.27715	100.40465	2959	Sierra el Coahuilón	Arteaga
Cueva de la Chuparrosa	25.25686	100.37164	3170	Sierra el Coahuilón	Arteaga
Cueva el Mentiroso	25.2890761	100.4227748	2333	Los Llanitos	Arteaga
Sótano del Milpie Azul	25.283011	100.4159413	2708	Sierra el Coahuilón	Arteaga
Cueva de los Tres Mentiros	25.2778489	100.5589625		Sierra las Alazanas	Arteaga
Cueva de Kiko	25.2776878	100.5242558		Sierra las Alazanas	Arteaga
Pozo Puerto de Aire	25.2778219	100.5589522	2316	Sierra las Alazanas	Arteaga
Tiro Puerto de los Chivos	25.284341	100.4166023	2760	Sierra el Coahuilón	Arteaga
Cueva Día de Entrenamiento	25.2423447	100.4399999	2831	Hoya de los Gringos	Arteaga
Cueva del Corral	25.29151	100.42397	2544	Los Llanitos	Arteaga



was lost somewhere in the large passages between Camps 2 and 3. Considerable time was spent looking for a sump bypass, with no success. Finally James Brown dived the sump, which was about 150 meters long and only 7 meters deep. Beyond was a breakdown chamber with another sump, which was not dived due to lack of adequate backup personnel.

Elsewhere in the cave, some passages were resurveyed to improve the quality of the sketch and to correct for a miscalibrated compass. Several side passages were explored, some of which looped back to known cave. One of these was an independent shaft series 160 meters deep. Some windy infeeders were also explored, and they continue. Several new caves were found in the vicinity of J2, but none have proven to connect so far. They have the potential to add significant depth or to bypass some of the more unpleasant parts of the cave. Another cave, near the point above the current end of exploration in J2, was explored and would provide a handy back door and possible sump bypass if it connects. A return trip in 2007 will pursue these possibilities. At present, J2 stands at 1209 meters deep and 9536 meters long. *Source:* Mark Minton.

COLIMA

The map of **Pozo Hermoso** arrived too late to include in the article on Tecomán 2004–2005 in *AMCS Activities Newsletter* 28, pp. 177–180.

NUEVO LEÓN

American Caving Accidents 2002–2003, published as part 2 of the September 2005 *NSS News*, contains a somewhat longer report on the bee-sting accident in **Pozo de Gavilán** than the one in *AMCS Activities Newsletter* 28, “Mexico News,” p. 7 (where the Nuevo León heading was inadvertently omitted). The *NSS* report is based on information from www.thedecostop.com dated June 4, 2004.

In August 2005, a new sinkhole opened up near Iturbide, Nuevo León. It is said to be about 60 meters deep, with sheer sides. There is a lot of gypsum karst in the area, including the famous

Pozo de Gavilán. *Source:* news reports passed on by Nicasio Escamilla.

OAXACA

The 2006 **J2** expedition took place during six weeks from April 3 to May 12. Nearly forty cavers from nine countries participated, with about twenty-five people present any given week. One of the first priorities was installing more than 6 kilometers of telephone wire from surface base camp all the way to the bottom of the cave, where a new deep camp, Camp 3, was established. The telephone was a boon to logistics, because it allowed those on the surface to learn what was happening in the cave and what supplies were needed in almost real time. Continuing exploration beyond the 2005 limit soon revealed a massive breakdown choke that was ultimately passed. Beyond, large passage continued until a deep sump was reached at –1198 meters. The tremendous airflow present higher in the cave

On February 20, 2003, Mike Frazier was on rappel in a 60-meter pit in **Sistema de los Tres Amigos** when he stopped to set a bolt for a rebelay. In the process, he inadvertently dropped down the pit the pack containing the foot and safety ascenders of his Frog system. He decided to finish setting the rebelay and continue to the bottom, hoping that the rope would reach. Unfortunately, it did not, and he was left hanging well above the floor.

Frazier tied off his rappel rack, pulled up the end of the rope, and used the tail to tie a makeshift foot sling above the rack. Several half-hitches served as a climbing knot, a butterfly knot in the middle provided a clip-in point for his cow's tail, and a double figure-eight formed a pair of foot loops. He clipped his chest ascender into the rope, removed his rappel rack, and climbed out of the pit. Frazier and companions then rerigged the pit with additional rope and descended without further incident. *Source:* *American Caving Accidents 2002–2003*, based on

Mike Frazier in *Rocky Mountain Caving*, spring 2003. There is a map of Tres Amigos on p. 34 of *AMCS Activities Newsletter 27* and an update in this issue.

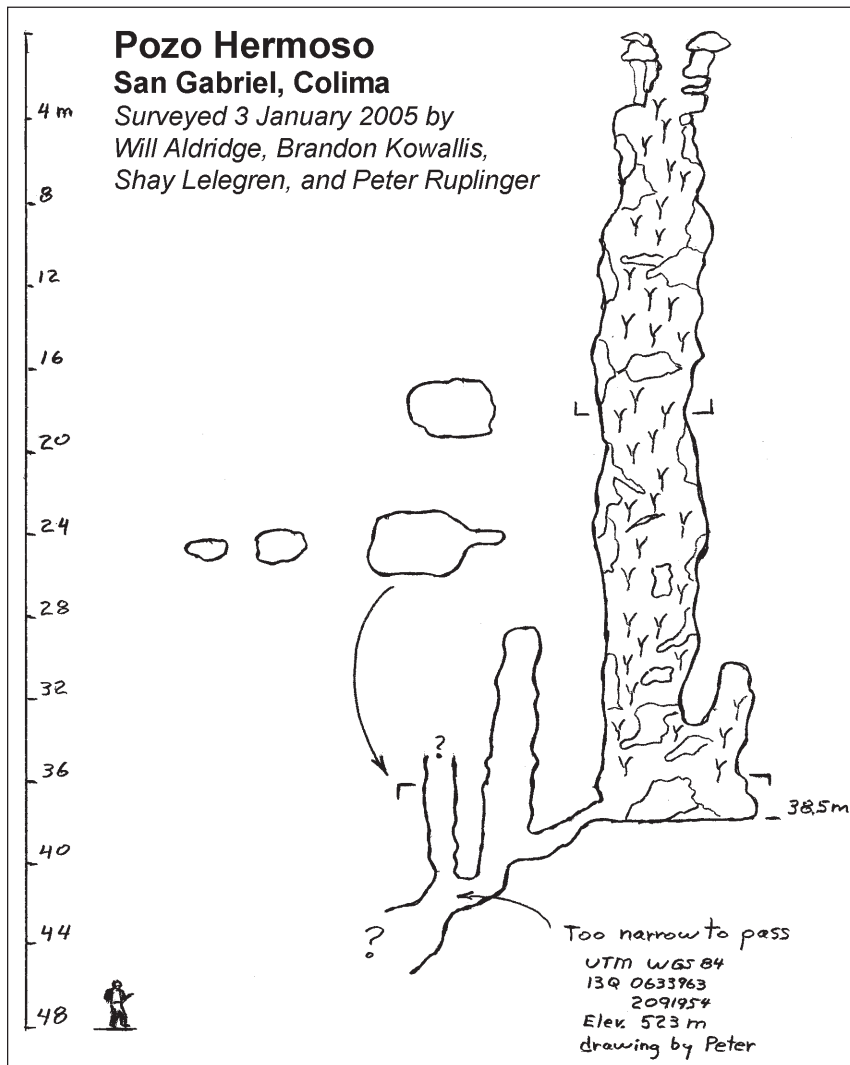
Polish participants in Proyecto Cheve expeditions through 2006:
 From Speleoklub Warszawski:
 Małgorzata Barcz—2004
 Katarzyna Biernacka—2001, 2003, 2004, 2005
 Tomasz Fiedorowicz—2003, 2004, 2005
 Marcin Gala—2001, 2003, 2004, 2005
 Katarzyna Kędraca—2005, 2006
 Katarzyna Okuszek—2003, 2004, 2006
 Lena Ostrowska—2005
 Paweł Skoworodko—2003, 2004, 2005, 2006
 From Speleoklub Gawra Gorzów:
 Artur Nowak—2004, 2005, 2006
 Source: Katarzyna Biernacka and Marcin Gala in *Polish Caving 2001–2005*, Yvonne Droms.

During February 2003, Aaron Zumpf entered **Cueva Cheve** with three companions on a trip to rig drops en route to Camp Two. While descending the Elephant Shaft, Zumpf hyperextended his knee while crossing a rebelay. He made it to the bottom and told his companions what had happened. His knee was painful, but was not swollen and did not seem to be fractured. Zumpf felt that he could leave the cave after some rest. Another team of cavers, who were making a day trip, was following, so he told his companions to continue on without him and settled down to wait, planning to make his way out with the second team.

By the time the second team arrived, however, Zumpf's knee had become very painful, and he realized that he would need more than a little help to leave the cave. One member of the team stayed with him, while two others left the cave to get help and equipment.



The entrance to Cueva La Esperanza, discovered by the GSAB 2005 expedition.
Gustavo Vela.



Expedition members entered the cave with ropes, pulleys, and additional equipment to rig hauling systems. They rigged a counterbalance haul to get Zumpf up the Elephant Shaft and started helping him toward the entrance. A litter was brought into the cave to make it easier to move Zumpf through the horizontal sections of the cave. After several hours of work and a few hauls up the entrance pit-series, Zumpf reached the surface at about 4:00 a.m.
 Source: *American Caving Accidents 2002–2003*, based on Mike Frazier in *Rocky Mountain Caving*, spring 2003. Articles on the 2003 Cueva Cheve expedition appear in *AMCS Activities Newsletters 27* and *28*.

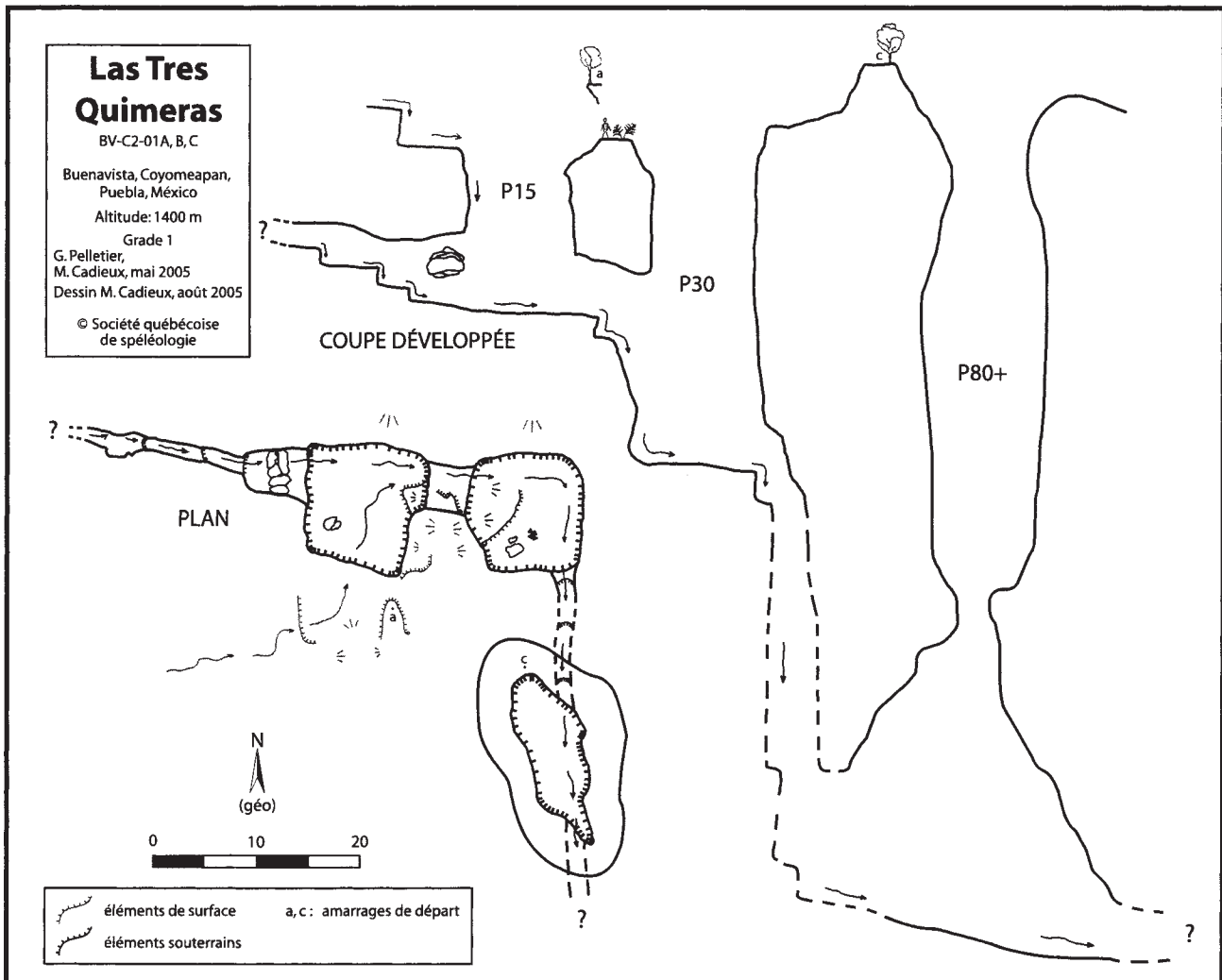
PUEBLA

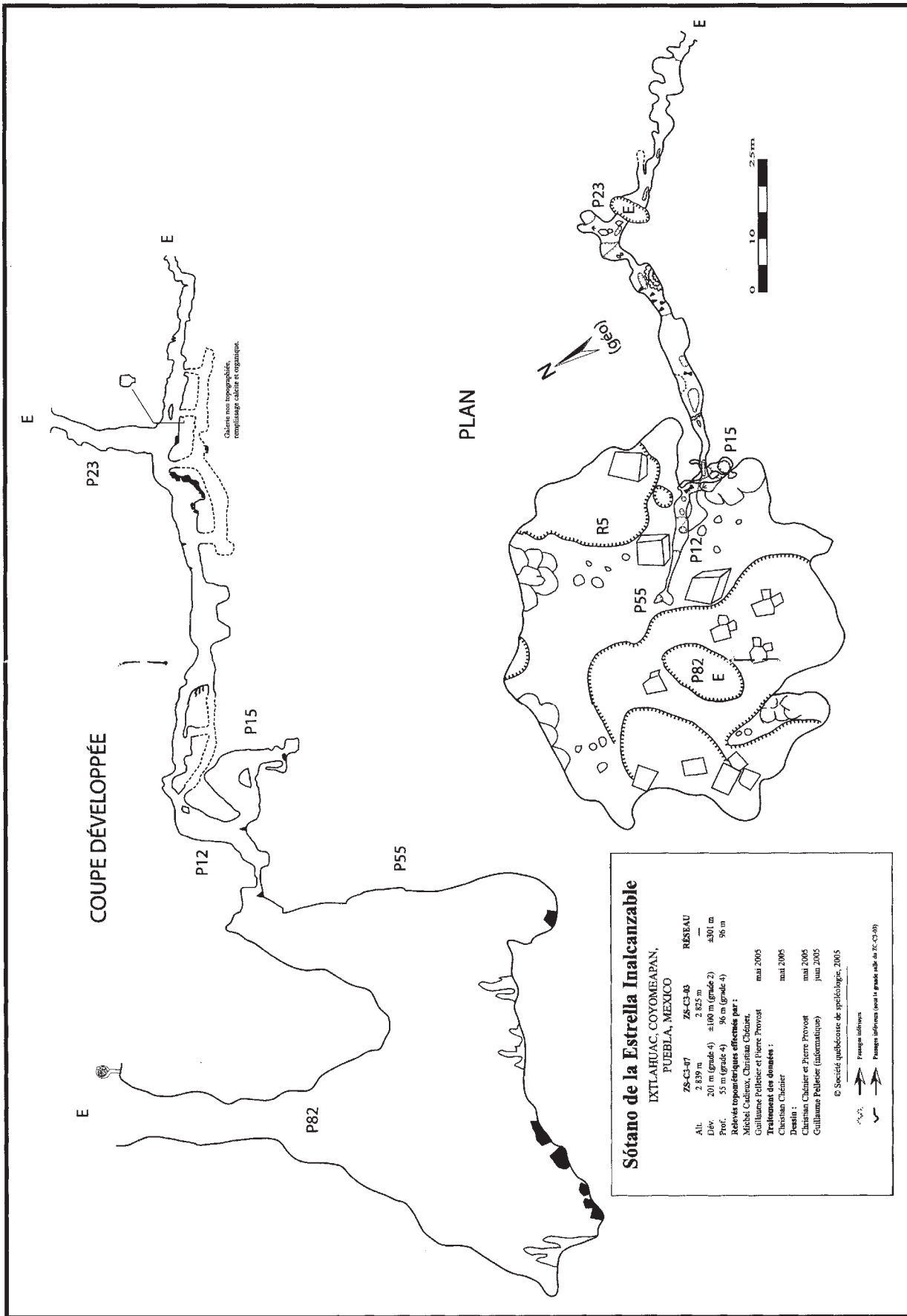
Marking the twenty-fifth anniversary of Belgian cave exploration in Mexico, the Groupe Spéléo Alpin Belge returned to its exploration zone in Zoquitlán, Puebla, from February 18 to mid-March 2005. Its main objective, as for the past five years, was to search for caves on the plateau that might connect with previously discovered resurgences that drain the Tzontzeuciculi Massif of the Sierra Madre Oriental.

The 2005 team, consisting of thirteen Belgian members with a brief appearance by two Mexican cavers, continued



Participants in the GSAB 2005 expedition. Left to right, top to bottom: Nathalie Strappazon, Gaëtant Rochez, Laurent Haesen, Stéphane Pire, François Sausus, Fernand De Cock. Richard Grebeude, David Gueulette, Didier Havelange, Georges Feller, Serge Delaby, Marc Herman, André-Marie Dawagne. Not in the picture: Gustavo Vela Turcott and Joël Tomé. *David Gueulette.*





exploration in **Cueva de Tepepan Zaragoza** (TZ48), discovered in 2002. The bottom of TZ48, at -480 meters, is known to be only 100 meters from upstream **Coyolatl**, a 20-kilometer resurgence cave explored by GSAB in 1985, but attempts to breach the windy breakdown pile were unsuccessful. However, in upstream TZ48 a new tributary stream was found at the -430-meter level and explored for 1.5 kilometers both up- and downstream. Constrictions stopped the team, but the existing leads could be the key to connecting Coyolatl with **Aztotempa** (-700 meters and 4 kilometers) as well as with the H31-35 system (-753 meters and 5.75 kilometers). An interesting downstream lead with good airflow also awaits a return. TZ48 is now 5.5 kilometers long.

Some old projects were continued: In **Cueva de los Sueños Perdidos** (TZ40), upstream exploration added another 150 meters of tight passage, ending at the bottom of a dome with no visible ceiling, and in **La Cueva** (TZ44), an additional 700 meters of passage was surveyed, ending in terminal breakdown at -274 meters.

A new cave, **Cueva de la Promesa** (TZ62), was found and explored for 500 meters to a depth of 212 meters on the last day of the expedition. A strong wind makes this a prime objective for the next trip. TZ62, according to the survey, passes under nearby TZ40 and beelines for the terminal breakdown area at the bottom of TZ48, which it could bypass.

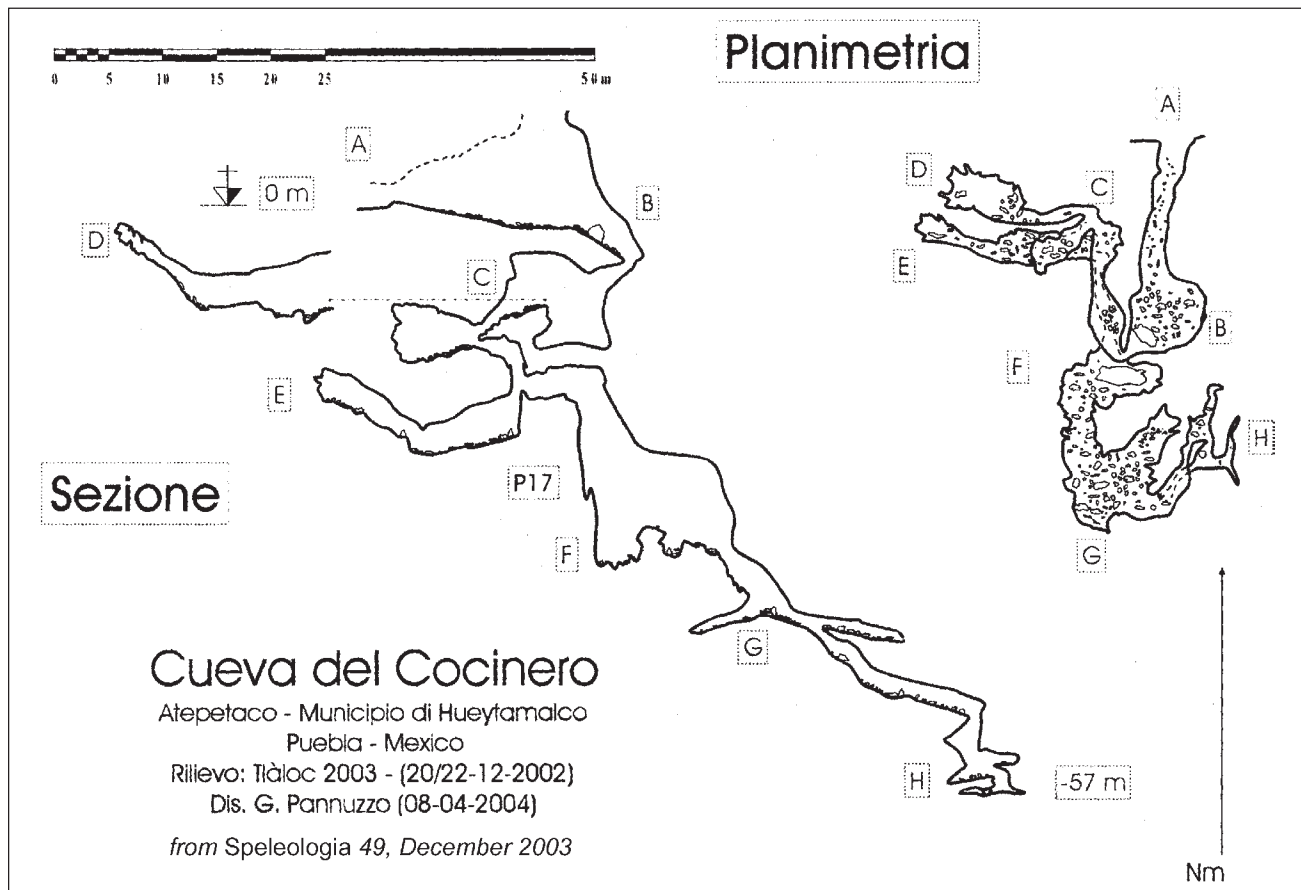
Another large piece in the puzzle is **Cueva Esperanza** (TZ57), found in 2003. The second part of the 2005 expedition was dedicated to its exploration. Various large drops were found: El Tiburón, a 60-meter pit that drops into the ceiling of a vast chamber 170 by 100 meters; Le puits des Météorites (Meteorite Pit), a 110-meter drop that, although rebelayed into three main pitches, is descended one person at a time due to dangerous rockfall; and a long series of downclimbs in short waterfalls that make for a taxing ascent on the way out.

Two main leads remain in TZ57. A big passage that was followed for 400 meters led to a vast room traversed by a stream and containing large leads, with strong wind. This could already be

Coyolatl, in one of its unexplored high fossil sections, of which at least seven levels are known to exist. The second lead is off a loop near the bottom of the cave, through a hole in the floor that led to a 20-meter drop with very strong wind. Using their last rope, the team descended that drop, only to find another one of unknown depth, with the sound of a river below. This was later determined to be located directly above an upstream passage in Coyolatl explored 20 years before. Therefore the junction between Cueva Esperanza and Coyolatl is imminent.

TZ57 is now 2.5 kilometers long and 454 meters deep. Once it is connected with Coyolatl, the system will be 23 kilometers long and 580 meters deep. *Source:* Yvonne Droms, summarizing an article in French by Richard Grebeude, *Regards* 60, May-June 2005. See also the article on Coyolatl connection in this issue.

A group of four from the Société Québécoise de Spéléologie participated in a reconnaissance Mexpé 2005 in April and May to areas southwest and south of **Sistema Tepepa** [see AMCS



Activities Newsletter 27, pp. 38–43]. About ten days were spent ridge walking on a plateau at 2800 meters just south of the summit of 3200-meter Cerro Zizintepetl, where numerous pits were encountered, most ranging from 10 to 30 meters deep. One 80-meter pit was discovered. The desert-like environment of this area, which contrasts with the jungle just a few hundred meters lower, made the going difficult. All water had to be brought in by mules. Lots of sharp and loose, very karstified limestone made all travel treacherous, while numerous cacti, scorpions, and rattlesnakes added to the fun. There is still hope that a going cave will be found one day in that area, but it's not going to come easily.

Then a week was spent around the village of Buena Vista, where one can look across the valley to the mountains of Sistema Huautla in Oaxaca. Interesting leads were found there. They will be explored in April 2006, when we return to the area. Numerous sinkholes containing entrances were noted, and they are just waiting to be explored.

Water in Sistema Tepepa flows northwest. Exploring caves south of the known system will enable us to determine where the underground watershed line is located. *Source*: Chris Chénier. The maps of Tres Quimeras and Estrella Inalcanzable are from *Sous Terre*, volume 19, number 1, summer 2005, where additional material about Mexpé 2005 can be found.

The Mexpé 2006 Expedition by the Société Québécoise de Spéléologie to the Sierra Negra in Puebla from April 8 to May 6 returned great results. More than fifty entrances, many of them still unexplored, were found. More than 8 kilometers of new passage was surveyed. Some connections between known caves were discovered. New entrances to **Sistema Tepepa** (899 meters deep, with a 782-meter-deep though trip) were found, adding more than 1 kilometer to the system, which is now 27.7 kilometers long. A new entrance, **TP-06-17**, made possible a connection between **Las Brumas** and **Gimnástica Selvática**, resulting in a system 7.8 kilometers long and 473 meters deep. In **La Ciudad**, now 6.4 kilometers long, four new entrances were explored. One of them, located 1 kilometer to the south, shed new light

on the hydrology of the system. [See *AMCS Activities Newsletter* 27, pages 38–43, for an article about most of these caves.]

Auriga cave-surveying software for Palm OS was used by members of the expedition to record survey data underground and to help draw up the surveys in base camp. The software was also useful in the caves for directing us to connections to nearby caves. See <http://www.speleo.qc.ca/auriga>. *Source*: Note on Iztaxochitla e-mail list by Chris Chénier, translated from Spanish by Yvonne Droms.

QUINTANA ROO

In December 2004, Alex Alvarez, Per Thomson, Fred Devos, Chris le Maillot, Simon Richards, and Daniel Riordan joined in the exploration of a new cenote recently discovered on the coast near Tulum. **Cenote Maya** is not the most attractive opening, since it has red, tannin-stained water and an entry hole no bigger than a bathtub, but it is directly behind an ancient Maya ruin overlooking the Caribbean Sea.

Initial dives showed that the visibility cleared 4 meters down, and a passage headed away from the coast. During the following week, 2459 meters of new passage was charted, and a video of the main passage was made. Unlike in most coastal caves, the freshwater layer goes down to 12 meters depth and shows little flow. The unusually deep passage and only one entrance also give the impression that one is in a more inland system. Many troglobites inhabit the cave, including blind cave fish (*Ogilbia pearsei*) and an abundance of small shrimp (*Agostocaris bozanic*). A mass of gelatinous, rust-colored sediment is most likely some sort of biological colony. *Source*: Fred Devos, <http://www.aquaexploration.com/English/News/exnews0505.htm>.

Several expeditions of the Czech and Slovak Speleological Society to the Mexican peninsula of Yucatan took place in the past two years in cooperation with UNAM, the Mexican national university, and the QRSS, the Quintana Roo Speleological Survey. The expeditions worked in the vicinity of the towns of Tulum and Chemuil. The first expedition brought the discovery of new passages in **Cenote Cangrejo**, where a total of 1328 meters has been

discovered and surveyed so far. The most important discovery was in **Cenote Joolis**. The entrance was found in 2002, and 167 meters of passage explored. During our first dive there, in 2003, a 180-meter extension was discovered and surveyed. The following dives brought the discovery of a huge tunnel, *Esperanza*, several hundred meters long. Within the first week, more than 1000 meters of new corridors were discovered, while the second week brought the discovery of a new cenote, called **Tatich**. In all, 2405 meters of new passages were discovered and documented, and they were joined to another three nearby cenotes, **Polo**, **Hoyt**, and **Chu-much-cho**. So a system 3587 meters long was created.

Later, two new cenotes were found 600 meters from the known parts of Joolis and 200 meters from the end of another cave called **Ich-Kin**. In the first of them, called **Nai-Bosch** due to the black walls, a huge tunnel 200 meters long was found. It leads directly to Ich-Kin. The second cenote brought a big surprise. Near the wall of the wide corridor, an old Mayan ceramic pot was found. Then the cavers discovered a dry cavern that contained a small island in the middle of a lake. The ruins of a stone wall were nearby and connected to the entrance. All these discoveries were documented.

Also, another cenote called **Zebra** was found. A huge tunnel 30 meters wide and 200 meters long was found during the first exploration. This tunnel leads to another big cenote. In all, 1819 meters was explored and documented.

Near Tulum, new **Cenote Dos Locos** was found and explored, and 493 meters of passage was surveyed there.

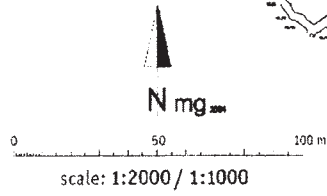
In all, Czech and Slovak cavers have discovered and surveyed 6860 meters of new cave in the Riviera Maya so far. An important part of the expeditions was also soil sampling and collecting troglobites for the research at UNAM.

Expedition participants: Motyčka Zdeněk, Husák Radoslav, Hutňan Daniel, Sirotek Jan, Magela Michal, Jančar Radek, Dvořáček Miroslav, and Mariano Fuentes Silva. Special thanks to all landowners from Unión Pequeños Proprietarios Rurales—Crescendo Maas Chan A.C. for their understanding and willingness to allow us to explore new caves on their property, and to all our

Sistema Joolis

Tulum, Quintana Roo, Mexico

Length: 3580 m (11 746 ft)



Explored: 2002-2004, M. Dvoracek, R. Husak,
D. Hutnan, M. Megela, Z. Motycka, R. Jancar,
B. Phillips, R. Schmittner, M. F. Silva

Surveyed: 2002-2004, M. Dvoracek, R. Husak,
D. Hutnan, M. Megela, Z. Motycka, R. Jancar,
B. Phillips, R. Schmittner, M. F. Silva

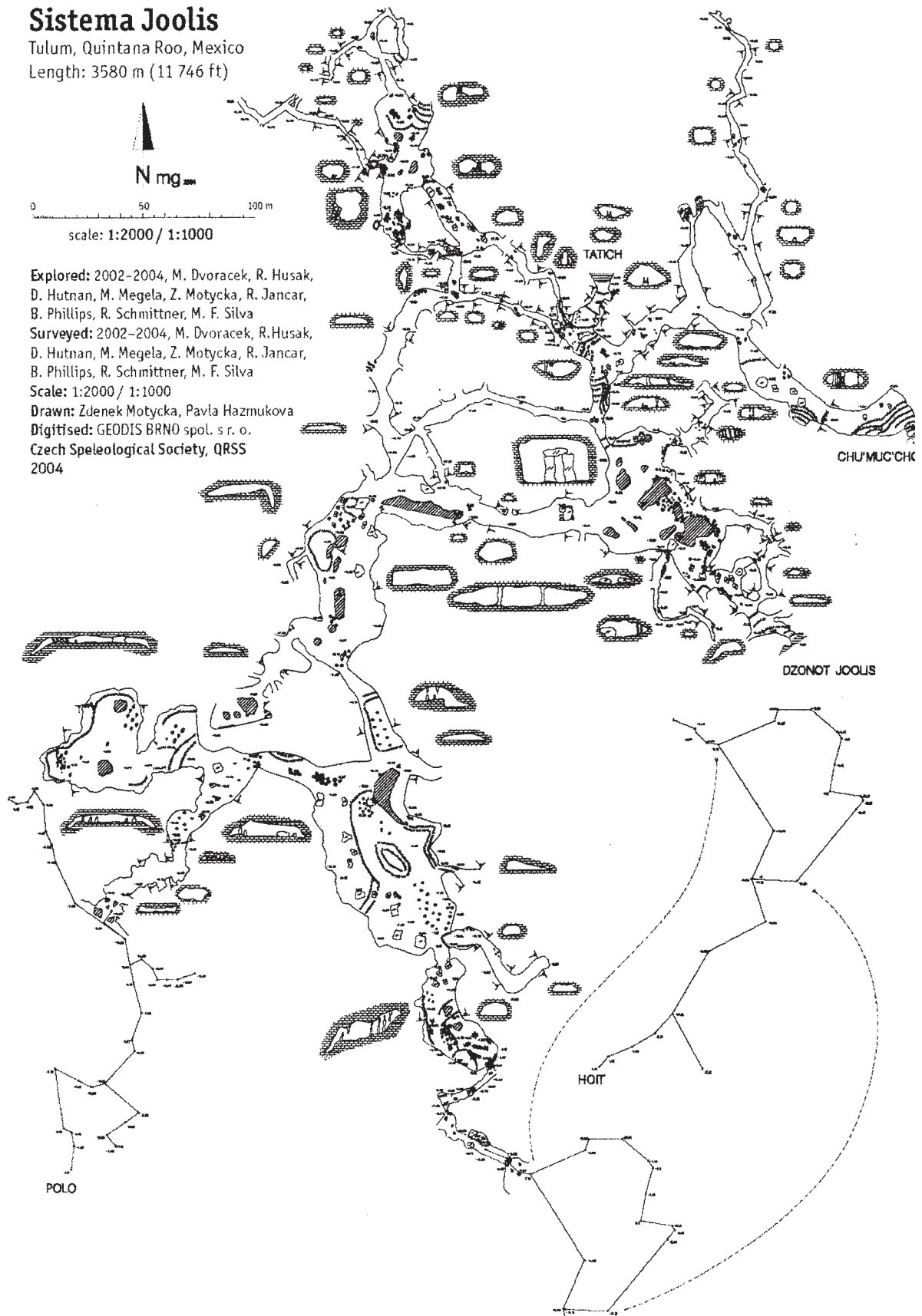
Scale: 1:2000 / 1:1000

Drawn: Zdenek Motycka, Pavla Hazmukova

Digitised: GEODIS BRNO spol. s r. o.

Czech Speleological Society, QRSS

2004



friends Bil Phillips, Robbie Schmittner, Nadia Berni, Dave Sieff, Roman Šebela, and Libor Matuška for their help. *Source*: “Exploration of Underwater Caves in the Riviera Maya, Mexico 2003–2005,” by Motyčka Zdeněk, in a special bulletin of the Slovak Speleological Society for the Fourteenth International Congress of Speleology, 2005. (That article begins with the same material that is the author’s abstract for the congress that is reprinted later in “Mexico News.”)

The Cave Diving Section of the National Speleological Society held a one-day workshop at Centro Ecológico Akumal on September 17, 2005. Guillermo Ande opened the meeting with an update on underwater archaeology in the Yucatan Peninsula. Diego



Romo Corzo, Juan Carlos Carillo, Germán Yáñez, and Alejandro Álvarez Enríquez reported their exploration of the newest underwater cave on Cozumel, **Cocodrilo**, and its 1.4 kilometers of surveyed passage. Jim Coke spoke about the future of the longest underwater caves in the world, which are located adjacent to the city of Tulum, forecast to grow to a population of five hundred thousand by 2035.

A post-workshop excursion led by Jim Coke visited **Sistema Yax Muul**, a dry cave that is well decorated. It contains two sumps, one of which leads to **Nohoch Nah Chich**. The other has never been dived. Other trips after the event visited **Aerolita**, **Quebrada**, and **Cocodrilo**. *Source*: *Underwater Speleology*, November–December 2005.

In June 2005, Polish cave divers completed a 14-kilometer cave dive using

multiple Silent Submersion scooters in the **Sistema Dos Ojos**. ProTec diving company had given the Polish team scooter training the previous February and hosted them during their record dive. While they were never anywhere near that far from an entrance, the dive was conducted entirely in the cave, without surfacing until it was finished. *Source*: *ProTec Newsletter*, August 2005.

The IANTD (International Association of Nitrox and Technical Divers) held a weekend of presentations, training, and guided dives the weekend of November 4–6, 2005, at ProTec in Playa del Carmen. *Source*: *Protec Newsletter*, October 2005.

After recovering fairly quickly from Hurricane Emily, the Caribbean coast was hit again, by Hurricane Wilma in October, 2005. Much of the information on its effect on cave diving came from commercial outfits anxious to reassure potential tourist customers, but it appears that, except perhaps on worst-hit Cozumel, things got back to normal fairly quickly at the major attractions to visiting cave divers.

Part of **Sistema Actun Koh** collapsed at **Cenote Bears Den**. It was initially believed that the extensive upstream circuit could no longer be dived, but Steve Bogaerts discovered a route that bypasses the collapse.

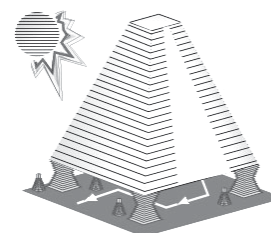
After general cleanup in Cozumel was more or less complete and things were getting back to normal, Germán Yáñez and others decided to check the cenotes. The access roads and paths had been closed by fallen vegetation and trees. Four days of intense activity cleared the entrances to the cenotes. Initially, low visibility and strong flow were present in all the cenotes, but conditions gradually returned to normal, and all cenotes are in perfect diving condition, except **Quebrada**’s exit to the ocean, which partially collapsed. All lines are back in place and ready to be used.

However, original exploration in the major systems is still hampered by the effects of Wilma. Back-country trails and *mensuras* (boundary trails) are blocked by fallen trees and new growth. Trails will need to be cleared before new exploration in outlying caves can resume. *Sources*: *ProTec Newsletter*,

March 2006, *Underwater Speleology*, March/April 2006, Jim Coke.

The Cambrian Foundation in Orlando, Florida, conducted another project at **Sistema Camilo** during March 2005. As before, a number of high-school students were included as an educational component of the project. About 1000 meters of new passage in Camilo was explored and surveyed using the knotted-line technique. Lines in the cave have been improved, with new arrows pointing to the new nearest entrances and a number of tees replaced by jumps so that the main route is easier to follow. Water samples were collected from Camilo and nine surrounding caves to investigate flow patterns and indicate likely connections. *Source*: *Underwater Speleology*, September–October 2005.

In May 2005, **Sistema Muul-Ha** was connected to **Sistema Sac Actun**, increasing the length of Sac Actun to over 77 kilometers. Also, in summer 2005 **Sistema Yaxchen West** was connected to **Sistema Ox Bel Ha**, making Ox Bel Ha over 142 kilometers long. More recent lengths of these systems are given below. *Source*: <http://www.caves.org/project/qrrs/new/htm>.



QUINTANA ROO
SPELEOLOGICAL SURVEY

As of May 2006, the longest underwater caves in Quintana Roo were

Sistema Ox Bel Ha	144,749 m
Sistema Sac Actun	79,617
Nohoch Nah Chich	67,184
Sistema Dos Ojos	56,803
Sistema Naranjal	21,525
Sistema Ponderosa	15,019
Sistema Yaxchen East	13,090

There are sixty-nine underwater caves in Quintana Roo with lengths of more than 1 kilometer. The longest dry caves are

Sistema Alux Sur	1663 m
Sistema Yax Muul	1555
Sistema Alux Oeste	1033

Yax Muul is connected to Nohoch Nah Chich, giving the entire cave, wet and dry, a length of 67,141 meters.

While the Quintana Roo Speleological Survey does not have the data, these additional long underwater caves are said to be present in the area: Sistema Aerolita 18,000 meters, Cueva Pitch 12,000 meters, and Sistema Taj Mahal-Minotauro 10,600 meters. *Sources:* <http://www.caves.org/project/qrss/qrlong.htm> and [qrdry.htm](http://www.caves.org/project/qrss/qrdry.htm), Mark Minton.

After sixteen months of interdisciplinary research, the park at **X'el Ha** (or Xel Há) on the Quintana Roo coast north of Tulum has established a strategic alliance with leading Mexican scientists and academic institutions to preserve its underground waters. Scientists and cave divers teamed up, monitoring water flow and quality and mapping underground rivers to establish the sources of the water that reaches the park, a 100-hectare collection of lagoons, cenotes, and caverns. *Source:* news report printed in *NSS News*, June 2006, page 25.

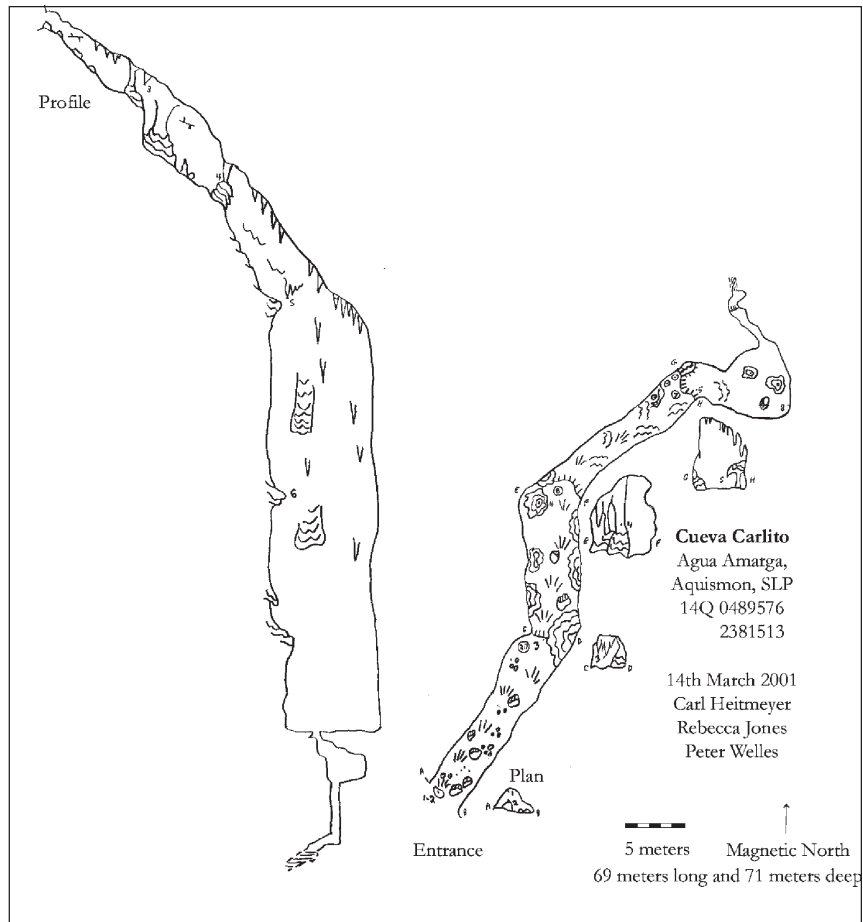
A Reuters dispatch about the underwater caves on the Caribbean coast of Quintana Roo appears on MSNBC at www.msnbc.msn.com/id/11943582. Biologist Tom Iliffe and cave-diver Sam Meacham were interviewed for the article, which emphasizes the threats to the caves from development.

SAN LUIS POTOSÍ

Cueva Carlito is near Agua Amarga in Aquismon, San Luis Potosí. The cave is in a small wall on the edge of a small, shallow sink in the bottom of a *dolina*. It was initially explored by Carl Heitmeyer and Yvonne Droms in February 2000. In March 2001 it was surveyed by Heitmeyer, Rebecca Jones, and Peter Wells. The cave is dry but well decorated, with several large columns convenient for rigging. The bottom of the main drop is fairly flat, with a small tube

Yvonne Droms and Carl Heitmeyer at the bottom of the main drop in Cueva Carlito.

Yvonne Droms.



leading off to the last drop, which is very small. At its bottom, the cave sumps where the ceiling comes down to a small pool of stagnant water. The horizontal extent of the cave is 69 meters, and it is 71 meters deep. *Source:* Carl Heitmeyer.

On August 18, 2005, the cave rescue section of the San Luis Potosí Red Cross was informed of an accident in a pit in the Valle de los Fantasma area. Paramedics and gear were dispatched, and upon arrival recognized the pit as **Sótano de la Cochera**, a well-known pit that has even been used for rescue practice. The total depth is 36 meters, with a 35-meter drop. A local was looking for a missing horse when he noticed a body in the pit.

Two lines were rigged, and two rescuers descended, while one remained on the surface in charge of the recovery operations. Initial assessment showed that the victim, 45 years old, had been dead for approximately

twenty-four hours and showed diverse injuries. No caving or climbing gear was found, and the victim was not wearing adequate clothes for such activities.

The total time for the call, from receiving notice to returning to base, was six hours, with actual maneuvers in the recovery accounting for three of these. *Source:* Antonio Aguirre Álvarez, translated by Fofo González; see also <http://ermexico.tripod.com/cochera.htm>.

TABASCO

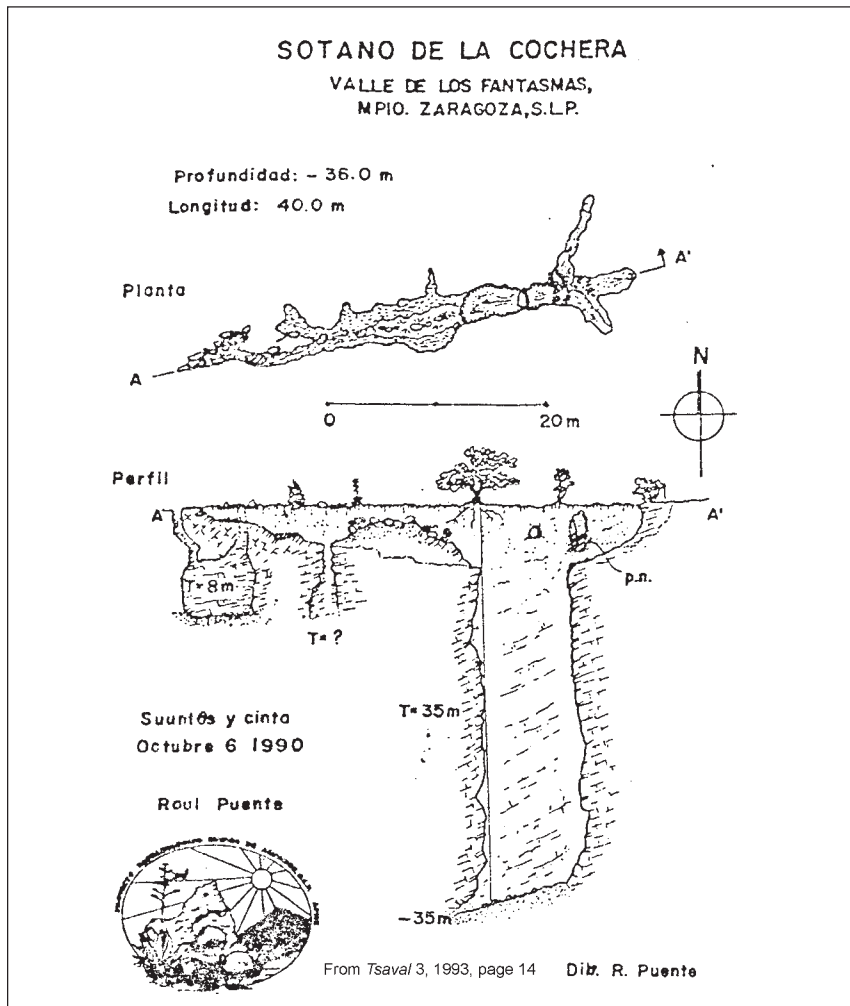
The New Mexico Tech Cave and Karst Studies Program team undertook a major research effort from the end of May through all of June 2005 in Tabasco, Mexico, at the sulfuric acid cave **Cueva de Villa Luz** and associated other sulfur features. PhD students Laura Rosales-Lagarde, a native of Mexico, and Kevin Stafford spent all month investigating sulfur springs, streams, and caves in the states of Tabasco and Chiapas. We are studying the source and ultimate fate of the sulfur

compounds that define these features and make the speleogenesis of Cueva de Villa Luz so unique. Early on in their stay, Louise Hose visited the site to help familiarize the students with local conditions, contacts, and other logistics assistance. The team of three also visited the volcano El Chichonal in the state of Chiapas under very hot conditions. Preliminary data have shown that about 20 percent of the gas coming into Villa Luz appears to be from magmatic sources like a volcanic system.

Kathy Lavoie of SUNY-Plattsburgh, accompanied by her son Jim Lavoie, came down in mid-month to quantify midge larvae in the stream-bottom sediments of Cueva de Villa Luz. Jim Lavoie, a former communications major, made recordings of the buzzing midge sounds from within Yellow Roses Room. He will analyze the sound spectra obtained to assess effects of auditory and other disturbances to the midges. Penny Boston of New Mexico Tech and Mike Spilde of the Institute of Meteoritics at the University of New Mexico sampled organisms, material for later SEM/microprobe studies, and DNA collected from various biomats and other biogenic deposits in Cueva de Villa Luz and **Cueva de Luna Azufre**, a sulfur cave that a team led by Jim Pisarowicz discovered last January. Laura and Kevin have been collecting water samples for chemical analyses, making measurements of physical parameters at the sites, and taking samples for stable-isotopic analyses. Swiss journalist Thomas Hausler accompanied Lavoie, Boston, and Spilde for part of their stay. He is writing an article about aspects of the cave for a European news publication, *Facts*.

Villa Luz was extremely dry, but the weather pattern shifted to the summer rainy season, enabling direct and immediate observation of the rehydration of deposits and any hydrological effects.

Boston, Spilde, Rosales-Lagarde, Stafford, and Hausler made a second trip to El Chichonal volcano after the rainy season commenced. The volcano contains numerous sulfurous fumaroles, mud pots, and boiling pools, an acidic (pH 2.0) crater lake, and brilliantly colored thermophilic organisms growing in these features. Boston and Spilde sampled the organisms, and all team



members took other measurements and samples. These will be compared to similar samples obtained from the caves to determine how much chemical, hydrological, and biological association there is between the sulfur caves and surface sulfur features. *Source:* National Cave and Karst Institute Monthly Report, June 2005.

TAMAULIPAS

In May 2005, prototype hardware for the DEPTHX project, which plans to send an autonomous robotic diving vehicle to the bottom of **Zacatón** sinkhole in 2007, was lowered by winch to a water depth of 200 meters in order to gather sample sonar data for the software developers. A detailed profile of the water-filled part of the pit was obtained to a depth of 200 meters. By then lowering the device on its side, so that some of the side-looking sonar sensors were pointed downward, limited additional data to a greater depth were gotten. The profile printed here is a result of combining all of the data. Note that the depth scale begins at the water surface, not at the land surface around the sinkhole.

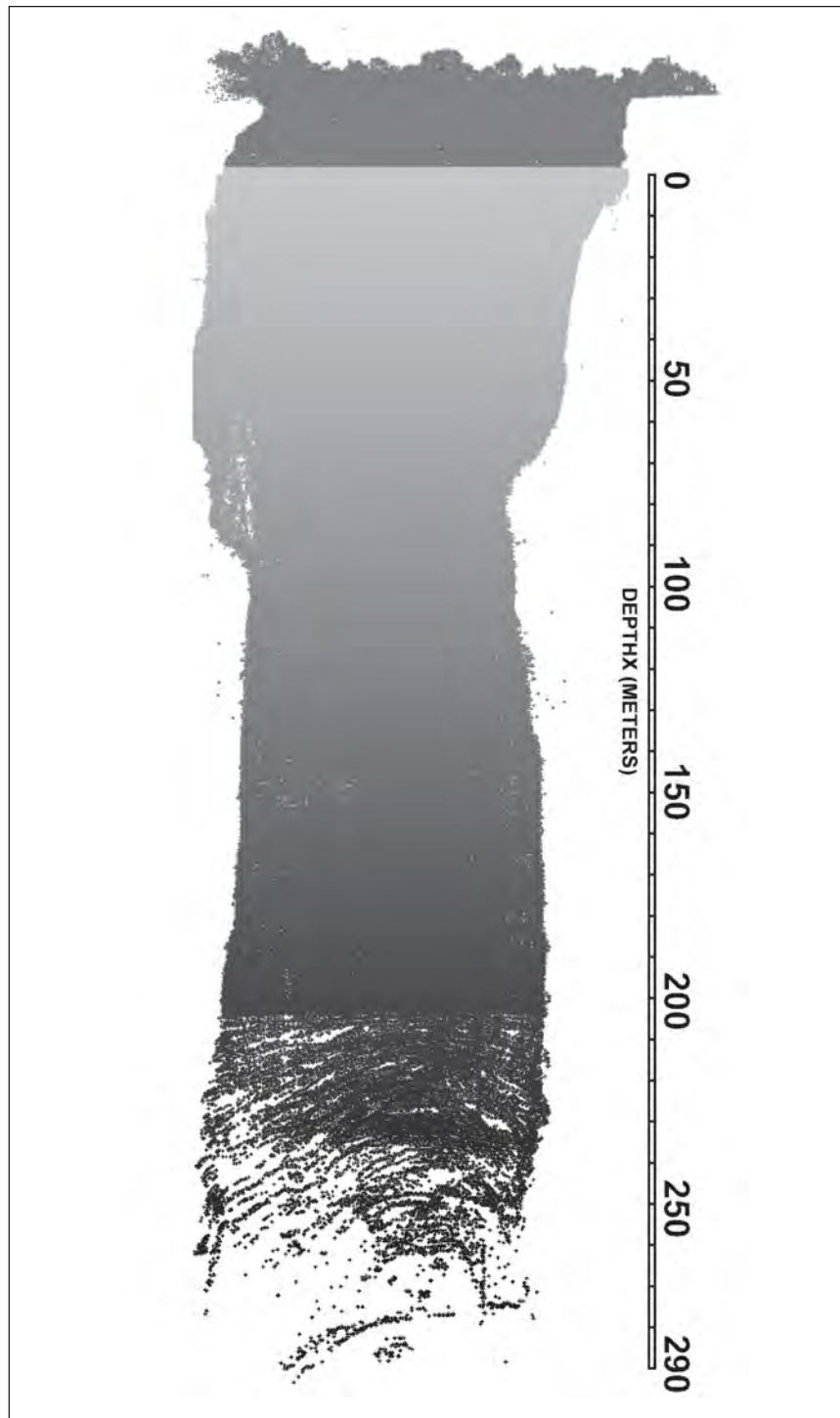
There is a short story by Sue Thomas titled “Sistema Purificacion” at www.pulp.net/fiction/stories/10/sistema-purificacion.html. Part of it is loosely based on that cave system.

The May 8, 2006, issue of the *Pittsburgh Tribune-Review* contained an article by Jennifer Bails about the DEPTHX project at **Zacatón**. Probably instigated by the press department at Carnegie Mellon University, the article is based on interviews with software engineers there who are working on the project and also with Marcus Gary, the Austin, Texas, cave diver who is handling site logistics for the project. The article is at http://www.pittsburghlive.com/x/pittsburghtrib/news/cityregion/s_451536.html.

YUCATÁN

Abstract of “Study of hydraulics and hydrocarbon pollution behavior of a karst aquifer in a tropical area: Yucatan Peninsula, Mexico,” by J. García-Sánchez and I. Navaro Gonzales—

The results of field investigation on hydraulic and hydrocarbon-pollution behavior in an unconfined aquifer are



presented. The study was performed in a site in the peninsula of Yucatan (Mexico), the main characteristics of which are: the presence of karst and tropical weather (hurricane zone), with substantial variations of the unconfined aquifer level. Hydrocarbon-layer thickness varies over time. Water flows very easily in contact with hydrocarbons, which flow very slowly toward moni-

toring wells. This fact allows us to evaluate the remediation methods already employed, as well as to recommend new strategies. The aquifer’s upper layer (1.5 m) shows high contents of pollutants, but no drinking water intake was found there. However, 2 km away, where drinking water is extracted at a depth of 40 m, no trace of contaminant was found. *Source:* www

geocities.com/karstology/TAK16.html. The full paper (not seen) is in *Theoretical and Applied Karstology* 16.

INTERNATIONAL CONGRESS OF SPELEOLOGY

The following abstracts of papers concerning caves in Mexico appear in the program booklet for the Fourteenth International Congress of Speleology that was held in Greece in 2005. Only a fraction of the papers in the program appear in full on the proceedings CD. (For that matter, some weren't actually presented at the congress.) For those that do, the file number in the FULL PAPERS directory on the proceedings CD is given.

Program O-45, proceedings paper 6: "Why are Cave Animals Colorless? Mechanisms of Pigment Cell Regression in the Cavefish *Astyanax*." W. R. Jeffery.

Many cave-adapted animals appear to be colorless due to loss of body pigmentation. The developmental mechanisms involved in this evolutionary change are unknown. We have studied pigment cell regression in the teleost *Astyanax mexicanus*, a single species consisting of a pigmented epigeal form (surface fish) and a de-pigmented hypogean form (cavefish). During vertebrate development, pigment cells differentiate from migratory neural crest cells, which are derived from surface

epithelium at the border of the prospective epidermis and neural plate. As the neural plate becomes the neural tube, neural crest cells leave the epithelium, migrate along specific pathways through the interior of the embryo, and eventually differentiate into many different adult derivatives, including the three types of teleost pigment cells: melanophores (black cells), xanthophores (yellow or orange cells), and iridophores (iridescent cells). All three pigment cell types are present in surface fish. In contrast, cavefish have xanthophores and iridophores but lack melanophores. The deficiency in melanophores could be caused by (1) the development of fewer neural crest cells, (2) the failure of neural crest cells to migrate correctly, (3) the failure of neural crest cells to become melanophores or their precursors, (4) the unscheduled death of melanophores or their precursors, or (5) the failure of melanoblasts to differentiate into melanophores. We have used several different experimental approaches to test these hypotheses. First, Dil (1,1A-dioctadecyl-3,3,3A,3A-tetramethylindocarbocyanine tetramethylindocarbocyanine perchlorate), a lipophilic cell surface marker, was injected into the region where neural crest cells originate, and labeled cells were followed during surface fish and cavefish embryonic development. The results showed that cavefish embryos produce as many neural crest cells as surface fish embryos and that

these cells migrate properly, discounting hypotheses (1) and (2). Second, analysis by TUNEL, a cell death indicator, showed that most cavefish melanophore precursors survive through development, discounting hypothesis (4). Third, the presence of melanoblasts in cavefish was determined by detection of cells expressing tyrosinase, the enzyme that converts L-DOPA to melanin. The results showed the presence of large numbers of tyrosinase-positive melanoblasts in cavefish embryos and adults. Thus, cavefish neural crest cells are able to develop into melanoblasts, which does not support hypothesis (3). Finally, we tested the ability of cavefish melanoblasts to convert L-tyrosine, the precursor to L-DOPA, into L-DOPA and melanin, a process that normally occurs during their differentiation into melanophores. The results showed that cavefish melanoblasts are unable to convert L-tyrosine to L-DOPA, indicating a deficiency in L-tyrosine uptake or utilization. Therefore, we conclude that cavefish lose body pigmentation because their melanoblasts fail to differentiate into melanophores (hypothesis 5). Cavefish melanoblasts could be diverted into other neural crest-derived cell types, which may confer an adaptive advantage in the cave environment.

Program O-46:

"The Biodiversity of Three Cenotes from Cozumel Island." L. M. Mejia-Ortiz, M. Lopez-Ortiz, G. Yanez, and R. G. Hartnoll.

The subterranean biodiversity in the Cozumel Island was analyzed in this work in order to know its current status. We reviewed three sinkholes in the western coast from Cozumel Island, and we registered the geographical position, the main abiotic parameters (temperature, salinity, pH, and dissolved oxygen), the animals from each sinkhole, and we obtained the survey map. The principal taxa collected were crustaceans of Decapoda, Isopoda, and Amphipoda. Also we found Pisces, Annelida, and Porifera. In this work, we registered for the first time the existence of organisms from the Echinodermata



The DEPTHX equipment being lowered by crane onto the floating platform for the May 2005 test run. *Bill Stone.*

phylum in anchialine caves and Theropodaceans and Decapods from genus *Barbaria* (Crustacea) in Cozumel Island. This work showed that the biodiversity in the subterranean environment is high, and the conservation of this system is necessary, because almost all the fauna registered are unique.

Program O-101:

“Lessons Learned from the Investigation of an Active Sulfidic Cave.” L. D. Hose.

The exploration of Cueva de Villa Luz (aka, Cueva de las Sardinas), an active, hypogenic, sulfidic cave in Tabasco, Mexico, presented unique challenges. Unusual atmospheric hazards in the cave include dangerous levels of oxygen (<9.5%), hydrogen sulfide (>210 ppm), and the apparent presence of carbon monoxide, an aldehyde, and an unidentified gas (recognized by occasional drops in identified gas levels). The gases are released by hypogenic springs entering the cave. Gas levels vary both spatially and temporally. In general, passages distant from springs (perhaps >20 m), larger passages (cross-sections of >15 m²), and areas near the many skylight entrances consistently remain at safe levels. Some isolated and smaller passages, along with areas adjacent to sulfidic springs, consistently contain hazardous gases. In addition, the hazardous gases’ levels occasionally vary rapidly, filling small chambers with potentially fatal concentrations within minutes. These atmospheric conditions have prompted the regular use of personal electronic gas monitors that travel with the team and constantly report the level of combustible gas (which has not been detected in the cave), oxygen, hydrogen sulfide, sulfur dioxide, and carbon monoxide. Unfortunately, the conditions cause frequent and costly refurbishing and calibration of the expensive monitors. Investigators also generally wear gas masks that filter out hydrogen sulfide, sulfuric acid, and organic vapors. Each person carries at least one extra set of filters in a waterproof container and changes the filters if they become wet or clogged. Filters are changed at intervals determined by the hydrogen sulfide levels. Passages subject to greater risks prompt the additional use of a carbon dioxide monitor by the team, and each individual

carries emergency compressed air (SpareAir tanks). Exploration of one remote passage required the use of self-contained breathing apparatus. Additional hazards include acidic ceiling drips, wall surfaces, and floor deposits (including bat guano piles) with pH values of 1 and lower. As long as the investigator exercises some precautions, no special clothing is required in the 28°C environment. Cave streams have a nearly neutral pH (~7.2–7.4) thanks to their contact with limestone and its buffering characteristics. The cave atmosphere has a pH of ~4 and presents no danger to explorers’ skin. If the skin (or clothing) comes into contact with almost any of the wall or floor coatings for an extended time, mild-to-serious chemical burns can form. Thus, investigators have learned to wash acidic materials off skin and clothes with the nearly neutral stream water. Drops of water that land on an eye or eyelid cause serious discomfort and, potentially, damage. The eyes should be thoroughly washed with drinking water. Researchers who spend time looking up at various features commonly wear face shields or safety glasses. One short, mud-lined crawlway caused a dermal rash on all flesh exposed to the mud and has necessitated the use of complete chemical protection coverage. The histamine-inducing substance has not been identified.

[An article on the exploration of Villa Luz appears in *AMCS Activities Newsletter* 24, pp. 48–54.]

Program O-139:

“Decoupled and Depth Stratified Circulation in a Coastal Carbonate Aquifer: Yucatan Peninsula, Mexico.” P. A. Beddows, P. L. Smart, S. L. Smith, F. F. Whitaker.

The conventional model for saline groundwater circulation in coastal carbonate aquifers is that a shallow zone of saline outflow is entrained coastward by the discharge of the overlying fresh water lens, with a compensatory inflow of sea water at depth. However, this model is supported by only a limited number of field observations, as in situ monitoring of groundwater circulation remains logistically challenging. Here we present an alternative model based on instrumental records (velocity, salinity, temperature) and dye tracing of groundwater circulation in extensive

flooded cave systems on the Caribbean coast of the Yucatan Peninsula, Mexico. The conduits are the focus of this study, as they account for >99% of the aquifer flux. The saline flow to ~5 m below the fresh-saline mixing zone is modulated by the semi-diurnal tides, while lower frequency alternating cycles of net inflow and outflow correspond to the annual periods of high or low Caribbean sea levels. The shallow saline groundwater temperatures are comparable to that of the Caribbean seawater at the coast, but decline by 1.8°C at 9 km inland, indicating that the saline inflow penetrates far into the aquifer. The semidiurnal tides impound the fresh water on top of the mixing zone during high tides, but all data indicate a persistent net discharge of fresh water regardless of mean sea level. The coastward freshwater discharge is decoupled from the reversing shallow saline groundwater circulation. As a result, the mixing zone within the conduits is characterized by very steep density gradients and strongly sheared flows. In contrast to the reversing shallow saline circulation, velocity measurements of deeper saline water in three conduits to depths of 45 m below the mixing zone indicate continuous inland flow irrespective of mean Caribbean sea-level. Whilst this is consistent with the conventional circulation model, it may also indicate a unidirectional cross-platform circulation channeling water from the Caribbean Sea into the Gulf of Mexico, the drive for which may be a head difference across the platform. A limited number of deeper profiles reveal a second but smaller density interface a few meters below the mixing zone, suggesting shear and decoupling between the shallow and deep saline flow regimes. The pathways for the cross-platform saline flows may in part be via a deeper tier of karstification formed during previous low sea levels. These results challenge the conventional circulation model, specifically by providing direct observation of decoupling of fresh and saline groundwater flows across the mixing zone, although we recognize that further research is required to confirm the proposed deeper cross-platform saline circulation. Our findings present new insight into speleogenetic processes in density stratified carbonate aquifers, as well as indicate the

difficulty of predicting the fate of effluent pumped into the saline water.

[Some of this research is in AMCS Bulletin 11, *Cave Hydrology of the Caribbean Yucatan Coast*, by Patricia A. Beddows.]

Program O-145, proceedings paper 234:

“Phenomenon of the Underwater Caves of Riviera Maya, Mexico.” Z. Motycka.

The Riviera Maya is a part of the eastern coast of the Mexican Yucatan Peninsula by the Caribbean. The area of carbonates is about 190,000 km². They are essentially pure, deposited from Paleocene to Pliocene. Uplift of the peninsula during the Pleistocene predisposed the karst platform to speleogenesis. Frequent rains penetrated through the porous surface and created shallow systems that led the water to the sea. In the next period, there was another drop of the sea level, and it caused the broadening of existing caves, while eroding deeper passages. In the meantime the process of secondary karstification and collapsing of thin cave ceilings occurred, and the cenotes were formed. About 18,000 years ago the sea started to rise to the contemporary level, and these caves were flooded. Today the surface is absolutely flat, covered with a jungle. There are lagunas and cenotes. Lagunas are big lakes, while cenotes can be small, often hidden behind the rocks. At the seaside there are caletas, where the fresh water flows into the ocean. The cenotes and caves are a really unique ecosystem. Hundreds of species of animals have been described in the past century. The first of the larger systems, Nohoch Na Chich, was discovered in 1986 by Mike Madden and his team. It was the beginning of an invasion by divers, and many other cenotes and kilometers of corridors were discovered. The exploration of cenotes continues, with many projects. At the present there are more than one hundred cave systems where five hundred kilometers of underwater cave corridors are known. Systema Ox Bel Ha is the longest underwater cave system in the world, with 134 km of corridors.

Program O-146, proceedings paper 256: “The Formation of the Grutas del Palmito (Bustamante, Nuevo León, Mexico): Preliminary Results.” P. Forti,

A. A. Cigna.

The formations found in the Gruta del Palmito confirm the existence of different climatic situations in the cave. Among the more common formations, this cave is characterized by a number of rimstone pools, sometimes very large. In some of them big cave pearls (up to more than 10 cm diameter) are found. Physical and chemical analyses of the material of the rimstone pools show a very fast deposition rate and the presence of thermal water.

Program P-8:

“The Cenotes (Anchialine Caves) from Cozumel Island, Quintana Roo, Mexico.” L. M. Mejia-Ortiz, O. F. Martinez, Y. J. Tun Chim, M. Lopez-Ortiz, G. Yanez.

Cozumel Island is a Caribbean insular landscape that has karst as a main component. In this place the caves formed are cenotes, and almost all are considered anchialine caves, for their sea connections. A cenotes register was made for Cozumel. In order to obtain it, aerial photography was analyzed, and we made a visit to each cenote identified to corroborate the geographical position. At the same time, we measured the diameter and initial depth at the entrance. This paper is a checklist of cenotes on this island, with location maps, and we identify the different regions in the distribution of natural caves in the island.

INTERNATIONAL JOURNAL OF SPELEOLOGY

The *International Journal of Speleology* is the official journal of the International Union of Speleology. It is published in Italy. The first forty years of the journal, 1963–2004, have been put on the web site www.ijs.speleo.it and are also on a CD prepared for the international congress in Greece in 2005. Both sources include the full papers, as very low resolution scans in PDF files, and a database of the titles, authors, abstracts, and keyword lists of all the papers. The database is searchable, and I have searched it for “Mexico” and “Mexican,” coming up with the following list of papers. Some of the mentions of Mexico are somewhat incidental; the papers on biospeleology in Cuba, for example, mention comparisons to Mexican fauna in the abstracts.—Bill Mixon

Nell B. Causey, 1964. New cavernicolous Millipeds of the Family Cambalidae (Cambalidae: Spirostreptida) from Texas (U.S.A.) and Mexico. Vol 1 (1/2), 237–246.

Gordon Gates, 1968. On a new species of Earthworm from a Mexican cave. Vol. 3 (1/2), 63–67.

J. Paclt, 1971. Occurrence of a new Genus of troglobitic Nicoletiidae (Ins. Thysanura) in Mexico. Vol. 3 (3/4) 423–424.

Guy Magniez, 1972. Two new cavernicolous Stenasellidae of Central America: *Mexistenasellus parzefalli* n. sp. and *Mexistenasellus wilkensi* n. sp. (Crustacea Isopoda Asellota). Vol. 4 (1) 19–31.

William R. Elliott and Robert W. Mitchell, 1973. Temperature preference responses of some aquatic, cave-adapted Crustaceans from Central Texas and Northeastern Mexico. Vol. 5 (2) 171–189.

Guy Magniez, 1973. Description of a male of *Mexistenasellus parzefalli* (cavernicolous Crustacea Isopoda Asellota of Mexico) and observations on this species. Vol. 5 (2) 163–170.

Vincenzo Vomero, 1973. Present state of the knowledge on hypogean Histeridae. Vol. 5 (3/4) 361–367.

Marina Cobolli Sbordoni and Valerio Sbordoni, 1973. Ecological and evolutive aspects of the communities of temperate and tropical caves: observations on the biological cycles of some species of *Ptomaphagus* (Coleoptera Catopidae). Vol. 5 (3/4) 337–347.

Lazare Botosaneanu, 1973. Observations on the aquatic subterranean fauna of Cuba. Vol. 5 (3/4) 209–218.

Jean Pages, 1975. A new species of Parajapygidae from the Caribbean shores of Cuba collected by Pr. L. Botosaneanu during the second Cuban-Romanian biospeleological expedition to Cuba 1973. Vol. 6 (4) 339–352.

Nell B. Causey, 1975. Millipedes in the collection of the AMCS. III. *Reddellobus troglobius*, n. gen., n. sp., an unusual troglobite from Puebla, Mexico, and other records of the Family Spirobolellidae (Order Spirobolida, Class Diplopoda). Vol. 6 (4) 333–338.

Thomas E. Bowman, 1975. Three new troglobitic asellids from Western

- North America (Crustacea, Isopoda, Asellidae). Vol. 7 (4) 339–356.
- Dan L. Danielopol, 1977. Investigations on the Entocytheridae Ostracods. Data on *Sphaeromicola cebennica juberthiei* nov. ssp. and *Sphaeromicola cirolanae* Rioja. Vol. 9 (1) 21–41.
- Guy Magniez, 1981. Biogeographical and paleobiogeographical problems in Stenasellids (Crustacea Isopoda Asellota) of underground waters. Vol. 11 (1/2) 71–81.
- John R. Holsinger, 1982. *Paramexiweckelia*, a new Genus of Subterranean Amphipod Crustacean (Hadziidae) from Northern Mexico. Vol. 12 (1/4) 37–44.
- Horst Wilkens, 1987. Genetic analysis of evolutionary processes. Vol. 16 (1/2) 33–58.
- Giuliana Allegrucci, Fabiola Baldari, Donatella Cesaroni, Valerio Sbordoni, 1988. Evolutionary genetics and morphometrics of a cave crayfish population from Chiapas (Mexico). Vol. 17 (1/4) 65–80.
- Peter Junge, Thomas G. Langecker, Horst Wilkins. Speciation of troglobites: studies in the San Antonio cave (Oaxaca, Mexico). Vol. 20 (1/4) 1–13.
- Laure Desutter-Grandcolas, 1993. The cricket fauna of Chiapanecan caves (Mexico): systematics, phylogeny, and the evolution of troglobitic life (Orthoptera, Grylloidea, Phalangopsidae, Luzarinae). Vol. 22 (1/4) 1–82.

MEXICAN ROAD MAPS

There are PDF files of good Mexican road maps for every state at <http://portal.sct.gob.mx/SctPortal/>. These are official government maps in files of 3 to 6 megabytes. These are object-oriented maps, not scans, with a page size of something like 2 by 3 feet. They are somewhat difficult to browse onscreen, because the place names are only legible at 50 percent or above, and then only a small part of the state can be seen at once.

Fortunately for those of us who are illiterate in Spanish, place names are not in all caps, and there are accents on them, which is helpful for knowing how to spell things correctly. Unfortunately, the accents aren't very reliable. They put accents on the final vowels of Tulum and Cuetzalan, for example.

Municipio boundaries are shown, and the municipal seats are indicated, which might make figuring out where to ask permission easier.

The maps seem pretty complete, but the small local roads are not perfect. For example, the route up to Conrado Castillo in the Purificación area is shown going up the Río Corona and through Yerbabuena. Still, it's impressive that Conrado Castillo and Yerbabuena are even shown on a road map. Cavers spend four or five hours in low range to reach them. Villages not on a road at all, such as San Martín in the Cerro Rabón, are not shown.

Gregory Brown 13 July 1963 – 23 February 2006

Gregory Brown died in the United States while convalescing from a devastating stroke. A memorial service was held on Cannon Point, Akumal, Mexico, on 25 February 2006. Greg was remembered for his long commitment to Centro Ecológico Akumal as a computer specialist, professional nature photographer, and underwater cave explorer.

During his early caving career, Greg made important contributions to the explorations of Sistema Dos Ojos and Cenote Miguel in Quintana Roo. Later, acting as a research assistant for CEA, he was able to expand his love and concern for local resource conservation through personal involvement in offshore-reef ecological studies, including the means to document these studies through sonar, computer software, photography, and videography. Through

personal commitments to exploring all facets of offshore-reef ecology, he discovered an array of underwater fresh-water discharge conduits in the Yal Ku *caleta*. During these explorations he surveyed and documented much of what is known today as Sistema Aak Kimin.

Sistema Aak Kimin (the Dead Turtle system) is the third-deepest underwa-

ter cave in Quintana Roo, at 68.6 meters (225 feet). Aak Kimin and its sister cave Sistema Laguna Lagarto are fracture-controlled caves that parallel the coast while coursing through newly developed areas. Both caves may well provide important access windows for sampling inland pollution levels in the fresh water aquifer before it is released to the Caribbean Sea.

Greg shared his experiences, survey data, and video recordings with many friends and scientists who are concerned with the development plans for the Akumal area. He also presented his work during QRSS workshops through maps and videography, while managing the technical aspects of coordinating other speakers' presentations. Greg will be missed as an explorer and a friend to many cavers in Quintana Roo.

—Jim Coke



DEEP PITS OF MEXICO

Mark Minton
May 2006
Depth in meters

1	El Sótano (de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de la Culebra	Entrance drop	Querétaro	336
4	Sótano de Tomasa Kiahua	Entrance drop	Veracruz	330
5	Sótano de Alhuastle	P'tit Québec	Puebla	329
6	Zacatón	Entrance drop	Tamaulipas	329
7	Akemabis		Puebla	310
8	Nita Xonga	Psycho Killer	Oaxaca	310
9	Sotanito de Ahuacatlán	Second drop	Querétaro	288
10	Sótano del Arroyo Grande	Entrance drop	Chiapas	283
11	Sistema de la Lucha	Entrance drop	Chiapas	280
12	Sima Don Juan	Entrance drop	Chiapas	278
13	Hálito de Oztotl	Entrance drop	Oaxaca	250
14	Sima Dos Puentes	La Ventana	Chiapas	250
15	Sótano del Aire	Entrance drop	San Luis Potosí	233
16	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
17	Sistema Ocotempa	Pozo Verde	Puebla	221
18	Sótano de los Planos	Puits Tannant	Puebla	220
19	Sótano de Eladio Martínez	Entrance drop	Veracruz	220
20	Live in Busch	Entrance drop	Oaxaca	220
21	Sótano de Coatimundi	Entrance drop	San Luis Potosí	219
22	Sótano de Sendero	Entrance drop	San Luis Potosí	217
23	Resumidero el Borbollón	Tiro Grande	San Luis Potosí	217
24	Sima de la Pedrada	Entrance drop	Chiapas	217
25	Sima del Chikinibal	Entrance drop	Chiapas	214
26	Cueva del Tizar	Third drop	San Luis Potosí	212
27	Kijahe Xontjoa	Son On Jan	Oaxaca	210
28	Nacimiento del Río Mante	Macho Pit	Tamaulipas	206
29	Hoya de las Guaguas	Entrance drop	San Luis Potosí	202
30	Nita Gatziguin	Entrance drop	Oaxaca	200
31	Sistema H3-H4		Puebla	200
31	Kijahe Xontjoa	Lajao Se	Oaxaca	200
33	Sima La Funda	Entrance drop	Chiapas	198
34	Sótano de Soyate	Entrance drop	San Luis Potosí	195
35	Sótano de Alpupuluca	Entrance drop	Veracruz	190
36	Cuaubtempa	Pozo con Carne	Puebla	190
37	Sótano de Tepetlaxtli No. 1	Entrance drop	Puebla	190
38	Sótano de Puerto de los Lobos	Entrance drop	San Luis Potosí	189
39	Sótano de Hermanos Peligrosos	Second drop	Veracruz	186
40	Sistema Soconusco	Darwin	Chiapas	180
41	Sima de Veinte Casas	Entrance drop	Chiapas	180
42	Ahuihuizcapa	Entrance drop	Veracruz	180
43	Hoya de la Luz	Entrance drop	San Luis Potosí	180
44	Croz 2	Entrance drop	Puebla	180
45	Sima del Cedro	Entrance drop	Chiapas	175
46	Sótano de la Cuesta	Entrance drop	San Luis Potosí	174
47	Sima Dos Puentes	Entrance drop	Chiapas	172
48	Sótano de los Monos	Entrance drop	San Luis Potosí	171
49	Sótano de Otates	Third drop	Tamaulipas	171
50	El Socavón	Entrance drop	Querétaro	171

DEEP CAVES OF MEXICO

Mark Minton
May 2006
Depth in meters

1	Sistema Cheve	Oaxaca	1484
2	Sistema Huautla	Oaxaca	1475
3	Cueva Charco	Oaxaca	1278
4	Akemati	Puebla	1226
5	Kijahe Xontjoa	Oaxaca	1223
6	J2 (Ozto Faustino, Ozto Barbie)	Oaxaca	1209
7	Sistema Ocotempa	Puebla	1070
8	Akemabis	Puebla	1015
9	Sonconga	Oaxaca	1014
10	Guixani N'dia Kijao	Oaxaca	955
11	Sistema Purificación	Tamaulipas	953
12	Sistema Perrito	Oaxaca	906
13	Sistema Tepepa (Ehécatl+Niebla)	Puebla	900
14	Nita Chó	Oaxaca	894
15	Sótano de Agua de Carrizo	Oaxaca	843
16	Sótano de El Berro	Veracruz	838
17	Sótano de Trinidad	San Luis Potosí	834
18	Resumidero El Borbollón	San Luis Potosí	821
19	X'oy Tixa Nita	Oaxaca	813
20	Nita Ka	Oaxaca	760
21	Sistema H31-H32-H35	Puebla	753
22	Sonyance	Oaxaca	740
23	Nita Xongá	Oaxaca	739
24	Yuá Nita	Oaxaca	705
25	Aztotempa	Puebla	700
26	Sótano de los Planos	Puebla	694
27	Sótano de Alfredo	Querétaro	673
28	Sistema Cuetzalan	Puebla	658
29	Sótano de Tilaco	Querétaro	649
30	Nita Nashí	Oaxaca	641
31	Cuaubtempa Superior	Puebla	640
31	Sistema Atlalaquía	Veracruz	623
33	Cueva de Diamante	Tamaulipas	621
34	Sistema Coyolatl	Puebla	620
35	R'ja Man Kijao (Nita)	Oaxaca	611
36	Sistema de los Tres Amigos	Oaxaca	611
37	Nita He	Oaxaca	594
38	Meandro Que Cruce (H54)	Puebla	588
39	Yometa	Puebla	582
40	Sótano de las Coyotas	Guanajuato	581
41	Sótano Arriba Suyo	San Luis Potosí	563
42	Sistema Tepetlaxtli	Puebla	535
43	Sótano del Río Iglesia	Oaxaca	531
44	Sótano de Nogal	Querétaro	529
45	Resumidero de la Piedra Agujerada	San Luis Potosí	521
46	Grutas de Rancho Nuevo	Chiapas	520
47	Sistema Soconusco	Chiapas	513
48	Sótano de las Golondrinas	San Luis Potosí	512
49	Sótano de Los Hernández	Querétaro	509
50	Hoya de las Conchas	Querétaro	508

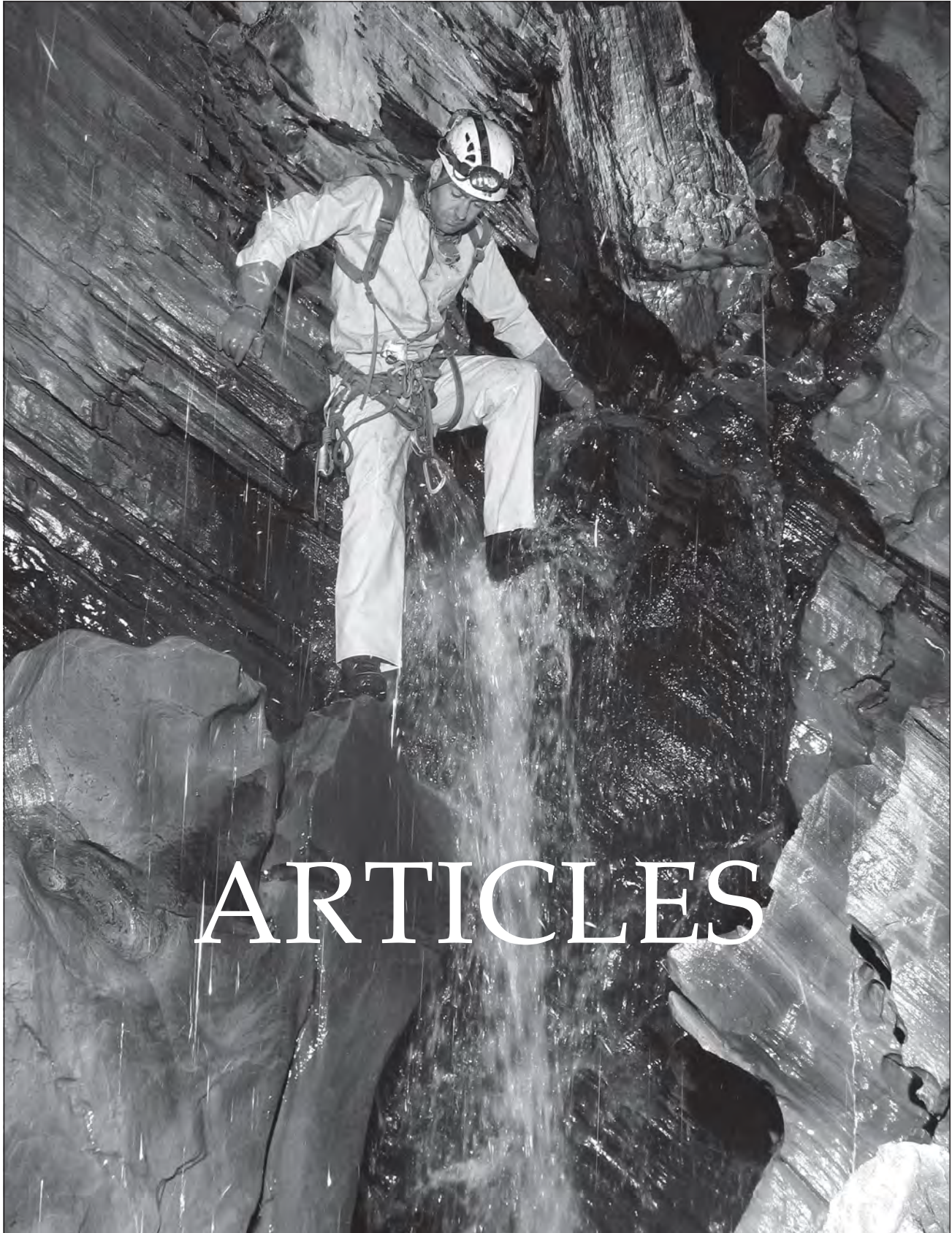
Updates and corrections:

Mark Minton
Department of Natural Sciences
New Mexico Highlands Univ.
P. O. Box 9000
Las Vegas, NM 87701
mminton@nmhu.edu

Mark Minton
 May 2006
 Length in meters

LONG CAVES OF MEXICO

1	Sistema Ox Bel Ha	Quintana Roo	144749
2	Sistema Purificación	Tamaulipas	93755
3	Sistema Sac Actun	Quintana Roo	79617
4	Sistema Nohoch Nah Chich	Quintana Roo	67184
5	Sistema Dos Ojos (Sistema Jacinto Pat)	Quintana Roo	56803
6	Sistema Huautla	Oaxaca	55953
7	Cueva del Tecolote	Tamaulipas	40475
8	Sistema Cuetzalan	Puebla	37676
9	Kihaje Xontjoa	Oaxaca	31373
10	Sistema Tepepa (Ehécatl+Niebla)	Puebla	27700
11	Sistema Cheve	Oaxaca	26194
12	Sistema Soconusco	Chiapas	23855
13	Sistema Coyolatl	Puebla	23000
14	Sistema Naranjal (Najarón-Maya Blue)	Quintana Roo	21525
15	Sistema Aerolito	Quintana Roo	18000
16	Cueva de Alpazat	Puebla	15200
17	Sistema PonDeRosa (Pondazul, Eden)	Quintana Roo	15019
18	Sistema Yaxchen East	Quintana Roo	13090
19	Cueva del Río La Venta	Chiapas	13000
20	Chjine Xjo	Oaxaca	12400
21	Atlixicaya	Puebla	12200
22	Cueva Pitch	Quintana Roo	12000
23	Sistema San Andrés	Puebla	10988
24	Cueva del Mano	Oaxaca	10841
25	Sistema Taj Mahal - Minotauro	Quintana Roo	10600
26	Actun Káua	Yucatán	10360
27	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
28	Cueva del Arroyo Grande	Chiapas	10207
29	El Chorro Grande	Chiapas	9650
30	Sistema Muul Three	Quintana Roo	9630
31	Sistema Tepetlaxtli	Puebla	9600
31	J2 (Ozto Faustino, Ozto Barbie)	Oaxaca	9536
33	Sistema Chac Mol - Mojarra	Quintana Roo	9193
34	Cueva Quebrada	Quintana Roo	8921
35	Sistema Camilo	Quintana Roo	8469
36	Sótano de Las Calenturas	Tamaulipas	8308
37	Gruta del Tigre	Quintana Roo	8200
38	Nohoch Aktun	Quintana Roo	8200
39	Sumidero Santa Elena	Puebla	7884
40	Cueva Yohualapa	Puebla	7820
41	Sistema Las Brumas - Gimnástica Selvática	Puebla	7800
42	Cueva de la Peña Colorada	Oaxaca	7793
43	Cueva de Comalapa	Veracruz	7750
44	Sistema Zapote (Toucha-Ha - Vaca Ha)	Quintana Roo	7697
45	Sistema Xunaan-Ha (María Isabella)	Quintana Roo	7600
46	Sótano del Arroyo	San Luis Potosí	7200
47	Sistema Perrito	Oaxaca	7148
48	Cueva de la Puente	San Luis Potosí	6978
49	Sistema Huayateno (Guayateno) -Tecaltilán	Puebla	6911
50	Sistema Actun Koh/Heder	Quintana Roo	6800



Tony Dwyer hauling gear in J2 during the 2005 expedition.
Kasia Biernacka and Marcin Gala / speleo.pl.

SUMMARY OF THE 2005 J2 EXPEDITION

Bill Stone

The cave J2 is located at an elevation of 2241 meters and is some 3 kilometers from the small village of El Ocotal in the *municipio* of San Francisco Chapulapa, district of Cuicatlán, Oaxaca. It was first discovered in early March 2004 during the 2004 Sistema Cheve expedition. This expedition had been organized by Bill Stone to conduct a reconnaissance of three areas to the north and east of Sistema Cheve with the objective of discovering a new entrance to Sistema Cheve that would provide a bypass to the obstacles that have blocked, at a depth of 1484 meters, further exploration in Cueva Cheve since 2003. The El Ocotal area was the last of the three areas. On March 2–3, 2004, a small team consisting of Andi Hunter and Bill Stone from the United States and Tjerk Dalhuisen and Maarten Poot from the Netherlands conducted the first reconnaissance above El Ocotal. They discovered the entrances to twenty-five new caves, located the site for what is now J2 Base Camp, and explored through the dense cloud forest to within 500 meters of the entrance to J2. On March 10 a large team began methodically searching for caves from that camp. Spanish caver Enrique “Zape” Ogando Lastra was the first to discover the sinkhole leading to the cave entrance. The first to enter the cave was Marcin Gala from Poland, who descended a very short way to a depth of 25 meters without rope. Subsequently, four exploration trips extended the cave to a surveyed depth of 346 meters. A final reconnaissance push in 2004 reached an estimated –450 meters before we had no more rope for rigging. The cave continued with a very strong

stoneaerospace@verizon.net

wind. (The 2004 expedition is the subject of a long article in *AMCS Activities Newsletter* 28, pages 119–140.)

The 2005 expedition was organized and led by Bill Stone and José Antonio Soriano and comprised thirty-six members from eight countries. The lead team left Texas on March 17. It took a week to establish base camp at J2 and rig to the previous limit of exploration, about 590 meters from the entrance. From there things proceeded rapidly over the next three days. Mike Frazier and Bill Stone set a bivouac at –553 meters, at what is now the site of Camp 1 and rigged on to a depth of 665 meters, where they ran out of rope. Replacement teams of Alan Warild, Greg Tunnock, Mark Wilson, Pavo Skoworodko, John Kerr, and José Antonio Soriano reached –752 meters, where they discovered a sump at the base of a large chamber 500 meters directly beneath the surface feature known as the Aguacate Canyon. This was a place we had been concerned about all along, because it is the only significant geological feature that could stop a cave between the J2 entrance and a postulated junction with Cueva Cheve. The main problem was that, for the first time in memory, we had brought no dive gear. The trucks had been packed with three kilometers of rope instead, in view of the extraordinarily strong wind at the entrance.

During the next two weeks we examined the passage leading to the sump, climbing high into the roof of the canyon in several locations looking for a bypass to the underwater tunnel. We had no luck in this endeavor. It then took three days of deliberation and several satellite phone calls to the United

States to decide how to proceed. At first nearly half of the team was in favor of simply resuming the search for new entrances in the Ocotal cloud forest, with the hope that perhaps a new cave might bypass the underwater tunnel. The search for new entrances did in fact continue during the two weeks the climbs were taking place in J2, and a few pits, including 105-meter Pozo de la Vaca Voladora, were discovered, but none continued. On April 14, four volunteers began a four-day trip to Texas, where they were met at the border by a truckload of cave-diving gear brought south from Austin. They returned to base camp on April 17, and a new team transported the equipment to Camp 2, established in the large chamber at –734 meters. Bill Stone made the first dive into the sump and quickly discovered that after 12 meters, at a depth of only 4 meters, it narrowed to a 0.5-meter-wide fissure. He could see the water surface on the downstream side, just 2 meters away, but he could not fit through with the traditional side-mount diving rig he was using. Then Alan Warild clipped the tanks to his SRT harness, donned a weight belt, and slipped through to reach an air-filled canyon on the downstream side of the sump. His brief reconnaissance confirmed that the cave continued and indeed had the wind, which must have been filtering through the tall, thin crack above the sump, where it had been impossible to detect due to nearby waterfalls whipping wind and spray in all directions. Alan also observed that the sump appeared to be held in place by a 6-meter-tall rock pile on the downstream side. For subsequent dives, the tanks were strapped into a neutrally buoyant self-contained pair, with two



Bart Hogan, Bill Stone, and Franco Attolini.

Hiking in the upper Aguacate Canyon.



J2 2005 photos by

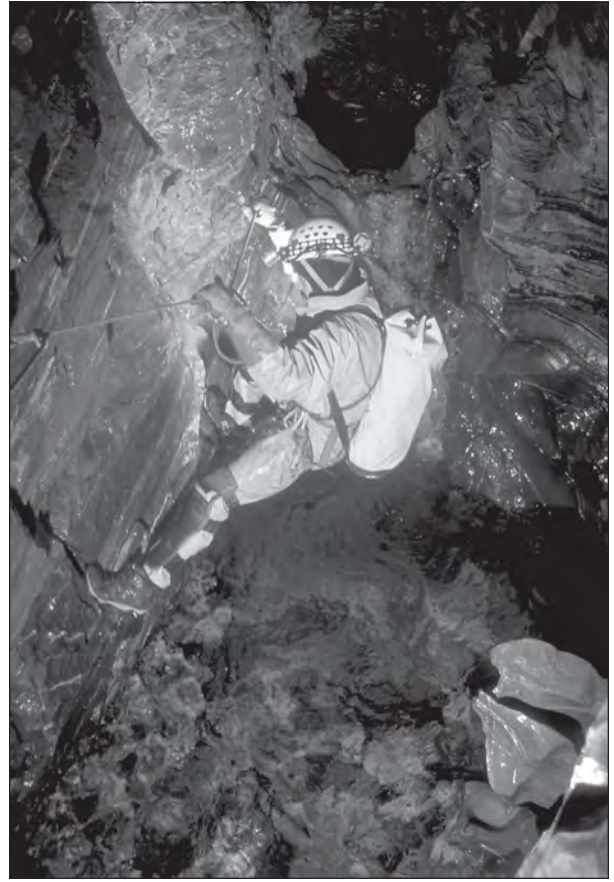
Above: Al Warild using the satellite phone in base camp. Enrique “Zape” Ogando Lastra at left. Below: Standing, Tony Dwyer and Mark Wilson; sitting or kneeling, Tjerk Dalhuisen, Marcin Gala, and Greg Tunnock; lying, Kasia Biernacka.





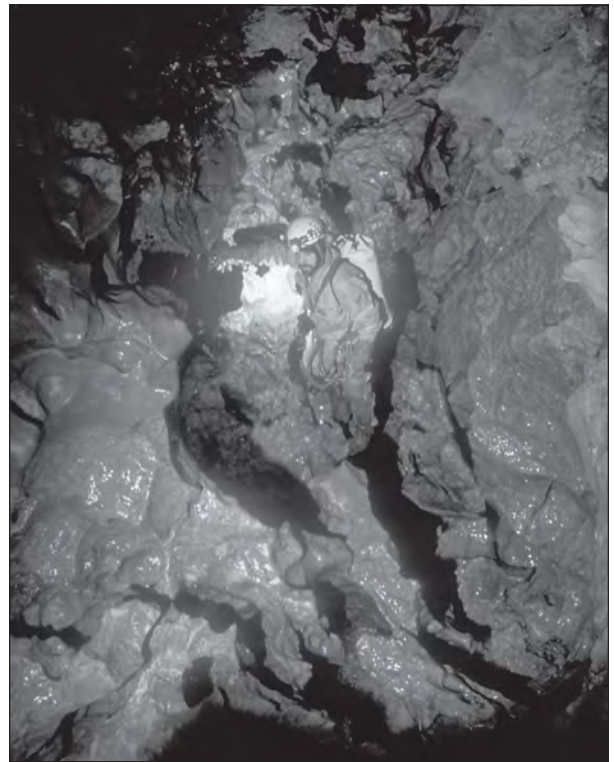
Gustavo Vela Turcott

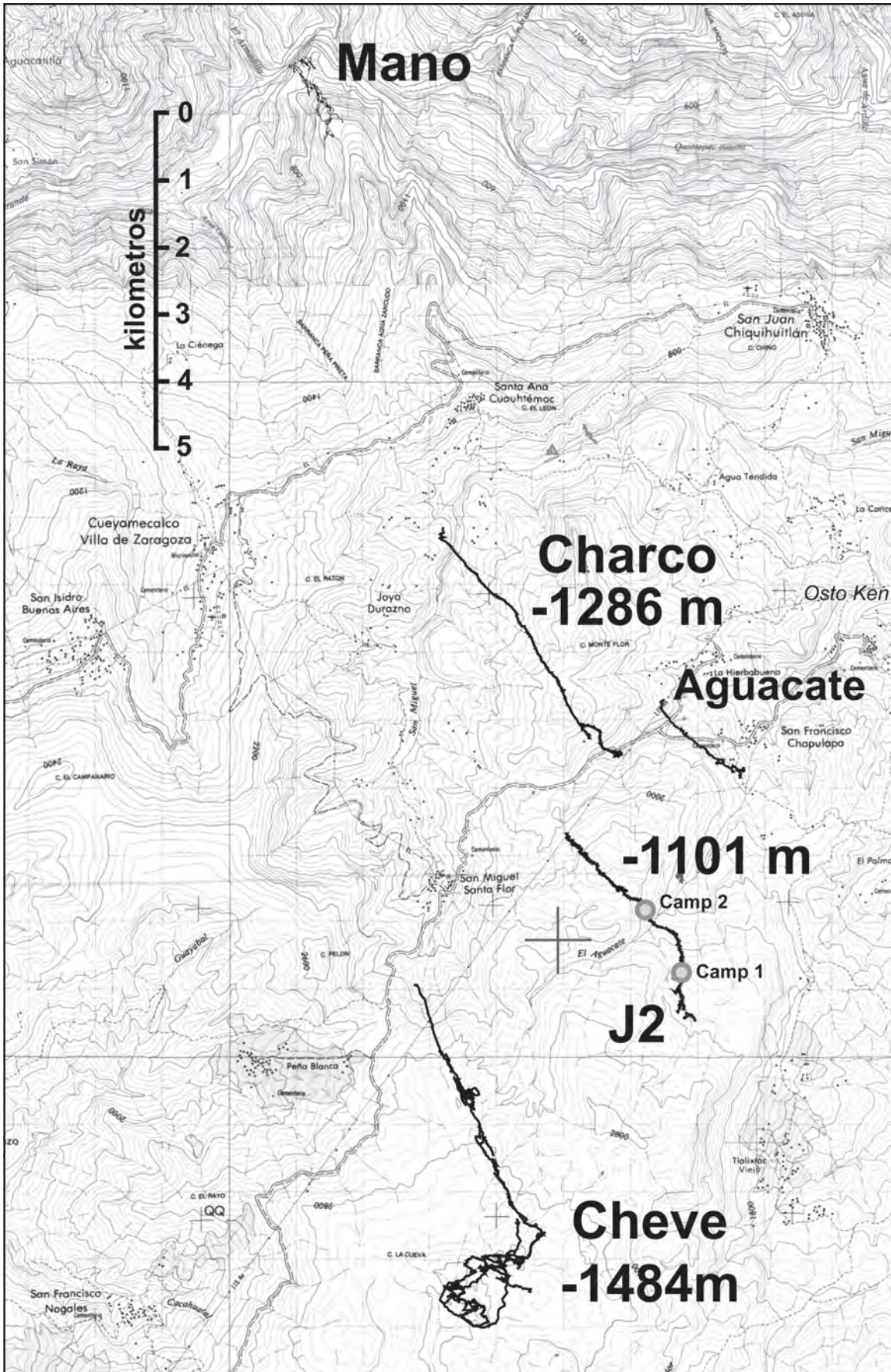
Above: Marcin Gala, Kasia Biernacka, John Kerr, Thomas Shifflett, and (foreground) Bart Hogan in Camp 2. Below: John Kerr in Black Canyon beyond the drained sump.



Bart Hogan between Camps 1 and 2.

Bart Hogan in the Slim Gym above Camp 1.





tanks and two regulators, that floated in front of the diver. This allowed us to push the “no-mount” rig ahead of us with one hand, turn sideways, and slip through the fissure.

During the following week a team led by John Kerr and Marcin Gala achieved something quite unprecedented. They managed to move about 10 tons of boulders from the collapse pile on the downstream side of the sump and drained it enough to lower the water level 2.5 meters and open an airspace for travel without cave-diving kit. The wind increased dramatically to storm velocity, due to the additional area available, creating whitecap waves on the sump lake. Surmounting this little obstacle cost us three weeks time. But by April 25 we had a strong rigging and survey team, equipped with a kilometer of rope, at Camp 2. The cave was extended a kilometer in a tall stream canyon through polished black rock, with the river roaring through plunge pools separated by 5- to 20-meter-deep pitches, not unlike the lower gorge in the famous Sótano de San Agustín. On April 30, reinforcements and a change of the team left us with the following group at Camp 2: Pavo Skoworodko, Artur Nowak, and Kasia Kędracka from Poland, John Kerr, Matt Covington, Jon Lillestolen, and Bill Stone from the United States, and Franco Attolini from Monterrey, Mexico.

During the next five days we conducted three pushes of fifteen, twenty, and twenty-four hours below Camp 2. On May 1 we almost immediately discovered a high-level borehole at -870 meters that went on for 1.5 kilometers as a trunk 20 meters wide by 8 meters high. On the May 3 push we reached a depth of 1067 meters at a point 5 kilometers from the entrance. But we were stopped by an extensive collapse. We returned there on May 5. A first team, consisting of Attolini, Covington, Kędracka, and Stone, surveyed the cave to the limit of exploration. The second team, Pavo Skoworodko and John Kerr, pioneered a complex route through the collapse zone. In fact it was so complex that Skoworodko could not find his way back. We got to a point so close we could shake hands, but getting through was impossible. We considered our options, and sending a sleeping bag and food through the handshake crack

was discussed. But John Kerr saved the day with the titanium crowbar he seems never to be without. He managed to pry loose a few ceiling blocks (and get out of the way in time), and the subsequent collapse stabilized into a precarious gateway. Skoworodko encouraged us to come through this dangerous place and continue exploring. We did this, but my professional opinion as a structural engineer was that it was held up by whim, and I prayed it would hold for this trip, which it fortunately did. Clearly, a significant objective for the 2006 J2 Expedition will be to find an alternate, safer route. At a location twenty hours from Camp 2, Covington, Kerr, Attolini, and Stone reached the deepest point for 2005, a depth of 1101 meters, 5.5 kilometers from the entrance. The four of us stood in a 12-meter-wide by 8-meter-tall tunnel looking down into a giant rift with a thundering river at least 25 meters below. With high-power lights we could see the gorge heading northwest, toward Cueva Cheve, 8 meters wide and 25 meters high.

The wind blowing through that tunnel is stronger than anything I have ever felt underground in thirty-seven years of caving, and this was at -1100 meters. Tommy Shifflett, one of the few remaining early Huautla veterans still on the expedition circuit—he has seen it all and isn’t easily impressed—casually predicted in base camp that “that thing is going all the way to the resurgence.” That would put us at a depth of 2000 meters. Completing a connection with Cueva Cheve, however, will represent one of the greatest exploration challenges in human history. Here’s the essence of it: Our two-month push on J2 got us to a point 5.5 kilometers from the entrance. We were stretched thin to reach where we did. A third underground camp will have to be placed at the present limit of exploration. Beyond that we are looking at a doubling or more likely tripling of the penetration distance to reach a junction with Cueva Cheve, far beneath the San Miguel gorge. That grand junction, however, merely represents the back door we have been seeking to get beyond the Cheve sumps. We project that we will likely need five or six underground camps by the time we reach the junction, if we are lucky. But then the full impact of the pending logistics crisis

begins to become apparent. From that point it is 7 straight-line kilometers to the closest point, the downstream sump, in Cueva Cheve and 9 kilometers the other way to the known resurgence springs. Caves never go in straight lines. At a minimum it will be double the straight-line distance, or 14 kilometers to Cueva Cheve and another 18 kilometers in the downstream direction to the resurgence. One can calculate that human endurance in the difficult passages of J2 will require a camp, on average, every three kilometers. This then implies that we will be at Camp 9, 10, or 11 by the time we reach either Cheve or the resurgence. There are no other known ways to access these areas. It is very clear from the phenomenal wind that J2 is going to get us on into the mountain; it is the key we have been searching for for more than a decade. A return is planned from April 1 to May 15, 2006, to push onward with the equipment and technology we currently have available. Using traditional techniques we may be able to reach -1400 or -1500 meters, leaving the hoped-for junction under the San Miguel still 5 to 6 kilometers distant.

We are currently thinking about how to approach this more methodically for a three- to four-month return expedition in 2007. It will require a new concept in subterranean exploration. To provide one simple example, some type of electronic communication from all the subterranean camps to the J2 surface camp is going to be essential. A request for logistics support from Camp 8, garbled if sent by human messenger up through the shallower camps, would, considering the lag time, lead to a complete collapse of the mission. We saw problems like this at Camp 2 this year, and that was just twelve hours distant from the surface, with only two camps in the human communications link. Likewise, we are going to have to completely reconsider the design of our helmet lights, because even lithium batteries begin to add up to significant weight. Similarly, the drills we use for rigging and climbing require heavy batteries. And there is a definite need to dry clothes at the underground camps. Everyone lost significant weight, again, on this project, despite consuming what we considered to be massive quantities of food. There were at least three incidents when the Camp 2 team was within

twelve hours of having to return to the surface for lack of food when a resupply mission arrived just in time.

We are considering a number of options for wireless, wired, or magnetic asynchronous communication for 2007. We are going to have to revisit the idea of small, lightweight hydropower for drill and helmet-light battery recharging. The issue of food remains probably the most daunting problem. I estimate anyone pushing from Camp 8 or 9 will be underground something like forty days. That will push the psychological envelope, as well. Some people on our crew in 2005 had a difficult time staying underground for more than a week. However, a few on the final thirteen-day push from Camp 2 were becoming comfortable with the idea of forgetting about the surface. This will be an essential adaptation. But medical conditions, mainly foot rashes and finger infections, are going to be a serious concern. In

any event, I think we are on the verge of something extraordinary at J2—a complete change in the game, and a complete revision of our perception of achievable remoteness inside this planet. The 2006 and 2007 J2 expeditions will give us a taste of this new frontier.

2005 J2 expedition team

- Franco Attolini [Mexico]
- Katarzyna Anna Biernacka [Poland]
- Marta Candel Ureña [Spain]
- Lewis Carroll [USA]
- Matt Covington [USA]
- Tjerk Dalhuisen [Netherlands]
- Luis Gabriel “Wicho” Diaz [Mexico]
- Yvonne Droms [USA]
- Tony Dwyer [Ireland]
- Tomasz Fiedorowicz [Poland]
- Michael Frazier [USA]
- Marcin Gala [Poland]
- Peter Hartley [UK]

- Bart Hogan [USA]
- Andi Hunter [USA]
- Katarzyna Kędracka [Poland]
- John Kerr [USA]
- Jon Lillestolen [USA]
- Mark Minton [USA]
- Artur Nowak [Poland]
- Enrique “Zape” Ogando Lastra [Spain]
- Marlena Ostrowska [Poland]
- Ignacio “Nacho” de Rafael Ramos [Spain]
- Thomas Shifflett [USA]
- Paweł Skoworodko [Poland]
- José Antonio Soriano Sánchez [Mexico]
- Bill Stone [USA]
- Mark Stover [USA]
- Anne Mariah Tapp [USA]
- Greg Tunnock [Australia]
- Gustavo Vela Turcott [Mexico]
- Alan Warild [Australia]
- Robbie Warke [UK]
- Paula Warke-Grgich [UK]
- Todd Warren [USA]
- Mark Wilson [Australia]

Resumen de la Expedición J2 2005

La cueva J2, en las alturas de Oaxaca cerca de la Cueva Cheve, fue explorada a una profundidad de 1101 metros. En ese punto continúa como un pasaje grande con una fuerte corriente de aire. Un sifón a -752 metros fue buceado, pero posteriormente se bajó el nivel del agua al escarbar en la parte rio abajo. Los espeleólogos esperan que J2 continúe y se una con la hasta ahora inaccesible parte del sistema entre el final actual de la Cueva Cheve y su resurgencia en la Cueva de la Mano, pero continúa siendo una gran distancia. Bill Stone discute los problemas de abastecimiento de comida y baterías a un posible Campamento 9 futuro.

AN EXCURSION TO SÓTANO DE LA CULEBRA

Terri Sprouse

After the vivid green mosses thick as a shag rug in the upper portions of the pit fade, beautiful black and thickly bedded limestone is found. The walls here are smooth and slick, and as I rappelled past them my feet stayed spread and planted as I skied down. With daylight fading in the pit's depths, the shape morphed from a canyon at the surface into that of a well, and the rope continued to plunge into darkness. Faint light filtered down from the surface as I passed rebelay after rebelay; all the while the floor of the pit held amorphous shapes and colors that my eyes failed to piece into a picture.

—Philip Rykwald

Having rigged the pit earlier in the day, Charley Savvas and Philip Rykwald were now relaxing back in camp, trying to describe the magnificence they had found as they created La Escalera, a bolted route down the east wall of Sótano de la Culebra. Hidden high in a remote area of the Sierra Gorda of Querétaro, the cave had remained unknown to cavers until recently, when Mexico City cavers were told of it by the locals. The initial explorers made several trips back to the cave early in 2004, but had underestimated its depth and ran out of rope before reaching the bottom. They returned with stories of profound depth, possibly as deep as Golondrinas. In November 2004, the cavers returned with enough rope, finally reached bottom, and then measured the rope length to determine its depth. A rough survey was made of the pit, and its depth was estimated to be 337 meters (see *AMCS*

terri@purificacion.org

Activities Newsletter 28, pages 7 and 10). In order to make a detailed map, Gabriel Garrido invited Peter Sprouse to survey the new pit. In June 2005, Peter put together rigging and survey teams and traveled to the high mountain village of Santa Mónica de las Tinajas to join the initial explorers for a survey of the cave. Now, back at camp, Charley and Philip confirmed to the rest of the crew, "It's as deep as they said it was." The next day the survey team would go in to take measurements and make a sketch of the pit.

It was during the Seventh Mexican National Caving Conference in Monterrey in February 2005 that Peter met Gabriel Garrido, a member of the Instituto Politécnico Nacional caving club of Mexico City. The club had put together a slick poster that described the discovery and contained a sketch of the pit. Gabriel and Peter maintained contact throughout the spring and discussed mapping the cave during the summer. In June, Barbara Luke, Peter, Philip, Charley, and I loaded into Peter's Land Cruiser, planning to visit several caving areas as we drove south before finally reaching Querétaro later in the week.

Our first objective was exploration of Cueva el Rutilo, a cave with an underground river that provides water for a ranch containing 2000 hectares. The ranch is located in Fe del Golfo, a small village near the town of Santander Jiménez in Tamaulipas. We spent some time locating our guide, who, once found, readily agreed to take us to the ranch. He took us down a long, dusty dirt road with many gates, only one of which was locked. We passed several

neighboring ranches and made many turns, finally arriving at a magnificent ranch house, with stained-glass windows and tiled patios, that perhaps was used as a weekend retreat. An untended cactus garden thrived there, despite neglect. Our guide first showed us a well that tapped into the river, and nearby was a trap door opening into a pit. Upon raising the trap door, we could hear the roar of the flowing river way below. This got us very excited, and we geared right up. Charley went down first, creating a rebelay over a steel beam that stretched across the pit. Then he zipped on down the shaft and was already on bottom when he noticed the pit had an extreme CO₂ excess—bad air. He stayed down just long enough to notice that the cave led off along a fissure that extended only a few meters before ending at a T-junction. He could hear roaring water beyond the fissure. Although the urge to explore the fissure was strong, the effect of the CO₂ was even more so. When Charley started feeling shortness of breath, he immediately turned around and started climbing out. Lightheadedness had set in even before he had completed a change-over to ascend. Not only was there bad air below, but also the cave was very hot and humid, making it a little harder to deal with. At some point during the climb out, he ascended beyond the mass of bad air, and he stopped to make further assessments of the shaft. There seemed to be an upper part to the fissure, leading off towards the river, maybe an upper in-feeder. When Charley emerged with the disappointing report of bad air, we realized that we would not be able to explore the roaring river, but most of us decided to

go down the shaft to have a peek anyway. Philip actually made a quick dash through the fissure and was able to make it to the water before having to turn back. This exciting cave will need to be revisited in the winter.

Then our guide led us over to a bat cave on the ranch next door, about a 1-kilometer hike. The locals call it Cueva del Guano. Fortunately, a cool breeze beckoned. The cave was in a 25-by-40-meter sinkhole that also contained large, elegant *higuerón* trees and cooing motmot birds. A short climbdown opened right up into a large chamber, with a borehole going straight ahead toward a bat colony. It was here that sketcher Barbara Luke acquired her moniker of Borehole Barbara, which had something to do with her borehole-sketching technique. The cave contained many tarantulas, as well as other spiders. Charley collected a pair of tarantulas and, not having a large enough specimen jar with him, deposited them in his small camera bag. This would provide some entertainment later, when Charley would offer to show his collection and a big hairy leg would come clawing out when the bag was unzipped. Team Borehole first mapped to the right and left in passages that circled the collapsed-sinkhole entrance. Straight ahead, the main passage of the cave was 25 meters wide and 15 meters tall, and went a ways to a small skylight. The cave continued smaller and wetter from there, but it got too wet and too full of bats to continue.

We hiked back to the house and left the ranch, saying goodbye to our guide in Fe del Golfo. Just north of Jiménez

we stopped at the Tiniebla mescal museum. The museum turned out to be a real treat. We entered through the restaurant, were presented with shot glasses, and were allowed to sample the mescal. We tasted the young, the middle, and the *añejo* versions. We then entered the museum and were pleased to discover that, in addition to the brewing vats and ageing barrels, original artwork lined the walls of each room, highlighting various artists. The paintings bordered on the surreal, incorporating agave in many of the images. We bought a bottle of the middle-aged mescal, which was so smooth that we realized, way too late, that we should have bought a case. We continued on into Ciudad Victoria and got a room at the Posada Don Diego, which is not far from the town square. There we showered and then had a late dinner at the Café Canton.

The next day we drove on to Gómez Farías, where we waited on the square awhile for our friend Jean Louis Lacaille Múzquiz. We passed the time by visiting Sótano de Gómez Farías, but we had only just located it when Jean Louis drove up. He warned us that a jaguar had been heard lurking in the area, so we were advised to be on the lookout. Although it is a crime punishable by jail time to kill a jaguar, some farmers have no choice but to hunt them when livestock are killed. He then offered to take us to a newly found deep pit. We drove north of Gómez Farías toward El Azteca and stopped on the ranch of Don Pablo Berrones. First he showed us a nice-looking 15-meter pit



Philip entering Sótano de Berrones. *Peter Sprouse.*

on the left side of the road, which is probably Sótano del Fin. We then geared up and started a hike. We saw that Jean Louis had done quite a bit of work in preparation for our visit; he had already chopped a path through the dense vegetation and flagged the trail to the pit. It turned out to be a wonderful discovery. The entrance drop to Sótano de Berrones is 12 meters wide and 67 meters deep. We rigged from a tree that extended over the entrance, making an easy free rappel. The pit belled out into a sloping borehole covered with breakdown that led to a level mud floor. Team Borehole mapped the passage as it circled to the left and, after a short muddy drop, ended in a muddy room. We climbed out and derigged just as it got dark, and then hiked back to the trucks. We rented the only room that had *clima* at the Posada de el Cielo (www.posadadeelcielo.com), which has a great eating and cooking area and space for camping if desired.

Before we were out of bed the next day, Jean Louis had already talked to the locals and obtained information on two new pits for us to explore on a future trip. We met him for breakfast in a restaurant surrounded by native *palmas*

Cueva del Guano. *Peter Sprouse.*





Jean Louis rappelling into Sótano de los García. *Peter Sprouse.*

and *plantas*. The restaurant doubled as a nursery, serving up *muchas gorditas* and a great display of local flora. We did not go into the first pit that Jean Louis took us to, which was owned by the Álvarez family, but it looked really inviting. It took an arroyo and had a natural bridge over an approximately 22-meter drop. We marked the location and later determined it to be Sótano Escondido, which was mapped in 1974. Next, Jean Louis took us to Sótano de los García, which is a two-drop, offset well 35 meters deep. It is located south of the highway near Sótano de Gómez Farías. The pit had recently been used as a trash dump, with a mattress and twelve tires having been thrown in. The pit walls contained skid marks from the thrown tires, causing it to be nicknamed the Tired Pit. A bolt was set at the top of the second drop, just below a natural anchor, and then there were two redirects.

Afterward we loaded up the trucks and headed down to the Río Frio for a swim at La Florida. The water was wonderfully cool, and many people went off the rope swing. We bade goodbye to Jean Louis and drove south toward Mante. We stopped at Cueva de El Abra, then drove on to Xilitla, where we got a room at the Hotel María Dolores.

Terri at Sótano de la Culebra. *Peter Sprouse.*

Early the next day, Peter stopped in to visit the municipal offices above the library, then we went on to Cruztitla, where we got permission to explore in what they called Huateacán. Peter, John Fogarty, and a local guide had surveyed this cave the year before, calling it Cueva de la Chuparrosa, and had gotten only a short way from the entrance when they came upon the first drop. Since they had no rope, they left well-placed flagging at their last station, hoping to make a return trip. When the survey was plotted, Huateacán seemed to be a possible through-trip connection with a resurgence that was surveyed on last year's trip, Cueva Vidal Ramos (see *AMCS Activities Newsletter* 28, pp. 173–176). The goal for this trip was to bring rope into Huateacán to determine whether the two caves would connect.

The approach to the cave is a steep climb-down into a sink formed in an arroyo. It was obvious that the cave takes a lot of water, since the rock at the entrance was washed clean. The entrance was a maze of skylighted rooms, then the cave took off in a series of down-climbs, but soon came to the first drop. Charley and Philip rigged, while Borehole Barbara and

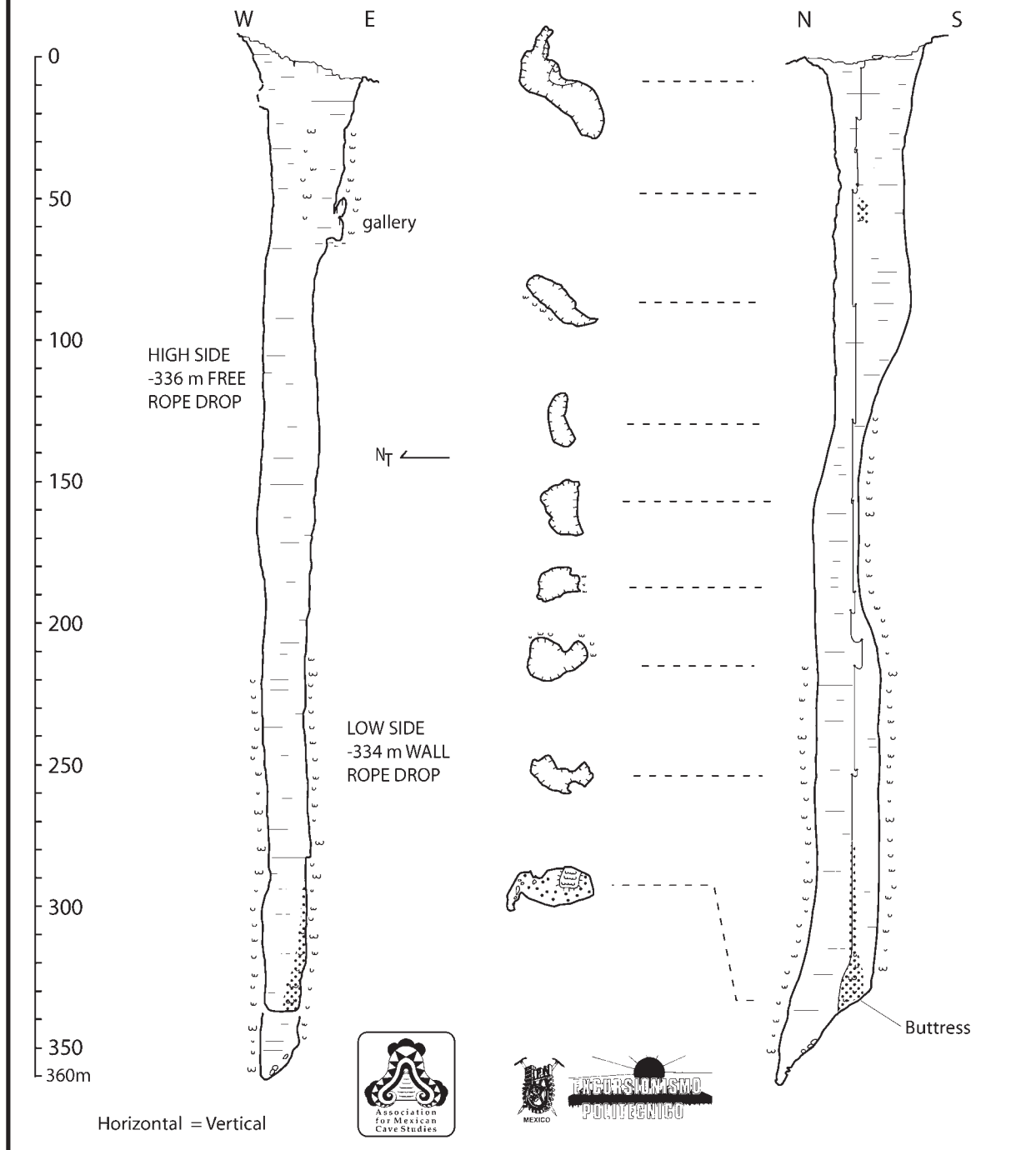
Terri surveyed. Peter had gone back into town to get gear we had forgotten, but soon passed the surveyors and followed the riggers in. He found them below drop three at a low airspace. Then Peter came back to rejoin the survey crew, and we mapped on to the low airspace. We knew early on that we probably would not be able to stay out of the water. After the first drop we waded a shallow pool, then one a little deeper. About this time, Charley and Philip came back through, reporting that they had located the last survey station in Vidal Ramos and made the connection. The rigging team then left the cave, while the survey team mapped on through the low air and into bigger passage beyond. At the fourth drop the survey tied in. Although the plan was for the survey team to climb back out after the survey was completed, Barbara and Terri decided to go for a through trip, while Peter derigged. Later that night we were surprised to find a roadside taco stand still open when we drove back toward town. We must have had five or six tacos each, then made it back to the Hotel Dolores. We decorated the room with smelly, wet gear and crashed well after midnight.

We got an early start leaving Xilitla the next morning, not eating breakfast until we had reached Jalpan. We needed to meet Gabriel Garrido, Alejandro Villagrán, and Gustavo Vela across the Sierra Gorda in San Joaquin



SOTANO DE LA CULEBRA

Querétaro, México



Suunto, compass and fiberglass tape survey June 9-10 2005 by:

Barbara Luke
Philip Rykwalder
Charlie Savvas
Peter Sprouse
Terri Whitfield

Gustavo Vela
Gabriel Garrido and
Alejandro Villagrán of the Asociación de
Excursionismo del Instituto Politécnico Nacional

Cartography by Barbara Luke
Digitized by Philip Rykwalder

Length: 442 meters
Depth: 360 meters

in mid-afternoon. We made a brief stop at one of the highest passes in the range, the Pinal de Amoles, after which we noticed that the vegetation is dramatically different on the western slope. The landscape changed from verdant forest to dry, dusty soil with fewer tall trees, less vegetation, and occasional arroyos. This drive through the mountains was scenic up until the part where we saw a dead horse on the side of the road with a dog feeding on the carcass, his head fully buried in the horse's ass. This was right before lunch. After a full morning spent traversing the long, winding mountain roads, we met the D.F. cavers in San Joaquín and joined them for lunch. We picked up a few supplies, then got back on the mountain road for what we thought would be a short trip.

We were excited to learn that a new road had just been cut through the mountain, reducing our travel time to camp considerably, but the new road turned out to be very sporting. Cut three hundred meters above the canyon floor, the winding road was so narrow in places that you did not need to get out of the car to enjoy the scenic overlook. The new road still had loose rock above and had already been scarred by massive rockslides, the remnants of which were visible down below. The road was in good shape because it was new, but we wondered how long it would remain stable, since it was apparent it would need a lot of maintenance. After a long, winding trek around the mountain, we made it to the top, where the new road merged into an old one that continued on through a considerable number of villages. After many turns and much route-finding, we finally made it to Santa Mónica del las Tinajas, which is a very remote village nestled way back in the mountains. Gabriel had befriended some of the locals, who arranged for us to camp in one of the few vacant flat areas in town. Before setting up camp we all decided to hike down to get a quick peek at Sótano de la Culebra.

Hidden among the karst and dense vegetation in a *dolina* on the arid, high mountain, the long and sinuous entrance to Sótano de la Culebra (Pit of the Snake) gives no hint of its depth.

Camp near Sótano de la Culebra.
Peter Sprouse.

There is no gaping hole wide enough for swallows to swoop or thrill-seekers to BASE-jump. In places, the narrow entrance could almost be jumped across. There is no dragon's breath of fog ascending from the pit's deep well. There is no ray of sun that illuminates the full length of the narrow shaft. Even the first few rock tosses were inconclusive, the sound seemingly lost in the void. But our pulses raced when the last tosses were answered with a much delayed, quite muffled, but very definite and echoing BOAAAAM!

We got up early the next day and headed off to the *sótano*. A survey team of Barbara, Peter, and Terri began the perimeter survey, while the rigging team, Charley and Philip, scouted for a good spot. They decided to drop a rope on the low side just to get down into the pit and get a better view of the entrance drop and determine where to place the main rope. In order to survey and sketch a pit of this depth, we needed rebelay stations that would be used to set survey stations. They looked for a route along the wall of the pit that would not produce an overhung drop.

The low side was rigged, but the route soon dropped to a leaf- and rock-covered slope that then poured over into the main well. Rigging here would cause major rock-fall on anyone climbing in the pit. The team briefly considered bolting a traverse line over the debris slide, but decided it would take too much hammer-drill battery juice and still leave the place too risky. When those of us at the top heard Charley

exclaim, "It's not gonna work, dude," we realized they would have to abandon this as a location for the main rope. However, their rope was in perfect position for the survey team to gain access to a side passage going off the north end of the pit. So the rigging team came out and started looking for another rig point, while the survey team surveyed the side lead to a small room.

While this side passage was surveyed, Charley and Philip chopped a path along a high ridge that was covered with *maguey de peña* and solid limestone boulders. The rope was tied around a huge boulder, then 300 meters of rope was gently fed over the drop. It went slowly at first, hanging up a time or two, and then it started to whiz. Soon the rope was taut, and Philip, who carried a coiled 60-meter rope, and Charley began the arduous task of bolting the drop. The drop began with a long rock wall, covered with moss and lichens and ending in a fin, then the pit narrowed into a deep well, and the route ran over smooth rock, making it difficult for Charley to brace himself in order to drill the bolt holes. In places he was able to wedge a finger into bedding-plane gaps to get enough grip to provide pressure on the drill. After tapping in a bolt and placing the hanger, he then had to lift the heavy rope with one arm, then hold it long enough to tie a knot with the other hand, slide in a maillon, and attach it to the hanger. Charley and Philip put in fourteen rebelay stations, using three 10-millimeter Cancord ropes (183, 115, and 60 meters), with the last rope tied



to the second midway down the last long drop, leaving 15 meters on the floor. So what could have been a daunting task for the survey team was transformed by the creation of a climbing route that came to be known as La Escalera (The Ladder).

The next day most of us headed off to the cave after a hearty breakfast. Taking the high trail past the school along the fence line, we soon reached the *dolina* that led to the pit. Gustavo, taking photographs, and Alejandro entered the pit first, and I followed. Then the team of Peter, Gabriel, and Barbara descended to survey. We were anxious to see the shape of the *culebra* from underground. The pit was magnificent. Negotiating the route was easy with an SRT descender on the skinny rope. For part of the rappel, the route flowed down a ridge that formed a curve of the *culebra*, allowing the rappeller to pull himself across the ridge to view around a bend. After a while the air in the pit became cooler. The bend in the canyon wall smoothed out, and we dropped into a deep, dark well defined by massive flowstone columns along the south wall. The pit depth was hard to judge as we continued to pass the rebelay. At some point toward the end, the rope hung free, leading to one final knot to cross before descending over an enormous flowstone slope. Beyond the slope, the pit bottoms out at 336 meters, 3 meters deeper than the short side of Golondrinas. At the bottom of the flowstone

slope, the well was quite cool, sending the survey team on a search for polypro in their packs. Beyond the flowstone slope, the floor slopes steeply down over rocks and leaves to a small room, then ends. Total depth of the cave is 360 meters.

The cool temperature and forced stops at the rebelay made for perfect conditions for climbing back out. I was really stoked about making this climb, not because of the depth of the pit or the technical challenge of crossing fourteen rebelay and one knot, but because I anticipated the powerful spiritual experience of climbing toward the light from such a deep, dark place. La Escalera is a gloriously intimate route, revealing the crags, crevices, and many colors of the rock face. In some places, the rock wall was smooth and dry; in other places, algae grew. Some cracks had small ferns, others just composting leaves. Only a few ledges had rocks, which the rigging team had placed out of reach. As I climbed, I developed a growing sense of satisfaction from being able to see the pit walls, up close, slowly and relaxed enough to feel the natural air, to be in that space, suspended, but safe and secure, on a short pitch of rope. No bounce. No dangle. No tandem climb,



Barbara nearing the bottom of Culebra.
Peter Sprouse.

just me on rope, in a deep, dank, cool-ass pit. I established a rhythm as I felt my mind, body, and spirit all engaged in negotiating the climb. I slid into the zone and, with my senses heightened, climbed toward the ever-widening circle of light.

Una Excursión al Sótano de la Culebra

Espeleólogos de Texas se unieron a otros de la Ciudad de México para hacer un mejor mapa del Sótano de la Culebra, la nueva cueva profunda en Querétaro que fue encontrada por espeleólogos mexicanos. El tiro inicial es de 336 metros y la profundidad total es de 360 metros. Durante el viaje hacia la cueva los espeleólogos texanos también visitaron cuevas cerca de Santander Jiménez y Gómez Farías, Tamaulipas, y Xilitla, San Luis Potosí.

A DREAM FULFILLED AT COYOLATL

Gustavo Vela Turcott

Since 1980, Georges Feller, Richard Grebeude, François Saussus, and other members of the Grupe Spéléo Alpin Belge have delved into the Sierra Negra in southern Puebla, trying to uncover its deepest secrets. In 1985, they explored several resurgence caves in the lower parts of the mountains, but one was especially big. They named it Coyolatl, which means *coyote water* in Nahuatl, and surveyed over 19 kilometers upstream into the mountain in five weeks, reaching a highest point 240 meters above the entrance, so far into the heart of the mountain that they established an underground camp 5 kilometers in, which they used as their base for exploration for four days. The cave's entrance is 80 meters high, and the water flowing from it is the source of the Río Coyolapa. They left several difficult climbs behind, which induced them to think that they could connect to entrances high on the mountain. For twenty-one years they have continued working toward a dream, the discovery of a through-trip in the area, from an upper entrance to the resurgence.

During the same expedition, several other caves were found in the areas of Loma Bonita, Alcomunga, El Mirador, Ocotempa, and Huizmaloc, among them Aztotempa, 700 meters deep and 4 kilometers long, and Pozo Verde, a deep pit entrance to what became Sistema Ocotempa. A total of 35 kilometers of passage was discovered in 1985.

During their first trip in 1987, searches in the high zones around Ocotempa, Huizmaloc, Xiapa, and San Miguel Eloxochitlán encountered caves with depths of 300, 500, 600, and 750

meters. Twenty-five kilometers of passages were surveyed year. During a second expedition, in December 1987, a team of Belgian and U.S. cavers reached a sump in Ocotempa at a depth of 1030 meters.

In 1988 there was a four-month expedition comprising cavers from four groups. The Belgians found another cave near Pozo Verde, OC-11, whose entrance was 40 meters higher. OC-11 was explored down a series of drops, including ones of 180 and 140 meters, to connect with Ocotempa at -900 meters, giving the system a depth of 1070 meters.

In March of that year, after finding a cave next to a trail, the cavers asked some locals what its name was. "Akemati . . . akemati." Therefore they named the cave that, only to discover later that *akemati* means "I don't know" in Nahuatl. But the name has a ring to it, so they decided to keep it. Seven cavers explored and surveyed the cave in eight days, impressive in comparison to the usual pace of caving in other systems. They worked in teams of two or three, using 8- and 9-millimeter rope and moving fast. When the numbers were compiled, they found that Akemati was 3356 meters long and 1135 meters deep.

During the same expedition, they explored other caves 400, 700, and 800 meters deep.

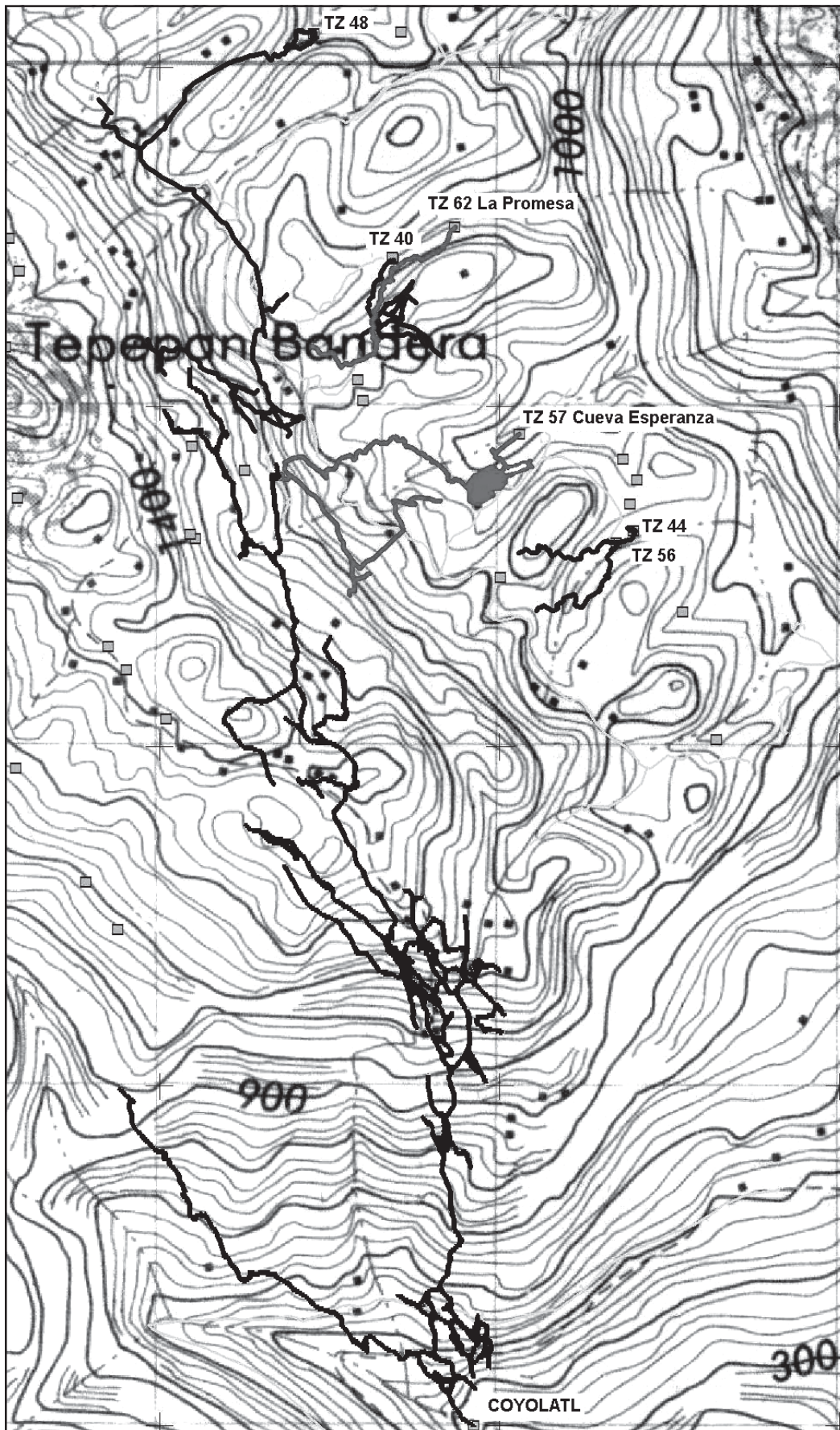
In 1989 they worked mostly in the lower zones and explored more of the Atlxicaya resurgence that had been found in 1982 and explored to about 1.5 kilometers in 1985. Five cavers

surveyed over 10 kilometers of new passages, giving a total of 12 kilometers and going.

The Ocotempa area was explored again in 1990. Checking for upper entrances close to Akemati, the explorers found a cave that was surveyed to -840 meters, where it joined a passage that looked somewhat familiar. They realized that they were in Akemati and named the cave Akemasup, or Akemati Superior. With this important connection, Akemati became a system and got 91 meters deeper. It is currently 1226 meters deep and 4918 meters long. The deepest and farthest point in Akemati is only 3 kilometers in a straight line from the highest and farthest point in Coyolatl. That same year, the Belgians explored another very vertical cave with pit after pit, almost devoid of horizontal

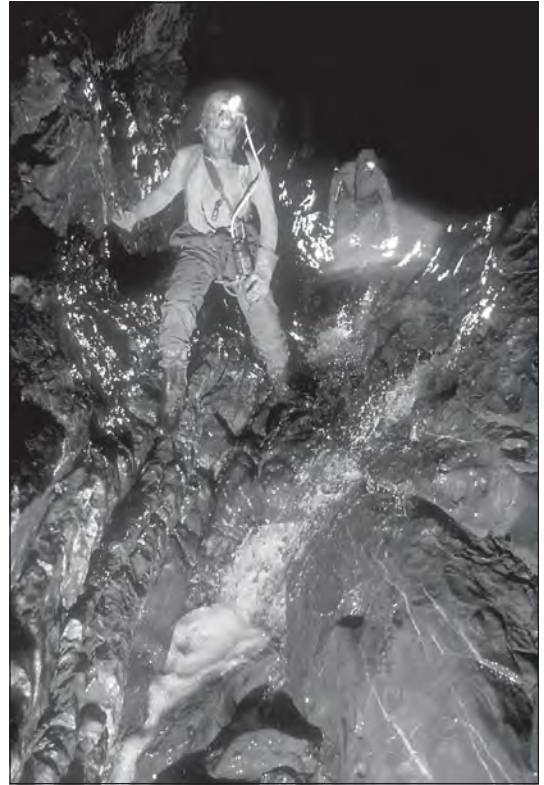
The entrance to Esperanza (TZ-57). *Gustavo Vela.*







Descending the mountain after the expedition.



Georges Feller and Richard Grebeude near the connection between Esperanza and Coyolatl.

Photos by Gustavo Vela

Franco Attolini admiring beautiful formations in Esperanza-Coyolatl.



Dinner in GSAB 2006 base camp.



passages, down to a depth of 1015 meters over a distance of only 1.5 kilometers. They named it Akemabis.

During the 1990s, explorations continued, several new caves were found, and more passages surveyed.

For the 2000 expedition, four Mexican cavers joined the Belgians, marking a new era in the projects. Since then, every trip has been in collaboration with Mexicans, bringing new points of view to the expeditions. That year, the base camp was established in Tepepan Bandera, in the middle of the limestone massif, just above Coyolatl, with the hope of finding a cave that would lead down all the way to the resurgence. But no such cave was found.

In 2002, several caves were found; ten were over 100 meters deep, and three were 200 meters. TZ-48 reached -242 meters and continued, right on top of Coyolatl.

In 2003, the base camp was set up in Tepepan Zaragoza, and the exploration of TZ-48 continued, reaching -480 meters and only 100 meters from one of the most remote points in Coyolatl, but a massive boulder choke stopped exploration 4 kilometers from the entrance. While ridgewalking at the end of the expedition, some cavers found an entrance 20 meters high and 25 meters wide, and they walked for about 150 meters through passage that got smaller and smaller, until it was a canyon 2 meters wide and 7 meters high that apparently ended in a small room.

A small opening 3 meters high was not explored for lack of time, and it was named Cueva de la Esperanza, or TZ-57.

During the 2005 expedition, several caves were found and explored, but two of them were most prominent in some cavers' minds. An hour away from base camp was TZ-57. They set up a trip, reached the feature that had not been pushed the year before, and found it continued through two short drops that led to a 60-meter pit, where they rappelled into a big room 100 meters wide and 170 meters long. The exploration—and the cave—continued through massive blocks and a series of meanders, traverses, downclimbs, and pits. The cavers were lured on by a constant air flow. When they reached another pit, they dropped a rock, and after counting off the seconds, somebody said, "It has to be over 80 meters."

Very technical rigging and a traverse marked the beginning of the descent, since several loose rocks and sharp edges had to be avoided. Finally the explorers descended the 110-meter pit. From the bottom, a larger passage, 8 meters wide and 15 meters high with some breakdown, led to a 20-meter pit that was blind, and a 20-meter climb up out of it was needed to reach a passage 25 meters wide and high. Several



The view out of the Coyolatl entrance.
Gustavo Vela.

rigging and exploration trips had been needed to reach that point. During the last one, the large passages and rooms and the water flow made them think that they might already be in the main drain. Were they already in Coyolatl? The expedition left several leads, including a 20-meter pit, in TZ-57.

TZ-62, La Promesa, reached 200 meters in depth and 500 meters in length, but its exploration stopped when time ran out.

In 2006, eleven Belgian cavers, two Mexicans, and one Spaniard met in the Sierra Negra to continue with the leads from the previous year. One of the descending passages in TZ-57 was only 100 meters away from TZ-48. But several attempts to find a route through the breakdown were unsuccessful. Other descending passages added almost 1000 meters to the cave, but did not lead to Coyolatl. The 20-meter pit lead from 2005 was an exciting prospect, however, and the survey data indicated

Franco Attolini crawls through solution sculpturing in the system.
Gustavo Vela.



that Coyolatl was only 20 meters away. Georges Feller and François Saussus, members of the 1985 expedition that had first explored Coyolatl, rigged a rope and dropped the pit, reaching a stream passage that they did not recognize. Maybe they weren't in Coyolatl after all. They walked in that passage for an hour until something caught their eyes—a chocolate wrapper, not trash, but a survey marker twenty-one years old. By dropping the pit, they had made the connection.

While the expedition was also pushing TZ-62 to 440 meters deep and 1700 meters long, a team prepared for the

historic through-trip. Eight cavers gathered all necessary material to be the first to travel through the earth from Esperanza to Coyolatl. Once they reached Coyolatl, the enormous passages, up to 50 meters high, and the strong water flow in the main river left everybody breathless. The trip took ten hours, from the TZ-57 entrance at 1000 meters elevation to the resurgence at Coyolatl at 380 meters. Thus the through trip is 620 meters deep and 7 kilometers long, making it the third-deepest through trip in Mexico, below Sistema Purificación, with a trip 8 kilometers long and 820 meters deep (total depth of system 953

meters), and Sistema Tepepa, 8 kilometers long and 769 meters deep (total depth 899 meters).

When all the data are added up, Esperanza-Coyolatl is 23 kilometers long and 620 meters deep. After so many expeditions and the exploration of so many meters into the Sierra Negra, the connection was a dream come true. Happiness!

The GSAB will certainly continue exploring and discovering more cave in the state of Puebla, and collaboration with Mexican cavers will continue to be an intrinsic part of the work.

Coyolatl: El Sueño Encontrado

Durante la expedición 2006 al sur de Puebla por espeleólogos belgas y mexicanos, la Cueva Esperanza en las alturas de la Sierra Negra fue conectada a la cueva Coyolatl, una resurgencia, teniendo la travesía 620 metros de desnivel y 7 kilómetros de longitud. La longitud total del sistema es ahora de 23 kilómetros. La cueva TZ-62 en la misma zona fue explorada a 440 metros de profundidad. El artículo incluye un resumen del trabajo realizado por los belgas en la zona desde 1980.

SÓTANO DE LOS HERNÁNDEZ, CAVE OF MANY PITCHES

Mark Crapelle

This trip started just like most caving trips. Chris Lloyd and I left Guadalajara a little late (noon) so that we could arrive at San Joaquín, Querétaro, just after dark. We stopped for dinner and to find out exactly where the cave entrance was. As is usual in Mexico, reports varied from “It’s just down the road” to “You’ll never get there tonight,” a range from a short, easy drive to a horrendously long four-wheel-drive epic that should wait until morning. It was a pleasant surprise to find that Los Hernández was less than a half-hour drive down a nice dirt road. The most difficult part of the drive was a ridiculously steep slope in the town of San Joaquín. It took three tries and a bit of burning clutch to make it up that one. Once in the hamlet of Los Hernández, we spotted a big bonfire that the crew from the Sociedad Mexicana de Exploraciones Subterráneas had going. Yelling down from the road, we were given directions to get down into the huge sink. Besides Chris and me, the group comprised Mexican cavers Ramón Espinasa, Victor Chávez, Susana Balderas, José Guerrero, Roberto Barrero, and Gustavo Vela and Americans David Jones and Ron Delano.

Delayed one day by van repairs and work commitments in Guadalajara, we had hoped that they would have already rigged quite a bit of the cave. Unfortunately, they had been waiting for us to arrive with the 150-meter rope and had spent the day settling in. Relieved that we had finally arrived, they were

chomping at the bit to get into the cave the following day. We were about to start reexploring a cave with a long and intriguing history. It was first explored in 1977 by an American group, who pushed it to a sump at –330 meters the following year. In the 1980s, the Grupo Espeleológico Universitario at UNAM, led by Noe Delgado, made various trips and produced a sketch map showing fourteen pitches to the same sump. Since the 1980s, the cave has been visited regularly by various Mexican caving groups. There is a beautiful spot to camp right by the entrance. It is only a five-hour drive from Mexico City, and the historic old town of San Joaquín is a bonus. Because there is a local caving group in San Joaquín and there has been caving in the area for many years, there are few hassles with local landowners or local communities.

Essentially a series of pitches that never seems to end, the cave is a perfect place to hone your rigging and rope-climbing skills. Trips were usually just for a long weekend, and the cave was never left rigged, so groups usually got down only a couple hundred meters. But in 1996 rumors started circulating that the cave was not actually finished. After a series of groups ran out of rope trying to bottom the cave, the Asociación de Excursionismo del Instituto Politécnico Nacional launched an expedition in February 1998. Rigging more pitches than are found in the original survey, they, based on their rough survey, estimated that they had reached the –400-meter mark and had passed the sump that the Americans had run into. Since the IPN group had not returned in three years and little interest was being shown, Victor Chávez of

GEU decided to recruit the SMES, who checked with Ricardo Arias of IPN, to continue the exploration.

The first thing we learned was that Easter is a perfect time to visit this cave. Conditions are much drier and more comfortable than you would find earlier in the dry season. Splitting into several groups and staggering our entrance times, on our first day of caving we were able to rig beyond where the Politécnico group had gotten to. This was mainly due to the dry conditions, good coordination among the groups, and the rigging skills and motivation of José and Victor. José could only be there for one day, but had been involved in previous efforts to push the cave and really wanted to get into new territory. On that first day, several pitches past where the Politécnico group had been, the final pushing and rigging team, José, Gustavo, and I, ran into a bit of a breakdown pile that looked a lot like a dead end. I must admit that at that point I was ready to bolt, but we had more rope, and José managed to squeeze his way through. The character of the cave changes at this point. Above is a series of big, open, clean-washed pitches, while below was looking very muddy, significantly smaller, and quite a bit wetter. But it was still going and still drafting.

All in all, it was a pretty successful start to the expedition. A tired but satisfied group reviewed the day around the fire that night. We had gotten past the Politécnico Room and a nasty squeeze, plus we had surveyed about a third of the distance that we had rigged. A resurvey of the cave was being done because the Americans published a rigging list but not a map and the Politécnico survey was more of a sketch

Reprinted from the *Canadian Caver* 59, 2002.

crapelle@yahoo.com

than a map (see *AMCS Activities Newsletter* 23, page 12).

The following day was pretty much a rest day, but Roberto and Victor had the energy to go back in. They returned with news that the passage continued and was opening up again. That set the tone for the rest of the week. We now knew that we had a cave going into new passage. There was even lots of talk about preparing for a return the next year and the need to find a spot for an underground camp.

Within a couple of days we had surveyed to the squeeze, and it was obvious what had confused the previous expeditions. The upper part of the cave is a series of pitches. Because each group rigged differently, they came up with different numbers of pitches and used very different numbers for the pitches and rope lengths. Without surveying or reaching the obvious squeeze, it is difficult to pinpoint exactly where you are.

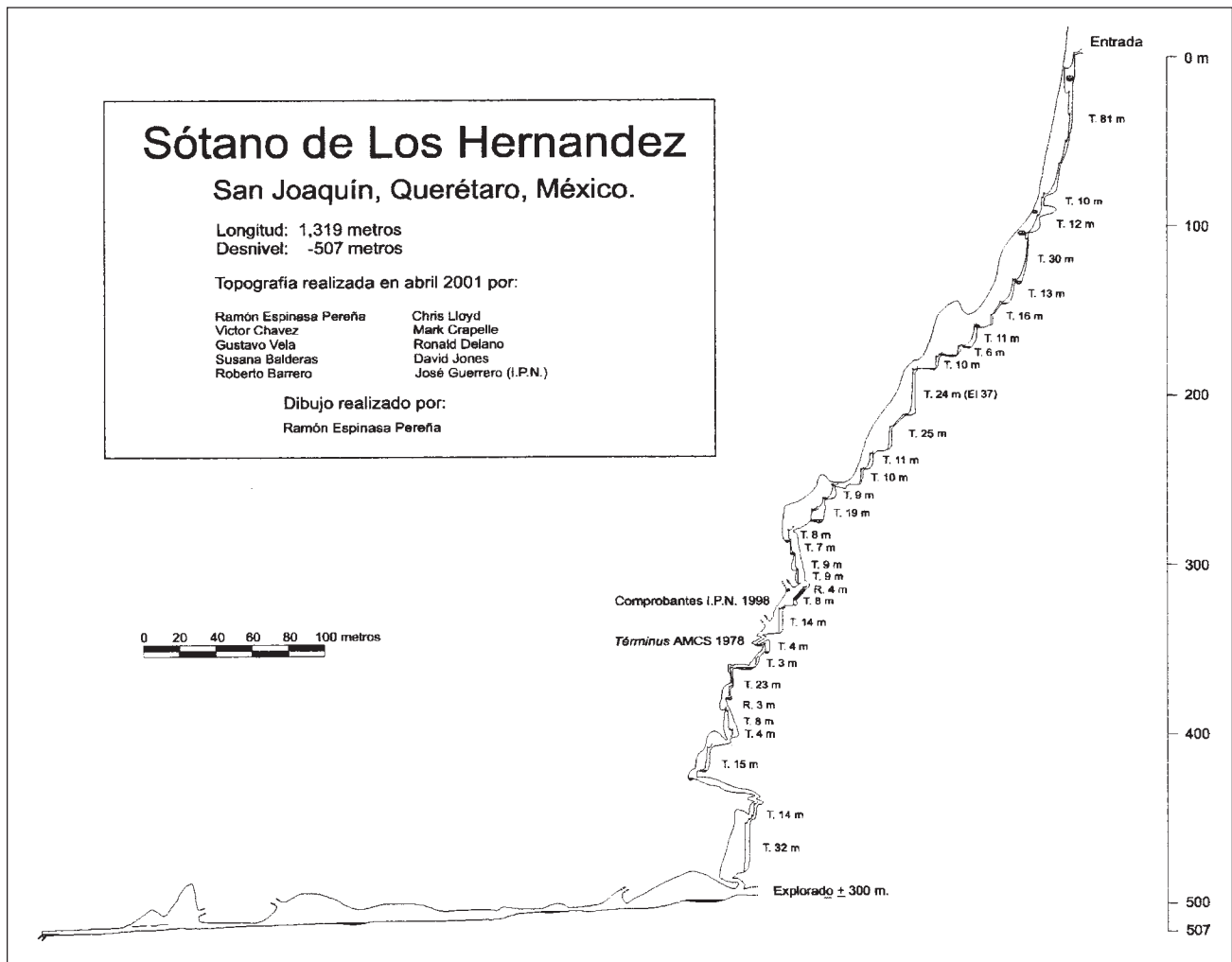
Our survey put the squeeze within 10 meters of where the Americans had found the sump during higher water. We also found out from the locals that there used to be a stream that entered the cave year-round. It now only flows in the wet season. So it turns out that none of the other groups had gotten past where the Americans had been. We had been lured to the cave with the story of a 400-meter-deep, going cave where the sump had dried up. We were pretty lucky that when we got there the sump had actually dried up.

The rest of the expedition was the sort of grind that you expect when pushing such a vertical cave. Everyone settled into caving every second day, and the trips lasted ten to twenty hours. Days off were spent lazing around camp, visiting town, or taking in some of the local ruins. Very civilized. The last push day saw six cavers spending seventeen to twenty-three hours underground and

over 600 meters of passage surveyed to a sump with no obvious way on. This was followed by a couple of very long, hard days derigging the cave. By the last day we were very tired, but also very satisfied with the results of the trip.

This was the deepest cave that I had ever done, and my vertical technique sure was better by the end of the trip. By the last push, it was taking about five hours to get out, and four of those hours were on rope. The rebelayes seemed endless. The price of glory, I guess. From a Canadian perspective it was a pretty pleasant cave, 10 degrees Celsius, and, strangely, the deeper you got, the warmer the water got. This was a very good thing, because we eventually dropped into a horizontal passage where we ended up having to survey in chest-deep water.

All in all, Sótano de Los Hernández was one of the most enjoyable and most successful expeditions I have ever taken part in. The group was a talented mix



of Mexicans and gringos, the camping area was ideal, the locals were friendly and helpful, the weather was perfect, and the cave is an absolutely classic vertical cave. Above the squeeze you have a series of big, beautiful, clean-washed drops. The squeeze and the muddy passage with the cold pools

remind you that caving is not always pleasant. Then you reach a spectacular big pitch that drops you into a huge meandering streamway. About 600 meters downstream you reach a sump, and upstream (unsurveyed) ends in a 50-by-20-meter room with a huge dome in the ceiling 20 meters above. Ramón

informed us that many of the caves in the area are like this—straight down until you intercept a horizontal streamway that eventually sumps. And we broke the 500-meter barrier without even cheating.

Sótano de Los Hernández, Cueva de Muchos Tiros

En 2001, el sifón que había detenido la exploración del Sótano de Los Hernández, Querétaro, fue encontrado en nivel bajo y la cueva fue explorada una vez más a través de muchos tiros pequeños hasta un pasaje con una corriente de agua. La profundidad topografiada se incrementó a 507 metros y la longitud a 1319 metros. Varios cientos de metros de pasaje río arriba fueron vistos pero no explorados.

REPORT ON THE INCIDENT AND RECOVERY EFFORTS AT RESUMIDERO OZTOQUITO, PUEBLA

Edited by Fanny Monreal

This report appeared in Mundos Subterráneos number 14–15, bulletin of Unión Mexicana de Agrupaciones Espeleológicas. It was compiled by the Grupo Espeleológico Universitario, UNAM, in May 2004. The English translation for the AMCS was done by Fofo Gonzalez. It has been slightly revised. The map of Resumidero Oztoquito, which was not in the report, is copied from Base Draco 8, 1991, page 27.

On Friday, April 9, several Mexican cavers received the urgent message that in Resumidero Oztoquito, in the state of Puebla, Mariano Fuentes, caver and cave diver, had attempted to dive its sump and that after the usual time and any safety margin, accounting for the amount of air in his tanks, he had not resurfaced. The phone call was a request for help in organizing a rescue. This is the general report that the Grupo Espeleológico Universitario has prepared about this event. It discusses how and under what circumstances Mariano Fuentes entered the sump, the recovery effort, with a complete account of all actions, rescue, and camp-ground management. It concludes with

general observations.

The GEU has prepared this report for the following reasons. The GEU was involved in every step of the recovery; therefore it has an obligation to report its intervention. Mexico does not yet have a body in charge of caving accident analysis, which has negatively influenced a culture of cave safety. The information that was available through mass media was sometimes confusing or incomplete. Not many, but some articles were published based on false information. The GEU would like to decrease the misinformation.

INCIDENT BACKGROUND

On Tuesday, April 6, 2004, José Montiel,¹ leader of the caving group Asociación Base Draco,² Fernando Chávez, and Alberto Maldonado left Mexico City with Mariano Fuentes,³ a guest for the trip, heading to Puebla, Mexico⁴. The goal for the small expedition was, based on published information, to attempt a connection between two pits located in the municipality of Tzicatlacoyan, close to the town of San José Balbanera, in the state of Puebla.

José Montiel, based on his experience and information, maintains the

hypothesis that the pits Oztoque and Oztoquito can be connected. Both pits, according to the map drawn from the survey data by José Montiel, have terminal sumps⁵. The caves' plans show that these two caves could be connected underground. To prove this hypothesis the sumps had to be dived.

On Wednesday, April 7, three of the four party members carried into the cave “two sets of diving gear,” rappelling “. . . down the 122 meter (and only) pit of the Oztoquito cave.” The gear introduced into the cave and described by José Montiel was “food and gear for up to three days inside the cave.” He continues, “Alberto, Mariano, and Montiel made a total of seven trips (3, 2 and 2) to bring the gear into the cave. The campground was established, and it was verified that everything was satisfactory before going to sleep.” It is not known, based on the limited information, if there was an additional campground inside the cave.⁶ Fernando, the other member of this trip, apparently didn't enter the cave up to this point.

Of Thursday, April 8, José Montiel says, “After waking up and having

1. This part of the background has been based in José Montiel's version, published on the Internet before the recovery was formally initiated. He points out that the facts are not entirely correct. It is necessary to state that this is not a research project about the circumstances leading to the accident that ended up taking Mariano Fuentes's life, but a report on the participation of the GEU in the recovery efforts where, as an addendum, some comments that we consider necessary will be included. It was discussed among cavers and divers that it will be very difficult to obtain a single version of the events that occurred before Mariano Fuentes

didn't resurface after his dive and the incident was reported, which is something that should be taken into account before making any judgments.

2. Asociación Base Draco is a caving group from Mexico. We don't know if all the members of the expedition were part of the group or just friends, but the trip is considered to have been organized by the group Draco.

3. Mariano Fuentes was not a member of José Montiel's Draco group.

4. José Montiel pointed out in an electronic posting on April 12 that “his small son” was present as well. There is no more information on whether

this refers to one of Mr. Montiel's daughters or the son of one of the other members of the party. It is not known if the minor entered the cave. [From Alberto Maldonado's account, it was Fernando Chávez's son. Note from the translator].

5. A sump is a completely water-filled passage in a cave. Sometimes this marks the end of the humanly passable passages in a cave. To determine if this is the case or if the cave continues it has to be dived. This type of diving is the most dangerous one.

6. From Alberto Maldonado's account, they camped inside the cave [Note from the translator].

breakfast the diving gear was prepared and the 600-meter underground passage up to the ‘high sump’ was traversed. Mariano was geared up.

“Montiel tended the guideline, which was anchored to a hanger. Alberto, on a raft, was at the very mouth of the sump. Mariano dived a first time and was excited due to the spectacular view of the sump. He returned because his guideline got entangled. The three made some adjustments in preparation for a second attempt, using the same original plan: an hour and a half would be allowed before anything else. In case Mariano connected the caves but could not return through the sump, we would leave Oztoquito and rig Oztoque, bringing material for Mariano to rest.” Montiel also said, “Mariano was excited, and he said that diving the sump was achievable and that he really felt positive about continuing through it.”⁷

“[The same Thursday] Mariano dove a second time. After the safety time elapsed, and without having signs of him, Montiel told Alberto that they should exit and rig the other cave.

“As much time as possible was spent at that sump, leaving gear behind in case Mariano surfaced through that side of the sump. A strobe light was left in place, turned on, the raft and gear were placed so that they would be easy to locate, and extra water and carbide were stashed also. Montiel started to ascend to rig the other cave, but told Alberto that he would call for help before going to Oztoque. Montiel asked Alberto to get gear for Mariano, such as a sleeping bag, and that he should go directly to Oztoque.”⁸

“Montiel reached Fernando (surface support), telling him what happened, gave him a notebook, pens, and some note cards, and enumerated ways to notify Draco about the steps that should be taken. They would contact Arturo Montero, Lorenzo Ortiz, Juan Montaña, Luis Palma and Antonio Aguirre, and also the Red Cross and local authorities. Montiel returned to Oztoque

and started to rig the cave. Shortly after that Alberto reached the cave, and both finished rigging the cave.

“Alberto, with a space blanket and a can of tuna, swam through 200 meters of cold water trying to reach the entrance to the Oztoque sump and possibly Mariano. Montiel studied the cave, trying to figure out how to get Mariano out of the cave because of the extreme cold he would be experiencing. After a short time Alberto returned, in early stages of hypothermia and indicating that Mariano was not on that side. Montiel gave Alberto a fleece hat, put on him a dry wetsuit, gave him some tuna, and made a heat tent for him with a space blanket and a stove.

“When Montiel reached the second of the four drops in Oztoque [on the way out], Fernando arrived at the mouth of the cave, along with local police officers, and Fernando rappelled the first drop. Fernando, Montiel, and Alberto, exchanged information at the base of the first drop.

“Montiel left Oztoque, talked to the policemen, and went to Oztoquito to shout from the surface, thinking that Mariano could be at the campsite inside the cave, reaching the top of the cave and doing five series of seven yells with approximately 15 seconds spacing each, thinking that he could be tired and sleeping. [While walking to the other cave he met Red Cross of Puebla members.] Montiel left to meet with Alberto and Fernando, who had not returned yet. Somewhere between the two pits he found them, sitting and surrounded by rescuers and reporters.”

There is a deposition by persons involved in the recovery, including José Montiel and Mariano Fuentes’ family members, at the Puebla Public Ministry.⁹

RECOVERY EFFORTS

Friday, April 9: Javier Vargas, head of the Área de Espeleología de la Asociación de Montañismo y Exploración (Caving Area of the Mountaineering

and Exploration Association) of UNAM, says, “On Thursday evening Mariano made a second solo dive, carrying two tanks. After three hours he had not returned. At that point one of the project members left the cave to call for help. Lorenzo Ortiz, GEU member, was called, and he called me. Very early on Friday Arturo Montero (Red Cross), Juan Montaña (president of the Unión Mexicana de Agrupaciones Espeleológicas, UMAE), Lorenzo Ortiz, Eric Molino, Rodrigo Remolina and Arturo Robles (all four from the GEU) left Mexico City.

“Around 10 a.m. the two sumps were examined from the surface, looking for signs of Mariano, to no avail. At 3 p.m., Antonio Soriano, Iván González, Gerardo Galindo, and I (all from the GEU) arrived with personal and group gear to be used in the rescue. We found that members of Espeleo Rescate México (Mexican Cave Rescue, ERM), firefighters, Civil Protection,¹⁰ and several sections of the Red Cross were present. Mariano Fuentes’ family members arrived also on this day.

“The organization of the recovery efforts was established in the following manner: Juan Montaña would be in charge, and Javier Vargas would manage the caving (technical) operations.

“Cave divers were needed. All afternoon was spent trying to contact divers from the UNAM, since we knew they were having a cave diving course.”

At 5 p.m., Javier Vargas rigged the cave and everything was ready. Cavers from San Luis Potosí and ERM arrived, joining the vertical work. The cave was rigged to lower gear. It was entered by cavers from the UNAM, Juan Carlos Carrillo, director of the Comisión Nacional de Buceo en Cuevas (National Commission on Cave Diving), and UNAM divers that arrived late at night. The dive was scheduled for Saturday at 10 a.m.

Rodrigo Remolina, along with Verónica and Flor García, GEU members, were in charge of finding as soon

7. From this point on, information from the Comisión Nacional de Buceo en Cuevas de la Federación Mexicana de Actividades Subacuáticas (National Commission of Cave Diving of the Mexican Federation of Underwater Activities) will be added. This version includes commentary from the U.S. cave divers Steve Ormeroid and Robert David Milhollin and the divers Germán Yañez, Aldo Castro and Ale-

jandro Álvarez.

8. There are no times associated to these events.

9. Public Ministry (Ministerio Público): In Mexico, the government agency in charge of clearing and solving crimes and non-natural deaths [Note from the translator].

10. Civil Protection (Protección Civil): In Mexico, a government agency in charge of integrating, coordinating, and supervising the

National System of Civil Defense to offer prevention, aid, and recovery before and after disasters and unfortunate events to all the population, their goods and surroundings. Their role is varied depending on the location; in some places they merely have a supervisory and planning role, while in others they actively participate in rescue, firefighting, medical emergencies, and training [Note from the translator].

as possible information about Mexican cave divers that could work on the rescue. The first contacts were made with the open water divers Iván Palacios and Bruno Espinosa, who were along with Juan Carlos Carrillo in the state of Mexico.

On Saturday, April 10, Javier Vargas continues, “Juan Carlos Carrillo, diving instructor certified by the National Speleological Society (NSS), made an inspection dive, helped by UNAM divers, his students. According to his information, he advanced about 40 meters, following Mariano’s guideline. He found some very narrow parts where he could barely pass. He said the visibility was less than 30 centimeters and that the guideline was laid in the mud. He didn’t find Mariano and decided a more methodical search by divers trained for these situations was needed.

“When Juan Carlos Carrillo arrived at the campground, he gathered information about the sump. José Montiel said he [presumably Mariano—ed.] had attempted it several times and that he had penetrated about 70 meters. He told him that Mariano could be in a crevice at about 35 meters and that he could also have found an air-filled room past 70 meters. Juan Carlos was also told that Mariano had been fed the guideline from outside of the sump, so he was not carrying his own reel, as is the norm in cave diving. Juan Carlos also inquired about the tanks and where had they been filled.”

Juan Carlos Carrillo says, “[Once inside the cave] the guideline that Mariano used was fixed outside of the water to a hanger. . . . The line was polypropylene. At that point I thought the guideline would be along the ceiling. These lines are not used in diving because they float and are difficult to handle. I decided to carry my own line, since it was clear that the one in place was not installed correctly.

“I descended, and while trying to find the entrance to the sump I noticed that the visibility was extremely low.

“I started to follow the guideline, which immediately entered the sump along the ceiling, which started to lower, and I had difficulty in keeping my guideline tight and following Mariano’s line with the other hand, since the orange line was totally loose. I looked for spots where I could do a secondary tie-off, but found none. I decided to keep going, looking for a spot for the tie. The visibility was zero, I had the ceiling right on my back, and I felt mud on my knees.

“The orange line had sunk into the mud, creating a line trap along the right side of the passage. . . . I followed to where the ceiling and wall didn’t allow me to keep going. I decided to turn around.” Juan Carlos left the sump and shared this information.¹¹

He continues, “I had only used 300 psi of one of my tanks. I entered the sump again. This time I tried to follow the left side of the passage. . . . I reached the same point and felt again that it was the limit for me. That was a very hard decision, because I knew that if Mariano was still alive it could mean his life or death. . . . Besides, the pressure on me from the outside was very strong.”

Javier Vargas’ story continues: “At 5 p.m. we finished getting the divers and their gear out of the cave and we had a meeting to make some decisions.

“It was agreed that we should contact cave divers in the United States and in the state of Quintana Roo that Juan Carlos Carrillo suggested for the rescue.

“During the night of Saturday, April 10 and the morning of Sunday, April 11, they were contacted. They were expected in Puebla late on Monday or early on Tuesday, depending on flight availability and the time needed to reach the site.”¹²

The firefighters and Red Cross of Puebla agreed that the rescue coordination should stay in the hands of cavers and divers, since the technical level required was not in their field. By Saturday morning members from Puebla’s Red Cross, fire department, and Civil

Protection were present at the scene.

On Sunday, April 11, there were no activities. Everybody is waiting for the arrival of the divers to start working. There was the possibility of the sump having air bells, unknown up to that moment, even though Juan Carlos confirmed the presence of a crevice. This caused the project to be thought of as a rescue and not a recovery. Cavers and divers created their work plans based on the emergency of locating Mariano Fuentes as soon as possible and determining his state.

Geologists from UNAM were contacted, since they have specialized equipment that could help locate Mariano Fuentes from dry locations, making the work of cavers and divers easier. This option was not followed, because the studies would have needed two to three days and because the accuracy of the cave map was not known.

At night most of the people in the campground returned to Mexico City, leaving only a guard at the site. General plans were confirmed. Aldo Castro, a diver from Puebla, arrived to help with the dive planning.

On Monday morning, April 12, Javier Vargas and seven UNAM cavers left Mexico City with gear and the rescue stretcher. Juan Montaña and divers from the URION group went along. Cavers from the URION group (led by Sergio Santana), Espeleo Rescate México (led by Antonio Aguirre) and Socorro Alpino (led by Jesus Torres) arrived during the day.

At the site, Puebla’s Red Cross installed a work tent. Also present were elements of the judiciary police, soldiers from the 25th Military Zone, cavers that were guarding the campground, and Aldo Castro.

A group of cavers changed the ropes rigged by José Montiel at Oztocito in order to use ones with a known history. The tyrolean used for the hauling system was also rearranged. Javier Vargas checked the rigging and installed permanent bolts for the work in the cave.¹³

Two U.S. cave divers had been contacted with help from Juan Carlos

11. At this point José Antonio Soriano, Iván González, and José Montiel were inside the cave.

12. Andrea Fuentes, sister of Mariano, started immediately to make some phone calls to save some time. The first person contacted was Denny Willis. He reached Steve Ormeroid, ex-director of the Cave Diving Section of the NSS and treasurer at the time, a sump diving expert

and member of the National Cave Rescue Commission. Denny also called Germán Yañez. Andrea talked to Germán and the Sociedad Espeleológica de Cuba—Sección Nacional de Espeleobuceo (National Cave Diving Section of the Cuban Speleological Society), since Denny mentioned they could have experience in sump diving.

13. Javier Vargas, Arturo Robles, and Roberto Rodríguez participated in the tyrolean rearrangement. The pit rigging was done by José Antonio Soriano, Lorenzo Ortiz, Sergio Santana, and Claudio Cruz.

Carrillo and Mariano Fuentes' family. It was confirmed that one of them would arrive in Puebla by Monday afternoon and the other cave diver could arrive at night in Mexico City and head immediately to Puebla. He was expected by Tuesday. Both divers reached Mexico with help of the NSS and John Green (NCRC South Central Region Coordinator), the Mexican Consulate, and the U. S. Department of Homeland Security.

On Monday night two cave divers from Quintana Roo arrived, Germán Yañez and Alejandro Álvarez. They immediately started to work. They checked the available map and were informed of the history that led to the incident.

They got their gear organized and gave instructions to lower it into the pit. Several cavers were assigned to work in the cave. The divers were lowered with the installed rigging, they walked to the sump and geared up. Through the rest of the night they requested more gear and personnel.

On Monday night the diving team of the science college at UNAM arrived, led by Gustavo Hernández, a specialist in rescue and disaster management. Juan Carlos Carrillo was with them.

Alejandro Álvarez, one of the cave divers, entered the sump in the first hours of Monday. According to his statement, he couldn't penetrate far because of the difficult conditions, low visibility, and the guideline in place. He turned back, and they decided to wait for the U.S. sump divers. He couldn't locate Mariano. The divers worked for over eight hours. Juan Carlos Carrillo says, "Germán and Alejandro made a first dive in the sump to exchange

impressions. I showed them where the orange line started and where the entrance was. They decided to carry a reel and try to follow the orange line. Alejandro entered first, and Germán followed closely. After a couple of minutes they exited, saying that the conditions were terrible: low visibility, loose guideline, a line trap, and narrow spots. Alejandro entered a second time to try to advance more. He turned back and described precisely the spot where I decided to turn back on Saturday. It was at about 35 meters of penetration, but it was hard to know exactly, because of the bad visibility. The maximum depth was 6 meters. Even accounting for the altitude (1.4 correction factor), this depth had no risk regarding nitrogen saturation."

On Tuesday, April 13, the Mexican cave divers left the cave before noon, along with the support cavers. Part of the gear was brought out as well, for example the tanks, to be refilled. No information yet about Mariano Fuentes.

UNAM cavers on the surface made some calculations based on existing information to try to validate the hypothesis of a connection between the Oztoque and Oztoquito cave through the sump.

The U.S. cave divers arrived on Tuesday afternoon. There was a meeting among the divers, Juan Montaña, and Javier Vargas. The recently arrived divers were briefed on everything that had happened up to that moment, including a description of the sump and the known issues.

The work was reorganized based on Steve Ormeroid's suggestions. All the cave divers present worked under his

orders. He requested, along with R. D. Milhollin, additional diving gear,¹⁴ dyes, and other things to be placed inside the cave, next to the sump for when Mariano was brought out. The logistics team in the campground pursued these suggestions. The divers also requested equipment to determine the characteristics of the water and air inside the cave, following their work protocols. Some objectives were to have a medic¹⁵ in the cave, with oxygen-therapy equipment, to send a smaller medical kit to the other cave, and to have a sealed container with a sleeping bag, light sticks, glucose, fruit juice, dye, granola bars and some candies. They also requested stakes, special diving equipment, and weights to control Mariano's dive line.

Following their request, Javier Vargas sent a team of cavers from UNAM, SMES, and URION to rig the Oztoque cave and place a small medical kit next to the sump and had the diver Aldo Castro survey it.¹⁶

Following these preparations, activities were divided into two major areas: cover all the support needs of the divers and be ready to move Mariano promptly to the surface if he was in need of immediate medical care or had died.

Around 4:30 p.m. on Tuesday, all the cave divers entered the cave, as well as most of the cavers.¹⁷ A total of approximately one metric ton of gear was taken into the cave.

During the night, Steve Ormeroid was lowered into the cave and guided to the sump.

According to his report, he dived about 60 or 70 meters (there are still no concrete numbers to validate the distance). His description of the sump

14. R.D., having ample sump diving experience, immediately suggested several ways to solve the problem of the guideline. These procedures are not usually done in diving in phreatic caves, but they worked. He suggested the use of PVC stakes placed into the sediment and using weights on the orange line to secure it down the middle of the passage.

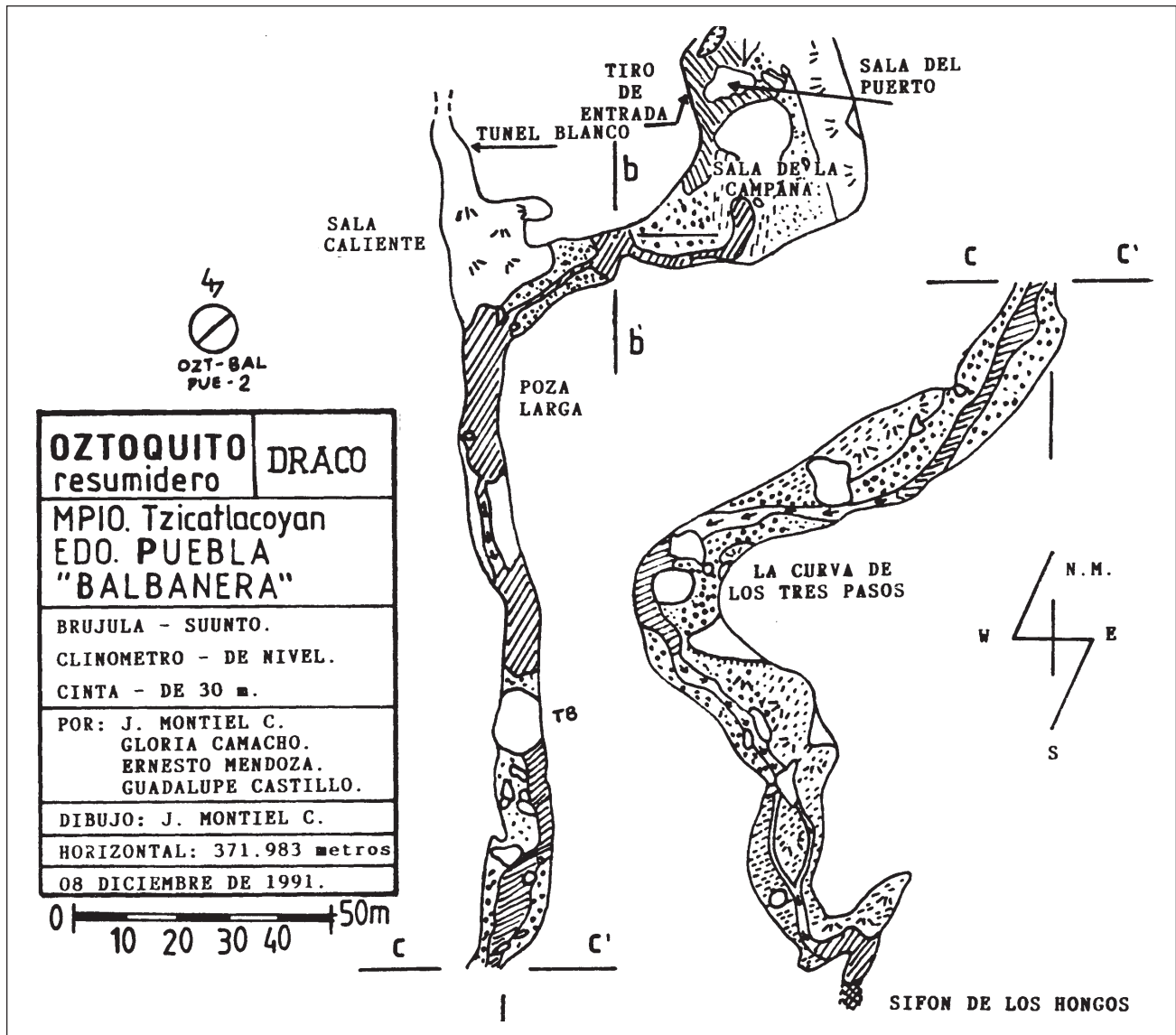
15. Gustavo Hernández, EMT III, was the paramedic in the cave.

16. The persons that entered the cave initially were Ramón Espinasa (SMES), Sergio Santana (URION), Ricardo Martínez (GEU), Omar Hernández (Draco), Marisol Monterrubio (GEU), and a paramedic from the Red Cross Wilderness Rescue School. To de-rig the cave: Iván González, Roberto Nolasco, Sergio Ortega, and Eric Molino (all from the GEU). Later,

Arturo Robles, Marisol Monterrubio, and Ulises Barrientos (this last one from the Socorro Alpino) entered the cave. The de-rigging was finished on Wednesday, April 14. Juan Carlos Carrillo mentions, "It was believed that if both caves were connected through the sump it would be convenient to dive that end to see if Mariano was on the Oztoque side. Due to the magnitude of what was implied, we wanted to make sure that the cave development made a connection probable. Aldo Castro went to the Oztoque sump to get that information. It was determined that there is no relationship and that it would be very hard for the Oztoquito sump to reach the Oztoque cave. The entrances are 784 meters apart and at 177° from Oztoque to Oztoquito. To have a connection the sump would have to veer north. To learn this was shocking, because

there was no basis to believe in a connection, since apparently both caves head south".

17. At that moment, inside the cave the following cavers were working: José Antonio Soriano, Pablo Skoworodko, David Tirado, Carlos Cardona (all from the GEU), Juan José Acosta, Karim Fortes (Tehuacan, Puebla rescue), cave divers Germán Yañez, Alejandro Álvarez, R.D. Milhollin, and Steve Ormeroid. At 7 pm Iván González, Lorenzo Ortiz, Ricardo Martínez, Roberto Rodríguez, Arturo Robles, Sergio Ortega, Roberto Nolasco (all from the GEU), Gerardo Galindo (GEU), and Ramón Espinasa (SMES) enter the cave during the morning to replace some cavers. We noticed a videocamera brought in by a Red Cross rescuer, and we later heard that the videos had been offered to the media.



made it sound very narrow. At some points his tanks were touching the ceiling and his chest the floor, which was not solid, so that it immediately clouded the water and reduced the visibility almost to zero. He mentioned also that the sump is curved, almost in an S shape. He said that waiting for the water to clear was hopeless.

During the night some extra equipment was requested from the surface campground, like weights, belts, and PVC pipes that were placed along the sump to control Mariano's guideline.

Juan Carlos Carrillo wrote, "Steve was wearing side-mounted tanks, a dry suit, and helmet, and he was using the PVC stakes and weights to keep the orange line along the bottom. He checked the cave and conditions and said that the conditions were really bad.

He asked me how I had seen the cave the day I dived. He asked if I thought it was safe to follow the orange line without him carrying his own. I answered that the orange line seemed to be permanent, but badly laid.

"He decided to follow the orange line without placing his own. I noticed he was uneasy. Alejandro would be inside the sump, a few meters from the exit, in case Steve needed anything, and Germán would be fully geared-up in the pool, as a safety.

"He surfaced from the first dive and said that he had started to place some weights on the orange line and to free it from the line traps. He entered again and this time got farther. He was placing the PVC stakes as he advanced. He passed the connection of the orange line to Mariano's white safety line.¹⁸ He

reached the constriction, which he described as a very big rock that made the passage very narrow, and he descended and returned. He said that the guideline was now in much better condition for a third dive to get past the constriction. It was about 6 a.m. on Wednesday, April 14."

Wednesday, April 14. Carillo continues, "Steve started his third dive, with the goal of getting past the narrow part. Approximately after 25 minutes we saw his light, he surfaced, took off his helmet and hood and said 'I found him.'

"He described passing the rock and

18. A normal cave-diving technique is to tie on extra lines when the first line ends. Mariano ran out of the surface-fed line and tied a second line and kept diving.

that the passage got bigger, forming a room. He saw Mariano's reel past the narrow spot. It wasn't entangled.

"He ascended and felt along the sides and then saw Mariano floating on the surface of a room partially filled with air. Unfortunately, he was dead. He said that he surfaced, took off his regulator, and felt shortness of breath. He noticed that the distance from the surface to the ceiling was about 7 meters. He observed that Mariano's equipment was intact; there were no signs of difficulty.

"He descended and came back. He mentioned that apparently it was about 70 meters from the entrance to the sump to where he found Mariano."

Steve Ormeroid, agreeing with the comments of the other divers, said that the guideline was a problem. It was very easy for a diver to get tangled in it. Steve left the sump for the dry part of the cave. The operation managers were informed that Mariano Fuentes had been found. Immediately his family was informed of this. The next steps were discussed among cavers and divers. The rest of the divers and cavers left the cave, and some of the gear was removed from the cave, among with the tanks to be refilled.¹⁹

New plans were made, given that time was no longer a factor. R. D. and Steve proposed several dives to secure the guideline and carry weights to be put on Mariano. Germán proposed a rope, so that a diver could pull and the other could push. Steve Ormeroid rested the remainder of Wednesday and planned on entering the cave again on Thursday morning, since he had been working for twenty hours straight. All the recovery personnel and Public Ministry agents were notified that, after 1 p.m. on Thursday, once the divers were working, Mariano's body could leave the cave at any moment.

On Thursday, April 15, cavers and divers started to work early in the day. Steve Ormeroid dived into the sump with a 200-meter rope. His goal was to reach Mariano again, which he accomplished. He took part of Mariano's diving gear off (tanks, fins and BCD²⁰) and the pressure in his tanks was measured and recorded; both were empty. He tied a rope and placed about 200 pounds of weights on him. Steve started back through the sump and had an incident, getting entangled in Mariano's line in

a narrow spot. He finally solved the problem, but while trying to maneuver Mariano through the sump he realized that the status of the body, bloated and with rigor mortis, would not allow it through the sump.

Some alternatives were discussed, but every one was rejected, since Mariano would not even fit through the more open parts of the sump. One alternative was to use strategic incisions to decrease the swelling, but that could have led to internal organ rupture. The possibility of leaving Mariano's body inside the sump was also evaluated. Steve Ormeroid discussed these options with the family, requested additional equipment, and waited for the family's decision.

The family chose to leave Mariano in the sump, a decision that was agreed to by the Public Ministry, around 4:30 p.m.. His recovery could not only damage his body, but would place the diving team in a high-risk situation. Steve Ormeroid dived the sump again and cut the rope that he had tied to Mariano Fuentes.

Between 6 and 7 in the afternoon of Thursday, all divers and cavers left the cave, and all gear was brought out, too, by fresh cavers. By the early hours of Friday there were nothing and nobody left inside the cave except Mariano's body.

During Friday morning, almost all rescue and support groups left, and also the reporters. The GEU, San Luis Potosí cavers, and URION picked up trash and reorganized caving gear.

RESCUE MANAGEMENT

From Friday the ninth until Monday, April 12, there was nobody in charge. Approximately ten to twenty people were present.

On the afternoon of Monday, April 12, a group of UNAM cavers arrived. Juan Montaña, president of the UMAE, and Javier Vargas, head of the caving group at UNAM came along with the group. Both had returned to Mexico

19. The Puebla firemen had the compressor to refill the tanks.

20. Buoyancy control device, an inflatable implement used in diving, commonly a vest as was in this case [Note from the translator].

21. The list of persons has 102, and it is known that some groups or people present were not registered.

City the previous evening.

Javier Vargas and Juan Montaña received information from the group present on new events. Regarding Mariano Fuentes' situation there was no new information.

Mexican divers were expected the same day, and the U.S. divers were expected between Monday and Tuesday, April 13, depending on the availability of flights and time needed to reach the airports and incident zone. The people who made contacting the divers possible were Andrea Fuentes and Juan Carlos Carrillo.

On Monday, Puebla's Red Cross installed a big tent. Juan Montaña and Javier Vargas agreed that Fanny Monreal would be the liaison between the cave and the campground to manage requests and services, Gerardo Galindo would oversee all the collective gear, Juan Montaña would be in charge of communication with the news media, Emmanuel Teyssier from the College of Science would be in charge of the kitchen. Every manager had a support team.

A registry of every person present was started. This registry included identification, group, specialty (caving, diving, medic, firefighter), caving or diving gear lent, and, sometimes, by request from the College of Science team, blood type and allergies.

Also starting on Monday, all rescue events were recorded, including activity, personnel that participated, work hours, and team leader. This would also help to identify who had been working over ten hours.

Puebla's Civil Protection, led by José Hernandez, Operations Chief, and by orders from the General Director of the agency, sent three people to provide full meals for about fifty people, twice a day, for the duration of the rescue. The first meal was at 9 a.m. The priorities, given that some days easily over fifty people were working in the zone²¹ were in the following and strict order: personnel working in the cave (cavers, divers and firefighters, about thirty people), logistics personnel working in the campground (around ten people), personnel with no assigned activities (ten to fifteen people). The second meal was between 3 and 4 p.m., with the same order. From 5 or 6 p.m. on, any meals were the responsibility of the people in the campground. The people

in charge of the night shift included troops from the 25th Military Zone, College of Science divers, and cavers from several groups.

Additionally, Puebla's firefighters, Red Cross, and several people with no specific activity gave away part of their food. A portable range, two big tables, over ten chairs, and utensils were installed.

The trash was picked up by military personnel.

No portable toilets were installed or specific areas designed as latrines. Campground management and Civil Protection pointed to this need, but nothing was done. The area was mostly flat and dry, which compelled people to look for spots away from the campground.

Gustavo Hernández and members of the UNAM's Medical Center installed on Monday night an information center, with the main data available, including maps, general information on Mariano until his last dive, and daily weather forecasts. The GEU also provided names of the team leaders, activities performed and participants. Gustavo Hernández, upon arrival, talked to everyone present in the campground, indicating the urgency of the situation and the correct attitude to have. That created a sense of integration and made him a main consultant on the surface.

When the Mexican divers arrived the campground coordinators contacted them to hear their needs and fulfill them. They had a meeting with Javier Vargas, Juan Montaña and Gustavo Hernández. They started to work and left the cave until noon on Tuesday.

Starting at 9 or 10 p.m., the campground liaison²² was in charge all night long of providing water and food. The personnel responsible for the campground were GEU members, firefighters, and some team members from the diving group of the UNAM's College of Science. Mostly, the campground team did not get close to the

cave except to help carry things, and even in those cases cavers from the Socorro Alpino, URION, GEU and Puebla's Red Cross or divers from UNAM hauled it.

On Monday, several units from TV, printed media, and radio arrived. By Monday night there were approximately forty-five to fifty people on record, and over ten reporters.

On Tuesday, April 13, the campground coordination efforts were the following: A restricted space with no access to reporters or people with no direct involvement in the rescue was defined. This included all the campground where the rescue personnel rested and the command center, and was necessary since people unrelated to the rescue were wandering among the tents and reporters were walking in and out of the main tent to listen to work meetings. Since the media was looking for information, Juan Montaña and Gustavo Hernández scheduled briefings with them. In that manner the access of people to the command center was controlled.

When the U.S. divers arrived, the campground coordination talked to them to find what their needs were. They had a meeting with the coordinators, they were informed about the prevailing conditions in the cave, and a new work procedure was implemented. At once, all activities were changed so that the cave divers got what they needed to work. They had lists of items that needed to be taken into the cave.

Tuesday evening and night were the longest shift and the one with the largest number of people participating, since practically all divers and cavers were in the cave. Tuesday had eighty persons registered, and through the night there were requests for gear, food and water.

On Wednesday, the US divers reported finding Mariano Fuentes with no signs of life, in a roomy spot within the sump. Cavers and divers talked to the reporters, informing them of the find. The work plan was modified again, but the campground routine remained the same. All orders from the coordinators and divers were followed.

At approximately 5 p.m. Juan Montaña organized a press conference where German Yañez (Mexican diver coordinator), R. D. Millhollin and Steve Ormeroid (U.S. divers), Javier Vargas

(caving coordinator) and Juan Montaña were present. Available information was shared during the meeting, and questions were answered.

The Public Ministry was informed of the find by the campground coordinator, since a representative was always available. They informed us that we should tell them when Mariano arrived in the dry part of the cave so they could start organizing their work to finish it in the fastest possible way. They were informed that the divers would rest all Wednesday night and that any time after 1 p.m. on Thursday the body could be out.

Shortly after 6 p.m., Puebla's Civil Protection started to pack up the meal service, since they had another place to go and they had not distributed water to the campground. They informed us that they would also take with them the tables and chairs. Nothing was gained by the coordinators' talking to them, and they took all their equipment. The problem was not a lack of food but the sudden way in which they left. If we had been notified earlier of this, we would have found other means to provide meals and water. There was an immediate reorganization to find water and food, which was accomplished. The firefighters shared part of their meals, and a group of GEU cavers brought water in 5-gallon bottles. Everybody shared as much food as they could, but it was clear that there would not be enough for everybody.

At about 9 p.m., while cavers and divers rested and the pace in the campground had relaxed, Arturo Montero organized a meeting in the empty Red Cross tent. At that meeting were José Montiel, leader of the Oztoques expedition, almost all cavers or at least a representative of each team, and no cave divers. During that meeting, confusing for some, he said that two Red Cross elements had been denied coffee the previous night. José Montiel said that some reporters had said that he was hiding. There was criticism of the way the recovery was being handled, but without naming specific instances or names, and it was asked if it was clear what would happen after Mariano's body reached the surface. These aspects had already been planned by Mariano Fuentes' family, the Public Ministry, and the campground and surface coordinators. All personnel

22. The diving gear used for the recovery was personal gear, but other teams lent gear, like URION and Buceo de la Facultad de Ciencias (College of Science diving team). All diving gear was located in a single spot, always under control. Several persons on the surface during the recovery efforts were in charge of the equipment needed in the cave and had a registry like the caving one, where they tracked the gear used, who was in charge, and the date.

involved knew schedules and names, the family's wishes, and the law's requirements. Starting days before, there had been periodic meetings where the information was reviewed and shared, since plans were constantly changing. Mariano Fuentes' family backed all the work done and all the decisions made. In that meeting, according to the people present, all coordinators were ratified, except for the link with the media, which became Arturo Montero.

On Thursday, April 15, all cave divers entered the cave again, and several cavers. All day long the campground routine stayed the same, except for the needs from the cave, where they required gear, food and water.

At 9 a.m. a new meal service arrived, with lunch boxes instead of menu-based foods, as it had been. They left enough food for two days and about sixty people.

At 3 p.m. the surface heard about problems of recovering the body. Additional gear was requested. Between 3 and 4 p.m., they were notified that Mariano Fuentes was to be left inside the sump, given the complexity of the recovery. All divers left the cave and most cavers. The Public Ministry was informed. They talked directly to the family regarding the legal steps required. The possible use of a helicopter to move Mariano's body was cancelled, and personnel and family members were required to appear at the Puebla's Public Ministry for their depositions.

The new information was delivered to the media. There was a public ceremony led by family members.

The efforts were now to extract all the gear used, approximately twenty tanks, extra diving gear, rope, and other things like bottles, clothes, and so on. During the night, along with cavers and divers, firefighters provided muscle to bring these items to the surface. At about 4 p.m. on Friday the cave was empty. At 8 p.m. the divers, family members, and some cavers left the area. Through the rest of the night the rest of the people and reporters left the scene.

23. There are some written norms, but basically they are general guidelines that have to be followed in certain activities, like diving or cave diving. Nonetheless, the majority of the rules deal with the techniques and limitations of the gear. It is often the human factor that determines an accident.

During Friday morning, cavers returned borrowed to its owners, the rest of the trash was burned, and the campground dismantled. By 11 a.m. everybody was gone.

GENERAL COMMENTS

Maybe the question that has been asked the most is, "What happened in Puebla?" Another question, mainly because of the lack of knowledge about caving and cave diving, is, "Who was responsible for this?" Those will not be the questions we try to answer here, since behind them lie other agendas. What we can try to answer is, "What are the possible errors that happened?" without forgetting that even in a perfect exploration accidents can happen.

What happened in Puebla was an accident. This was the primary idea we propose to elaborate with conclusions and analysis (that we don't consider definitive). In spite of the lessons that other accidents have taught us and of the different efforts to increase the safety in caving and cave diving, it is not realistic to believe that an accident could have been avoided, given that all participants know that there is an inherent risk to the activity. That is why there are standards for equipment and the adequate use of techniques, extensive publication of success or failure cases, and the existence of sometimes unwritten rules that shape this type of sports.²³

There is a more complex issue that constantly arose through the recovery, especially among the reporters and people outside of the caving circle: "Why did he go in? Why was he there?" Maybe the people closer to him could try to answer this, since, knowing him, they would have an almost immediate answer.

Other people equally able to answer this are cavers, explorers, climbers, mountaineers, and professional divers, since they pursue their activities based on their convictions and their desires. But, even after explaining it, the majority of the population will hardly understand why, which speaks volumes about the poor understanding of the adventure sports in our country.

We don't wish for these incidents to happen again, but one of the most enduring lessons is that accidents do happen, and cavers interested in these situations must strive to respond in a

more professional way when facing them. Luckily, several caving groups not only worked together very efficiently, but also really understood that it was an underwater recovery and that all they could do was support the divers so that they could work as efficiently as possible.

It is important to clarify that the freedom that all members of this community have to practice this and other activities is a principle that can not be debated. When, following certain events, some decisions are made that limit or stop the spirit of exploration, an erroneous path has been taken. In fact, what is needed is to have more men and women interested in exploration and to increase the level of Mexican caving.

Based on the previous considerations, we will accompany the preceding observations and records with some general comments to complement the record and to try to errors in the spirit of increasing our knowledge.

- A caving trip that involved diving was organized, which raises the minimum safety levels that need to be in place and which were not followed by the exploration leader, responsible for all work done during the trip. The trip was organized around the central idea of connecting the caves through the sump.
- The leader, José Montiel, is a Mexican caver that since 1973 has led a group called Asociación Base Draco. He has explored and surveyed caves for many years. His account on the events indicates a high amount of motivation, but not enough knowledge of the minimum safety norms to be followed during a caving trip. It is hard to understand that such a trip would be organized with so small a support team both in the cave and for the dive.
- No support diver was present, and one is necessary in case the main diver has problems.
- There were too few support cavers. When Mariano Fuentes didn't return from the sump, the other two members of the trip had to leave the cave and rig the other pit, but a support caver should have already been present there. If the hypothesis was for the caves to be connected through the sump, was he expected to return through it too? It would have been

safer for him to leave through the second cave, Oztoques. How much time was estimated for the maneuvers? Who would help Mariano with his gear in the other cave?

- The trip should have been postponed pending adequate support, both human and material. Cave diving requires experience, knowledge, and planning.
- The diving gear used by Mariano Fuentes was not adequate. His lights were of low quality, the guideline was not satisfactory, and his gear was not clean.²⁴
- Mariano Fuentes was a professional open-water diver, a caver with many years of experience, and a biologist. He had been part of national and international expeditions. The certifications in diving, even the highest in cave diving, can reduce some risks, but all cave divers face possible dangers.
- It is true that the cave is relatively accessible, which makes for an easy approach, but it is still important to point out that once the request for help was received, a group was en route in a short time. In less than ten hours rescuers from different organizations were already present and evaluating the situation. At fifteen hours from the rescue call, more cavers arrived, with all the necessary gear for a vertical rescue.
- Granted that this was an uncommon sort of event, the coordination to locate cave-diving experts was slow, because no directory of cave diving experts with vertical and/or rescue experience exists.
- There were enough cavers. There was only one pit, and there were enough resources to help the cave divers with the gear, plus cavers to work the haul system. There were other agencies like firefighters to help with it, and several cavers were constantly ready to help.
- Cavers should have been better informed about the situation to prevent their arrival at the rescue site before

they were needed.

- The total number of rescuers on the site was high, but not everyone was proficient in basic vertical techniques; therefore not everybody was able to work efficiently.
- The rigging for rescuer access and for gear movement worked. The system operation was by cavers, and firefighters gave most of the labor. The cavers in the cave were essentially moving medical supplies, diving gear, and other diver requirements.
- The coordination in the cave was not good, since sometimes additional cavers were requested without a real need, having at one point up to twenty cavers in the cave. Even with this overpopulation, there were no incidents.
- Most of the time, the good disposition of cavers and their good judgment put the correct people in the correct places, according to their own capabilities, which contributed to the workflow and to the absence of serious incidents.
- It was a complicated task to communicate with interested parties in, for example, Mexico City. The urgency of the operation and the lack of phone coverage led to misinformation. It is necessary to have adequate communication tools. A rescue can not be organized using personal cellular phones. Every group involved should have a reliable communication system. There should be at least one satellite telephone.
- Another serious problem was the uncontrolled flow of information exchanged through the FRS²⁵ radios used as an internal communication method. Data were exchanged without any thought, and anyone with a radio could listen to what was going on. That in itself was not a problem. The problem occurred when the information was passed on to third parties or when conversations were interrupted or orders questioned.
- There are groups in Mexico, as there could be in other countries, that list

capabilities they don't have and people who falsely claim to have the ability for vertical rope work. Requesting more responsibility without having putting forth sufficient effort is not consistent, and this sort of behavior was noted during the rescue.

- In the media, the original expedition was constantly labeled as scientific. It was in fact difficult to find the word "sport." It was also said that it was an expedition by a group from the UNAM. It was neither a scientific trip nor related to a UNAM group. It was a sport trip by the group Draco.
- Several erroneous comments were broadcast that need to be challenged: Versions of what happened up to when Mariano Fuentes entered the sump. That the visibility would decrease, and therefore the recovery was stopped. That Mariano Fuentes was the most skilled diver in Mexico, so there was nobody left who could rescue him. That the rescue could be started immediately through the other cave, and that it was an error to not start working there. That waiting for the U.S. divers was not important. That the U.S. divers had advanced communication systems. That Mariano Fuentes' goal was not to explore the sump, but map it, since the caves had already been connected. That 5 metric tons of gear were lowered. That the divers were doing things wrong. That the UNAM group hid some information out of respect for family. All these comments are false or clearly manipulative.
- There is one point that needs evaluation, and since it needs to be reviewed by experts, we can not answer it, but will pose it, and at a later date we will publish the information. A caver, a diver, and two geologists from UNAM claim, based on the survey data and on work done in Mexico City, that (1) there is a possibility for the caves to connect, but the connection could take place far away, and (2) there is no possibility for a connection.

24. "Clean" refers to how the gear is set up. Mariano's diving gear was composed of: One 80-cubic-foot aluminum tank on his back, mounted on an open-water BCD, and a first-stage regulator with four hoses, two second-stage regulators, and one console. A second tank, steel 72 cubic feet, with an improvised harness to mount it on his left side; the first stage regu-

lator had three hoses, two second stages, and a console with no depth gauge. A gap reel as a safety line (he carried no primary reel). One helmet with two safety lights. No computer or other instruments. A 6-millimeter wetsuit.

25. Family Radio Service [Note from the translator]

- It is not possible to determine the cause of Mariano Fuentes' death, but we present the different hypotheses about contributing factors proposed by the divers and some cavers, considering that the diver had his

complete gear on and that the valves were open.

- a) Excessive presence of carbon dioxide in the air bubble where Mariano Fuentes was found, which caused him to faint and drown.
- b) The batteries in his lights were exhausted, so he could not find his way back.
- c) His air ran out, since that was his second dive with the same tanks.
- d) The visibility was zero due to the excessive sediment, which complicated his movements.
- e) His guideline was not safe, because it was not well laid.
- f) He lost the guideline.
- Every rescue has, in greater or lesser degree, errors, wrong decisions, bad planning, lack of control, show-offs, efficient people, stress, losses, good luck, bad luck, frustration, mistrust, excess of confidence, lack of confidence, weariness, sadness, and anger. What is not correct is to show a lack of respect toward the victim and the effort of every participant. Some words should not be used to refer to the victim, persons or events. Respect between all members of our community is what will let Mexican caving grow. There could be serious differences of opinion, but these should be solved without offending anyone or anything.
- There is a pressing need for a good way to manage the inventory in these situations. It is very hard to control, given the urgency of the situation and the number of people involved.

Special thanks to:

State government of Puebla, Mexico.
State government of Quintana Roo, Mexico.
National Autonomous University of Mexico (UNAM)
Mexican Army
Mexican Red Cross
National Speleological Society (NSS)
Director of the Puebla Civil Protection System
Firefighters, Divers and Urban Rescue of Puebla
Puebla's Red Cross
Quintana Roo Diving Group
National Commission of Cave Diving
Mexican Federation of Underwater Activities
Puebla's Public Ministry
Municipality of Tzicatlacoyan, Puebla.
First Aid and Rescue of Puebla
Mexican Society of Underground Explorations (SMES)
Mexican Union of Speleological Groups (UMAE)
University Caving Group (GEU)
Mountaineering and Exploration Association of the UNAM
URION
Mexican Alpine Rescue (Socorro Alpino)
Tehuacan, Puebla Rescue
National Speleology School, San Luis Potosi, Mexico.
Family members and friends of Mariano Fuentes

There should be a system to prevent any losses.

- The Grupo Espeleológico Universitario at UNAM is a Mexican group with a passion and deep interest in caves. Its main objectives are the training of new cavers and exploration of new caves. Accordingly, it is a group with the capability of conducting vertical rescues, but it does not pretend to be nor it will be a cave rescue group.

Nonetheless, given the specific characteristics of a cave rescue, cavers are the best persons to handle it. Accordingly, we will continue to prepare ourselves.

- The loss of Mariano Fuentes is a terribly sad event in the history of Mexican caving and exploration. The people who met him will keep him in their memories forever.

Informe del Accidente y de las Labores de Rescate en la Cueva Oztoquito, Puebla.

Un reporte publicado por el grupo de espeleología de la UNAM sobre el accidente que cobró la vida de Mariano Fuentes. Incluye los antecedentes del suceso, narraciones de las labores en el interior de la cueva y en el campamento en la superficie e incluye comentarios y observaciones generales sobre la pérdida de Mariano y las labores de rescate y recuperación.

BOOTY AND SOLITUDE: TWO WEEKS IN THE PURIFICACIÓN KARST

Mark Minton

Six cavers spent two weeks over Christmas 2005 prospecting in the Purificación region of northern Mexico, as we have done every year for the last several. Yvonne Droms from Virginia, Bill Steele and Diana Tomchick from Texas, and James Hunter, Tanja Pietraß, and I from New Mexico returned to continue our search of the relatively little explored middle section of Purificación karst between Arroyo Luna and Cerro Pizafña. We had leads left from the previous year and new areas that looked promising.

Yvonne and I arrived a couple of days before the rest of our group, so we did some hiking. We explored some long-abandoned and overgrown side roads off of the main road down to Arroyo Luna from Caballos. One of the roads led nowhere fairly quickly, and, though in the fog we could not see far, it did not seem very cavey. The lower road, however, led to some nice karst, and we found small caves and a couple of pits worth returning to. Our next objective was to explore up the Arroyo Rillitos that joins Arroyo Luna at the concrete bridge. There is always at least some water in this side arroyo, and it has clean-washed, slick rock and looks cavey. We hiked around 4 kilometers, gaining significant elevation, and saw some wonderful canyon scenery (and nary a soul), but found no caves.

When the others arrived, our first real project was the small *sumidero*, Cueva de la Nochebuena, Nuevo León, that Yvonne and I had located but not entered just west of Arroyo Luna and north of Potreritos a few years earlier. Last year (*AMCS Activities Newsletter* 28, p. 144) we had surveyed as

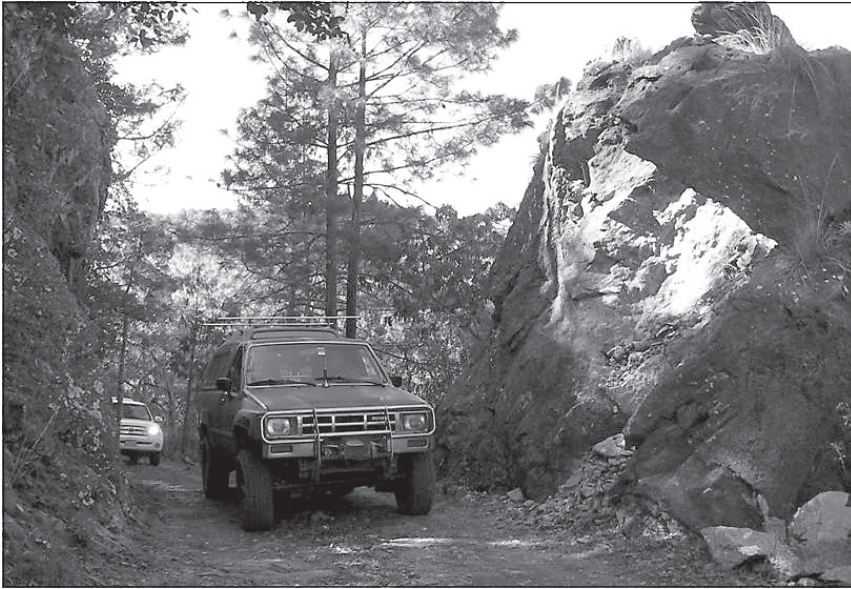
mminton@nmhu.edu

far as a pool that required immersion, and no one but me had been willing to continue, so I looked ahead and found that it continued. This year we had come with wetsuits, prepared for a wet trip. When we arrived at the entrance, we were surprised to see the entire sink covered in deep leaf litter, including on top of a fallen log a meter and a half off the ground. Apparently the entire sink had filled with water during a storm. Inside, the entrance crawl was lower than usual, and the air was stale. Worse, the first climb-down was gone. There was a flat floor of debris in the first small room. Had we not known where to dig, we would have thought the cave ended right there. Fortunately, jammed rocks and logs had effectively held back the bulk of the debris, and once open, the rest of the cave was relatively clean.

We divided into two teams, with Bill, Diana, and Tanja beginning the survey where we left off last year, while James, Yvonne, and I went ahead into the unknown. I had expected to collect blind, white flatworms that had been present in abundance last year, but this year there were only a few juvenile specimens. The flood must have wiped most of them out. Not far beyond where I had stopped previously, the cave became very narrow, and the way on was blocked by flowstone. With only rocks to chip away with, we found it slow going, but eventually James slipped through and was then able to open it further from the far side. We pressed on down flowstone climbs and crawls, making the usual 180-degree turns both horizontally and vertically, all of it small and relatively tight, until we hit a sump. This was no surprise, because the cave is not far above Arroyo Luna and would thus not seem to have much depth potential. We surveyed out and

tied in to the last station left by the other crew. They had not gotten beyond the squeeze because Bill wouldn't fit, but the women had pushed through and set the last station as far in as possible. It was a welcome sight! Nochebuena is 196 meters long and 27 meters deep. (The previously reported length was in error.) It doubles back on itself so often that the sump is almost directly below the entrance.

The following day we returned to the more promising side road Yvonne and I had scouted a few days before, and we explored several small caves and pits, but nothing went far. Having depleted our leads in that area, we decided to move west and check out the village of Los Toros, Nuevo León. In spite of the fact that there is a road to the village, apparently no one had ever visited it looking for caves. As soon as we got to the first arroyo-crossing, we found out why. The road follows the arroyo bed for a few hundred meters and was completely washed out. We walked on in a nicely wooded valley until we came to the village. The first woman we spoke with was friendly, but said there were no caves. However, farther along we spoke with a young man who said there were some, but we would have to go talk to his *jefe* (father). The elder led us up to an incredible overlook of Arroyo Luna and pointed toward the bottom. There was a cave with water coming out down there, he said. However, it was a long hike (always an indication of a tough trip when the locals say it), and since it was only a couple of days before Christmas, he would not be available to guide us for three days. We thanked him and headed back to the trucks, and then we drove up near Cañada Verde, Nuevo



Interesting road cut on the way to Arroyo Luna from Caballos.
Yvonne Droms.



Bill Steele, Diana Tomchick,
Tanja Pietraß, James Hunter,
Yvonne Droms, Mark Minton.



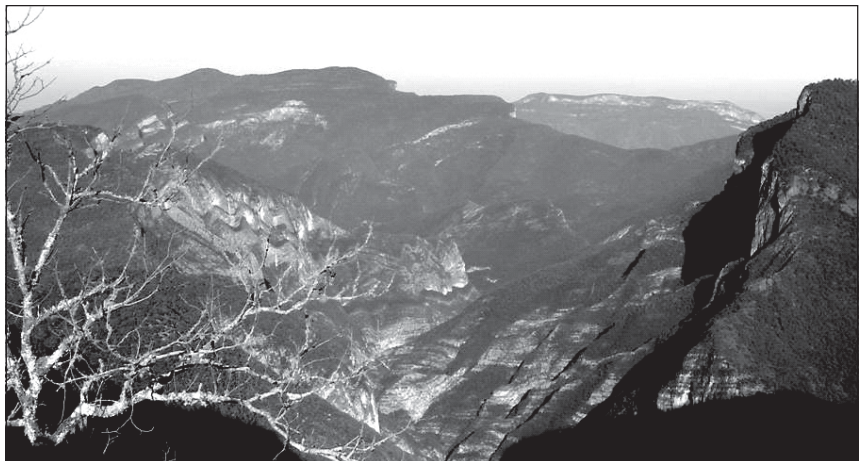
Clothes drying after a Noche-
buena trip. *Bill Steele.*



Hiking to Los Toros overlook of Arroyo Luna. *Yvonne Droms.*



Tanja Pietraß rappelling past formations at the bottom of the fourth drop in Soplo. *James Hunter.*



View down Arroyo Luna from the Los Toros overlook. *Yvonne Droms.*

León, to make camp at a spot we had found the previous year.

Our first objective at Cañada Verde was a large pit, called Tinaja Verde, that had been mined for phosphate. It sounded very deep and had what appeared to be multiple shafts going down. We had brought a 600-foot rope specifically for this lead. James got the honor and descended carefully, checking out the parallel shafts as he passed them. Most reconnected, and the pit ended in a small, flat-bottomed room with no leads. We taped it at 84.5 meters deep. Tanja checked a small side shaft that was separate, but it also ended, about 40 meters down. The road past Tinaja Verde continued, and we had been told there were other mines farther along. We hiked the roads and found another small mine called Santa Isabel, but no real cave associated with it. We did find some small pits along the way, and some incredible rillenkarran. Another branch of the road led all the way to the bottom of Arroyo Agua Nueva. James spied a small pit near a twisted tree that took a small arroyo and looked interesting, but it was too late to check that day. We also found a flat-bottomed sink where people had been collecting Spanish moss (*paxtle*) to sell in Victoria for Christmas decorations. Other than people on the main

Yvonne Droms descending Pit 74.
James Hunter.



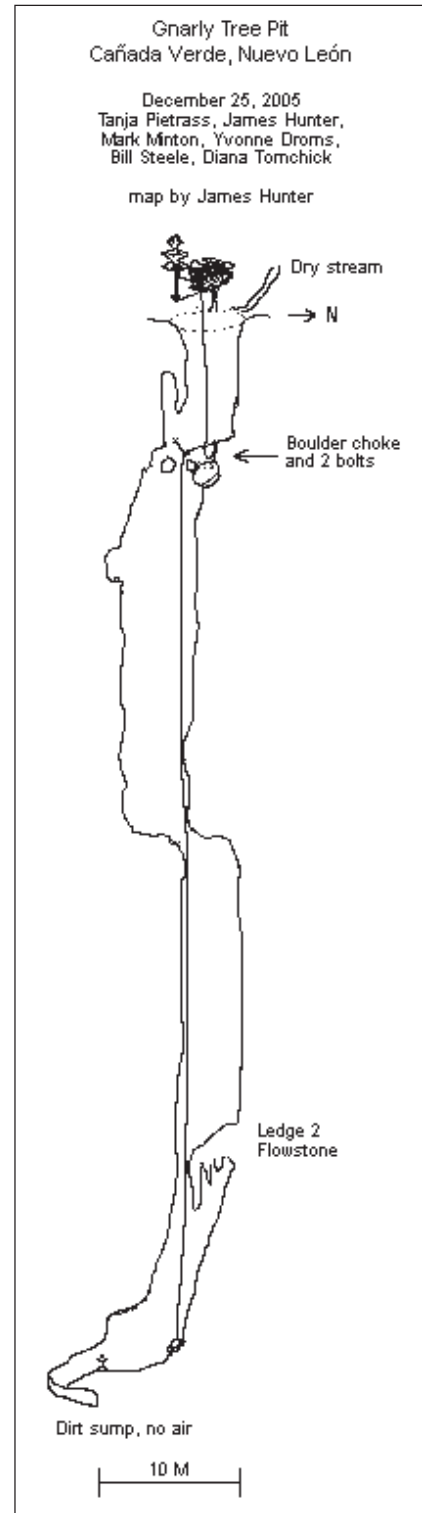
roads or in towns, we saw almost no one.

The following day we took ropes and gear and hiked a different direction to look for pits. A few blind 15- to 25-meter shafts were explored, including one already tagged, but nothing went. Bill and Diana checked the pits near Santa Isabel, and the rest of us went to James's Gnarly Tree Pit. The entrance drop was 13 meters, followed by a very deep drop with an unstable lip. Bill and Diana joined us at Gnarly Tree, and then Bill hiked all the way back to camp for a longer rope and bolt kit. After substantial clearing, Yvonne and I bolted a Y-hang, and James descended a fine 65-meter free shaft past two ledges. The cave ended in a small slot with no air. Tanja descended and James took photos, for a satisfying day.

Finally it was time to return to Los Toros. We made an early start and arrived before 10 a.m. Our guides led us up over the ridge beside town and then descended into a small valley. We crossed another small ridge and then dropped steeply into Arroyo Luna. The trail went down relentlessly and seemingly forever. Finally we could hear rushing water. We crossed a small side arroyo and traversed along a cliff to arrive at a beautiful oasis with a babbling stream and travertine pools perched on a cliff about 100 meters above the bottom of Arroyo Luna. There was a small cave, which James and I explored by chimneying over deep water for 50 meters or so to a corner where it widened out over a very deep pool. We could hear a waterfall just out of sight, but there was no noticeable airflow. Although it was tempting to strip down and dive in, it was already mid-afternoon, and we had a long hike back out. Three hours later, at the top of the last ridge, we split into two groups and looked for other pits. Some goatherd girls showed Bill, Diana, and Yvonne a couple of large pits and a small blowing hole that got us very excited.

The next few days we spent hiking back to the ridge top and exploring the pits. Bill, Diana, and Yvonne explored the large

shafts. The deepest, Poza Honda, was 50 meters deep, but dead-bottomed. The smaller one, Poza Zorillo, had a couple of drops and ended in a room with a potent dead skunk. Meanwhile James, Tanja, and I dug open the blowing hole. The more we dug, the stronger the airflow became. One had to keep his mouth and eyes closed while





Close-up of soda straw with helictite at the Four-Way Ledge in Soplo. *James Hunter.*



Mark Minton passing the ledge in the second drop in Soplo. *Yvonne Droms.*

digging to keep out the flying debris. This promised to be a significant find. Soon we had opened a short drop, which I descended. Immediately there was another drop over old, eroded flowstone with great airflow, but it was late, so we planned a big trip for our last day.

We returned to Soplo de Los Toros with as much rope as we could handle and split into two groups. Bill and Diana would survey in, while James, Tanja, Yvonne, and I pushed on. The second drop was 30 meters, with beautiful flowstone all the way down. But at the bottom there was no way on and no airflow. We took to the walls, knowing there must be something we missed. Finally James managed a crumbly climb

to a ledge and found a small hole with all the air that led back down. He rigged ropes down both ways from the hole and continued. The rest of us followed past an awkward rebelay into another well-decorated drop. Immediately there was another drop under a tall dome, which Yvonne descended first. Tanja took the next lead, a small hole that led to a short drop to a small pool and with a ledge at the side to the next drop. I got that lead, and I descended to a ledge with four holes going down and fantastic meter-long soda straws, one of which had a helictite bush growing out of its center. All four holes reconnected, and continuing down led us to a room with nice formations, including a long bacon

rind. We were out of rope, but another drop blowing air beckoned. Leaning over the edge, we could see yet another hole going down in the floor. Soplo goes! And almost straight down, so far. We surveyed back to tie in with Bill and Diana's survey for a very exciting trip. Soplo is 81 meters deep and only 129 meters long so far, in eight pitches.

It was time to pack up and head home, but with great expectations for next year. It is possible that on a single day we were shown the upper and lower entrances to a new system near Los Toros over 900 meters deep. We can't wait to get back!

Dos semanas en el Carst de Purificación

Seis espeleólogos estuvieron dos semanas en la Navidad 2005 buscando cuevas en la zona de Purificación en las montañas al noroeste de Ciudad Victoria. Un número de pozos fueron explorados, incluyendo un tiro de mina de 84.5 metros donde habían sido explotados fosfatos. Un orificio con viento fue abierto brindando una entrada a Soplo de Los Toros, que fue explorada a una profundidad de 81 metros en ocho tiros. La cueva continúa y tiene un potencial de profundidad de 900 metros.

THE HELICOPTER AND THE BEE CERRO RABÓN 2006

Mike Frazier

The rotor spun round and round on the Chinook. The weather was clear and pleasant. The wind was coming in from the west, so we had a tailwind to help push us along. We were fairly heavily loaded when we took off, but it didn't seem to faze her much. She was a good ship that had successfully gotten us through several other missions. But this was her premier excursion into Mexico.

It has long been a dream of mine to fly a helicopter over the Cerro Rabón and search for pits. Well, one has to dream. The Chinook in this story is actually a 1978 Toyota Chinook motor home nicknamed the Chinookie. The toilet has been removed to make room for more caving gear. Some friends were probably placing bets about whether it would make it back.

On March 10, 2006, Patricia Malone (Czarina) and I (Dad) climbed aboard and left Colorado, bound for the Cerro Rabón. We stopped briefly in Texas at Bill Stone's new lab to pick up the project's rescue Sked. From there, it was off to Oaxaca City to obtain letters of permission from Protección Civil and speak to Marcus Winter of INAH.

By the fifteenth, we had arrived in San Bartolomé Ayautla, where we were to meet the rest of the team. They had yet to arrive, so we spent the day swimming at the Nacimiento del Río Uruapan and repackaging food into Baggies so it would pack more efficiently. In the evening, I killed a little time by composing three songs, "Heavenly Home of the Ancient Wall Builders," "Machete Circumcision," and finally "Road Rash."

In the late morning of March 16 we

frazier22@msn.com

returned to town to find that the Polish cavers had arrived. They were Kasia Kędracka (Kasia the Third), Kasia Barcz (Kasia the Fourth), Piotr Pilecki (Pikus), Paweł Skoworodko (El Beastia), and Andrzej Szerszen (The Bee). It seems like most Polish woman cavers are named Katarzyna, Kasia for short. I had also met Kasia Biernacka and Kasia Okuszko on previous trips to Oaxaca. The Bee is a large fellow whose middle name translates to *hornet*. The Bee was recently the "victim" in a mock cave-diving rescue during which he was strapped to a Sked and hauled through a sump. The horror!

We obtained local permission, then tried to hire some help to shuttle gear up the mountain. Guides were nearly impossible to hire at a reasonable price this year, but after many hours of searching we found a couple of guys who said they would to it. We spent the remainder of the day preparing our packs, and then we went for a swim. On the seventeenth, we woke at 5:30 a.m. Our guides didn't show, so we began repacking to minimize our gear. We left Ayautla around 7:00, and five hours later arrived at the base camp for Sistema de los Tres Amigos. (See *AMCS Activities Newsletter 26*, pages 70–75, and 27, pages 31–37.) A few hours later, the guys prepared to hike back to town for our food supplies, while the ladies set up a water-collection system in the cave and dug trenches around the tents. Some of the locals were surprised to hear that the women were spending the night alone in the forest.

The next day the guys returned to camp with the supplies and made plans to start rigging the cave. It was now March 19, and everybody except Paweł,

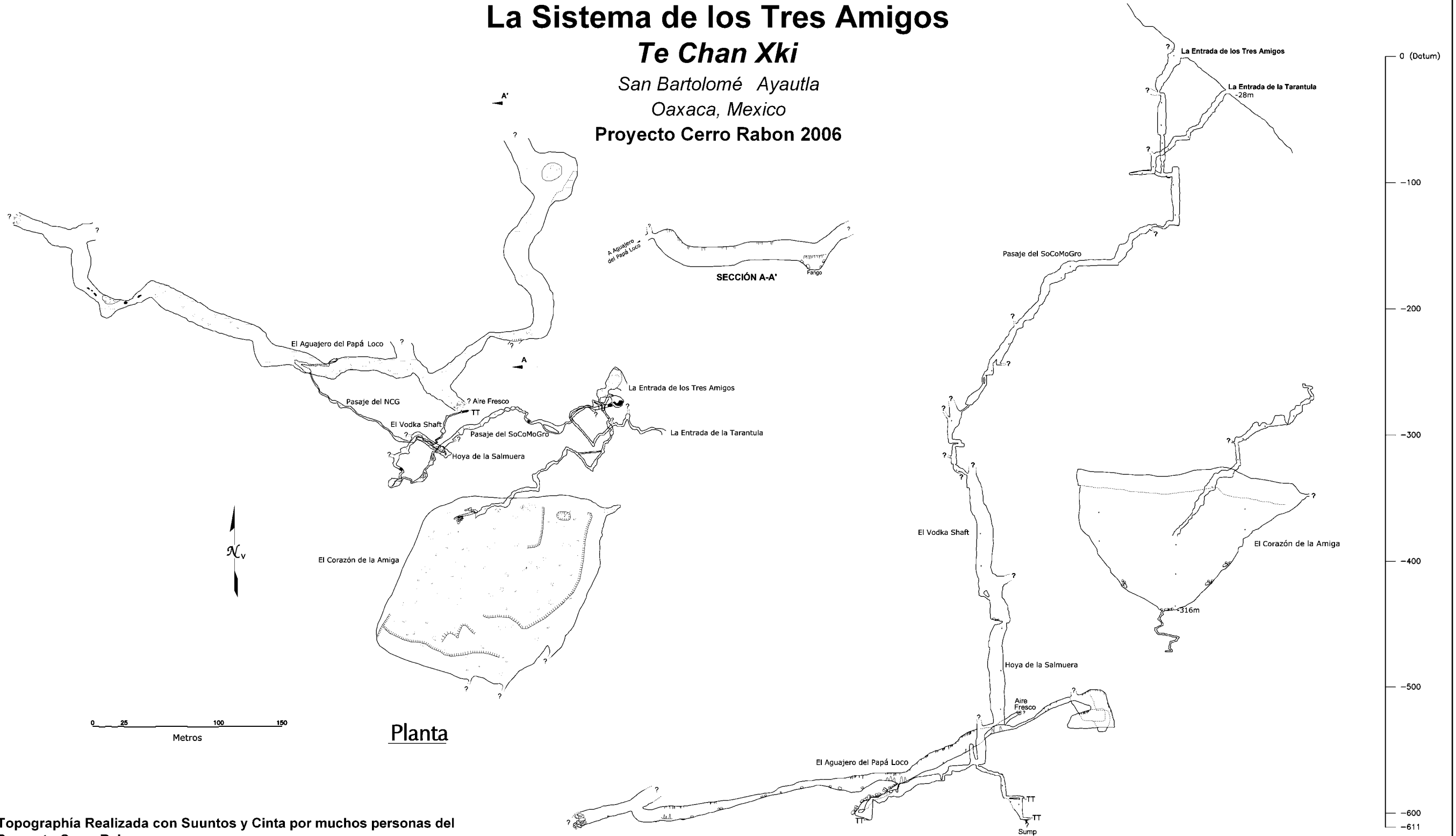
who was camp guard, entered the cave. It was a great warm-up trip, and the cave was rigged to below –400 meters.

Franco Attolini, a Mexican caver, was to arrive in town the next day. Due to the lack of guides and the difficulty of finding the correct route through the series of trails, someone had to return again to Ayautla. I volunteered to go while the others rigged the cave to the sump. On their next trip into the cave, they were short-roped by 10 meters on a 60-meter pit, but by the end of the next day, The Bee, Kasia the Fourth, and Paweł had managed to finish rigging Tres Amigos and begun pushing a muddy lead about 30 meters above the sump. They left the cave going, at the top of a 4-meter pitch. Meanwhile those on the surface found several new entrances within shouting distance of camp.

Franco arrived in Ayautla the evening of the twentieth. He was able to hire a couple of guys to help us the next morning carry up his gear and the remainder of the food. As we worked our way up the trail, we soon came to realize our "guides" had no idea where we were going. Neither of them had ever ventured this far into the rain forest. Still, they were exceptionally strong for their size, and we were making excellent time. That is, until we reached the final steep gully that leads up to the cave, where I spotted a snake slithering between the rocks. I yelled down to warn the others and tapped the rocks where it had disappeared with my walking stick. A moment later Franco yelled, "I think they just quit." I told them we were only a half-hour from camp and that we would soon be finished. If they wanted to quit now, we

La Sistema de los Tres Amigos Te Chan Xki

San Bartolomé Ayautla
Oaxaca, Mexico
Proyecto Cerro Rabon 2006



Planta

Perfil
0° Norte

Topografía Realizada con Suuntos y Cinta por muchos personas del Proyecto Cerro Rabon
Cartografía por Randy J. Macan

Longitud: 3008m
Profondeur: -611m

would only give them half of the agreed payment. They eagerly accepted the 50 percent and disappeared back down the trail. This left Franco and me to deal with two heavy bags each on the worst part of the trail. We yelled for the others, and after a bit we could hear them yelling back. Unfortunately, we were within sight of camp before they understood that we could use a hand. By then, we figured we might as well finish it ourselves.

The next morning, Pikus, both Kasias, and I entered the cave to survey the passage that had been pushed the previous day. We also hoped to rig the 4-meter pitch and continue exploration. The new passage was quite muddy at the beginning and much smaller than most of the cave. The walls seemed to be a different color and texture. The floor was sometimes muddy and sometimes sandy. The drops were all short and dry. There was a light breeze. Someone mentioned that it was like we were in a whole new cave. We called it the NCG lead.

After Pikus rigged the virgin drop, we all descended to a large, muddy chamber. The floor was tilted, which caused each one of us to slip onto our backsides at one time or another. At floor level at the far end of the chamber, there was a low, muddy crawl without any wind. Above it was a tall, muddy fissure. I climbed up for a look and found that all down-dip leads were choked. There was a lead that went up dip and ended at a breakdown pile. Pikus and I crawled around for a while and, though we could feel air, we could not seem to make the cave go. This lead didn't look great, but it is always best

to send two different groups on at least two different trips before calling a section of a cave finished.

The next day, The Bee, Paweł, and Pikus entered Tres Amigos to check the breakdown, and it if ended, derig to the level above. Part of the way down, The Bee's harness ripped apart just below the D-link attachment, and he had to return to the surface to borrow mine. This gave Paweł and Pikus plenty of time to look around the breakdown. One meter above the place where Pikus and I had turned around the previous day, Paweł climbed up into a 12-meter borehole. The ceiling, walls, and floors were heavily laden with formations. After looking around a bit, they found their way back to the surface. Great news: the cave went big.

On March 24, Franco, Kasia the Third, Kasia the Fourth, and I entered the cave to have a look. It was big, all right. We picked up the survey and were soon surveying northward in borehole, taking quite long shots. Soon the passage split. It was exciting as all hell. Going to the right, we surveyed upward through an area where calcite coated the entire passage. We set a station on a large stalagmite and continued upward until we hit a large breakdown pile with fresh air blowing out. Backing up one station, we started mapping into a smaller side passage. After four or five stations, this passage began to open up, and then our route split once again. An easterly lead went steeply upward with a dirt floor, while the north-trending passage headed downward across a breakdown pile. There were smiles on both Kasias' faces as they led the way down the virgin breakdown slope into

ever-expanding borehole. Beyond a mud sump, the passage began trending upward, eventually widening to 40 meters at one point.

In this area there is an immense, eye-widening display of soda straws. We shot several more stations, before deciding to backtrack to the beginning of the borehole and have a well-earned snack consisting of MREs and candy bars. We then began surveying down dip. The passage was like a roller coaster, down then up then down. Soon we passed several pools of water and an area where the floor climbed up to within a meter and a half of the ceiling. But soon the ceiling rose to an undetermined height, and yet another borehole came in from the right. After several more shots, we decided we should think about wrapping it up. Down the passage a hundred meters or so was another breakdown pile. I took the liberty of investigating it, and after several minutes was able to pass it and reach a pitch. Ahead I could hear a waterfall. This passage was named Loco Papa's Borehole.

This year our team surveyed more than a kilometer of new cave and left lots of leads to return to. Perhaps we will place an underground camp in the borehole at -600 meters to facilitate exploration.

We thank this year's sponsors: Gonzo Guano Gear, the Northern Colorado Grotto, and the Southern Colorado Mountain Grotto. We also thank Severo and Virginia Leyva and family, who live in Ayautla and opened up their home and their hearts to us, asking nothing in return.

Cerro Rabón 2006

El Sistema Tres Amigos, en el Cerro Rabón en San Bartolomé Ayautla, Oaxaca, fue visitado de nuevo. Más de 1000 metros de galerías nuevas fueron descubiertas y topografiadas.

EVOLUTIONARY BIOLOGY AND CUEVA DE VILLA LUZ: ICHTHYOLOGICAL RESEARCH IN A SULFIDIC CAVE IN TABASCO

Martin Plath^{1,2}, Michael Tobler^{1,3}, Rüdiger Riesch¹,
Francisco J. García de León⁴, and Ingo Schlupp^{1,5}

Who could resist being interested in cave animals? They look cool and are unusual, often eyeless and without pigments. At the very least they are different, providing biologists with valuable tools to study evolution and ecology. Cave animals come from a variety of different taxa, such as insects, spiders, crayfish and crabs, and amphibians. Many wet caves have been colonized by fishes, but one cave in Tabasco ranks prominently as harboring one of the most extreme fishes ever. Cueva de Villa Luz (also known as Cueva del Azufre or Cueva de las Sardinas) is a sulfidic cave near the village of Tapijulapa in Tabasco, Mexico [see *AMCS Activities Newsletter* 24, pp. 48–54]. The cave is inhabited by a small fish species, the cave molly *Poecilia mexicana*. Scientifically the cave molly is recognized as a form of the widespread Atlantic molly. The cave has long been known to the local Zoque Indians, and for over 100 years to scientists. According to an unpublished manuscript of the recently deceased American ichthyologist Robert Rush Miller, which was made available to us

by James K. Langhammer, the first scientific collections of fish in the Cueva de Villa Luz date back to 1896, when A. Dugas sent specimens to the U.S. National Museum. M. W. Stirling, Chief of the Bureau of American Ethnology, Smithsonian Institution, and his collaborators researched the cave and collected cave fish several times between 1944 and 1948. The first map of the cave and a scientific description of the cave molly were published by Gordon and Rosen in 1962; a second, more detailed map was later published by Hose and Pisarowicz (1999). Ever since the 1960s, several research groups have worked in Cueva de Villa Luz, mainly studying its most prominent inhabitant, the cave molly. This research was spearheaded by a group from the University of Hamburg, lead by Jakob (Jack) Parzefall. Parzefall pioneered maintaining the cave molly in captivity and published numerous scientific studies on cave mollies (reviewed in Parzefall 2001).

The cave molly is also tightly connected to the local native culture. Stirling mentioned in his field notes that

the cave is sacred to the Rain God of local Zoque Indians. Once a year around Easter (toward the end of the dry season), the Zoque penetrate into the cave and, with the aid of toxic *barbasco* root, poison and capture the cave mollies, which are then cooked and eaten. During this act, which is accompanied by appropriate prayers, the dead fish act as messengers to the Rain God, bringing on the first rains of the rainy season.

For more than fifteen years, members of our group have repeatedly visited Cueva de Villa Luz. Our main focus was to study the cave molly. The logistical effort to work in Cueva de Villa Luz is substantial, given that sometimes-large amounts of equipment have to be hauled to Mexico and back. During the past years, the new hotel Maison de la Sierra in Tapijulapa proved to be an extremely valuable and ideal base camp for us. We could use the hotel practically as our laboratory away from the laboratory. From Tapijulapa, we usually take a locally operated boat up the Río Oxolotán to the trail that leads to the cave. The twenty-minute hike over pastures and through the forest with all the equipment needed for work can be demanding. Although the cave can easily be entered by stairs at the cave entrance, it is actually hazardous. The creek flowing through the cave is fed by several springs containing high concentrations of hydrogen sulfide (H₂S, Tobler et al. submitted), and the air is rich in this toxic gas (see table; Hose and Pisarowicz 1999). The levels measured exceed the concentrations reported to be toxic for humans.

Schlupp: schlupp@ou.edu or schlupp@mail.utexas.edu

1. University of Oklahoma, Zoological Institute, 730 Van Vleet Oval, Norman, Oklahoma 73019
2. Unit of Evolutionary Biology and Systematic Zoology, University of Potsdam, Karl-Liebknecht-Str. 24-25, 14476 Potsdam, Germany
3. Institute of Zoology, University of Zürich, Winterthurerstr. 190, CH-8057 Zürich, Switzerland
4. Centro de Investigaciones Biológicas del Noroeste, S.C., Mar Bermejo No. 195, Col. Playa Palo de Santa Rita, A.P. 128, La Paz, Baja California 23090, México
5. University of Texas, Section of Integrative Biology, University Station C0930, Austin, Texas 78712

Consequently, security measures need to be taken. We always carry a portable H₂S measuring device with us and wear protective masks as needed. Furthermore, we limit our work time in the cave to one hour and place a guard in front of the cave who could initiate rescue efforts if the cave team is not out on time. Luckily, other than minor bruises and scratches, we never had any accidents.

Our group is generally interested in how cave animals adapt to darkness, focusing on behavioral adaptations. Besides darkness, the cave molly has to cope with highly toxic hydrogen sulfide. This is unique for a cave fish. No other fish is known that has to deal simultaneously with darkness and H₂S. The concentrations of this chemical measured in the cave water are toxic for animal life. Hence, one goal of our investigations is to examine how cave mollies manage to survive under such

harsh conditions.

We usually apply a variety of methods. The standard program includes the characterization and measurement of environmental parameters, mainly the water chemistry, and the collection of basic information on the population structure of cave mollies. The additional work varies from trip to trip. Previous projects included behavioral experiments on site, parasitological examinations, and analyses of the feeding ecology of the fish. Furthermore, we collect fish for laboratory experiments and tissues for genetic analyses.

Mollies are typically small fish up to 10 centimeters long and belong to the family Poeciliidae (live-bearers). They give birth to fully developed young, which are instantly independent. Males use a modified anal fin, the so-called gonopodium, to transfer sperm to the female during

copulation.

Cave mollies differ in several traits from their relatives inhabiting surface habitats. Cave mollies are essentially free of melanin, the pigment that colors our skin and protects us and other surface-living animals from UV radiation. Because skin pigment is lacking, the red blood shows through the skin and gives the fish a distinct rosy appearance. In contrast to many other cave fishes, cave mollies still have functional eyes, which are, however, reduced in size (Parzefall 2001). Furthermore, female cave mollies have developed an enlarged genital pad around their genital opening, and males nipping at the pad use their sense of taste to tell receptive from non-receptive females.

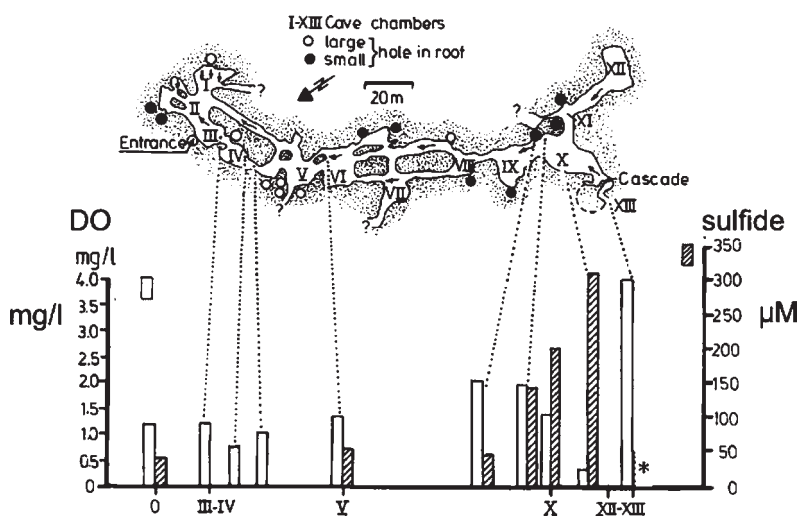
In their natural habitat, the cave mollies do not only encounter darkness, but also deadly concentrations of H₂S. How did these fish adapt to darkness and toxic H₂S? Our experiments have shown that cave mollies need access to the water surface, which is relatively high in oxygen and low in H₂S, to survive in the toxic water. This behavior is called aquatic surface respiration and is energetically very costly. It is not surprising then that cave mollies are chronically malnourished and their survival in the toxic water is influenced by energy (i.e., food) availability.

Early studies on the behavior of cave mollies found that they show far less aggressive behavior than surface-living mollies (Parzefall 2001); males simply don't fight! Fish reared in the laboratory are no more aggressive than males observed in the cave or wild-caught males, indicating that cave mollies are genetically distinct in this way from surface mollies. Our preliminary data on the population genetics in this system support this assumption. The reduction of aggressiveness has previously been interpreted as a consequence of life in darkness, where visual triggering of aggressive behavior is impossible. However, other cave animals, such as the Somalian cave barb *Phreatichthys andruzzii*, can be highly aggressive. An alternative explanation, then, is that cave mollies simply avoid any energetically expensive behavior as an adaptation to the toxic environment. In line with this reasoning, we found cave mollies to also have reduced amounts of other costly behaviors, such as coercive male mating tactics, which are

Sulfide concentrations in the air in different cave chambers, measured right at the surface and 1 meter above the surface. Concentrations were measured with a Pro GasBadge of Industrial Scientific.

Location (cave chamber)	Water surface [ppm]	1 m above surface [ppm]
V	1.5 (0.0-3.0), N=3	1.5 (0.0-2.9), N=3
IX	0.0, N=2	0.0, N=2
X	13.3 (0.7-29.6), N=3	8.7 (1.5-16.3), N=3
XIII	4.0, N=1	3.6, N=1

Oxygen and sulfide concentrations in the water in different chambers in Cueva de Villa Luz



regularly observed in surface-living mollies (Plath et al. 2003).

Beside reduction processes as an evolutionary response to life under extreme conditions, we found novel traits that have evolved in the cave molly and are absent in the surface population of this species. Surface-dwelling molly females typically prefer to mate with large males and reject small males, and they differentiate among males of different size using their eyes. When tested in darkness, however, surface females do not discriminate between large and small males. In contrast, cave molly females apparently evolved the ability to distinguish between different size males without using their eyes (Plath et al. 2004). The same is true for male cave mollies (Plath et al. 2006). Although cave mollies can still use visual information like conspecifics from the surface when they are exposed to light in the laboratory, these fish also use a novel way of assessing their partners' quality by using non-visual cues. In another study, we examined whether the extreme environmental conditions in the cave interact with the evolution of female mating preferences (Plath et al. 2005). When surface-living females were given an opportunity to choose between a well-nourished male and a starved male exhibiting the malnutrition typically observed in the cave, females did not show any mating preference, not even in light. However, cave molly females preferred well-fed males in light and in darkness. It seems that the indicator value of good male nutritional state is higher in the extreme habitat. In other words, a male in a good nutritional state is likely to sire better quality offspring.

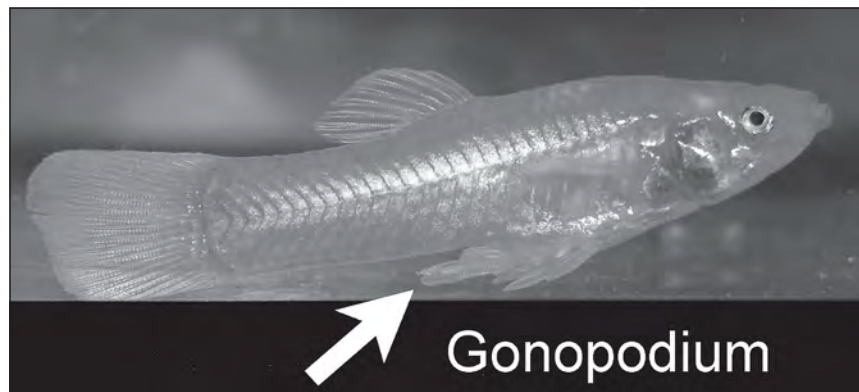
The cave molly is one of the relatively few vertebrates able to survive in an extreme and highly toxic environment. It has become a model system for

studying adaptations to darkness and toxic water. It is not yet completely understood which unique traits of the cave molly have evolved in response to the darkness and which have evolved in response to the toxic environment, but future research efforts hopefully will shed light on this.

Animal populations with a small distribution are often vulnerable. The cave molly has a very limited distribution and only occurs in Cueva de Villa Luz. Although locally very abundant, its uniqueness should be taken into account when the cave is visited or developed for tourist purposes. The area around Tapijulapa is developing more and more into a center for ecotourism, with the cave being one of the major

attractions. This is a great opportunity for the local people and will hopefully benefit the whole region. Soft tourism seems like the perfect way to go.

Cueva de Villa Luz is already well developed and an established tourist destination. So far no negative impact on the cave has been detected, but this may also reflect the lack of long-term studies tackling this question. Further development of the cave, however, may be a threat to the cave molly. It is critical that future development of the cave and its vicinity be accompanied by conservation efforts. Visits by tourists should be guided and restricted to the front chambers of the cave. This is also a safety issue, as the deeper parts of the cave show higher concentrations of H₂S in the air. Furthermore, any



Top: Male cave molly with the modified anal fin, the gonopodium, used to transfer sperm during copulation.

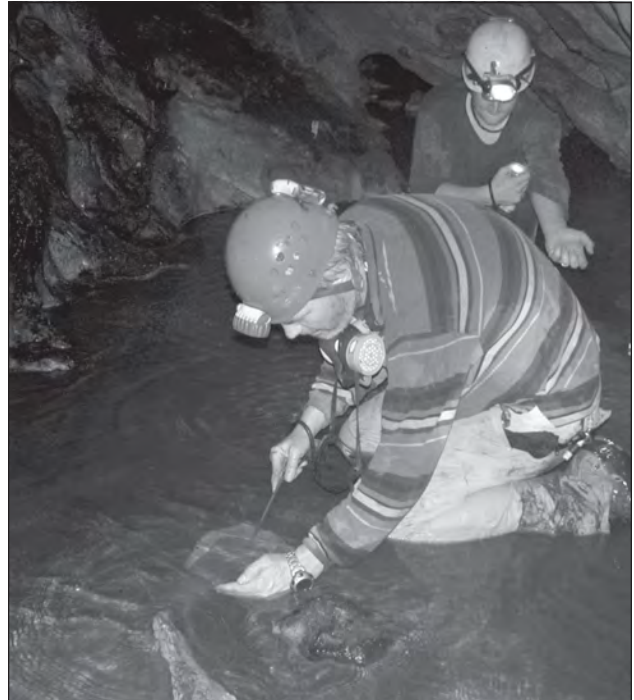
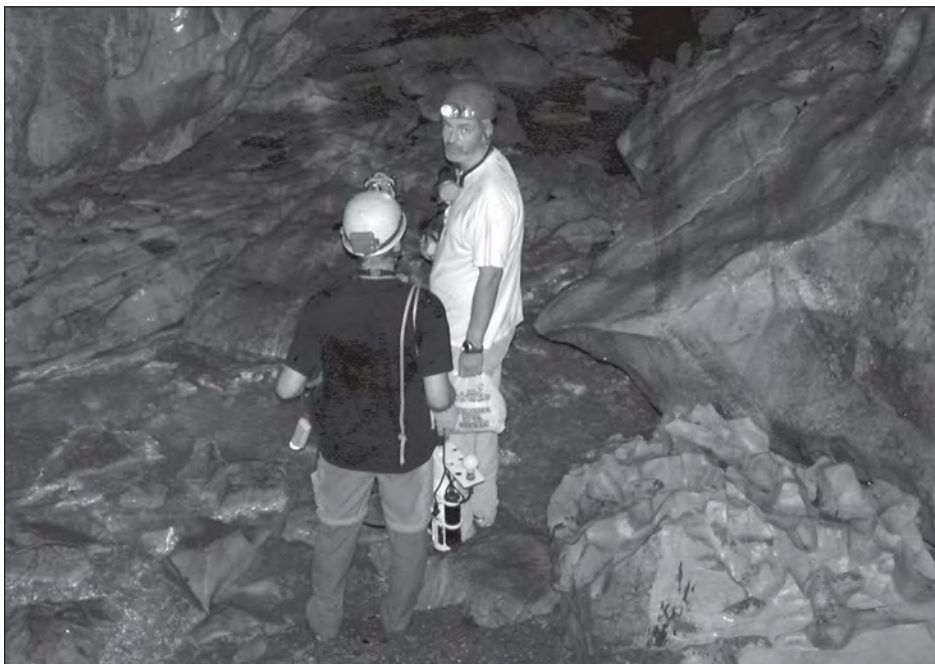
Middle: Female cave molly with a pronounced genital pad.

Bottom: A female *P. mexicana* from a surface population.



Rüdiger Riesch taking water chemistry measurements using a Hydrolab.

Ingo Schlupp and Rüdiger Riesch standing in the creek that drains Cueva de Villa Luz.



Due to their high abundance, cave mollies can be easily caught using dip nets.

construction within the cave should be avoided. In particular, the installation of permanent lights as found in many other developed caves will negatively affect the inhabitants of the cave.

On a larger scale, any accident that pollutes the cave has the potential to wipe out the whole existing population of the cave molly. With the extinction of the cave molly we would lose not only one of the most interesting populations of fish in Central America, but also a valuable model system for studying cave and extremophile organisms. Further information on the cave molly can be found on our webpage: <http://faculty-staff.ou.edu/S/Ingo.B.Schlupp-1/>. We would be very interested in any information concerning other fish species in caves that may be discovered during caving activities.

We thank the people of Tapiculapa for their continual support. We are grateful to James K. Langhammer (Royal Oak, Michigan) for giving us access to an unpublished manuscript by R. R. Miller. We thank M. J. Ryan (Texas) for his ongoing,

generous support. The Mexican government kindly issued several permits to conduct this research (the most recent ones are: *Permiso de pesca de fomento* numbers: 291002-613-1577, DGOPA/5864/260704/-2408 and DGOPA/16988/191205/-8101). Financial support came from the DFG (SCHL 344/15-1; PL 470/1-1), the University of Oklahoma, the University of Texas, the German Ichthyological Association (to M.T. and M.P) as well as the Basler Foundation for Biological Research, the Janggen-Poehn Foundation, the Roche Research Foundation, and the Wolfermann-Nägeli Foundation (to M.T.). M. Hänel kindly prepared the map in this article. We owe special thanks to Jakob Parzefall for introducing us to the cave and its fascinating inhabitant, the cave molly!

Gordon, M. S., and Rosen, D. E. (1962) A cavernicolous form of the Poeciliid fish *Poecilia sphenops* from

Tabasco, México. *Copeia*:360–368.
 Hose, L., and Pizarowicz, J. (1999) Cueva de Villa Luz, Tabasco, Mexico: Reconnaissance Study of an Active Sulfur Spring Cave and Ecosystem. *Journal of Cave and Karst Studies* 61:13–21.
 Parzefall, J. (2001) A review on morphological and behavioural changes in the cave molly *Poecilia mexicana* from Tabasco, Mexico. *Environmental Biology of Fishes* 50:263–275.
 Plath, M., Seggel, U., Burmeister, H., Heubel, K. U., and Schlupp, I. (2006) Choosy males from the underground: Male mate choice in surface- and cave-dwelling Atlantic mollies, *Poecilia mexicana* (Poeciliidae, Teleostei). *Naturwissenschaften* 93:103–109.
 Plath, M., Heubel, K. U., Garcia de Leon, F. J., and Schlupp, I. (2005) Cave molly females (*Poecilia mexicana*, Poeciliidae, Teleostei) like well fed males. *Behavioral Ecology and Sociobiology* 58(2):144–151.

Plath, M., Parzefall, J., Körner, K. E., and Schlupp, I. (2004) Sexual selection in darkness? Female mating preferences in surface- and cave-dwelling Atlantic mollies, *Poecilia mexicana* (Poeciliidae, Teleostei). *Behavioral Ecology and Sociobiology* 55:596–601.
 Plath, M., Parzefall, J., and Schlupp, I. (2003) The role of sexual harassment in cave- and surface-dwelling populations of the Atlantic molly, *Poecilia mexicana* (Poeciliidae, Teleostei). *Behavioral Ecology and Sociobiology* 54:303–309.
 Tobler, M., Schlupp, I., Heubel, K. U., Riesch, R., Garcia de Leon, F. J., Giere, O., and Plath, M. (in press) Life on the edge: Hydrogen sulfide and the fish communities of a Mexican cave and surrounding waters. *Extremophiles*.

Biología evolucionaria de la Cueva de Villa Luz

Científicos de los Estados Unidos, Alemania, Suiza y México han estado estudiando los peces de la Cueva de Villa Luz, Tabasco, la cueva de ácido sulfúrico. Los peces son similares a sus parientes de la superficie, pero tienen ojos más pequeños, carecen de pigmentos en la piel y tienen otras diferencias. Los peces sobreviven en agua con altas concentraciones de ácido sulfhídrico al permanecer cerca de la superficie, con una relativa abundancia de oxígeno.

HIGH DESERT CAVING

Bev Shade and Peter Sprouse

Saturday morning, January 21, 2006, a group of cavers met at Zara world headquarters in Buda, Texas. Jean Krejca, Charley Savvas, and Bev Shade joined Peter Sprouse in Peter's silver 4Runner. With four cavers, four computers, and all our gear, it was a cozy fit. We headed from Buda to Eagle Pass, where we met up with Jim and Cat Kennedy, also in a silver 4Runner. Properly color coordinated, we were all ready for high adventure in eastern Coahuila, searching for caves, bats, guano, invertebrates, and springs, roughly in that order.

Our group crossed the border into Piedras Negras and drove to Zaragoza, Coahuila, to search for the source of a bat flight. This lead had been on a list of radar signatures made by Steve Walker at BCI. We hoped to find a bat colony, perhaps a cave, although Zaragoza is an unlikely spot to find caves. We did not find any bats or caves in Zaragoza, but did meet Sr. Gustavo Herrera, who owns a large ranch northwest of there that he reports does have caves and, possibly, blind cave fish in some wells. Once we explained our purpose, he was quite friendly and offered to host us sometime at his ranch at Río San Antonio. While visiting with Don Herrera, we had a chance to observe a bull getting slaughtered, as well as several coyote heads in various states of preservation nailed to a fence. We tried to track down the owner of the Ojo de Agua southwest of Zaragoza, since it is rumored to have blind fish, but he was not at home.

We continued south to Múzquiz to pursue other leads; on the way we

Shade: bev@purificacion.org
Sprouse: petersprouse@yahoo.com

stopped at a warm spring complex along Highway 57, at San Esteban. The springs were bubbling up through thick alluvium, but after a few minutes of looking, Jean did find a possibly stygobitic isopod. We searched the pools until dusk, then drove on to stay the night at Múzquiz.

On January 22, we got a key to the ranch gates that lead to the Cañon la Alameda, which has at least one known cave, Cueva de la Virgen, a bat cave that Jim Kennedy had visited several years ago. This ranch was also reported to have another bat cave, Cueva de León, which we hoped to find and map. The drive to the ranch took us through some beautiful mountains and canyons. Along the way, we spotted a number of small dark holes in cliff faces. We checked out several that were close to the road. They were all small paleo-springs. A few minutes down the road from them, another dark blip looked more compelling, so Jean and Bev hiked through the scrub to reach it. Of course, it was farther away than it looked, and the hike there involved bashing through a lot of cactus, agave, and cat's claw. The cave turned out to be another small paleo-spring, and it was clearly big enough to provide shelter to some mammals, judging from the dry scat in the cave. We named it Cueva de Ouch Ouch Ouch Hanta for its painful approach hike and scatological contents. Jean and Bev mapped the 7-meter-long cave, since they had made such an effort to reach it. We then searched for the rancher whom Jim had met previously to get directions to Cueva de León,

but were turned back by some closed gates for which we did not have a key.

We opted to try to map Cueva de la Virgen, which has been a guano mine and does not have a good map. Hours of hiking in steep, prickly terrain later, we had found neither cave in León. The group split up in an effort to cover more ground. Jim and Bev tried to take a clever route back to the road, a Bad Idea. We eventually regained the road and were picked up by the others. Back in the trucks, we drove farther up the canyon to a ranch house belonging to Sr. Mario Cárdenas, an elderly man who had lived his entire life in this canyon. After some discussion, it became apparent that Cueva de la Virgen and Cueva de León are in reality the same cave. As it was almost dark and we were out of bat-cave leads, we drove back to Múzquiz, returned the gate keys, and headed south to San Buenaventura.

On January 23, we were joined by two biology students from the Instituto Nacional Politécnico Durango

Río Candela below Gruta de Consuelo.

Peter Sprouse.





The main passage at the bottom of Pozo Cokendolpher. *Peter Sprouse.*



Charley at the entrance to Cueva el Tulillo. *Peter Sprouse.*

campus, Emma Gómez Ruiz and Miryam Coronado Saldaña. We drove north to San Lorenzo in search of permission to visit Cueva el Tulillo, a bat cave mapped by Terry Sayther and others in 1975. We arranged access to the cave for the following day, then visited Cueva del Carmen, which is the cave entrance adorned with a large painting of the Virgen de Guadalupe that is clearly visible on the south side of the road as you drive from San Buenaventura to Cuatro Ciénegas. Supposedly this painting was made after the victim of a serious auto accident on the highway below prayed to the Virgin of Guadalupe and was cured.

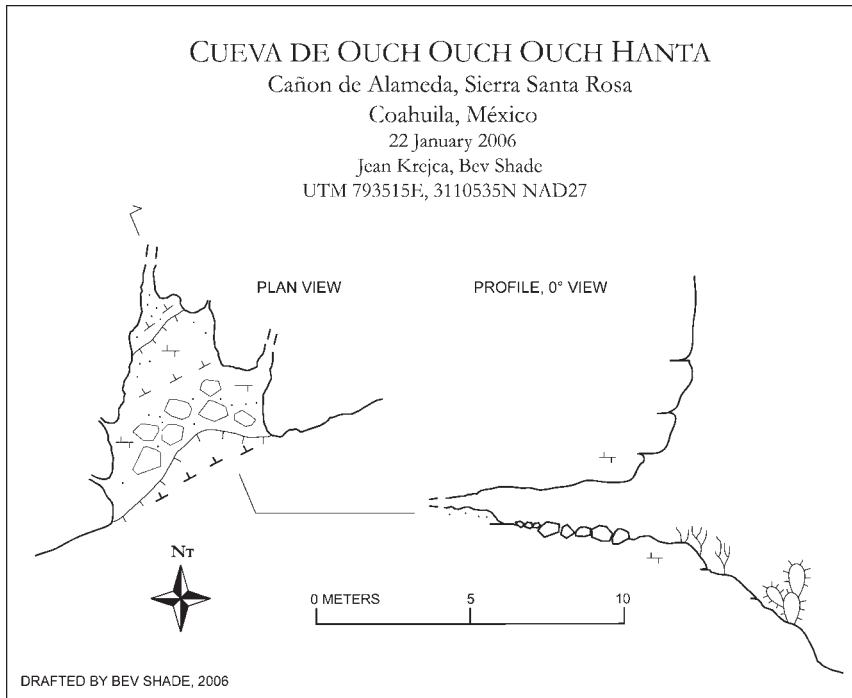
The cave most visible from the road is Cueva del Carmen no. 1, a short section of big, old phreatic passage that runs right through a thin ridge. The cave is perched high above the road, and both ends of this short through-trip provide fantastic views of the Lamadrid Valley. Cat, Emma, Miryam, and Bev

mapped and photographed cave no. 1, while Jean, Jim, and Peter found and mapped three more caves. Cuevas del Carmen no. 2 and 3 are on the south side of the ridge and contained a few bats (*Corynorhinus townsendii*), traces of bat guano, evidence of mining, and a few other critters. Cueva de Carmen no. 4 is on the north side of the ridge, just east of no. 1 along the cliff face. Its entrance is a bit larger than that of Cueva del Carmen no. 1, and leads to a main passage about 30 meters long. Number 4 has also been modified by digging; what for isn't clear, since, while the cave does contain guano, it is not present in mineable amounts. A bat was seen in the cave, and several pseudo-scorpions (probably a new species) were collected in the back of the cave.

We finished our surveys at dusk and hiked down to the trucks in the dark. The first people down to the trucks got to look back at the line of bobbing

headlamps snaking down the steep hillside, with stars silhouetting the dark outline of the mountain behind them.

On January 24, we drove out to Cueva el Tulillo. We started out following the rancher we had contacted the previous day, but his truck broke down about halfway there. He loaned us the gate keys, we loaned him some jumper cables, and we continued to his ranch. His wife guided us to the fence line of the next ranch and gave us directions to the cave. The fence cut across the valley on a straight line, ending 3 kilometers to the east in the Cañon el Guano, where the cave is located. An old mining road runs up the valley to the base of a pile of tailings that spills out of the cave entrance, making an easy hike to the cave. At the top of the tailings pile were two entrances. The one on the left didn't go far, but it did have a set of bed springs in it, along with scattered clothes. The main entrance opened into a gallery that immediately split. The passage to the left led to a skylight entrance and also down to a dusty lower level. The right hand passage led to the main part of the cave, which is very large passage with several branches. At regular intervals, there were deep expanses of bat guano, which we measured. The cave had originally been mapped in summertime, when the cave is chock full of bats, making conditions in the cave very . . . challenging. Since our trip was in January, we were able to see the cave at a much



more leisurely pace and also avoid the several deep guano “pools” that had waylaid the original explorers. In a right-hand passage we located a colony of two to three hundred *Mormoops megalophylla*. We caught one of these in a mist net and photographed it. Among the invertebrate fauna were numerous spiders, pseudoscorpions, and tenebrionid and dermestid beetles. We also got to see several ring-tailed cats in various corners of the cave. We hiked back to the truck and drove off the ranch at dusk. In San Buenaventura we bid farewell to Emma and Miryam, who were headed back to school in Durango.

January 25 was rainy and cool. Jim and Kat headed back to Texas, while the rest of us sorted data and caught up with e-mail. About midday, we headed to Candela in hopes of visiting several caves and mines in that area. On the way, we tried to make our way to Mina de San Pablo and Cueva (Mina) de las Animas, but the ranch gates were locked. The same was true for access to Gruta del Polvo and Mina el Alce. We stopped at the municipal president’s office in Candela. He told us that it would be very difficult to arrange access to those sites, as well as Cueva del Alamo, but he was able to arrange access to Gruta de Consuelo and Gruta de Carrizal, although we didn’t end up visiting the latter.

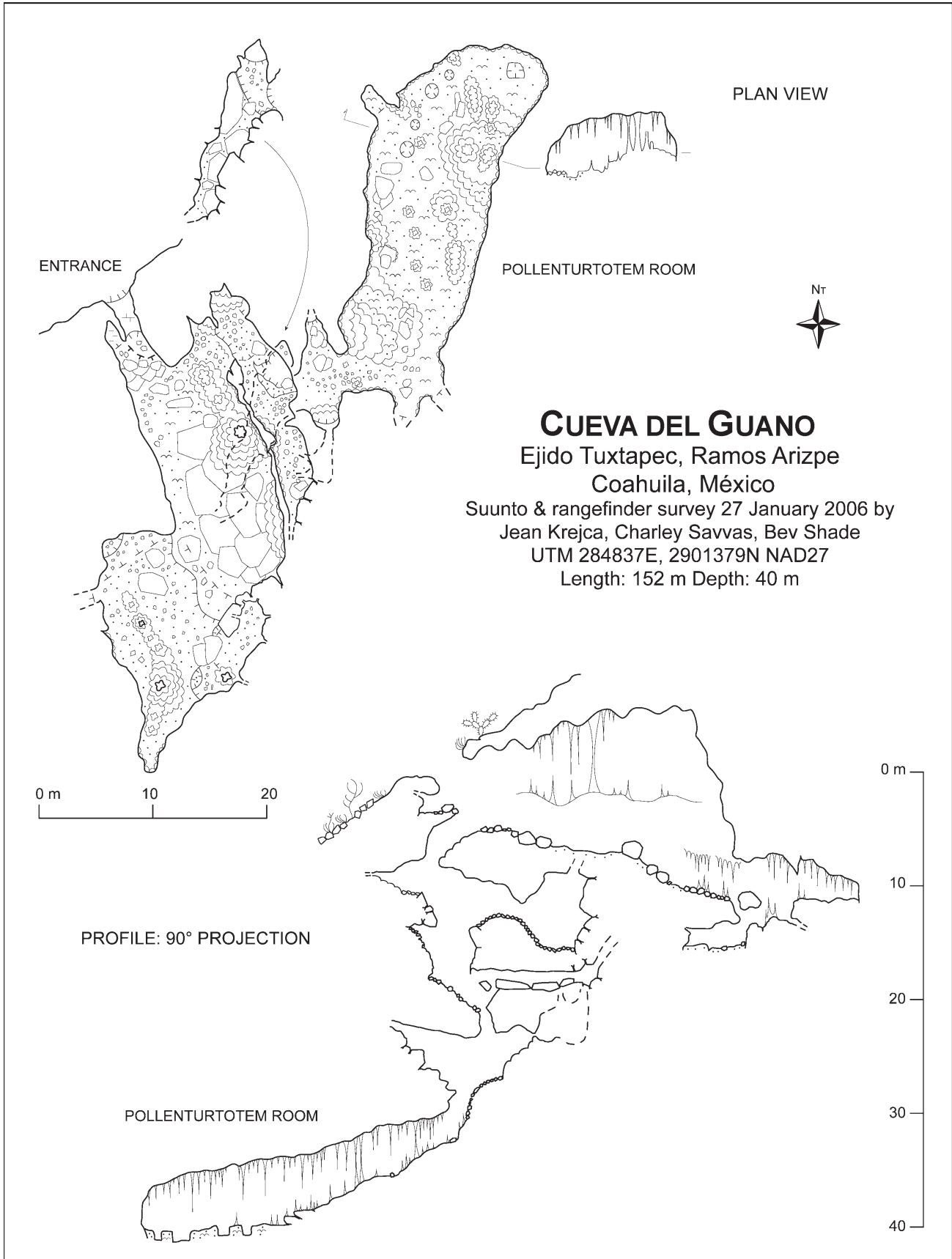
On January 26, we set off first thing to visit Gruta de Consuelo. The folks from the *presidencia* let us in the gates of the closed Parque Recreativo los Carricitos. The drive up the Río Candela was nice, with views of clear pools and exposed bedding planes. There were a number of hot springs below the cave, and we placed mop-head traps in some of them that we would pick up after caving. The first spring, next to a vandalized chapel, was dammed up for tourism, with water boiling up through sand in the middle. We followed another tributary to the south that wound past a very dead horse and past another warm spring. This spring had a more



Above: Jean in the entrance room to Cueva del Carmen #4. Peter Spourse.



Below: Jean leaving Cueva de la Azufrosa. Peter Spourse.



distinct orifice, where we found a stygobitic isopod, a probable new species. Another small spring up the Río Monclova proved suitable for a mop trap as well.

A short, but steep hike got us up to a mine tunnel stacked high with sacks of guano. The tunnel led into the natural cave at a spectacular entrance that is reported to have a very large bat flight in summer. The cave has nice large borehole passages, with lots of guano deposits and evidence of guano mining at some time in the past. In all we counted nearly seven hundred sacks of guano in the cave. The main loop through the cave had enormous quantities of fresh guano on the floor and extensive roost stains in a series of contiguous domes. We were running short of time, so we hurriedly split into two survey teams to map most of the cave, sketching in the guano deposits. We hiked down the hill at dusk and drove back to Monclova for the night.

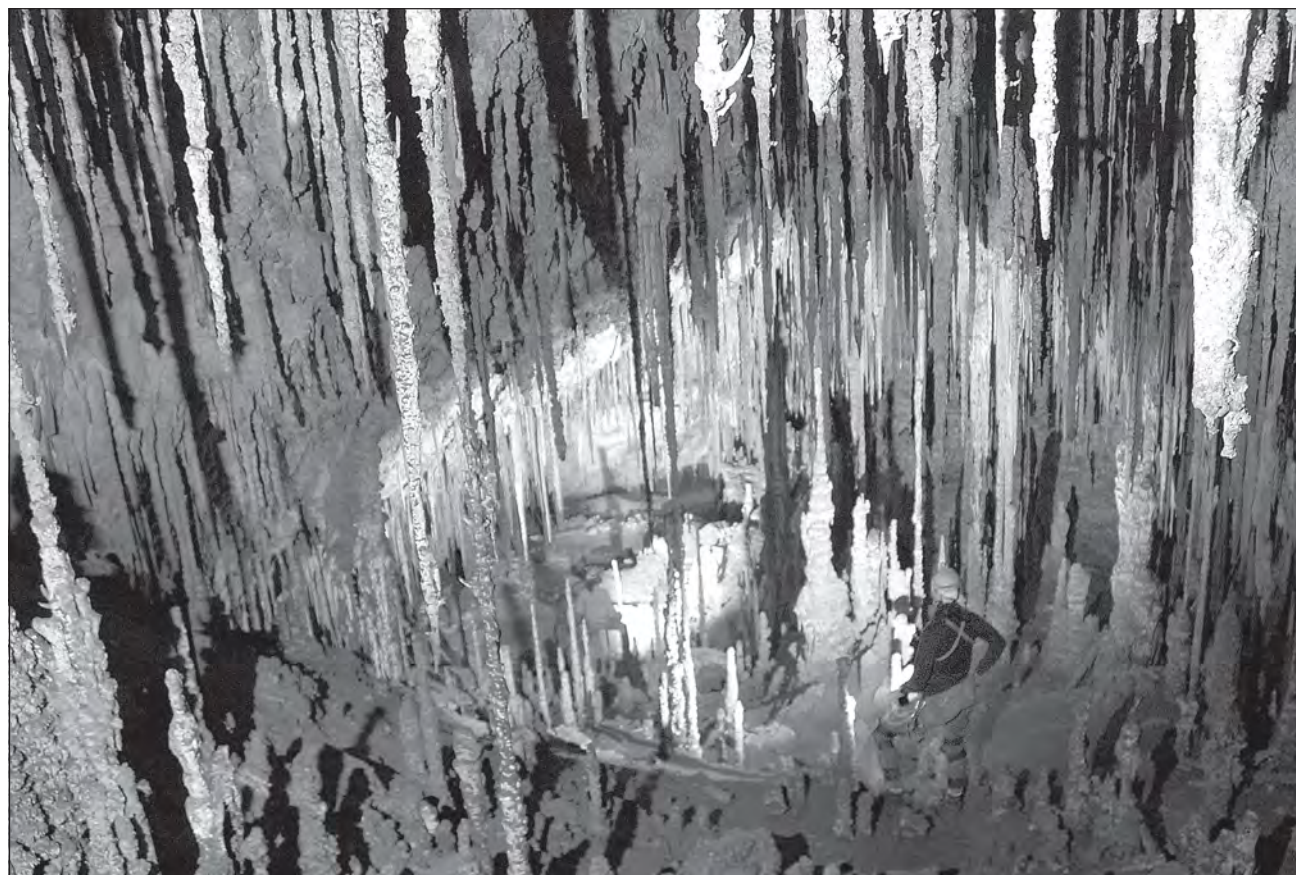
We left Monclova on the morning of January 27, headed south toward Saltillo. At Plan de Guadalupe we

turned east off the highway and drove to Ejido Tuxtepec. We asked about two guano-cave leads on the south flank of the Sierra la Gavia and picked up a guide to take us to the southern one. We talked to centenarian Degollo Rodríguez, who told us that in 1950 engineers had come from San Antonio, Texas, to assess the guano deposits in the cave. They had descended the pit on sisal ladders with metal rungs, but ran into trouble getting the ladders back out. They never returned to mine the cave. With a young guide from town, we were able to drive about halfway to the cave. Our guide found the cave quickly. It was a very nice pit entrance located right in a steep arroyo. We could see sculptured walls dropping into blackness, and a guano smell wafted out. Birds obviously roost in the entrance area. There were occasional thick deposits of bat guano on ledges, although only one bat was seen in the cave, flying around in the entrance pit. At the bottom of the third pit we reached a large passage going in two directions. On the floor lay two steel ladder rungs. We split into two teams,

Jean and Bev mapping westward while Charley and Peter mapped to the east. To the west there wasn't too much guano, as water from the entrance flows into that passage, which had a number of interesting formations and ended in a silt fill. We named this cave Pozo Cokendolpher in honor of cave biologist James Cokendolpher.

To the east, Charley and Peter descended a steep climb into a large gallery that went two ways. One, which Jean and Bev surveyed later on, led back under the climb, and Peter and Charley followed the bigger passage to the east. A guano-covered slope led down into a larger gallery with forests of stalagmites. A bank of gypsum sand ran along the left wall, and deep guano patches lay on the floor. Here were found the remains of a wood-handled shovel, presumably from the guano recon trip in 1950. They ascended a slope and reached a drop-off where you could climb down on the right side via a stal ledge. A moderate-sized room lay below, the apparent end. Charley climbed down into a gypsum ear to find that it soon pinched below. They made their

The formation room at the bottom of Cueva del Guano. *Jean Krejca.*





Peter peering into Pozo Cokendolpher.
Jean Krejca.

way back and found the others wrapping up the lead under the initial climb-down. We derigged and hiked back to the truck to make camp for what remained of the night.

Several of us opted to sleep out without tents, as the night was pleasantly cool, so an early morning drizzle a few hours after we went to bed sent us scurrying to get packed up and ready to go. We returned to Ejido Tuxtepec, intending to just check in with them and head on, but ended up finding out about another guano cave in Cañon Verde. We were able to drive to the mouth of the canyon with three young men from town as guides. From there we walked up to the cave. Charley and Bev hiked back to the truck to collect gear. Jean was done sorting collections by then and joined them in mapping the cave. Cueva de Guano is located up a small arroyo on the east side of the canyon. It has a 2-meter climbdown into a large room with bird and bat guano, and a narrow, mined passage on the north side of the room drops to another large room, which was very well decorated and had substantial deposits of guano from pollen-eating bats, possibly *Leptonycteris*. It was mined for guano sometime in the past.

While Bev and Charley were returning to the truck for gear, Peter followed the guides up the mountain to see a blowing pit. It turned out to be all the way on top of the ridge, overlooking Nuevo León to the north. The ridgetop was only 15 meters wide, and right in the middle was the pit. It was about 1.5 meters across and seemed to drop 20 meters through fault breccia. It was lined with green moss and was blowing a lot of warm, moist air. After a steep hike down through lechuguilla,

Peter rejoined the others as they were leaving the truck to map Cueva del Guano. We finished mapping the cave after dark and drove to Castaños for the night. Despite Jean's encouragement, we were too tired to enjoy the Rodeo Bar next door to our hotel. In the morning, the hotel offered rooftop access by ladder for views of scenic Castaños. We drove north and, after a brief detour back to Castaños to retrieve Charley's camera, stopped to look at the Hermanas hot spring.

We tried to look at some of the springs west of Allende, but couldn't get through various locked gates. Since it was only noon, we decided to swing by Cueva de La Azufrosa near Allende to try to finish the map. We got the key from the village and drove on up to park at the sulfur spring. At the entrance we donned our P100 histo masks. Once inside the cave, Charley and Bev went into the right hand (southern) passage to continue the survey, while Jean and Peter went toward the back to assess bats and guano deposits. They mist-netted two

Mormoops and photographed one of them. Then they decided to map a passage that went left at station 13. It went well, and soon they could see a flowing freshwater stream below them in the canyon. Jean spotted a gopher snake hanging around hunting bats. It disappeared into a lower level as their route turned to a crawl. Jean checked ahead and flushed quite a few bats. She came back reporting about three thousand bats and a walking stream passage. They decided to leave the lead for later and went back to rejoin the others, who were wrapping up their survey and had collected some cave scorpions, an exciting find. Peter and Jean returned to the truck and packed up, while Charley and Bev examined the sulfur springs for biology and geology.

As the sun set we headed home to Texas. Thanks to Bat Conservation International for sponsoring this trip.

Sacks of guano in Gruta de Consuelo.
Peter Sprouse.



Espeleología en el Desierto.

Espeleólogos visitaron cuevas en el este de Coahuila, principalmente para colecta biológica y localización de cuevas con un número importante de murciélagos.

GÓMEZ FARIÁS CAVING

NOVEMBER 2005

Peter Sprouse

I had a number of goals in mind for this trip, and we met all of them: to share caving experiences with the cavers from Cd. Mante, to map the caves of the Gómez Farías valley, and to further the experiences of the UT Grotto. An added bonus was the presence of more caving friends from DF, Saltillo, Wyoming, and Catalonia. Gómez Farías is the gateway to the El Cielo Biosphere Reserve in southwest Tamaulipas. Many cavers had ventured to the heights of the Sierra de Guatemala over the past forty years with dreams, mostly frustrated, of finding the deepest cave. But they were driving past some of the best caving in the area right in the town of Gómez Farías. This town is strung out for several kilometers along a narrow basalt ridge that separates the Sierra Chiquita from the larger range to the west. On the west side of this ridge there is a narrow valley at the foot of the Sierra de Guatemala, or the Sierra de los Mangos, as it may be called locally. Many small streams leave the basalt and flow across a narrow band of shale to sink into pit entrances in the limestone. The resulting caves are multi-drop systems that reach sumps, usually containing blind fish of the genus *Astyanax*, at around 150 meters depth.

A number of these caves were explored and mapped in the years around 1970. Caves with names like Molino, Jineo, Escondido, and Plan caught the interest of AMCS cavers for a brief period, mostly due to the blind fish. I visited Gómez Farías a few times in later years and mapped Sótano de Gómez Farías and Sótano de Laksi, but

petersprouse@yahoo.com

it wasn't until a chance meeting with Mante caver Jean Louis Lacaille Múzquiz at EspeleoCoahuila 2004 that the stars aligned. We decided to collaborate on a caving project, which we began in June 2005 on our way to do a deep pit in Querétaro [see *Culebra* article elsewhere in this issue], when we joined JL to map two pits, Sótano de Berrones and Sótano de Los García. A larger trip was then planned for November, and I lined up a large crew with the ideas of both resurveying some of the old caves that still lacked good maps and also finding new ones.

As usual on such trips, we headed south from Austin in a fleet of (mostly) Toyotas. On 18 November 2005, Terri Sprouse, Juan Laden, and I stopped to pick up Barbara Luke, who had flown into San Antonio. Unfortunately, she had forgotten her passport, so we visited a famous local caver to borrow her voter's registration. But they wanted a photo ID as well at the border, so she couldn't get across. We left her at a Laredo hotel and forged on; she would find her way to us in a few days. We found a good camping spot right before the toll-road junction.

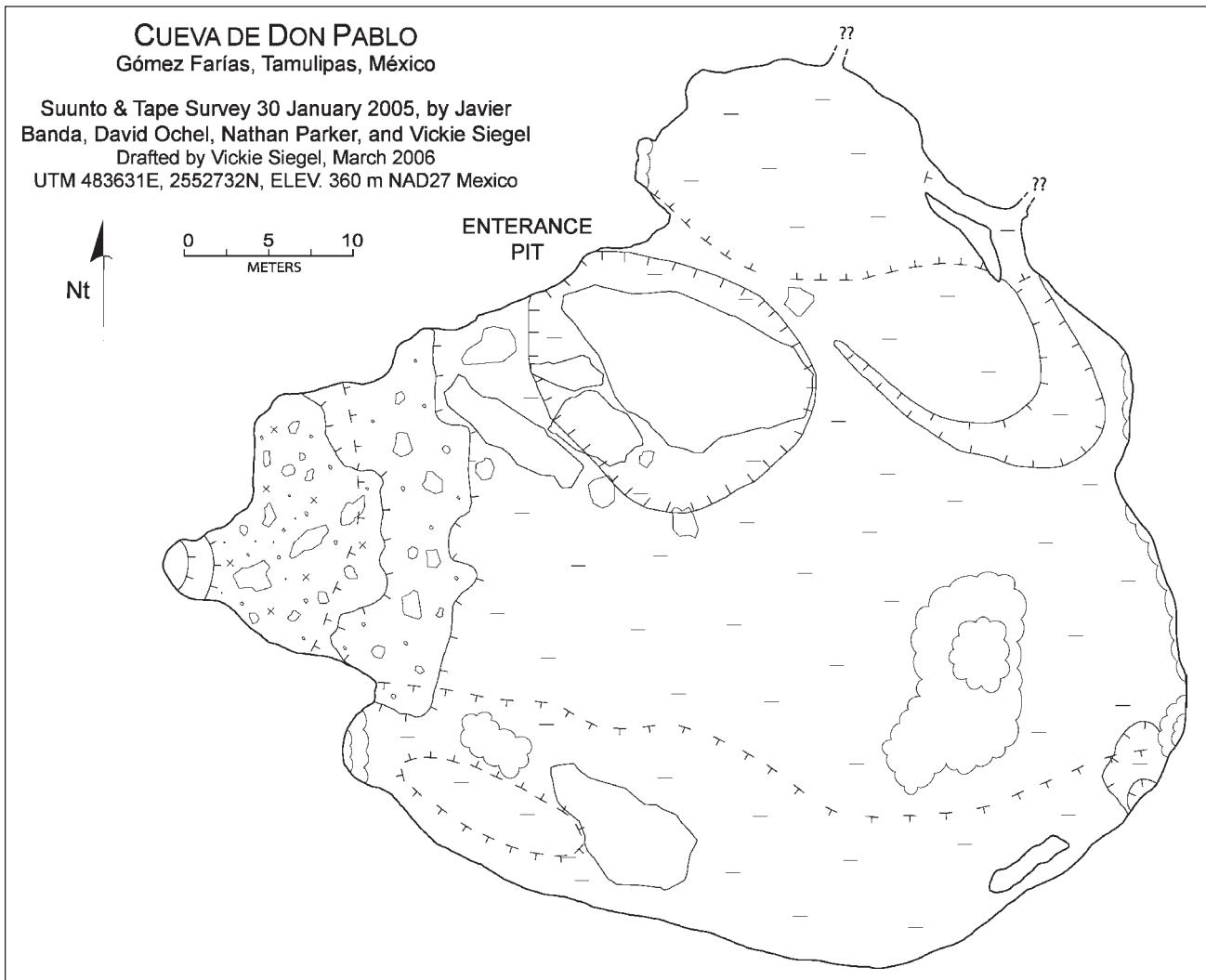
The next day we headed south through Monterrey and visited Cueva de la Boca. Juan and I made the steep hike up to the entrance. It was impressive as always, although the chain-link fence installed by ProNatura to protect the bat colony had been breached. The walls of the entrance passage were decorated with vast murals of graffiti. The rest of the drive was uneventful, and we arrived at Gómez Farías to be greeted by Charley Savvas, Vickie Siegel, Kara Dittmer, Mónica Ponce,

and Javier Banda. We settled into the Posada Campestre, our headquarters for the week, and soon Aimee Beveridge, Nathan Parker, Marlena Cobb, Ernie Garza, David Ochel, Pat Rhodes, and Shannon Summers arrived there.

The next morning we found that Philip Rykwaldler had arrived in the middle of the night. It had rained all night, and several people had soaked tents and sleeping bags. Aimee, Monica, Patrick, and Ernie went to Cueva del Ojo de Agua, a large resurgence cave on the east side of the Sierra Chiquita for which we lacked a map. They mapped about twenty stations in large passage with lots of biology. Jean Louis joined Terri and me to locate various caves, first taking Charley, Juan, and Kara south to look for Cueva del León. We spent about forty minutes locating it. Charley's crew went down several short drops in a semi-wet canyon with airflow. They stopped at a deep drop. My crew went off to a cave in the valley west of the plaza. It had no name, so Jean Louis suggested we call it Cueva de Álvarez, after the landowner. It was next to a not-yet-open tourist cabin Jean Louis had commissioned, and a new stone stairway went down into the sink. The cave opened under a headwall, with a climb-down into a flat-floored room. There were three aboriginal hand prints underneath twentieth-century graffiti. I collected schizomids and terrestrial isopods. Philip, Marlena, and Shannon went to look for Resumidero de Jineo, but instead Marlena found a different stream-sink, a small hole with airflow. David, Nathan, Vickie, and Javier went to the north along the road to El Azteca and mapped Sótano de El Fin, a cave by the road that had been sketched by

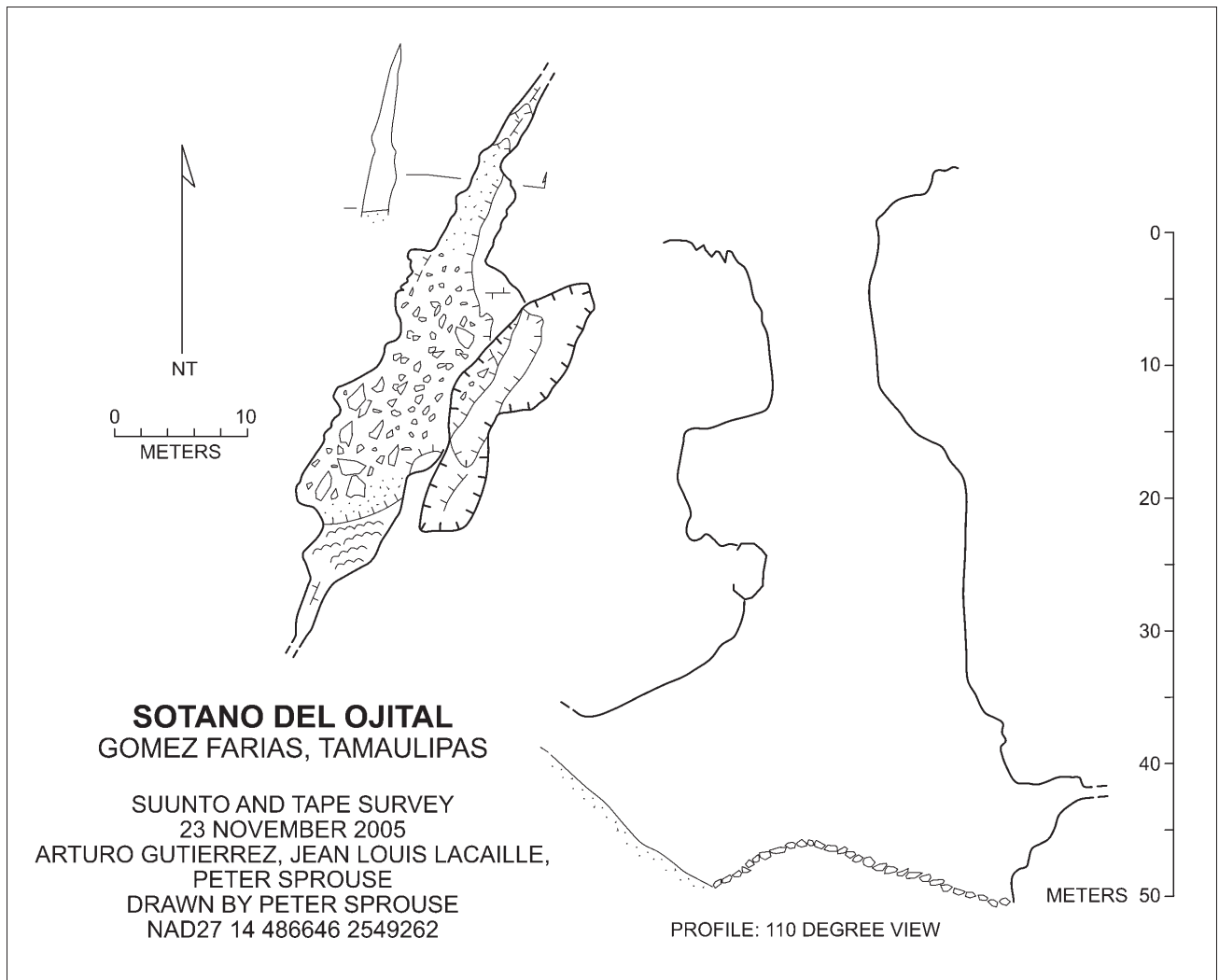


Peter Sprouse.





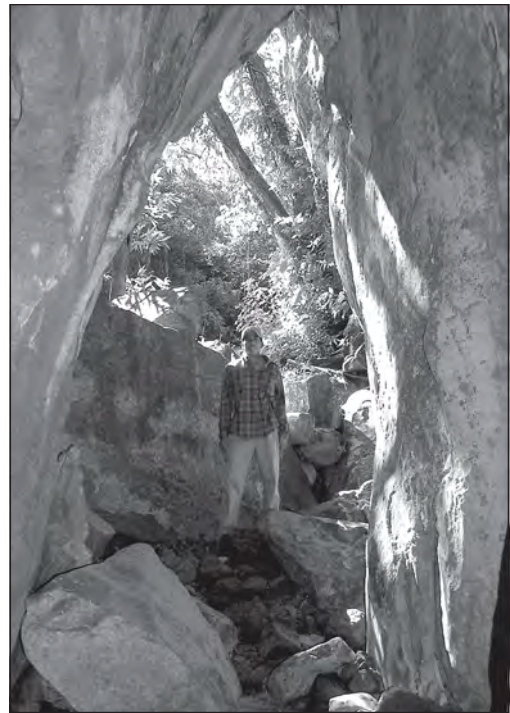
David Ochel at Sótano del Catedral. *Nathan Parker.*



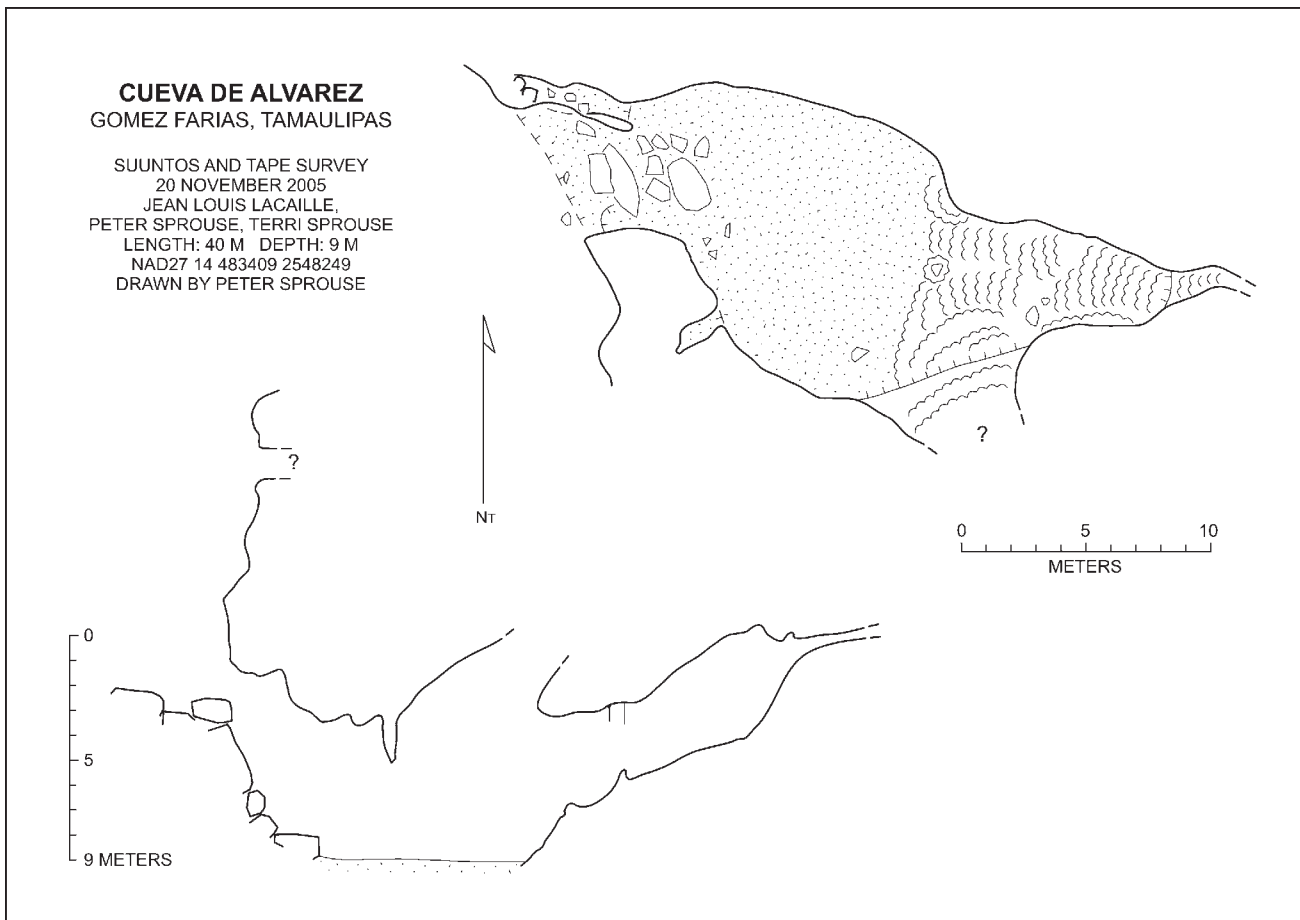
William Russell in the 1960s. They were also shown a cave that they named Sótano de Don Pablo, after the landowner, Pablo Berrones. My crew came across them hiking back, and they joined us to look at two pits JL knew of. The first one was just south of Sótano de Berrones, and it looked nice, maybe 20 meters deep. We named it Sótano del Pájaro Vaquero after an odd-sounding bird we heard calling. The next one was north of Berrones, a smaller pit we called Sótano de las Espinas. When we got back to the *posada* we found that Gustavo Vela and Sergi Gómez had arrived.

Nathan and crew went back to the Azteca Road area the next day and went to the ostensibly marked location of Cueva de Ask Patty, vaguely reported by Patty Mothes and Roy Jameson in the 1970s, but found only a shallow crack. So they returned to Cueva de Don Pablo and began mapping it. It was a large room that went about 60 meters deep, with little fauna. Charley's crew went back to Cueva del León, and it kept on going in clean-washed passage.

They found a tube-maze area six drops down with several pits going off, with air. Lots of fauna were seen. Philip's crew pushed the pit Marlana had found, Sótano del Brinco de Alicia (Alice's Plunge), rigging down four drops through canyon passage. It kept going. Aimee, Pat, Gustavo, and Ernie finished mapping Cueva del Ojo de Agua. Terri, Jean Louis, Mónica, and I were taken by Gustavo Berrones to see the deep pit he had found just west of town. We did a jungle chop through the karst to get there. It was a nice pit four seconds deep, and we named it Sótano de Gustavo in his honor. After lunch we left Mónica to catch the bus back to Saltillo, while we went off to meet Rogelio, whose friend took us to a pit near Sótano de Gómez Farias. It was a small pit on a hill, not very impressive-looking, but we knew this was a good area. We named it Sótano de la



The entrance to Resumidero de los Mangos. Peter Sprouse.



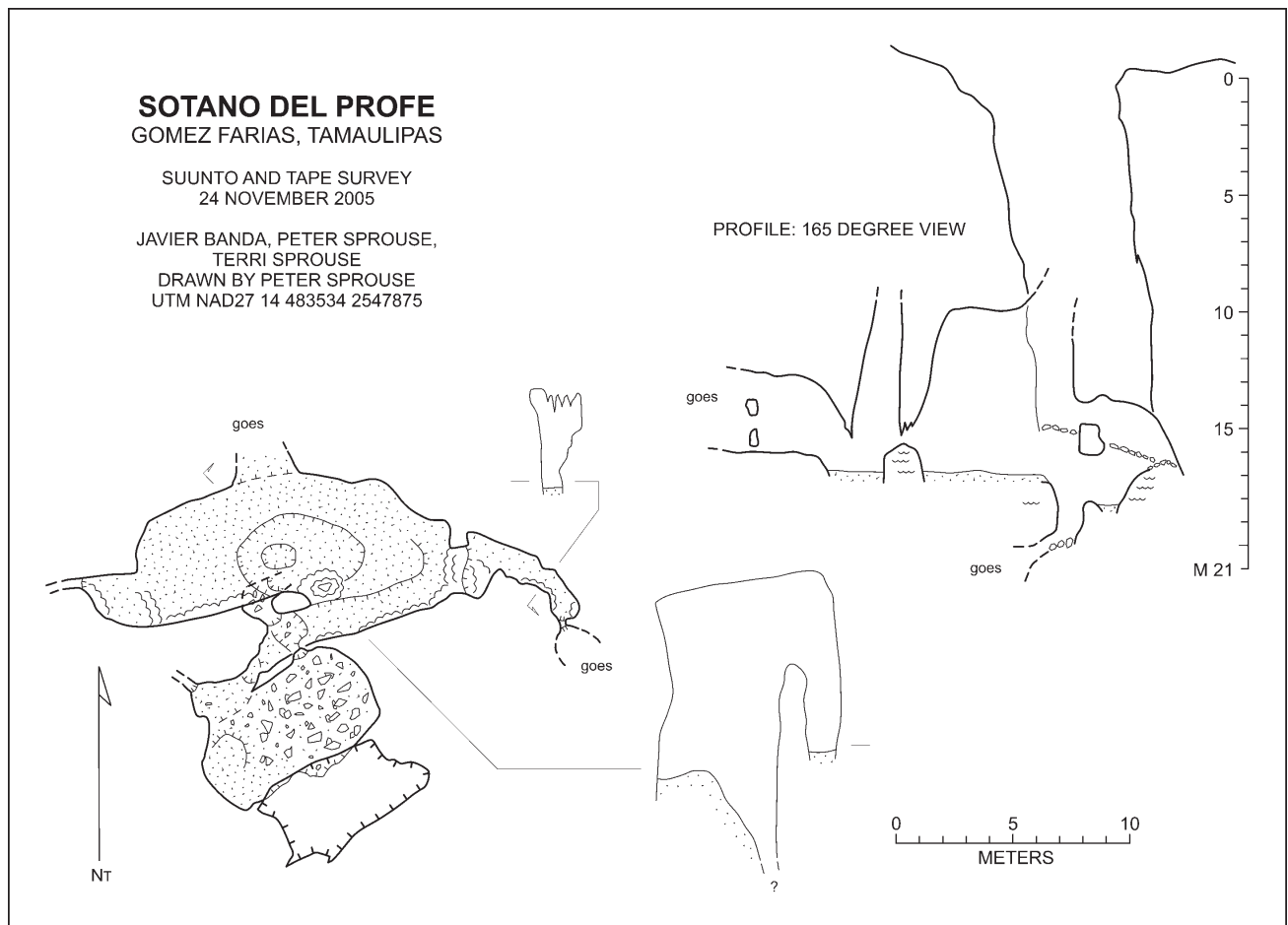


Javier Banda in Resumidero de Jineo.
Peter Sprouse.

Tinaja, after the name of the area. The 14-meter entrance pit was followed by a 2-meter climb up to a stal-constricted window that we enlarged a bit with a rock, allowing us to squeeze through into the following 6-meter drop. This went into a spacious room with two pits going off and a climb down into breakdown. We fed the rope on down the pit closest to our landing point. JL went down to see if the rope reached, but it didn't. So I checked the breakdown route, but couldn't get too far before it got vertical again. JL agreed to go get another rope, so Terri and I collected and took pictures until he got back. When he returned, Terri and I surveyed on down. It was a 23-meter drop that was followed by a 4-meter climb down to a mud plug with bad air. We climbed back up and rigged the rope down the parallel shaft. After 12 meters,

this shaft landed on a flat floor, but an offset pit continued down. I rappelled this pit to a bridge that had pits on each side. Since it was getting late, we left it for the next day. That evening Andy Gluesenkamp, Leah Adams, and Geoff Hoese arrived from caving in Querétaro.

Nathan's crew got an early start the next day to the Azteca Road caves. They finished mapping Cueva de Don Pablo, then mapped Sótano de las Espinas. It had a short second drop to it. To our delight, Barbara Luke arrived just in time to join us for breakfast. She had taken a bus back to San Antonio and had arranged to have her passport shipped to Chris Vail's house there. Tucked inside her passport she found a 180-day visa that she had acquired in June. It was still valid. She hopped on a bus to join us in Gómez Farías and, ironically, was able to cross the border on the bus without ever having to show her visa. After breakfast, Barbara joined Charley's crew to help survey the tube maze in Sótano de León. Aimee and Geoff joined Philip's crew in Alice's



Plunge. They bottomed out the cave at 113 meters depth, but some side leads remained. Sergi, Arturo, and Patrick joined me in Sótano de la Tinaja. We were joined there later by JL and Gustavo. We riggered the cave, with Sergi (Dimoni) setting some self-drive bolts. He rigged the fifth drop from a natural over a horn. It dropped 26 meters to a ledge, where another bolt was set to get down a sixth drop, of 21 meters. Only Sergi and I went down that, where the air was getting poor. Sergi pushed a sloping seventh drop down to a muddy constriction that ended at a mud plug at -104 meters. We wrapped up the survey and de-riggered. Once we were back on the surface, our guide showed us a nearby cave that blew good air. JL dropped 5 meters down into a chamber, but couldn't find

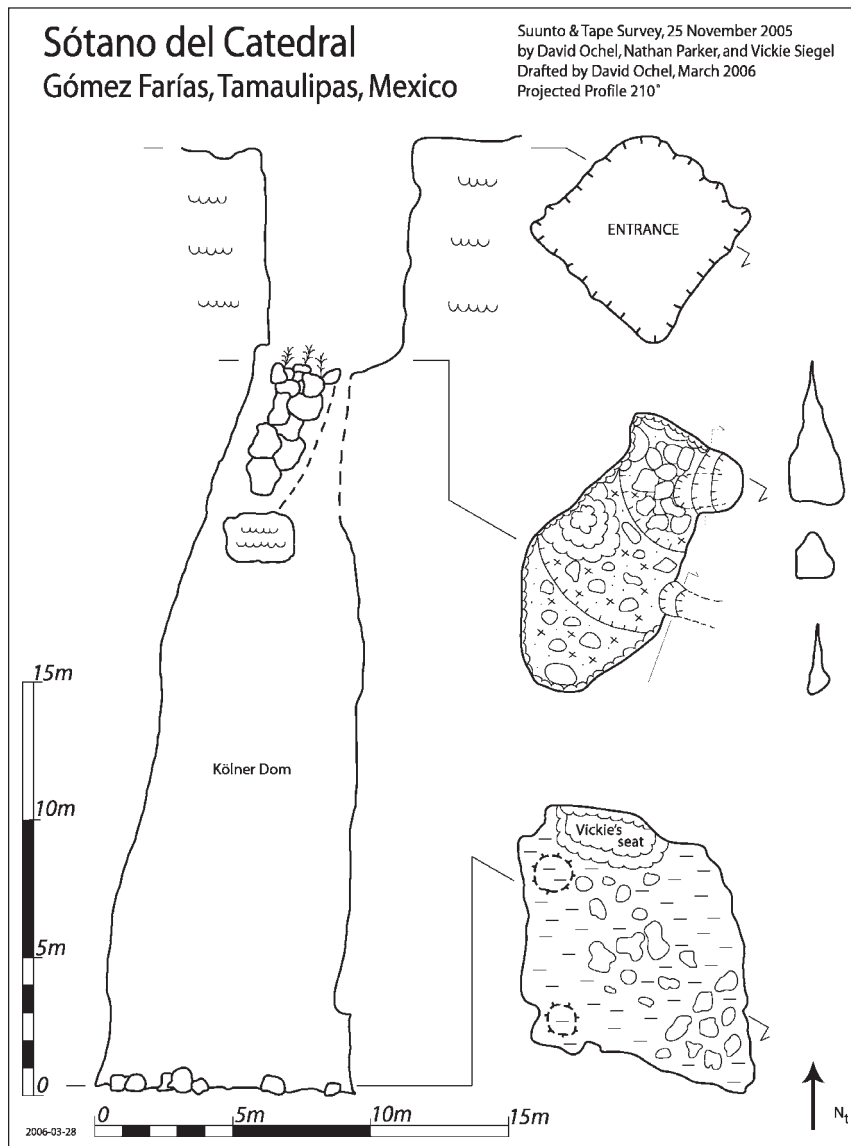
a good way on. We never got back to this lead. Charley's crew finished up Cueva del León at -84 meters. They got back to camp last. Ed Alexander and family showed up from Real de Catorce to join us.

On 23 November, Terri, JL, Profe, and I went to look for some caves with local guide Moisés. First we found Sótano del Profe. This had been previously descended by Arturo "El Profe," who said that it didn't go at the bottom. But with an arroyo dumping into it, it looked too good not to go, so we decided to go back and map it during this trip. Then we drove over and found the entrance to Sumidero del



Jean Louis at Sótano de la Tinaja. Peter Sprouse.

los Mangos, which had been reported by William Russell back in the late 1960s. It had an arroyo going into a walk-in entrance under a big headwall. Terri, JL, and El Profe went in and checked it out as far as the top of a 30-meter pit. The cave started down as a fissure, which led to various side passages, some with skylights. Next we went back into town to look for Sótano de Laksi, but we couldn't find it because the area had become quite overgrown. Then we found a guide to take us to a cave up on the Sierra Chiquita. The guide said that the hike up the mountain would take an hour and a half, so Terri decided to hike back to the Campestre, while the rest of us hiked first down into the valley. After about fifteen minutes, our guide led us to a pit that looked about 12 meters deep. We named it Sótano del Rincón, after the place name. Right below it was a cave entrance blowing cold air. But we never got back there, since there was so much else to do. Then we hiked over the Sierra Chiquita and tried to find the pit that the guide was looking for, but we couldn't find it. But we ended up stumbling across another pit. Even though it was almost dark, we decided to do it anyway. It was a 45-meter pit, and JL got to cross his first knot. The pit was ample, 10 by 50 meters at the bottom, but plugged. We named it Sótano del Ojital, after a local plant. By then it was dark and we had to bushwhack down the mountain to find our way home. Meanwhile Philip had taken a large crew to Alice's Plunge, where they finished mapping and de-riggered. They also started mapping in





Vickie in Sótano del Catedral. *David Ochel.*

Resumidero de Jineo, which had been surveyed years ago but still lacked a useable map. Nathan's crew went to Sótano de Gustavo, which turned out to be 65 meters deep and blind.

The next day Aimee, Geoff, and Jean Louis hiked east from the hotel and were shown several small caves and some Indian mounds. They mapped two caves, Cueva de Goyo and Sótano Vidrioso. Vickie, Nathan, and David derigged Cueva del León. Actually the part that got surveyed this trip seems to be the *sótano*; the *cueva* next to it went uninvestigated. Charley and I accompanied them there and then were taken by a local resident to see two pits a kilometer down the hill toward the *nacimiento*. They appeared to be about 12 and 15 meters deep and were 25 meters apart. Charley, Philip, Andy, Sergi, and Gustavo went to Resumidero de los Mangos and surveyed through the fissure maze. Left at a T-junction

led to a small pour-off that dumped into the main pit. Philip and Sergi rigged until they ran out of rope. Terri, Javier, and I took Gustavo Berrones, a local guide and Posada Campestre employee, down his first drop as we surveyed Sótano del Profe. It was a 23-meter pit that at first appeared to be blind, but it had a small, debris-filled drain. When the debris was cleared, Terri was able to squeeze down the tight passage, which dropped to a flat muddy area where the drain continued on down. From there she could see a large room, but she had to do a small traverse around the drain and then climb up a mud slope into the large room, which had a very high ceiling and a mud

funnel in the floor that sloped down on one side into what appeared to be a deep, muddy drain. At the far end of the room, there was a low crawl that Terri went through to discover another large room with a floor of thick mud. A muddy passage continued on. Terri retreated from that and crawled through a window in stalactites to more passage on the other side. Meanwhile, Javier was attempting to squeeze down the tight drain, but could not work his chest through the constriction. I went down, and we continued with the survey. Since it was getting late and we wanted to be back in time for a Thanksgiving feast, we surveyed down only one passage to a room with a small window, but the passage continued. We left this cave with three going leads that will have to be explored on a future trip. The climb back up through the constriction seemed a lot easier than the climb down. We left the pit and made it back

to the Campestre in time to help prepare a fantastic potluck Thanksgiving feast of turkey, ham, pastas, salads, stuffing, green beans, and a host of side dishes, in addition to delicious grilled chicken and flautas prepared for us by the hotel.

On our last caving day, Philip, Charley, Andy, Sergi, and others returned to Resumidero de los Mangos and surveyed it down to a mud fill. It was about 103 meters deep. Nathan, Vickie, and David went to map Sótano del Pájaro Vaquero. They were also shown another cave, which David named Sótano del Catedral. It went down two drops. I joined a large crew in Resumidero de Jineo. Shannon and Juan went in first to continue rigging. Barbara and Ernie followed to resume the survey, and a bit later Jean Louis, Javier, and I headed in after them. The cave was a superb series of clean pitches in smooth, blue-gray bedrock, expertly rigged Bosch style. My crew dwindled as we got deeper: JL climbed out after drop seven, and Javier had left his shoes behind and had to go back and get them. When we got to base-level, I recruited Shannon to help me map the right-hand passage to the sump. This was very muddy and included the last pitch, Diarrhea Drop. There were lots of invertebrates down there, and *Astyanax* in the sump. I headed out first, with three ropes, and ran into JL at the top of the fourth pitch. He had come back in to help derig. When I got to the entrance I could hear live music drifting down from town. I had a pleasant walk back to the hotel. The others came in a few hours later.

Saturday morning everyone packed up and headed north, south, or west toward home.

Espeleología en Gómez Farías, Noviembre 2005

Un gran número de espeleólogos de los Estados Unidos y México visitaron Gómez Farías, Tamaulipas, y exploraron y topografiaron varias cuevas ahí.



FIRST THROUGH-TRIP, RESUMIDERO IZOTE— POZAS AZULES

Rodolfo Pertack E.

I conceived this project several years ago. From the reports of those who mapped the Gruta de las Pozas Azules and the Resumidero del Izote, it appeared that both caves were likely to join, being separated by a common sump, in which diving had been attempted, but without success. [A map of Izote appears on page 6 of *AMCS Activities Newsletter* 16.] Of course, it was difficult to accurately predict the distance between the ends of the caves. Maps of caves are made by adding up many individual measurements, each containing some error that is impossible to avoid. Therefore the position of the end of the cave will be uncertain by an unknown amount. So we could only be sure that the sumps at the ends of the caves were close, but the real distance between them remained unknown, as was what might exist between them.

In one of many trips to the Gruta de las Pozas Azules I reached the sump. The dry season was coming to an end, and water no longer flowed through the cave. At the sump, I noticed that the water was not clear like that in all the other pools in the cave, but muddy, with a lot of organic material in suspension and a little methane. At another time, we visited Resumidero del Izote and also reached the sump there. When I walked into that sump waist-deep, I noticed that the water there was also muddy, unlike the rest of the pools in Izote, and was similar to what I recalled from Azules. At that moment I concluded that the sumps were the same pool and that maybe I had only to pass under the stone wall before me to arrive in Pozas Azules, but how?

r_pertack@i.com.mx

Intrigued, I continued to think about this and the evidence that the two caves were the same. The sand of igneous origin of their floors is the same. It comes from Cerro Huixteco, the hill that is adjacent to the limestone in which the caves are developed. The heavy rain that falls there runs downhill to enter the Resumidero del Izote and resurge at Pozas Azules, which flows strongly in the rainy season, and then goes on toward the canyon of the Río Chontalcoatlán. It spreads sand and diverse vegetative debris through both caves.

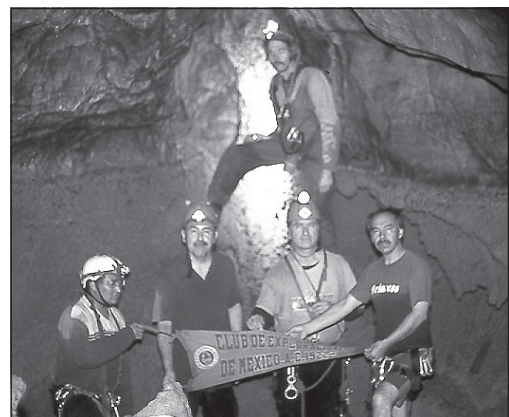
Obviously the two caves connected, and it was very likely that the sumps were the same pool. Other pools in the vicinity in the two caves are not connected to the sump pools when water is not flowing. And the sump pool in Azules is higher than the pools that precede it. For these reasons, it looked possible to drain the water contained in the sump to a lower pool with an appropriate hose, using a siphon, the same principle that allows one to siphon gasoline out of a car into a container at a lower level.

Implementing this system in a cave is not an easy task. We had to acquire 100 meters of hose and manage to take it as far as the sump, through all the crawlways. Well, if we could carry some 1000 meters of rope in our expeditions to the bottoms of Sótanos de Tilaco and Alfredo in Querétaro, we should be able to get the hose to where it was needed. Also, getting the water flowing through such a long hose once it was in place

would not be easy, but with patience could be achieved. Marcelino Gaona, Arturo Alemán, and I had planned an attempt several years ago, but the rainy season began too soon.

A team of fellow members of the Club Exploraciones de México AC (CEMAC) supported me in the successful attempt. They were Marcelino Gaona, Moisés Caballero, Vicente Elizalde, Deniker Castro, Sergio Martínez, Miguel Arriaga, Arturo Alemán, Sonia Caballero, and Carlos Miranda. We were able to lower the water level in the sump about 2.2 meters and walked down the sand to the bottom of the pool, where we located a crawl that would take us toward Izote. We proceeded to dig enough sand out to make it passable. I went first, lying in the water remaining in the pool on my back and feeling for obstacles with my feet. I moved on through the tunnel, which had smooth walls and roof

Rodolfo Pertack (behind), Vicente Elizalde, Deniker Castro, Miguel Arriaga, Moisés Caballero.



and a floor of sand. It was a meter or more wide and had a space of 20 to 30 centimeters between the water and the roof, providing plenty of room to advance easily. But it was not surprising that a diving attempt had failed, because we had to remove a lot of sand.

I was surprised to find that the first part of the crawl was only 1.5 meters long. It leads to a small dome, which we called *la bóveda*. The dome is about 2.5 meters high and is usually full of water. From this point, the crawl turns at almost a right angle. Lying in the water again, I directed the beam of my most powerful light along the water and observed a muddy beach not far away. I moved forward again in a stone tunnel similar to the other one for a distance

of 3.5 meters and arrived at the beach. Rising from the water, I was pleased to find myself in the sump pool, now empty, of Izote. We had achieved the goal of connecting Gruta de las Pozas Azules and Resumidero del Izote by passing their common sump. The total length of the two crawls was only 5 meters. I was pleased to find that the caves were so close and that, as I had suspected, the two sumps were really the same pool.

Having achieved our objective, we surveyed the connection and packed up our hose and equipment. It now remained only to do the first through-trip from entrance to entrance.

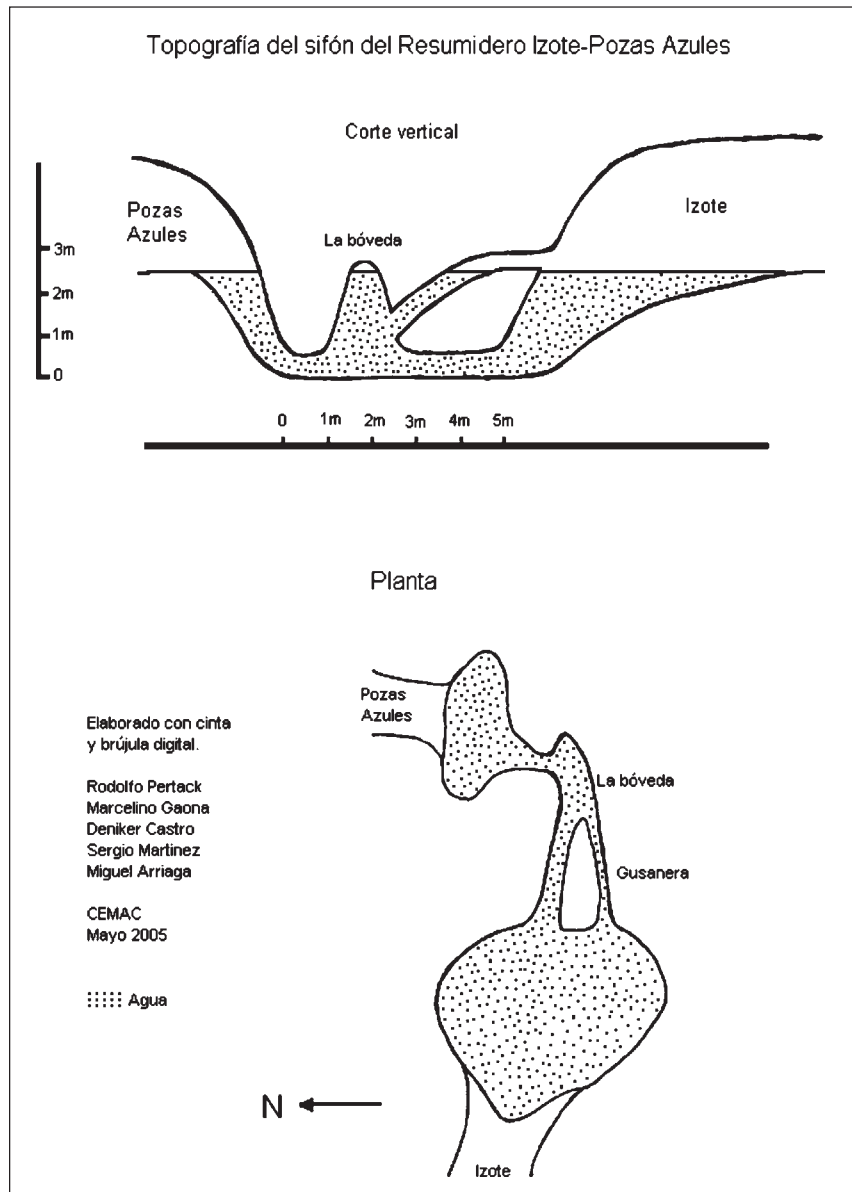
For this, we got together again on June 4, 2005, and we decided to make

the trip by entering Izote and leaving Pozas Azules. As usual, we left our cars at Don Pablo's house at El Gavilán. We rigged the drops in Izote in the usual way and proceeded to the location of the former sump. Having made sure that the sump was still drained, Moisés and Vicente returned to the last drops and recovered the ropes. Next we passed the crawls in Pozas Azules and made our familiar march toward the exit, but with the strange sensation of leaving without having entered, since we had never done the cave that way before. The increased weight of our backpacks was a less pleasant sensation, because we had never carried so much equipment through the crawlways. Finally we reached daylight, leaving the mountain at another place, after a nine-hour journey. One could do it in less time, but we took time to have a lot of fun.

Then we walked to Papala, found a ride to El Gavilán, and walked to our cars, arriving at them from the other direction. The next day we went back to the Izote entrance, and I went down to recover the remaining ropes from the drops. Mission accomplished!

We had of course considered the possibility of dividing into two groups to make the trip in opposite directions, passing at some point in the cave. While we were tempted, we decided not to do this for our own safety. It was best to complete the trip in the early afternoon at the Pozas Azules, which would be much safer in case of sudden rain. Anyone who does the trip from Pozas Azules takes a risk, because if the weather suddenly deteriorates, the sump is likely to refill. It would not take much water to flood the sump again; it will certainly happen in the next rainy season. The crawlways near the entrance to Izote will also fill with water, forming another sump, if there's a sudden strong rain, leaving one trapped between sumps in Izote.

This project requires changes in the list of Mexican caves, because the two caves are now one. Acknowledging the work of previous explorers who mapped the two caves and provided the data that were so helpful to us, we present the following current data on the three parts of Resumidero Izote-Pozas Azules, Guerrero:





Deniker Castro in the drained crawlway.

Izote entrance: 18°36'45.4"N,
99°33'22.8"E, elevation ~1640 meters.
Pozas Azules entrance: 18°37'26"N,
99°32'55.7"E, elevation ~1400 meters.

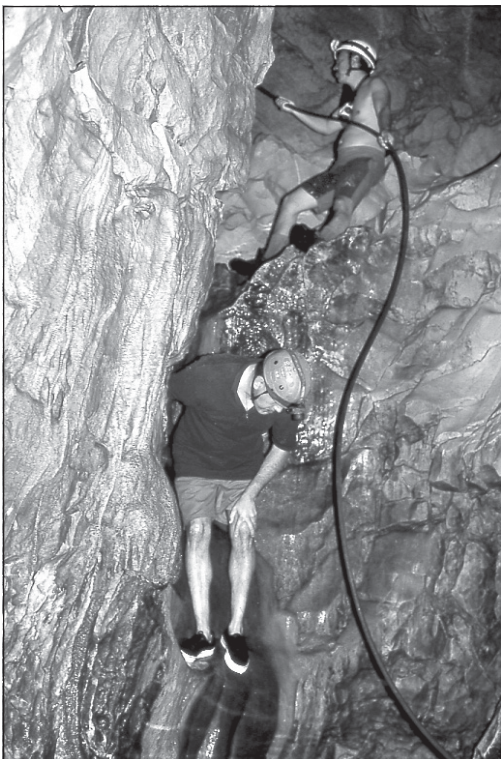
Izote	length 1649 m	depth 197 m
the sump	5 m	
Pozas Azules	1399 m	52 m
total	length 3053 m	depth 249 m

According to the AMCS long-caves list, other river caves in the vicinity with similar lengths are Resumidero La Joya, 3377 meters, and Resumidero de Zacatecolotla, 3066 meters. The connection also makes possible another through-trip in the area. Previously this was only possible in the well-known underground rivers of San Jerónimo and Chontalcoatlán. Of course, the new trip is much more difficult, even if the sump has been drained, because, although swimming is not necessary, one must descend or ascend ropes, which requires special training.

Gruta de las Pozas Azules is a popular cave. Although the exact number is unknown, it is possible to guess that five hundred or more people visit it every season. It is very satisfying to us to have been able to successfully finish this connection that had remained hidden for so many years. We have learned that even in previously explored caves there is always the possibility of finding something new. Those who have gone before are only human too, and may have overlooked something, or perhaps they did not have the knowledge or support to pursue an idea. Our project was definitely a team effort, in which the skills of each of us added up to finally solving all the problems that it presented. It may seem at bit ridiculous that we only mapped 5 meters of cave, but in all the previous fifteen years, those caves had not been connected before, and for that reason those 5 meters will probably end up being the most important in my life.

Primera travesía, Resumidero Izote — Pozas Azules

Al vaciar el sifón entre estas dos cuevas del estado de Guerrero, miembros del Club de Exploraciones de México las conectaron formando un sistema de 3053 metros de longitud y 249 metros de profundidad. Las cuevas estaban separadas únicamente por 5 metros.



Moisés Caballero and Deniker Castro with the siphon hose.

HYDROLEVELING OF VERY DEEP CAVES, WITH AN EXAMPLE FROM VORONJA (KRUBERA) CAVE

Alexander Degtjarev, Eugene Snetkov, and Alexey Gurjanov

This interesting article on a technique for measuring the depth of a deep cave with high accuracy appeared in Svet (The Light), magazine of the Ukrainian Speleological Association, number 29, 2006. It has been revised and rearranged by the editor based on a translation from Russian for the AMCS by Tatyana Nemchenko, who also kindly provided some clarifications by e-mail. Authors and translator are Moscovites.

An expedition to Voronja Cave was held in October 2005. It was organized by the Ukrainian Speleological Association under the leadership of George Kasjan, now president of the association. Cavers from the Russian Geographical Society in Moscow and the Bulgarian Speleological Federation also took part. One of the aims was to measure the depth of the cave by the hydroleveling method. This goal was partly fulfilled. Leveling was done downward and upward between the entrance and 916 meters depth and downward only from -916 meters to -1195 meters, at Camp 1200. The work was done by two people, Alexander Degtjarev and Tatyana Nemchenko of Moscow, supported by Vladimir Solomentzev of Moscow, Fory Kolov of Plevna, Bulgaria, and Svet Stanichev of Sofia, Bulgaria.

Hydroleveling is used in building construction for finding two points with the same height, as in leveling a floor. In the simplest case, a tube with both ends open is used, attached to a strip of wood.

In Russia, measuring the depth of caves by the hydrolevel method began

Translator and participant in the leveling Tanya Nemchenko:

cdg.r@shadow.east.ru

in the beginning of the 1970s. The device was a vinyl-coated fabric tube 30 to 50 meters in length with a manometer with fine scale divisions at one end. Such manometers were 25 centimeters or more in diameter. They were inconvenient and often broken. The water bottle that was used to keep the tube filled overturned, and bubbles appeared in the tube. Nevertheless, the method was used and considered the most accurate method of determining depths at the time. The accuracy was estimated to be about 2 percent. Cavers from the Krasnoyarsk' club used the method in some caves. In Forelnaja, in the Bzybysky Ridge area of the Caucasus, hydroleveling of a narrow passage about 1 kilometer in length gave a level difference that was 5 meters different than the one determined by the conventional method with a clinometer and tape. The depth at the time of Sneznaya Cave in the same area went from 720 to 700 meters when measured by hydroleveling, and Kievskaya Cave in the Zeravsanksij Ridge, Central Asia, went from 1030 to 980 meters deep. Hydroleveling was also used for other purposes, such as water-supply work in expeditions to Central Asia.

The method was revived in 2000, when Eugene Snetkov made a new model of the device in which the bulky and unwieldy manometer was replaced by a diver's depth gauge. Metallic parts of the device were made by Constantin Mukhin. The water-bottle reservoir was replaced by a rubber glove, an idea borrowed from Australian wine-makers, who packaged wine in plastic bags with a cock at the bottom. A buyer could drink from a package that did not leak when upset, and the wine did not oxidize when the container was partly empty. The new model was used for vertical measurements in Mchishta

Cave in the Bzybysky Ridge. The length of a river passage from the resurgence sump at the entrance, called a gryphon by Russian cavers, to the terminal sump is about 1.5 kilometers, and the elevation difference is only 20 meters. Gena Somokhin of Ukraine did a hydroleveling in V. Pantjukhina Cave in the same area, and the depth of the cave changed from 1508 to 1488 meters. New interest in the method appeared after discovery of the deepest cave, Voronja, in the Arabica Massif in the Caucasus. There was a lot of interest in the true depth of the cave. In the summer of 2005 Gregory Shapoznikiv and Larice Pozdnykova, both of Ekaterinburg, Russia, hydroleveled the cave to the dry bottom at -2080 meters, according to the conventional tape survey. However, the difference between their downward and return levelings was quite large, 8 meters, and errors in the method were discovered. A new hydroleveling was made in the cave in October 2005. The results are discussed in this article. The influence of atmospheric pressure on the readings was discovered, the high accuracy of the method was proved, and the method of measurement by intervals was introduced. Alexis Shelepin and Martha Rushechka, both from Moscow, took part in the development of the method, and Alexis Gurjanov took part in the mathematical justification. The authors could not find any mention of this method in non-Russian publications.

A hydrolevel device is made of a 50-meter transparent tube filled with water, on one end of which a rubber glove is placed, and on the other a metal box with a transparent window. An electronic diver's depth gauge or watch with a depth-gauge function is submerged in the box. The tube is

coiled or on a reel. If the rubber glove is placed on one station and the box with the depth gauge is placed on a lower one, then the hydrostatic pressure between the two points, according to Pascal's law, depends only on the difference in heights and the liquid density. The route of the tube does not affect the pressure in the box. Adding readings of the gauge from consecutive pairs of stations gives us the depth of the cave in relative units. They are relative because depth gauges are calibrated for sea water, and we fill the hydrolevel with fresh water. Therefore we determine a coefficient to recalculate the measurement in meters. For this purpose a measuring tape is hung on a free drop, with the 0 on the tape and the glove of the hydrolevel at the top point. The gauge reading is taken with the box at several vertical locations, according to the tape, for example, at 5, 10, 15, 20, and 25 meters. The Casio watch with depth gauge that we used works from 1 to 30 meters sea water. The relative values read are plotted on a graph against the tape values. The points should lie on a straight line, and the parameters k and b , describing the line $h = kx + b$, are determined by mathematical methods. h is the true difference in station heights in meters and x is the reading of the hydrolevel in relative units. The parameter b is not necessarily equal to 0 because of air pressure.

Measuring with the help of a hydrolevel is today the most exact way of determining the depth of a cave. Its correct application allows an average

accuracy of 0.2 percent, or 4 meters for a cave depth of 2000 meters. For comparison, geometric measurement with a tape and slope measurement gives an error not less than 2 percent, 40 meters for a 2000-meter-deep cave, hydroleveling with the old manometer method gives about 2 percent, and barometric leveling can give an accuracy of 15 meters, regardless of the depth of the cave, but has a number of methodological difficulties.

Let's consider separately errors that are random and systematic.

Random errors. There is an error due to the discrete scale divisions of the gauge device or calibration tape. Each measured value, on average, differs from a true one by one quarter of the scale division. For the tape, it is 0.25 centimeters, and for the depth gauge used, with a display reading to 0.1 meters, it is 2.5 centimeters. However, there are ways to reduce the reading uncertainty for the depth gauge, as described later.

Frequently, flow of liquid in the tube, expansion of the tube under pressure, and possible slow equilibrium of pressure due to such causes is suggested as sources of errors. This is completely incorrect. Pressure in a liquid is transmitted with the speed of sound in the liquid, in times less than a tenth of a second in our case. Pressure drop in the tube due to flow would only significantly affect the pressure in the box for high speeds. Expansion of the tube under pressure does not influence the hydrostatic pressure reading.

There will also be random error due to placement on the stations, most often a rigging anchor bolt. The gauge of the hydrolevel was placed on the bottom station with an accuracy of about 1 centimeter. The water-reservoir glove was laid on the palm of a hand with the top of the glove aligned on the top station. On average, the position error of the glove was also about 1 centimeter.

It is possible to estimate the error due to these random deviations. Random errors partly cancel according to the formula $R = x \sqrt{N}$, where R is the total expected error in N measurements, each of which differs from the true value by x on average. For example, in our case of 80 stations to a depth of about 1200 meters, errors in placing the device on station of a total of 2 centimeters each time would add up to $2 \sqrt{80} = 18$ centimeters. Assuming 160 stations to a depth of 2000 meters, the error from this source would be about 25 centimeters. As noted above, errors due to the discrete scale of the depth gauge will be about the same size, and they will therefore contribute about the same amount to the expected random error, and random errors are expected to add up to no more than half a meter in 160 stations to a depth of 2 kilometers, considerably less than the claimed error of 0.2 percent for the method, or 4 meters at 2000-meter depth.

There could also be random errors in the operation of the depth-gauge sensor itself, due to, for example, inertness (stickiness) or random inaccuracies. We can estimate this only by examining actual results of repeated measurements, that is, closure errors. In our case, as we were attempting to pin down the world depth record, we carried out the measurement from 0 to 916 meters depth twice, both going down through part of the cave and then returning upward through it the same day. Of this depth, 712 meters was measured by the hydrolevel in 46 shots each way. (The



Alexander Degtjarev and Tatyana Nemchenko at the camp at -1200 meters with the hydroleveling equipment. Alexander is holding the depth gauge in its chamber, and the water-reservoir rubber glove is lying on the rock.

Vladimir Solomentzev.

true vertical drops were taped.) The vertical closure error turned out to be 5 centimeters, which, for a total of 92 measurements, implies by the square root formula an average random error of only 0.8 centimeters. Generally the closure error in a single day's series of measurements was 5 centimeters; it was only once 10 centimeters. The worst day gave an average random error of 4 centimeters, and the typical day gave 1.25 centimeters. Overall, the average vertical measurement was 15 meters, of which the average error of 0.8 centimeters is 0.05 percent. (All the figures in this paragraph are uncalibrated depths, as read directly from the depth gauge. All the data are in Table 1.)

Systematic errors. Such phenomenal reproducibility of the results indicates the absence of significant random errors. But this is only one aspect of the problem. It is possible to have a random closure error of 5 centimeters to the kilometer and still have an error in the true depth of 20, 40, or more meters. There may still be systematic errors due to errors in calibration of the gauge or mistakes in applying the method. These are more sneaky and difficult to detect, and they do not tend to cancel, but are cumulative, reaching perhaps unacceptably great values.

Bubbles in the system will lead to systematic underestimates of the depth. Bubbles are of two sorts, gas and vacuum. The first comes from degassing of the water. It is especially great if chlorinated water is taken from the faucet. Solubility of gasses falls with rise in temperature, so if we fill the tube with cold water and put it in the sun, we will get bubbles in the tube. Fine bubbles stuck to the walls do not influence the reading. But they come off the walls and merge to form large bubbles that fill the cross-section of the tube. A bubble 10 centimeters in length will cause a regular error of 10 centimeters in each measurement. Bubbles should be expelled by flicks of the fingers when the tube is filled. It is best to prepare the tube on the surface, not in the cave, having unwound the tube on a steep slope. During use, the tube, which must be transparent, should be examined visually for bubbles once a day. They usually do not appear after proper initial preparation, especially if the tube is filled with warm, boiled water. Fine

bubbles that do appear later migrate quickly to the glove during work on vertical drops. Large bubbles, at least, should be released from the glove, but bubbles in the glove influence the result much less, as the glove is laid horizontally, with little thickness, during the measurement.

Vacuum bubbles are formed if the device is prepared in the wrong order. For example, if the device is filled with water and then the box, at a lower level, is opened, for example to insert the gauge, water from the glove will flow downward, and if the glove is emptied, a vacuum bubble can appear in the tube. Such a device will be impossible to use. Another possible source of vacuum bubbles is a leak in the box under pressure.

The reader should try to understand this example of an actual case. The depth gauge was zeroed in air. The box was opened in a saucepan of water and the gauge was inserted in it, while the tube was run 10 meters above up a slope to its reel. After that, the depth gauge showed 0.0 under 10 meters of water. Why?

The glove can be a source of systematic errors. It should be strong but thin and should at all times be flabby, not full and stretched tight. A stretched glove creates additional pressure, hopelessly spoiling the result. We recommend that the glove be approximately half to one-third full of water, but empty of air. But even a half-filled glove will cause errors if compressed, for example trapped within the reel of tube or bent backward upon itself. We recommend laying the glove out on open palm for each measurement.

The glove must hold enough water that it never becomes empty due to either leaks or expansion of the tube under pressure. A shriveled-up glove can allow an error of up to 10 meters, even without producing a vacuum bubble.

Another source of error could be nonlinearity of the depth gauge. The test values obtained when calibrating the device against a tape should lie on a straight line. It might happen that the device is linear only, for example, from 5 to 20 meters, and that the data above 20 meters depart from a straight line. Such things need to be determined for every specific depth gauge. Plot the points on graph paper. We used a Casio diver's wristwatch with a depth-gauge

function. It was good enough and gave a linear response in the range from 2 to 25 meters. At 30 meters it turned off. In the range from 0 to 1 meter it showed 0, and indications were unstable and slow to settle in the range from 1 to 2 meters.

In our project, we used a tape to measure the free drops. We recognized that on such a drop a measurement by the hydrolevel cannot be more accurate than one by the tape against which the level was calibrated, so hydroleveling in those cases was not done. It is difficult to achieve an absolutely vertical position of the tape. The cosine of 1 degree is 0.998, and the cosine of 3 degrees is 0.9986, and these would create an error of only 0.02 or 0.14 percent, more exact than the general accuracy of our method, 0.2 percent. But such errors always have the same sign, always overestimating the depth, and are systematic, so they must be taken into account. In our project, ten tape measurements were a total of 211 meters, 18 percent of the measured depth. In two cases, where the bottom station was displaced horizontally less than 2 meters from true vertical, we measured the hypotenuse of the triangle with the tape and calculated the depth using the Pythagorean Theorem.

Another source of error, either in taping the vertical shots or calibrating the device against the tape, is possible stretching of the tape under its own weight. But a tape gives an error of no more than 1 centimeter on a 25-meter drop, as indicated by comparison with a laser range finder on a free entrance drop. This possible error was not considered further.

An important source of systematic errors is change in atmospheric pressure after the depth gauge is zeroed. During past years, when hydroleveling was carried out by manometers with an elastic spiral, the influence of the atmosphere was not taken into account. That was correct, because the atmosphere pressed on the outside and the inside of the spiral tube equally. In our case the situation is completely different. The depth gauge is reading absolute pressure, the sum of the hydrostatic pressure and the atmospheric pressure. When the Casio watch is functioning as a clock, it continuously zeros the depth gauge for ambient pressure. When it is submerged and functioning

as a depth gauge, that calibration is retained. But if the atmospheric pressure subsequently changes, this will inevitably be reflected in the readings. Ordinary daily fluctuations in pressure influence the gauge very little. For example, usual daily fluctuations of 2 millimeters of mercury equal 27 millimeters of water. In practice, over the course of a day, such fluctuations cancel out almost completely.

But major weather fronts or changes in surface temperature can occur. Under such conditions, air pressure can change during a day by 0.2 meters of water. For the control of such phenomena, we advise carrying a barometer with you. Record the air pressure at each calibration of the system, at each zeroing of the depth gauge, and from time to time during the survey. With these readings it will be possible to calculate the barometric offset (parameter *b*) precisely enough.

While major changes in the weather may be rare, loss of zero calibration in the gauge is absolutely inevitable while moving deeper into the cave. The density of air at 1 atmosphere pressure and 0° Celsius is 1.293 kilograms per cubic meter. At the average height of our measurements, 1500 meters, it is 15 percent less. Pressure of the air column from our entrance to our maximum depth of 1200 meters, under a linear approximation and the formula $\Delta P = r g h = 1.293 \times 0.85 \times 9.8 \times 1200 = 12940$ Pascals or 1.32 meters of water column. It is possible to add additional corrections for temperature (factor 0.98 for 4° Celsius) and humidity. The total effect is about 1.3 meters.

Practice confirmed these theoretical calculations. Having zeroed the depth gauge at the entrance to the cave, we did not open the box up until the depth of 1200 meters. After having been opened to the air, the gauge showed a stable water depth of 1.2 meters instead of 0, a displacement of 10 centimeters per 100 meters of depth. (At other elevations above sea level and other temperature this value will differ somewhat.) Thus it turns out that the calibration parameter *b* need not be calculated from a calibration, but can be determined from the depth at which the gauge was last zeroed and the approximate depth of the current station. For example, after we zeroed the device at the surface, then for measurement taken at 360

TABLE 1
HYRODLEVELING OF KRUBERA CAVE
by Alexander Degtjarev and Tatyana Nemchenko, October 2005

station	hydrolevel data				atmos. corr.	tape	depth (m)	
	up	down	ave.	scaled			hydro	conven.
entrance to Mozambique								
0-1	18.90	18.85	18.875	18.2903	0.01		19.28	
1-2	12.25	12.30	12.275	12.5451	0.015		31.81	
2-4						24.23	56.04	
4-5	16.15	16.10	16.125	16.4798	0.06		72.46	
5-6	6.50	6.50	6.500	6.6430	0.07		79.03	
6-7	12.80	12.80	12.800	13.0816	0.085		92.03	93
7-8	23.00	22.95	22.975	23.4805	0.1		115.51	
8-9						32.62	148.03	
9-10	29.20	29.20	29.200	29.8424	0.16		177.71	
10-11						3.14	180.85	
11-12	18.50	18.55	18.525	18.9326	0.19		199.60	205
12-13	22.50	22.55	22.525	23.0206	0.21		222.41	226
13-14	3.45	3.50	3.475	3.5515	0.22		225.74	
14-15	17.05	17.10	17.075	17.4507	0.23		242.96	
15-16						23.35	266.31	
16-17	21.15	21.00	21.075	21.5387	0.28		287.57	
17-18						14.10	301.67	
18-19	19.75	19.70	19.725	20.159	0.31		321.52	
19-20	9.60	9.60	9.600	9.8112	0.315		331.01	
20-21	6.75	6.80	6.775	6.9241	0.33		337.61	
21-22	2.70	2.70	2.700	2.7594	0.34		340.02	340
Mozambique to Camp 500								
22-23	9.30	9.30	9.300	9.5046	0.34		349.19	
23-24						33.18	382.37	
24-25	7.05	7.05	7.050	7.2051	0.385		389.19	
25-26						27.37	416.56	
26-27	15.05	15.15	15.100	15.4322	0.42		431.57	
27-28	19.50	19.50	19.500	19.9290	0.44		451.06	
28-29	20.85	20.85	20.850	21.3087	0.46		471.91	
29-30						14.04	485.95	
30-31	3.40	3.40	3.400	3.4748	0.49		488.93	490
Camp 500 to Camp 700								
31-38	12.35	12.35	12.350	12.6217	0.495		501.06	
38-39	20.10	20.10	20.100	20.5422	0.51		521.09	
39-40	14.10	13.95	14.025	14.3336	0.53		534.90	
40-41	1.50	1.55	1.525	1.5586	0.53		535.93	
41-42	10.70	10.75	10.725	10.9610	0.54		546.35	
42-43	6.70	6.70	6.700	6.8474	0.55		552.64	
43-44	22.75	22.75	22.750	23.2505	0.56		575.33	572
44-45	5.25	5.25	5.250	5.3655	0.575		580.12	
45-46	25.00	25.05	25.025	25.5756	0.59		605.11	
46-47	20.75	20.70	20.725	21.1810	0.61		625.68	
47-48						15.24	640.92	
48-49						23.49	664.41	
49-50	27.30	27.30	27.300	27.9006	0.68		691.63	693
Camp 700 to -916 meters								
50-51	21.55	21.55	21.550	22.0241	0.7		712.96	
51-52	15.35	15.35	15.350	15.6877	0.72		727.92	
52-53	19.15	19.10	19.125	19.5458	0.74		746.73	
53-54	26.85	26.85	26.850	27.4407	0.76		773.41	
54-55	23.90	23.90	23.900	24.4258	0.78		797.06	
55-56	21.15	21.15	21.150	21.6153	0.81		817.86	
56-57	18.15	18.10	18.125	18.5238	0.825		835.56	

TABLE 1
continued

station	hydrolevel data				atmos. corr.	tape	depth (m)	
	up	down	ave.	scaled			hydro	conven.
57-58	1.35	1.35	1.350	1.3797	0.825		836.11	827
58-59	16.85	16.85	16.850	17.2207	0.84		852.50	
59-60	19.05	19.10	19.075	19.4947	0.86		871.13	
60-61	5.65	5.65	5.650	5.7743	0.87		876.03	
61-62	21.55	21.55	21.550	22.0241	0.89		897.17	
62-63	19.75	19.75	19.750	20.1845	0.91		916.44	
-916 meters to Camp 1200								
63-64g	6.40		6.400	6.5408	0.92		922.06	
64g-64d	12.25		12.250	12.5195	0.93		933.65	
64d-64c	10.70		10.700	10.9354	0.94		943.65	
64c-64b	7.75		7.750	7.9205	0.95		950.62	
64b-64a	18.15		18.150	18.5493	0.96		968.21	
64-64a	4.75		4.75	4.8545	0.97		972.09	
64-65	5.10		5.100	5.2122	0.97		976.34	
65-66	9.70		9.700	9.9134	0.98		985.27	
66-67	16.20		16.200	16.5564	0.99		1000.83	
67-68	16.10		16.100	16.4542	1.01		1016.28	
68-69	8.95		8.950	9.1469	1.02		1024.41	
69-69a	11.60		11.600	11.8552	1.03		1035.23	
69a-70	6.45		6.450	6.5919	1.04		1040.78	
70-71	6.70		6.700	6.8474	1.04		1046.60	
71-72	15.50		15.500	15.841	1.05		1061.39	
72-73	11.20		11.200	11.4464	1.065		1071.77	
73-74	4.90		4.900	5.0078	1.07		1075.71	1109
74-76*	35.00	35.10	35.050	35.8211	2.17		1109.36	
76-77	24.90		24.900	25.4478	1.12		1133.69	
77-78	23.80		23.800	24.3236	1.14		1156.87	
78-79	23.65		23.650	24.1703	1.17		1179.87	
79-80	15.55		15.550	15.8921	1.19		1194.58	1211

Notes on Table 1.

While time permitted, gauge readings were recorded both going down and then going back up through the area. The two readings were averaged. The scaled value is the average multiplied by the factor $k = 1.0220$.

The atmospheric correction is derived from the reading obtained when the gauge chamber was opened to air at Camp 1200, scaled by the relative depths of the stations.

A tape was used to determine the vertical distance on some strictly vertical drops.

The hydrolevel depth is determined by either adding the taped distance or by adding the scaled hydrolevel average and subtracting the atmospheric correction.

For comparison, depths from the conventional survey are listed for some stations.

*The area between stations 74 and 76 is complex, and the gauge data were taken twice, with different intermediate stations. The two values in the table are the sums of the pairs of measurements. Because the line contains two measurements, the atmospheric correction is double.

meters depth, the correction b will be -0.36 meters. Similarly, if we zeroed the device at -500 meters, the correction at -930 meters would be $10\text{cm} \times (500-930)/100 = -0.43$ meters.

Errors caused by not taking this cor-

rection into account can be significant. Say that 300 vertical meters are surveyed downward in a day, after zeroing the gauge at the start. The atmospheric correction increases from 0 to 30 centimeters, with an average of 15 centimeters.

If there were twenty measurements, then ignoring the correction would lead to an accumulated error of $0.15 \times 20 = 3$ meters. If the process is repeated each day for seven days to the bottom of a 2-kilometer-deep cave, the total error would be 20 meters, or 1 percent, five times as high as the accuracy claimed for hydroleveling done correctly. The situation will be even worse if there are long nearly horizontal stretches of cave, so that each measurement gives only a small increase in depth, but still the (now relatively larger) barometric error.

It is possible that omitting the atmospheric correction will cause an opposite error to accumulate on the way back up, if measurements are repeated on the way out after rezeroing the gauge at the bottom, and averaging will cancel out the error to some extent. Where?

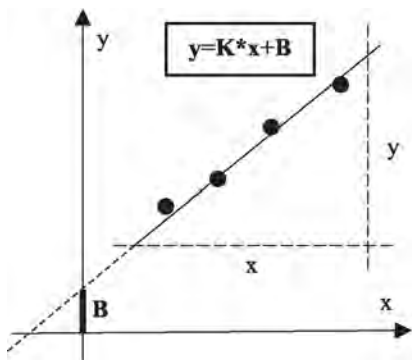
The temperature dependence of the density of water, 0.0053 percent per degree, is insignificant. In Voronja (Kruber), the temperature varies only from 2°C at the entrance to 7.5° at the bottom, and this does not give cause for anxiety. However, the difference from 22° on the surface and cave temperature gives a density change of 0.2 percent, similar to the accuracy claimed for the method, and cannot be ignored. Calibration should be done only after the water in the hydrolevel has cooled to cave temperature.

The calibration coefficient k must be accurately determined. This is very important, as it is a source of systematic errors, and different results can be gotten from the same raw data by using different values. For example, the data taken by Gregory Shapoznikiv and Larice Pozdnykova during their hydroleveling were processed four times using different ways of estimating k . For Camp 1200, four different depths, ranging from 1160 to 1187 meters, were calculated. From the data in Table 1, taken by Alexander Degtjarev and Tatyana Nemchenko, Degtjarev calculated a depth of 1194 meters for the same place. Such a dispersion of values is inadmissible. It is necessary to choose one proven method of calculation. In fact, calculating k and b is a matter of choosing an average straight line through test points gotten when calibrating the hydrolevel device against a tape.

One method is graphical. Place the test data on graph paper and draw a straight line over them. The graph may enable you to reject some points as defective. If three test points are on a straight line and the fourth is located to one side, it should not be taken into account in calculating k . Such an approach, however, can sometimes lead to unreasonably rejection of some points, since the rejection is done just by sight. After defective points are rejected and the drawn straight line adjusted to pass through the remaining points, it is possible to calculate k by the formula $k = (y_n - y_1) / (x_n - x_1)$; see the figure. The graphical method is very simple to use, but it is difficult to estimate accurately the position of the straight line and the error in the result. We advise using the graphical method only in field conditions for quality control and to afterward calculate the coefficient k mathematically.

If points are not on a straight line, as will certainly be true to some extent, it is possible to calculate a straight line by the least-squares method, that is, calculate the line such that the sum of squares of the distances of the points from the line is the least. The great fault of this method is that we cannot automatically determine which points are simply small random deviations from the line and which should be rejected due to poor quality of the reading. Therefore the calculated line can be different in both k and b from the line calculated from just the good points. [A description, with formulas, of the method for calculating the least-squares linear fit and estimating the confidence limits on the result has been omitted from this version of the article. Interested readers can find it in any elementary statistics book.—ed.]

It is possible to carry out calculations



by Student's criterion. It differs from the previous method in that it mathematically rejects as defective some points, calculates parameters of a straight line, and estimates the accuracy of the resulting k and b based on the size of the deviations of the remaining points.

The difference in the coefficient k calculated by A. Degtjarev by the geometrical method and by Student's criterion was in the third digit after the decimal. That would give a difference in depth at -1194 meters of 0.45 meters.

Opinions differ about how to calculate the correction b . One opinion holds that b should always be 0. That is obviously incorrect for our method, where changing atmospheric pressure with depth since the device was zeroed affects the reading. Another opinion is that we should use the b calculated along with k by one of the mathematical methods. We claim that the coefficient b must be calculated or measured first, because it is possible to calculate it from the barometric formula or carry a barometer and take accurate readings. Then the coefficient b should be fixed in the calculation of k by one of the methods such as least-squares.

There is one more essential point in the discussion of the calculation of k . The first set of data for Voronja, that of Gregory Shapoznikov and Larice Pozdnykova, were processed in four different ways, giving values from 0.976 to 1.095. Various reasons why there may be systematic errors were discussed above, but in our opinion their calculated coefficients differed because of incorrect methods of calculations. We welcome comments.

We think the coefficient should not be calculated. It should always be equal to 1.022, at least for the depth gauge we used. Significant deviations from this value point to methodical mistakes in calculations. Degtjarev and Nemchenko, for example, found values of 1.0232, 1.0217, 1.0252, 1.0217, and 1.0184 for five different calibrations against a tape at different depths from 0 to 1165 meters (see Table 2). The average was 1.0220. The average dispersion of values from the average was about 0.2 percent. It is necessary to note that the coefficient 1.0220 applies only to the depth gauge we used. Other models, and perhaps other examples of the same model, might be different. And

does the sensitive membrane in the gauge change with time? This question is open. It will be necessary to continue experiments and gather statistics.

Even the most inaccurate use of a hydrolevel will not create a closure error in the raw readings of more than 10 or, rarely, 20 centimeters. If closure errors after corrections for k and b are 0.8, 1.2, or even 1.5 meters, then there is some systematic mistake in the calculations.

In summary, we recommend the following techniques for calibration:

Graph test points and reject defective points. Calculated values of k should be very close.

Take a barometer with you to determine b from time to time. (Lacking a sufficiently accurate barometer, we did not do this for the data in Table 1. But the barometer we did have showed that there had been no major changes in air pressure.) The value of b should vary by about 10 centimeters per 100 meters depth; this depends somewhat on elevation and temperature.

Test the hydrolevel against a tape occasionally. Repeated measurement should give minimal differences.

What accuracy is needed in k ? We believe that it should be accurate to one unit in the third digit after the decimal point. An error of .001 will give an error of 2 meters at a depth of 2 kilometers. When we write of an error of 0.2 percent, or 4 meters at 2 kilometers depth, we are allowing 0.5 meters for random errors such as those caused by the coarseness of the readout scale and errors in positioning the device on station and 3 or 3.5 meters of systematic error in the calculation of k . So our estimation of k should be mistaken by no more than 0.0015. The tests of Degtjarev and Nemchenko in Table 2 give hope that this number has not been exceeded.

In the earlier measurement by Sapozhnikov and Pozdnykova, the gauge was zeroed by opening the box before each calibration against a tape. The atmospheric correction did not grow large. But their coefficients from the various calibrations differed significantly and were not useful for averaging. Degtjarev and Nemchenko, on the other hand, did not allow the device to zero

until all measurements had been completed and they were at a depth of 1200 meters. The change in b was, not surprisingly, noticeable to the second group. Their calibration values of k did not differ significantly, so the average was used to calculate the results in Table 1.

We think the second method is best, without rezeroing the gauge or changing the water during the entire process. In this case, it is probably enough to carry out one calibration, not far from the entrance to the cave, but with the

device already at cave temperature. There the correction b should not turn out to be significantly different from 0, because if it is, either the calibration has been done incorrectly or there is something wrong with the system. The coefficient k is assumed independent of depth, and is checked only at convenient points against a tape. The correction term b is taken to be exactly 0 at the surface and increase monotonically, proportionally to the depth from the entrance.

However, it may be that the device has had to be rezeroed, for example to repair a broken water tube. In this case, after mending the device, it must be carefully recalibrated, and it is important that b turn out again to be insignificantly different from 0. It should be possible to average the new k with the others, but this should be determined from the actual data. (The Casio watch we used as a depth gauge automatically rezeros itself after 30 minutes with continuously less than 1 meter of water pressure.

TABLE 2

	test data			calculation 1		calculation 2		calculation 3	
	gauge	tape interval		k	b	k	b	k	b
TEST 1	5.0	4.98	5.03	1.0232	0.	1.0248	-0.02	1.0248	0.
depth 30 to 57 m	7.3	7.50	7.60						
stations 2 to 4	9.8	9.97	10.05						
	13.5*	13.95	14.05						
	14.65	14.80	14.90						
	23.7*	24.20	24.30						
TEST 2	5.3*	5.00	5.09	1.0217	-0.36	1.0209	-0.38	1.0204	-0.36
depth 350 to 380 m	10.2	9.98	10.08						
stations 23 to 24	15.1	15.00	15.10						
	20.0	19.95	20.05						
	24.8*	24.92	25.02						
TEST 3	5.6*	4.93	5.03	1.0252	-0.67	1.0263	-0.80	1.0209	-0.67
depth 665 to 692 m	10.6	9.97	10.07						
stations 49 to 50	15.4	14.95	15.05						
daytime	20.3*	19.92	20.10						
TEST 4	5.6*	4.91	5.00	1.0217	-0.67	1.0228	-0.79	1.0157	-0.67
depth 665 to 692 m	10.6	9.96	10.08						
stations 49 to 50	15.4	14.92	15.03						
nighttime	20.3*	19.92	20.03						
TEST 5	6.0*	4.99	5.09	1.0184	-1.15	1.0184	-1.09	1.0258	-1.15
depth 1133 to 1157 m	10.9	9.93	10.03						
stations 77 to 78	15.8*	14.97	15.07						
	17.6**	16.95	17.05						

Notes on Table 2.

The tape interval is the range of distances on the tape over which the gauge gave the indicated reading. The average of the two values was used in all subsequent calculations.

Calculation 1 is from the original paper. These are the numbers cited in the text. The factor k was calculated by the graphical method: The points were plotted, two of them (the ones indicated with an asterisk) were selected as typical, and the slope of the line between those two points was calculated. The offset b (barometric correction) was not obtained from the test data, but was calculated from the approximate depth of the test. It is the same as the b used in Table 1. The average k is the 1.0220 used in Table 1.

Calculation 2 is the least-squares linear fit to the test data. Both k and b are calculated. The average k is 1.0226. If the b values are taken seriously, a systematic error of about 10 centimeters per station might have occurred in using the data for the day of tests 3 and 4.

Calculation 3 is the least-squares fit for k , assuming that the intercept b is the same as that under calculation 1. This was done by adding the given b to each gauge reading and then doing a fit with no constant term, forcing the line to pass through the origin. The average k is 1.0215.

Calculations 2 and 3 are by the AMCS editor.

** This line declared erroneous by the authors. It was not used in any of the calculations.

During the entire process, it is necessary to keep this from happening. This is most likely to be a problem during breaks or overnight, when the glove should be hung up at least 1.5 meters above the box.)

If data from several tests are available, it is possible to use statistical techniques to estimate how accurately k has been determined, based on the scatter of the values. For example, from our data in Table 2, we see that the values are 1.0232, 1.0217, 1.0252, 1.0217, and 1.0184, with an average of 1.0220 and a root-mean-square deviation of 0.0024. While the sample is limited in size, we can estimate that with probability 95 percent the true value of k is in the range 1.0220 ± 0.0030 . This translates to an error from this source of ± 3 meters at Camp 1200. Adding estimated random errors of 0.4 meters, we get that the depth of Camp 1200 is, with 95 percent probability, 1194.6 ± 3.3 meters. [This statement depends critically on the authors' treatment of the atmospheric correction being appropriate. Not having great confidence in the graphical method, I have also added two methods, varieties of least-squares, to Table 2. My k s exhibit a bit more scatter, but the averages do not differ from the authors' by more than 0.06 percent.—AMCS ed.]

MMeasurement by intervals. The display on the depth gauge gives us discrete numbers such as 1.2 or 24.7. The accuracy of each measurement seems to be half a division, or 5 centimeters. It is actually possible to winkle out of the device much more. The number, say 1.2, on the display actually stands for some interval, such as 1.15 to 1.25. When Degtjarev put the hydrolevel on a station, usually an anchor bolt, he waited for the reading to settle down, and slowly moved the depth gauge upward and downward, looking for where a change in readout occurred. If the reading on the station was 15.7 and it jumped to 15.6 only 2

centimeters higher, he recorded 15.65. But if the reading stayed 15.7 more than 2 centimeters above the station, he recorded 15.7. Thus he reduced the average error in reading by a factor of 2, to 2.5 centimeters.

If the measurements are made twice, as in much of the data in Table 1, the same effect could be gotten by deliberately displacing the box, alternately by plus or minus 5 centimeters, from the stations during the second pass. The averages will reflect the reduced error.

But this is not the limit yet. The real sensitivity of the Casio depth gauge is about 1 to 1.5 centimeters, instead of the 10 that the display shows. Remember that sensitivity is the ability to respond to small changes, whereas the accuracy is the deviation of the displayed value from the true one. A device can be very sensitive, but have low accuracy, either because of limits in reading it or because it needs to be adjusted. The Casio gauge is an example of an inaccurate (or, rather, imprecise) but sensitive device. The result displayed is coarsened artificially by a factor of 10. First, divers don't need to know depth to within a centimeter. And the salinity of the Baltic Sea differs from the salinity of the Pacific Ocean by 30 ppm, so accuracy in the second digit after the decimal point is senseless; without knowing the exact salinity, it means nothing.

When Degtjarev did the test calibrations against a tape shown in Table 2, he recorded the interval on the tape where the device gave a particular reading. For example, the device might show 5.3 at exactly 5.0 on the tape. If it jumped to 5.4 at 5.07 on the tape and 5.2 at 4.97, the interval 4.97 to 5.07 was recorded, and the mid-point 5.02 of that interval was taken to be the point on the tape that really corresponded to a gauge reading of 5.3. This gave an accuracy of reading 5 times greater than that of the numbers on the display. There is no need to make this high-accuracy measurement at every station, as

the expected random error is low enough without it. But for calibration and the calculation of k and b , it is extremely necessary.

It must be noted that the stated sensitivity is characteristic of the particular model of Casio dive watch. For other depth gauges, it might be lower. The sensitivity needs to be determined for each particular case. An insensitive device may make it impossible to attain the desired accuracy, such as 0.2 percent. For example, we tried to use an expensive Swiss depth gauge and totally came to grief. It appeared to have very low sensitivity.

We conclude with some advice and observations that have not been covered already.

Do not use medical IV tubes, but use tougher tubes with an internal diameter of 4 to 5 millimeters. Use transparent tubes, so bubbles can be seen.

The plastic reel for the hose was broken by rocks, and it took seven minutes to reel in 50 meters of tube. Alexander Degtjarev and Tatyana Nemchenko refused to make use of the reel after some practice in the cave. They kept the hose in two loose coils. One, 20 meters, was seldom unwound. The other, 30 meters, was uncoiled and recoiled by one or the other of them, depending on the situation.

Speed of measuring is slow. Degtjarev and Nemchenko could not do more than 300 vertical meters, up and down, in twelve hours. It was very difficult to locate the stations. They should be marked by strips of colored material with large, clear numbers.

The tape for calibrations or measuring free drops must be long. Twenty meters is not enough; use at least 30 or better 50 meters.

Beyond 15 meters, understanding the partner is difficult. Use a few standard, easily understood commands ("ready," "understood," etc.) or whistle equivalents. Write data clearly, on suitable paper.

Hidronivelación para Cuevas de Gran Profundidad

Los autores rusos describen su método para lograr topografías verticales de gran precisión en cuevas profundas. La técnica usa un sensor de presión al fondo de un tubo lleno de agua. Datos de una topografía parcial de la cueva Voronja, la más profunda en el mundo, son mostrados como ejemplo.



LA VENTA
EXPLORING TEAM

THE JUQUILA CANYON, OAXACA

Antonio De Vivo, Tullio Bernabei, and Leonardo Piccini

The Juquila Canyon is located in the Sierra Mixteco-Zapoteca, within the large Reserva de la Biosfera de Tehuacán-Cuicatlán in southeastern Puebla and northwestern Oaxaca. The canyon collects water from a large highland at about 2000 meters elevation and therefore carries water year-round, despite being in a semi-desert area. There are large karst springs at the exit from the canyon. The Italians of the La Venta group have been exploring this area. This is the same group that has worked in the vicinities of the Río La Venta in Chiapas and Cuatro Ciénegas in Coahuila and published large books about those areas. This article has been compiled from several sources, as noted.

Overall summary from English abstract to “La gola verde dentro il canyon di Juquila,” by Tullio Bernabei, Antonio De Vivo, and Leonardo Piccini, *Speleologia* 51, December 2004 pp 46–47. The maps, tables, and photograph are from this article—

Since 2002 the La Venta team has been carrying out a new speleological project in the karst area of Juquila Canyon, Oaxaca, not far from the town of Tehuacán. Initial investigation has discovered well-developed karst, mainly represented by relict caves. Several caves are located on the steep slopes of the major canyons, but they are short. Only a large paleo-phreatic tunnel is more than one kilometer long. The exploration of two active vertical caves, 280 and 135 meters deep, located in the upper part of the karst plateau shows the potential of this area, which is still largely unexplored.

De Vivo: tonodevivo@tin.it

This diary of the 2002 expedition is by Antonio De Vivo and appeared in *Kur* 1, 2003, pp. 26–31—

The Juquila Canyon is located in Mexico’s Sierra Madre, at the border between Puebla and Oaxaca. It is more than 40 kilometers long and descends more than 1000 meters. Tullio Bernabei saw the canyon for the first time in 1998, during an aerial survey. The place was intensely fascinating; totally isolated, it seemed that nobody had ever traveled through its entirety. Inside it certainly hid underground systems, maybe similar to that found near Huautla, one of the longest and deepest in Mexico, located just a few tens of kilometers away. We therefore decided to organize a reconnaissance, similar in many ways to our first descent of the Río La Venta many years before. The expedition’s aim was to assess its difficulty and look for cave entrances and springs.

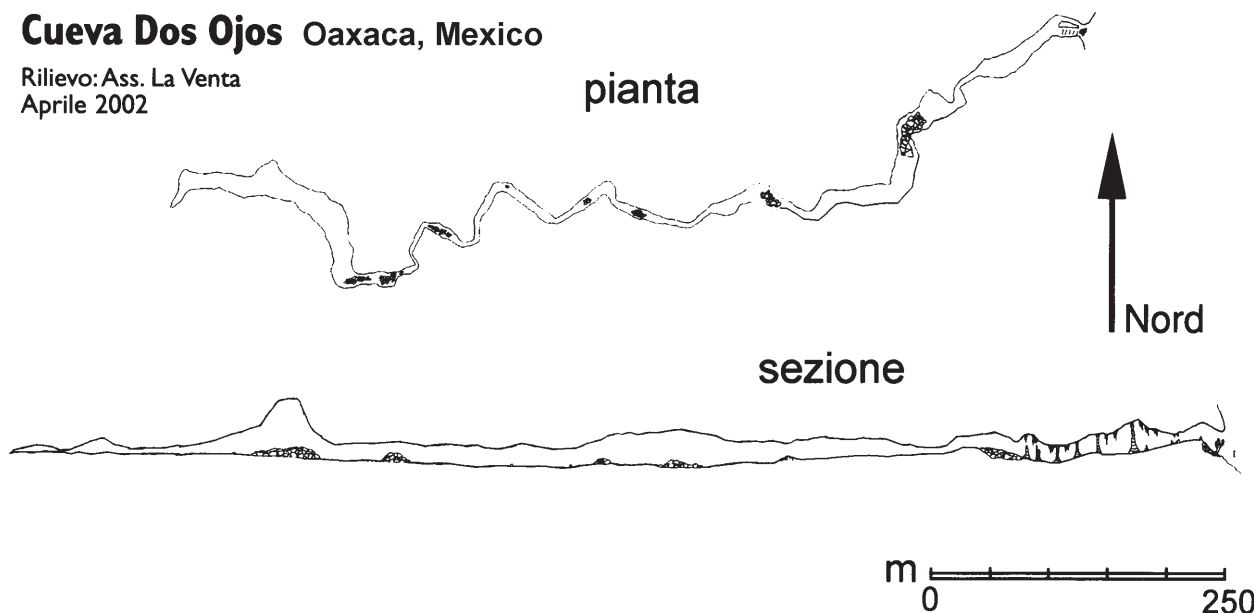
Four years passed before we could actually organize a quick but intense trip to Oaxaca, a long wait that was, however, well repaid by a real adventure like we hadn’t seen in a long time.

Tehuacán is located just over 150 miles from Mexico City. We reach our destination at about 1:00 a.m. on April 17, some with the indestructible Toyota and a rented van, others by public transit. There are twelve of us, overloaded as usual; we occupy a significant portion of the Monroy Hotel and its courtyard. The hotel is right in the middle of downtown, a few steps away from the cathedral that reminds us of its presence after dawn with a happy round of thirty-six bell tolls every fifteen minutes. Tehuacán, Puebla, has a population of about one hundred thousand and provides a good starting point for the

canyon. The headquarters of the Tehuacán-Cuicatlán Reserve is also here, and we go to get the permits for exploration in the protected area. The main problems are not paperwork, however, but logistics. The idea is to form two groups of six people each. One will enter the higher part of the canyon via the Río Grande, and the other will get to its central part starting from the bottom or going down from the plateau, following beaten paths in both cases. We’ll set the base camp at the two groups’ meeting point, an area partially used for banana plantations, very rich in springs. The second group has to look for horses to carry most of our equipment, while the first one has to travel as light as possible. We fight a long battle with medical, technical, dietary, and documentary material; in the end, however, nobody manages to carry less than 30 kilograms of stuff.

From Tehuacán we move to the little village of Tepelmeme, Oaxaca, and then to Puerto Mixteco, the beginning of the dusty path that leads to the Río Grande. This is the starting point for the long descent of group one. By the time we enter Puente Colossal (also known as Puente Mixteco or Ndaxagua), it is the middle of the afternoon. This is a natural tunnel more than 250 meters in length and 50 meters high that is well known to the locals and renowned for its pre-Hispanic rock paintings of Mixtec origin. Some are big and disquieting, towering over the dry riverbed where we set the camp. We make a map of the tunnel while being whipped by a strong wind coming up from the valley, strengthened by the funnel effect of the tunnel. The wind stays with us all night, quickly burning the last coals of the evening fire.

Birdsong, amplified by the walls of

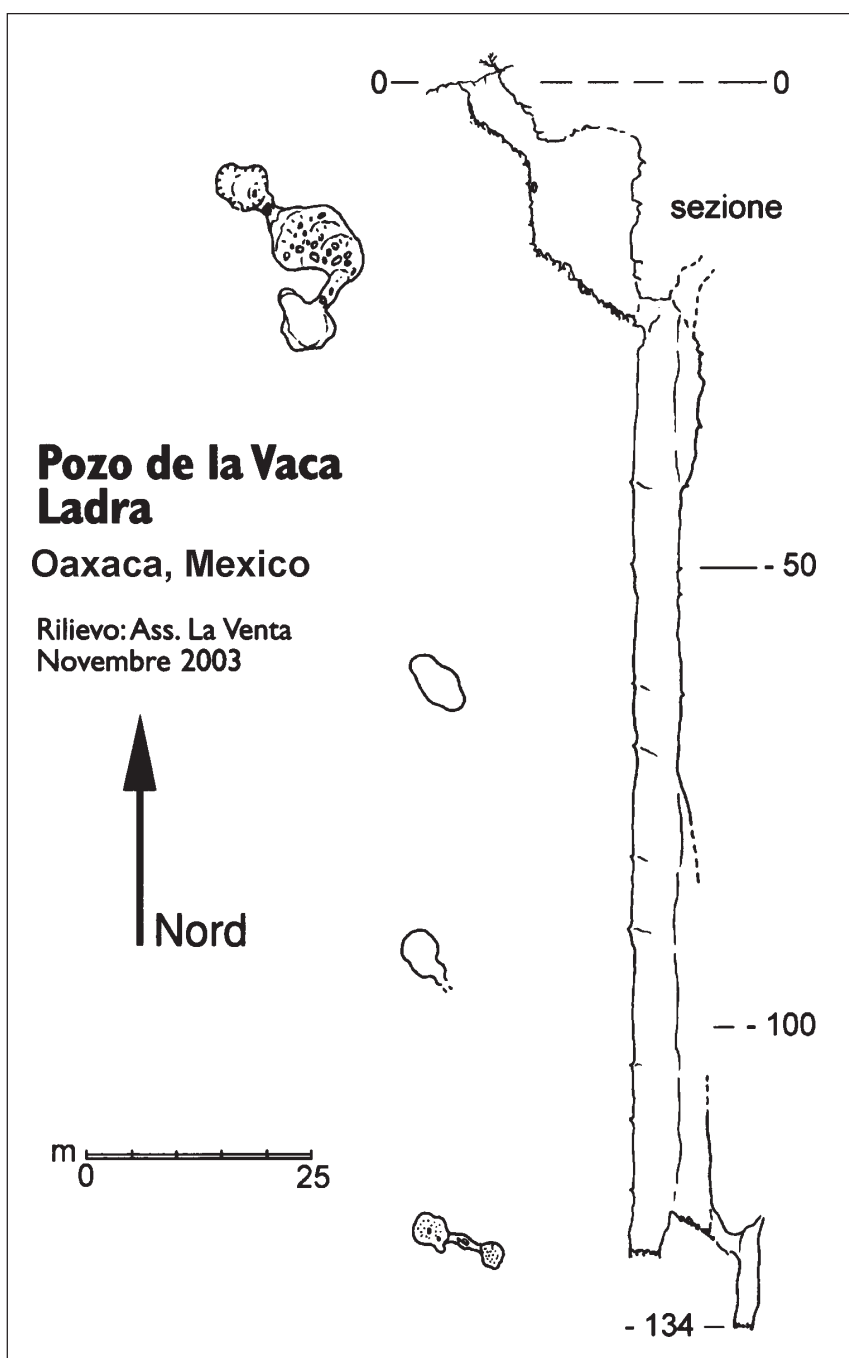
Cueva Dos Ojos Oaxaca, MexicoRilievo: Ass. La Venta
Aprile 2002**Localizzazione e dimensioni metriche delle grotte esplorate nella zona del Cerro Verde - Cerro Tequelite**

Nome	UTM E (14) (NAD 1927)	UTM N (NAD 1927)	Quota m s.l.m.	Dislivello m	Sviluppo m
MZ-1	678160	1991470	2630	- 10	13
MZ-2	678393	1992460	2680	- 37	50
MZ-3	678980	1993585	2665	- 7	10
MZ-4	6781760	1994636	2480		
MZ -5	678240	1992885	2635	- 11	15
TK-1	678345	1987080	2665	- 5	9
TK-2	678375	1987100	2665	- 7	11
TK-3	678420	1987040	2660	- 13	20
TK-4	679620	1987220	2605	- 11	25
TK-5	679785	1987455	2735	- 21	25
TK-6	680955	988035	2690		
TK-7	679560	1987615	2620	- 8	10
TK-8	679525	1987460	2625	- 19	25
TK-9	679200	1987439	2695	- 2	8
TK-10	677980	1986375	2515	- 6	15

Localizzazione e dimensioni metriche delle grotte esplorate all'interno del Canyon di Juquila

Nome	UTM E (14) (NAD 1927)	UTM N (NAD 1927)	Quota m s.l.m.	Dislivello m	Sviluppo m
Puente Colosal	683060	1984840	1760	- 37	255
JQ - 1	684200	1984980	1580	- 4, + 10	15
JQ - 2	683950	1985850	1550	+ 10	30
JQ - 3	683900	1985900	1550	+ 2	23
JQ - 4	683780	1985800	1580	+ 16	75
JQ - 5	678200	1982350	2600	- 20	
Cueva Dos Ojos	684538	1990564	1495	- 25, +30	1020

the tunnel and canyon, sure makes a sweeter awakening than the bells of the cathedral and adds to the harmony of this extraordinary place. We start our descent, loaded with extra-heavy backpacks. We are short of water, but we know where to find it: at the confluence with Juquila Canyon, some kilometers downstream. Our hopes to get there without hitches are soon lost. Ugo Vacca is feeling sick and stops; Italo Giulivo slips while jumping, and his knee, already weakened by a previous accident, is badly sprained. Little by little the group gets stretched out along the vertical drops that break the slope of the Río Grande, Gaetano Boldrini and Ugo in the higher part, Tullio Bernabei, Alessandro Beltrame, and Italo Giulivo in the lower part, trying to reach the water, and I shuttling between them to maintain contact. After many hours of fatigue and thirst, the crystal-clear waters of Juquila are finally reached, and I can get back to the guys upstream with plenty of water. We spend the night divided into two groups, lulled by the thousands of sounds of the dark. The following day we finally regroup and begin the descent toward the banana plantations together, with no more problems with water supply. We proceed sluggishly; the morphology of the terrain, the weight of the backpacks, the poor conditions of Ugo and Italo, and the need to film the descent (we are shooting a documentary) slow us down. The pace, however, allows us to fully take in all the fascination of the long crevice we are going through. Every now and then it feels like we are back in the Río La Venta. Cave entrances look at us everywhere from high up the vertical walls. Some are really huge, ancient resurgences or tunnels truncated by the deepening of the canyon. We'd like to climb up to explore



Localizzazione e dimensioni metriche delle grotte esplorate nella zona del Cerro Granudo

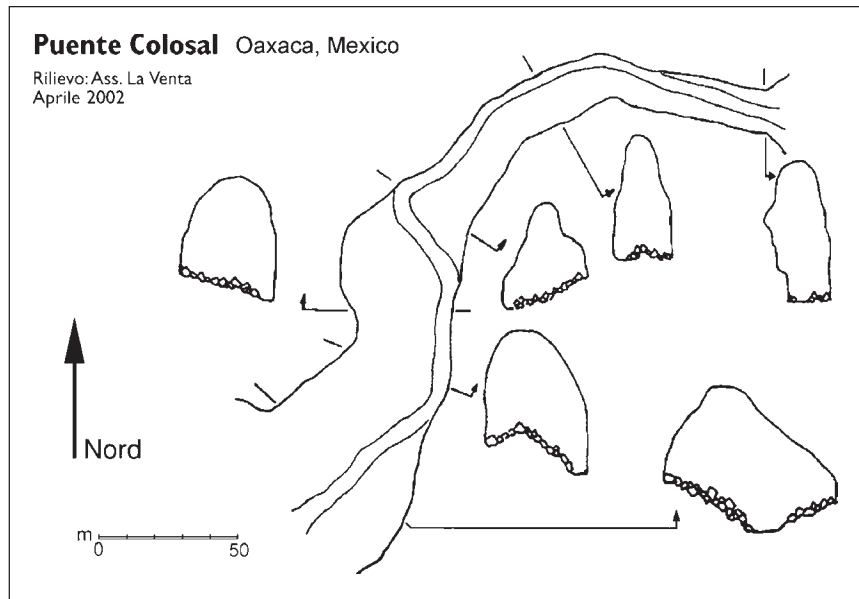
Nome	UTM E (14) (NAD 1927)	UTM N (NAD 1927)	Quota m s.l.m.	Dislivello m	Sviluppo m
Pozo de la Loma (CG-1)	686045	1980035	2420	- 10	13
Pozo Canada Pericon (CG-2)	686805	1983650	2300	- 6	10
Sotano de la Laguna Prieta (CG-3)	687555	1985460	2490	- 280	330
Pozo de la Vaca Ladra (CG-4)	688335	985380	2455	- 134	180
Pozo de la Mosca Molesta (CG-4)	688070	1986344	2525	- 35	50
Pozo el Timbre (CG-6)	688825	1983195	2370	- 10	20
Pozo el Campamento (CG-7)	689270	1983925	2320	- 17	25
Pozo de la Canada de la Cruz (CG-8)	687500	1983650	2405	- 7	10

them, but all we can do is note their positions with the GPS. We do check out a little cavity at river level; both the floor and the ceiling are covered with calcite crystals.

We keep going through an amazing environment. Huge, house-size blocks that can only be passed by rope are separated by flooded areas we have to swim through, pushing our backpacks on small inflatable rafts to keep them dry. The canyon continues like this the next day, too, and my bad luck is waiting for me just behind one big rock. It's a small drop, only a few meters, and holding a double rope in my hands should be enough. My heavy backpack tricks me, though, and I lose my balance. I realize all too well what's happening, but there's nothing I can do about it. My feet slip and slide, my forehead slams violently against the rock, and I drop downward. I splash into the water, bleeding and with my hands burnt by the vain attempt to grasp the rope. The others come to the rescue, and Ugo stitches my eyebrow up with Gaetano's help. One hour later we are on the go again, one limping, one near to complete exhaustion, one wearing a patch on the left eye, very little food left, the raft punctured, and no idea how long it will take us to reach the others down the valley—not bad for experienced explorers.

It doesn't take much to lift our morale, though. At dusk we set a camp, which we christen Refosco after the name of the wine from Friuli. Tullio had brought a bottle with him with great secrecy and care, and its content wipes out the fatigue and warms up our hearts. On top of that, Ugo's small radio manages to grab the signal from RAI International News, which makes us feel a little bit at home.

April 22 finds us busy climbing among piled blocks and crossing lakes hanging from ropes. The weight of the backpacks is still the main problem; any step is treacherous. We are exhausted, but we have to make the appointment with the second group coming up from the bottom. Toward 3:00 p.m. we reach a beautiful spring on the orographic left. Ponds and lakes force us into continuous portages, but radio contact with our



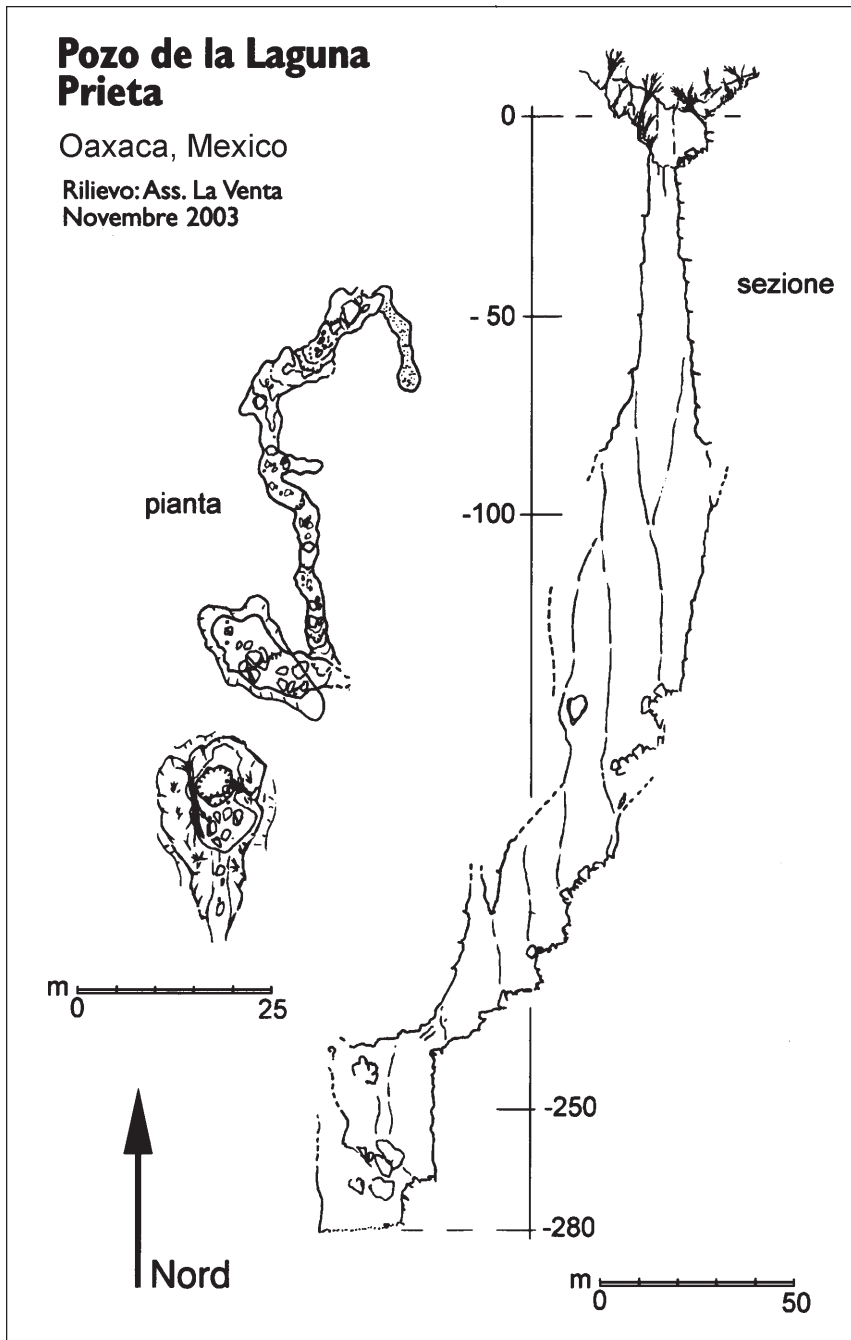
friends tells us we are almost there. We soon spot them. One last, 20-meter drop and we are all together again, exchanging news and redistributing the loads. One more hour and a half walk along old canals, still in use to take water from the karst springs to farmlands, takes us to La Huerta. This is the banana farm where our friends have set base camp. They had arrived here after a grueling twelve-hour hike under a scorching sun, crossing a sheer 800-meter pass located at the rim of the canyon with the invaluable help of Don Enrique and Don Elpidio, 64 and 72 years old, respectively, who were tireless and perfectly familiar with the area. Just below camp the river enters a wide tunnel, followed

by a series of falls and springs that merge with the main branch among luxurious vegetation and tufa concretions. All this water creates an environment that is totally unexpected in a semi-desert area like this.

The last few days are spent exploring caves and springs that carry the water all the way from the sinks in the plateaus, 1500 meters above. We survey a big cave for more than a kilometer. Another cave shows signs of ancient use. We can clearly see the leftovers of corncobs and a tomb that has been, unfortunately, pillaged. The return deserves to be told, too, but space is running out. Suffice it to say that Luca Massa, Tullio, and I have the brilliant



Karst on Cerro Tequelite.
Leonardo Piccini.



idea to follow the canyon all the way to Ignacio Mejía, many kilometers downstream, rather than climb back with the others to the pass to the plateau. We get there many hours later, in the middle of the night, completely exhausted, following the tracks of the Oaxaca-Mexico railway. Now we know for sure that it'll be much better to follow Don Enrique's advice. The next expedition will see us sweating through the pass.

This anonymous note of the 2003 expedition appeared in *Kur* 2, 2004, p. 4—

The second part of the project on karst and caves in the area of Juquila Canyon took place in November 2003. Eleven Italians and five Mexican researchers from the Universidad Nacional Autónoma de México took part in the expedition. Its aim was to carry out a preliminary survey of the most promising areas for vertical caves. During the first few days we surveyed the W zone, on the left bank of the Río Juquila and the E zone, on the right bank in the vast, high plain that reaches Cerro Grande, 2520 meters. We also carried out further research inside the canyon. Within a few days we spotted many caves, most of which were just a few tens of meters long, except for two deep pits on Cerro Grande. After reuniting the teams, we decided to concentrate our efforts in that area. The biggest cave we explored begins with a magnificent 200-meter pit, but ends at -280. In another cave, the initial 12-meter pit is followed by a cylindrical drop with a diameter of just a few meters, closed at the bottom by mud and debris. In both cases, the caves are still active, demonstrating the existence of a well-developed underground karst system. Altogether, these findings make us hope that in the future we will be able to find an access point to the vast underground karst systems that must exist here and whose depth potential exceeds 1700 meters.

Cañón de Juquila, Oaxaca

Espeleólogos italianos han estado buscando cuevas en el Cañón de Juquila en la Reserva de la Biósfera de Tehuacán-Cuicatlán, al norte de Oaxaca, y en sus alrededores. Hasta ahora la mayoría de las cuevas son pequeñas, pero han encontrado dos cuevas verticales, de 134 y 280 metros de profundidad, en el Cerro Granudo. Hay manantiales cársticos en la boca del cañón y el potencial de profundidad en el área es de 1700 metros.

SOME PITS IN NORTHERN OAXACA

Marion and Tony Akers

August 2004 saw Tony Akers, Simon Akers, James Burkhart, and me, Marion Akers, in Mexico for a variety of reasons. The main one was our business, buying and selling Mexican art. Whether it is for the spring or, as in this case, the holiday season, we travel the country in our Dodge truck. We have been doing so for the last seven years or so. This was James's fourth trip with us, earning his way to see the Mexican countryside and be included in the vacation part, which we always managed to fit into our ventures.

Having finished the first leg of our business journey in Oaxaca City, we decided to relax a little. James took a side-trip to the beach of Zipolite, located in an area off the southern end of Oaxaca close to Puerto Angel, to enjoy the beach and have some freedom. His bus trip was relatively cheap, and we made arrangements to pick him up in Huautla later in the week. The rest of us planned to do some small caving trips in the Sierra Mazateca in northern Oaxaca, and we had made arrangements with Protección Civil before leaving Oaxaca City. They had also given us three sets of regional reference books to deliver to the local governments we would have to get permission from. We hoped these would make getting permission from all three towns that much easier.

After a late-afternoon drive to Teotitlán del Camino and a morning drive to Huautla de Jiménez, Tony, Simon, and I met Waldo García as arranged and spent the day with him. Waldo is a friendly man whose well-

respected family owns an old coffee plantation, or *cafetal*, east of Huautla in La Carlota. Tony and I have known him for years, as have some of our friends who have traveled with us in this part of Mexico. He has always been kind and generous and eager to learn about us and accompany us. He has a large family in Huautla, but works at the *cafetal*. His latest venture is fish farming, using the fresh water from his land to fill the hand-made pools, where he raises *mojarras*, a type of trout. He invited us to stay in one of the buildings at the *cafetal* and allowed some of his workers to accompany us around La Carlota as we explored pit leads.

But first we went to get additional permission from the local governments in La Soledad and San Bartolomé de Ayuatla. During the wait at the office of the *presidente* at Ayuatla, I took Simon around to the small market there to buy fresh chicken and some tortillas. We then took a walk down a wide concrete pathway past houses separated by makeshift fences. We saw a lot of animals, including ducks, chickens, pigs, dogs, and cats, in the dirt courtyards and watched the people peeking out of their houses to look at us. They came to know us somewhat through my son, whom they jokingly called Guero, blond boy. All went well with the permission, and we dropped off the books, which were filled with statistical, geographical, and physical information about the region.

Back at the *cafetal*, Tony planned the next day of exploration, while Simon played soccer with the children. I, of

course, cooked for the men. Overnight, seemingly, I had turned into one of the women there, and it felt somewhat foreign. Domestic I am, but washing clothes using a rock sink and washboard, a brush, and a bucket is not part of a lifestyle I envision for myself.—

Marion Akers

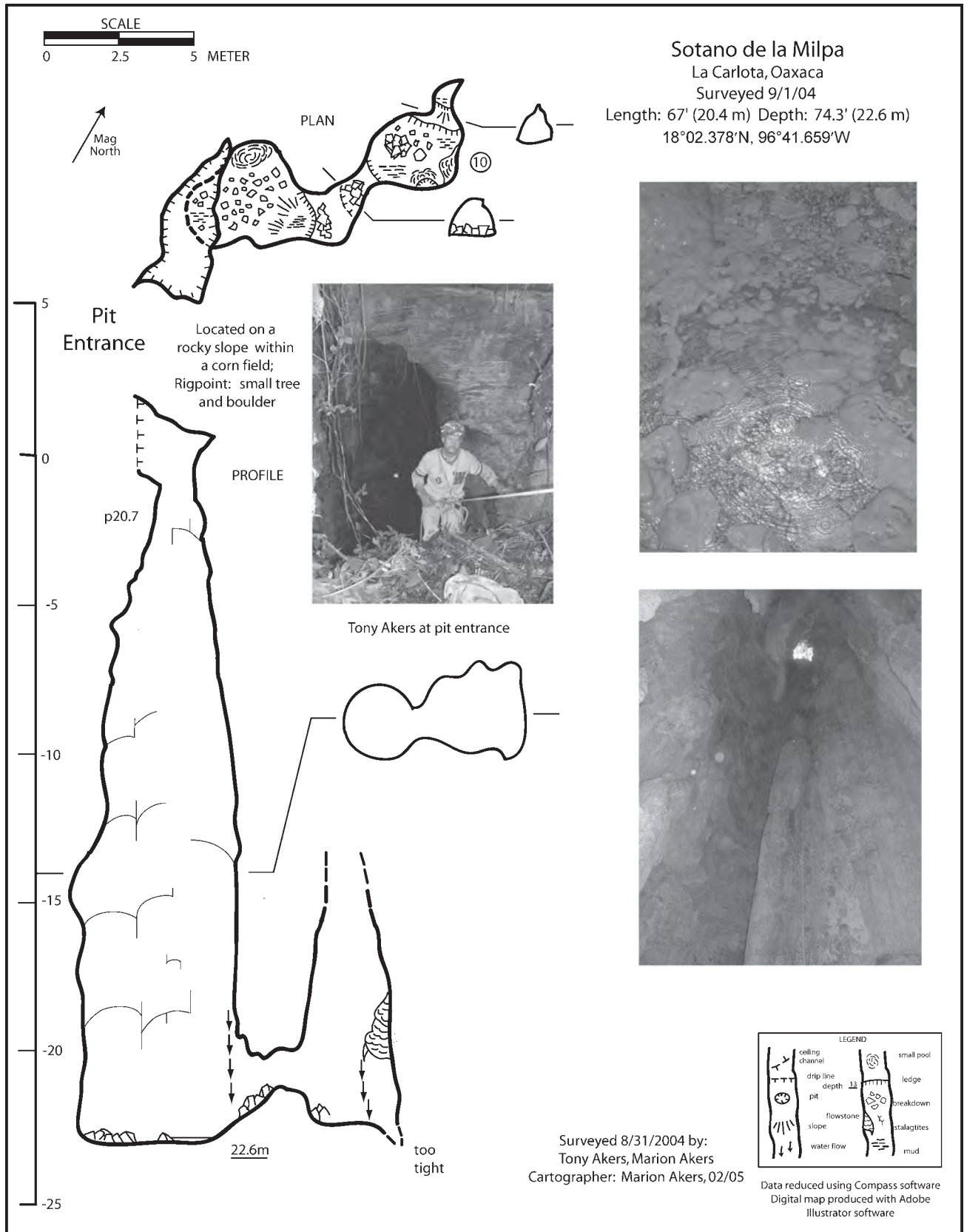
We slept well, as usual, in La Carlota. Our bedroom was located in a large building that was owned by Germans in the early 1900s, when La Carlota was a *cafetal*. There was total tranquility and silence, and it started raining hard at around 4 a.m., filling all the arroyos and making sleep even better. The weather was actually very nice, with rain during the night, but gone when the sun rose over the

Simon and Dad on the way to some of La Carlota's finest pits. *Marion Akers.*



Reprinted from the September 2005 issue of the *CIG Newsletter*.

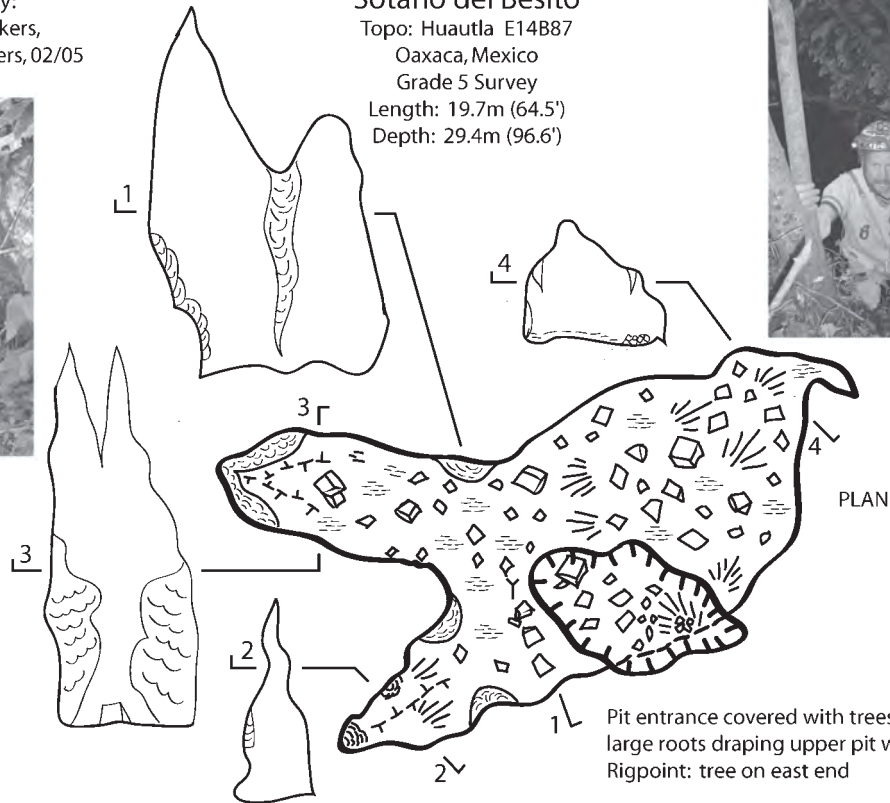
atoz@atozimports.net



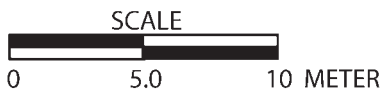
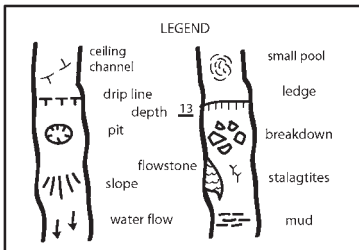
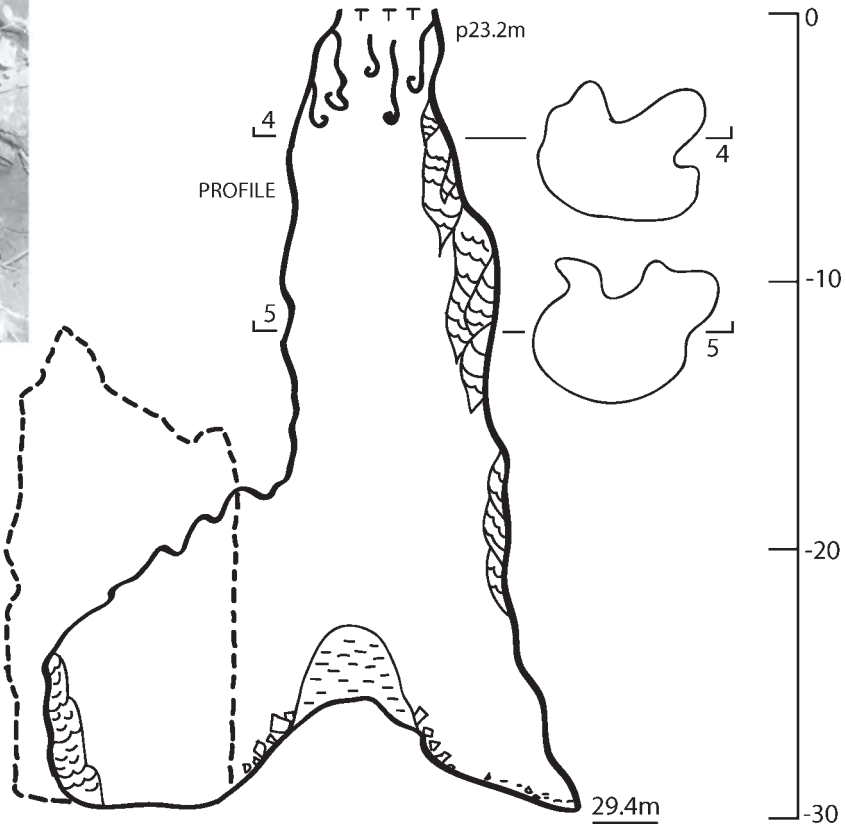
Surveyed 9/1/04 by:
 Tony Akers, Marion Akers,
 Cartographer: Marion Akers, 02/05

Sotano del Besito

Topo: Huautla E14B87
 Oaxaca, Mexico
 Grade 5 Survey
 Length: 19.7m (64.5')
 Depth: 29.4m (96.6')



Pit entrance covered with trees with large roots draping upper pit walls;
 Rigpoint: tree on east end



Data reduced using Compass software
 Digital map produced with
 Adobe Illustrator software

Surveyed 9/6/04 by:
 Tony Akers, Marion Akers, James Burkhart
 Cartographer: Marion Akers, 02/05

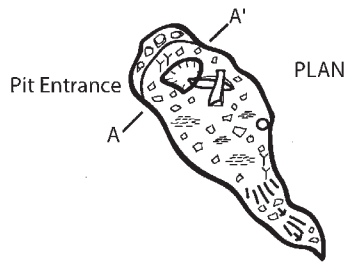
Sotano del Agua Pajaritos

Topo: Huautla E14B87
 Oaxaca, Mexico
 Grade 5 Survey
 Length: 4.1 m (13.6')
 Depth: 13.0 m (42.7')

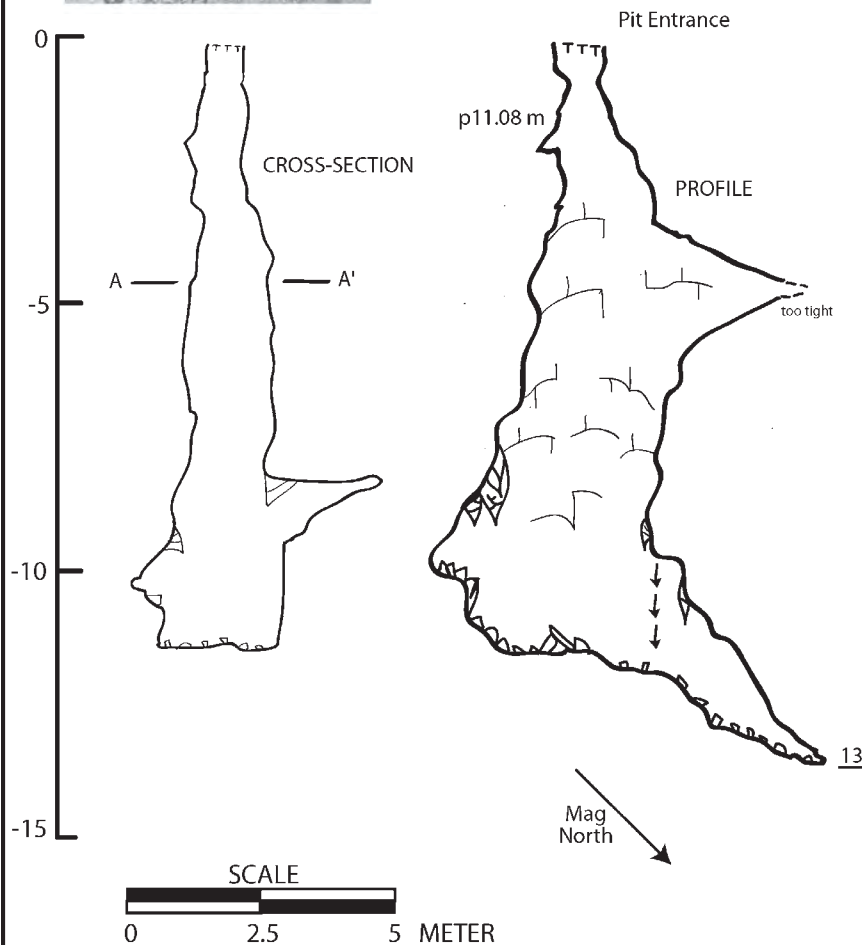
James, descending through tight entrance



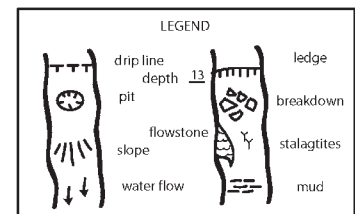
Entrance in a cluster of small trees & shrubs, inbetween fields of corn, sugar cane, and grazing animals; Rig to nearby tree



○ Goat skull and partially buried skeleton found on bottom floor



Amblypigid - Paraphrynus grubbsi; nickname - whipless whip scorpion, commonly found only in caves in this region



fresh, clear mountains.

At 10 a.m. on September 1, we met our friend Fortino. We visited a pit in a cornfield just down the mountain, several hundred feet from La Carlota. We named it Sótano de la Milpa. It is 22.6 meters deep and has a small lead with no airflow at the bottom. I descended the pit first, while Marion stayed with Simon and Fortino at the top. We measured the depth, and then I ascended and Marion went down to complete the sketch. Two-year-old Simon was entertained the whole time by a grasshopper Fortino had caught and tied a thread to, Simon's pet grasshopper on a leash. After Marion finished the sketch and ascended, we headed off.

The second pit, which we called Sótano del Besito, is a nice 29.6-meter pit. We named it for a tree growing at the entrance that the locals call *caca de la gallina un besito*. There is a very small edible fruit that grows on the tree. To eat it, you pucker your lips as for a small kiss (*besito*) and suck from the flower the small amount of slimy fruit, which has the size and texture of a chicken dropping (*caca de la gallina*). Not much sustenance, but actually pretty tasty.

Both caves contain the amblypidid, or whipless whip scorpion, *Paraphrynus grubbsi*, identified from photos for us by Andy Grubbs himself. Also, in Benito I noted a number of pottery shards. It appears that someone in the past had tried to draw water from the pit, breaking a water jug on the wall near the bottom.

After completing the survey, we headed back to Carlota, where Marion made a great dinner for all of us. Later that evening, Raymundo, our neighbor, treated us to fresh milk from one of his cows, a fascinating experience for Simon.

On September 6, Marciél, another local neighbor in La Carlota, wanted to take us to a small pit close to La Soledad in an area the locals call Agua Pajaritos. He had found the pit one day while walking with his dog. His dog had fallen into the entrance, but had stopped at a restriction near the top. Marciél had been able to retrieve his pet before it fell on to the bottom. Once we located the pit, we removed a small boulder choke at the top so that it could be entered. James, back from the coast, was the first to enter the pit. This was his first virgin pit, named Sótano del Agua Pajaritos. Marion and James surveyed the 13-meter pit, while I waited at the top with Simon and Marciél.

Marion and James were just finishing the survey when the landowner came down to the entrance to see what was going on. He asked where we had gotten permission to enter the cave. I explained that I had shown all the necessary documents and letters of permission to the municipal agent in La Soledad. He asked which agent, and I explained that we had talked to the



“Sweet! On rope again.” *Tony Akers.*

agent from PAN. He then informed me that he was with the PRI party and that we should have talked to the PRI representative in La Soledad. He mentioned the problems with British cavers in Puebla and even the unrelated pit-jumping suicide of a local in Puebla soon afterward. After some further conversation, during which I explained what we were doing in Mexico and how we loved the Sierra Mazateca, he finally put out his hand, introduced himself as Ermilfo, and announced that we were friends. In the future, he would help me find bigger caves and help with relations with other landowners. This was a lesson for me about landowner relations in this particular part of Mexico. The same guidelines of respect we use here with landowners in the U.S. should apply even more in Mexico, where we may find ourselves in a much more unpredictable situation. No matter from whom or what government offices you have permission, there are landowners everywhere.—*Tony Akers*



Looking down on the morning clouds above Cafetal Carlota. *Tony Akers.*

Cafetal Carlota.
Marion Akers.



Algunos Pozos en el Norte de Oaxaca.

Espeleólogos visitaron el viejo cafetal de La Carlota, al este de Huautla, exploraron y topografiaron tres pozos pequeños.

UNDERGROUND IN GÓMEZ FARÍAS, THANKSGIVING 2005

Philip Rykwald

Sitting down on a log in a field of *Snopal*, I dragged out the map for the umpteenth time that day, extremely frustrated at having not found any caves and rather confused as to our location. Three caves were marked on our topo map, but something was lost, and I couldn't figure out if it was the caves or me. And now it was well past noon, and all we'd done that day was walk, walk, walk. The area around Gómez Farías, Tamaulipas, is rich in caves. In the summer of 2005 I had visited the area and had mapped a beautiful 70-meter open-air pit, and thoughts of it and similar caves had drawn me back. There are many caves in the -100-meter range in the area, which is the perfect depth to be explored in a day or two. And so we had walked from Gómez Farías that morning, Marlana Cobb, Shannon Summers, and I, toting ropes, vertical gear, and a survey kit with great hopes of finding and mapping caves.

Now I was frustrated. We had walked on paved roads, over *topes*, and down cobbled lanes, we had followed dirt paths that skirted *nopal* fields, and finally we had bushwhacked with no machete and found nothing but sweat and failure. In some dense vegetation Shannon and Marlana found some small features and poked into them for awhile, while I pressed on to our dissolving goal. Finally, dense forests of vines, cacti, and *mala mujer* pressed in from all sides, and I sat down and slumped to pull spines from my legs, thoroughly disgusted.

Returning to the others, I did manage to find a small blind pit, Pozo Oscuro, but it was tiny, perhaps only 8

meters deep. Normally I would have overlooked it, but on this day we mapped it, because we were so desperate for anything resembling a cave. After the short survey we decided to take a meandering route back to Gómez Farías. While walking, I got to thinking about the geology of the area. In Gómez Farías there is a large, cigar-shaped volcanic caprock sitting on a package of limestone. I reasoned that all I had to do was find the contact of the two rocks and I'd find caves, but with no geology map and thick green vegetation obscuring everything, I did not know where to start.

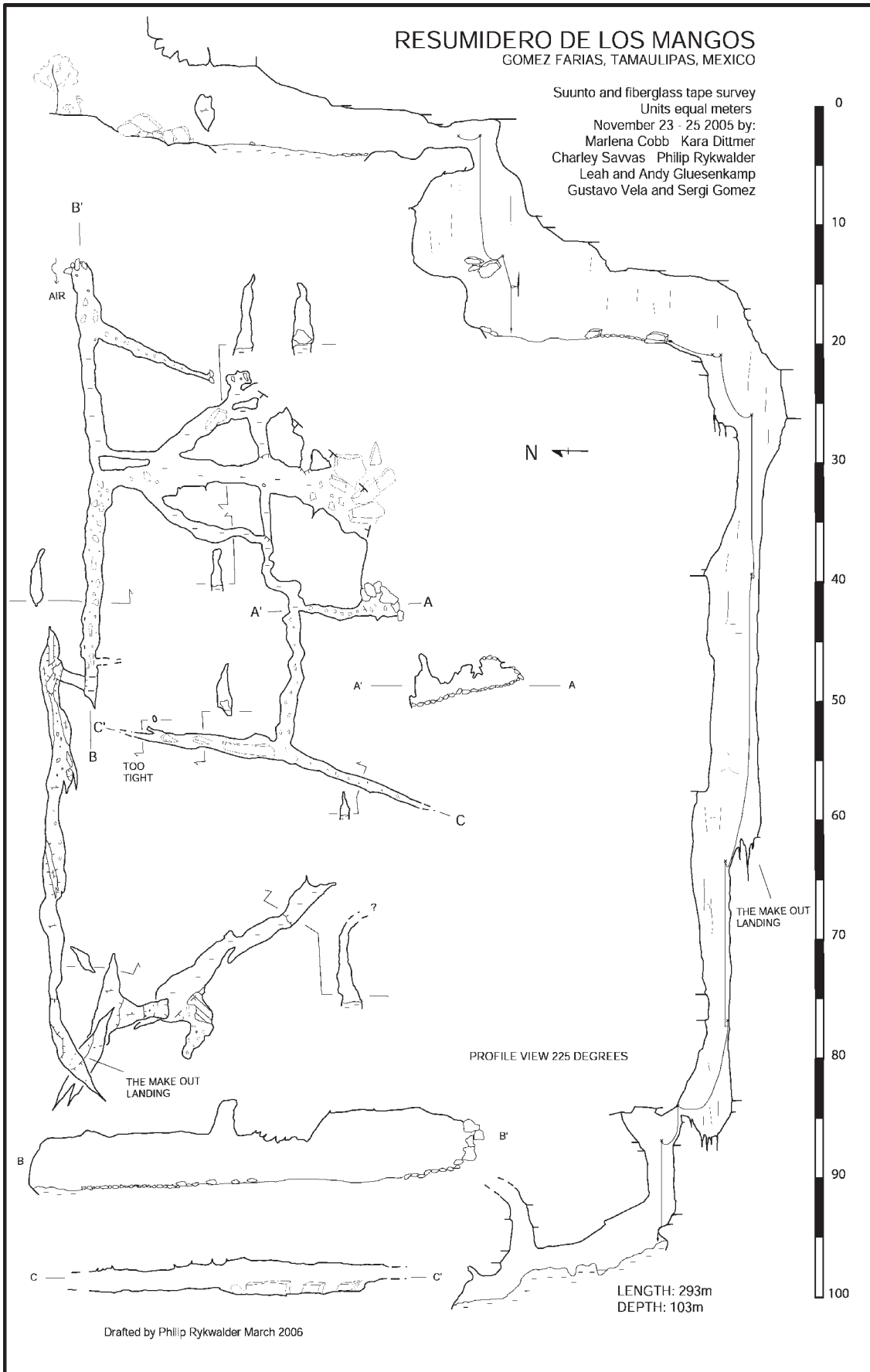
On the walk home, Shannon spotted what appeared to be a large depression off the road, and we decided to check it out. Following the path into the sink, I noticed that we were walking right along the very geologic contact between the volcanic rock and limestone that I had been pondering about, and soon I found a small cave, maybe 10 meters long, with two entrances. Knowing that the area had the potential for more significant caves, we ignored it and walked farther into more inviting terrain in a dry drainage just below the contact. Soon Marlana hooted that she had found an entrance, and all three of us convened at her newly found cave.

The entrance to Marlana's cave was a round hole a bit less than 1 meter in diameter, and it obviously takes water from the arroyo when water flows in it. Though it was a rather unimpressive entrance, we were enticed with the facts that it was blowing air and the grass around it danced in the breeze. I shimied about 5 meters down the entrance, past a tire wedged in the passage, and

into a small room. Passages continued in three directions from there, and the most inviting one continued down. Realizing that this was going to be a real cave and not another dinky little hole, we decided to return the next day to explore it. We named it Alice's Plunge. Marlana was particularly excited, as this was the first new cave she had ever found.

The following day, Shannon, Marlana, and I returned with rope, a hammer drill, and high hopes, and we started the exploration and survey of Alice's Plunge. Beyond the entrance junction, the main passage led to a crawl and then to the top of the first pit. Side passages led to a small maze, but we started off down the pit series. Shannon armed himself with the Bosch hammer drill and rigged down the first pit. Below we found ourselves in a beautiful tall, vadose passage that led immediately to a second pit, which took the last of our rope. The passage was the sort of tall, narrow vadose passage that meanders back on itself as it drops down, down. In wet times there would be many waterfalls and plunge pools, but now it was all dry. Having run out of rope, one of the best ways to end the day, we headed back to Gómez Farías victorious, thrilled that our find was proving to be a nice multi-drop cave.

The third day Geoff Hoese and Aimee Beveridge returned to Alice's Plunge with Shannon, Marlana, and me. Shannon and Geoff rigged the remaining drops, and Marlana, Aimee, and I followed with the survey. In total we rigged nine drops in Alice's Plunge and surveyed it to a final depth of 113 meters. Months later it was determined that Alice's Plunge had been explored



in 1972 by a French caving group, Spéléo Club de Paris, and called Sótano del Plan. [The French map is reprinted here. It was originally published in *Grottes et Gouffres* 50, December 1973, page 25.]

While I had been busy with the exploration of Alice's Plunge, Charley Savvas had been leading crews to other caves. He had spent one day at Resumidero de los Mangos, and in that time he had mapped an upper maze level. There was a drop he had not gone down, and we assumed the cave would be another 100-meter deep multi-drop, so the next day I and Sergi Gómez started rigging down the drop series. I rigged the first drop, placing a rebelay next to an awkward chockstone, and then Sergi rigged the second drop, a long, thin rift that opened into an offset 55-meter drop. The lower 30 meters or so was a beautiful drop in space, and at the bottom we both got off rope on a narrow ledge, later named the Make Out Landing, and stared down a drop that we did not have enough rope to rig. We would have to return the next day to finish Resumidero de los Mangos.

Sergi and I returned the next day with Gustavo Vela, Andy Gluesenkamp, and Leah Adams. The other team for the day consisted of Charley Savvas, Kara Dittmer, and Marlena Cobb, and their job was to finish surveying the upper level that Charley had started. Sergi and I rigged down two more drops to the bottom of the cave. As Andy, Sergi, and I surveyed out from the cave's muddy bottom, Gustavo climbed out last and derigged the cave behind me. At home that night we entered the survey data into the computer and found that the cave is 103 meters deep and 293 meters long. There remain many more caves in Gómez Farías, and many of them are very fun 100-meter-deep mini-projects. While deep caves are always alluring, the caves of Gómez Farías are high in fun factor and very appealing, as they can be completed in a few days.



**Bajo Tierra en Gómez Farías,
 Acción de Gracias 2005**

Algunas cuevas verticales cerca de Gómez Farías, Tamaulipas, fueron exploradas y topografiadas. Una de ellas fue posteriormente identificada como una que ya había sido topografiada por franceses en 1972. La otra, Resumidero de los Mangos, tiene 103 metros de profundidad.

JALISCO CAVING 2005

John Pint

On October 25, 2005, while visiting a rancho between La Venta and Nextipac, at the northern foot of Cerro El Tepopote, I asked Raul, a young ranch hand, if there were any caves in the area. Much to my surprise, he pointed in several directions. “There’s one right over here, another one over there, and a couple we can best reach on horseback.” When we asked him to describe these caves, he talked about areas of total darkness and—of course—added that one of the caves goes “all the way through the hill” to another entrance on the other side. Since we had long ago visited a genuine, if small, cave below the east flank of Tepopote, I had hopes that Raul’s mountain-traversing cave might be more than the usual three-meter arm-pit.

My wife Susy and I returned a week later, and Raul and his younger brother Oscar led us through a cornfield and up a rock-covered hillside. This part of Cerro Tepopote is, for some reason, known locally as El Carro. First they showed us three spots they said had once been holes, but they were now filled with dirt. These all lie in a straight line, are about 10 meters apart, and look suspiciously like evidence of another qanat (see *AMCS Activities Newsletter* 28, pp 181–184). But the rocky nature of the hillside precluded the possibility of an underlying man-made aqueduct. A little farther up the hill, we came to a triangular hole that was obviously 100 percent natural. Curiously, it was in line with the others.

We scrambled to a floor about 2 meters down. The small room looked like a typical hollow under large rocks,

thepints@saudicaves.com

but a crawlway led down to total darkness and another climbable drop, perhaps 1.5 meters. Below, we found a room about 5 by 12 meters and 6 meters high, with water dripping down one wall. The humidity was high enough to sustain patches of cave slime covered with tiny water droplets that looked like white paint from a distance.

At the very bottom of this sloping Big Room, we found a low crawl leading to a T-junction. The narrow passage went at least 15 meters in both directions. The left branch appeared to lead to a wide, upper-level passage or room about 7 meters up. In the other direction, the passage seemed to continue at our level. The wall of this passage was coated with what looked to me like the small droplets of hardened lava you sometimes see on the walls of a lava tube, but this was certainly not a lava tube. There was also soot on the wall at about eye level, perhaps deposited from a hand-held torch. We had seen what I guessed to be around 70 meters of cave in Cueva El Carro. We stopped at the tee because the boys had to get back to work.

A few weeks later, we returned to Cueva El Carro with Chris Lloyd, Sonia Calvillo, Alberto Cortés, and Victor Hugo Zaragoza. It turned out to be a big crew for a small job. Mapping the cave to the tee took only a few minutes. Then, alas and alack, we discovered that further progress was very difficult to the right and downright dangerous to the left, where the potential climb to an upper level was below hundreds of precariously piled

rocks that looked like they would all descend if anybody sneezed.

Still, we were impressed by the boys’ little cave, so there’s a glimmer of hope that their big one might actually go right through the mountain. But we aren’t holding our breaths.

In April 2005, Pedro Fernández Somellera and I visited Cueva del Chapuzón to get the GPS coordinates of the Easy Entrance. A few weeks later, Jan Paul Vanderpas, visiting from the Netherlands, and I took a sonic distance-measuring device in Chapuzón, where we proved that such a device is utterly useless in a cave, unlike the Disto laser rangefinder. The Strait-Line Sonic Laser Tape is deceptively named, as its laser is only for pointing, and the measurement is made by sound waves. The gizmo worked fine in a house with

Oscar at the entrance to Cueva El Carro.

John Pint.



**COLD DUNK CAVE - LA CUEVA DEL CHAPUZON
TALA, JALISCO, MEXICO**

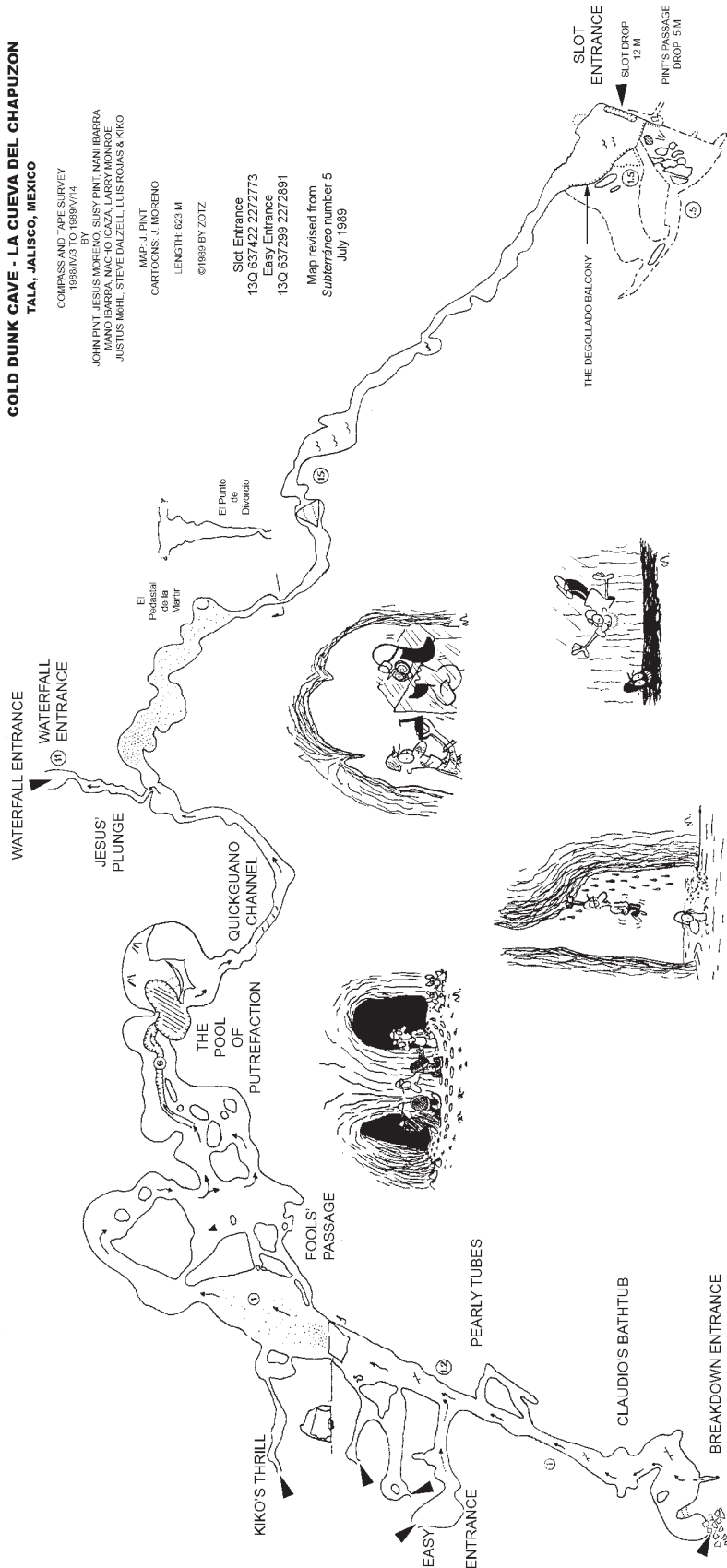
COMPASS AND TAPE SURVEY
1988/IV/3 TO 1989/VI/4

BY
JOHN PINT, JESUS MORENO, SUSY PINT, MANI IBARRA
AND
JUSTUS MATH, STEVE DALZELL, LUIS ROJAS & KIKO

MAP: J. PINT
CARTOONS: J. MORENO
LENGTH: 623 M
©1989 BY ZOTZ

Slot Entrance
130.637422 2272773
Easy Entrance
130.637299 2272891

Map revised from
Subterraneo number 5
July 1989



flat surfaces, but even with a clipboard as a flat surface, it didn't work in a cave. After weeping over the wasted twenty bucks for the device, I led Vanderpas out of the cave through the boulder-choke entrance, whose GPS location was duly noted. We then searched for and found the slot entrance, noting its location, too.

On October 16, Luis and Mary Rojas, Sonia Calvillo, Mario Guerrero, and I drove out to Chapuzón to put my new Nikon D70 to a real test in a cave. I figured my companions were either very altruistic or very crazy, because they all knew how it is to be models or sherpas on a cave photography trip. The GPS coordinates I had taken saved us much time. We utilized a new, much better parking spot, avoided the infamous irrigation ditch entirely, and marched straight to the Easy Entrance without the usual sinking to one's knees in muddy swamp.

Although there had been heavy rain prior to the trip, the water level in the cave's small stream was very low. I have long suspected that this level is less related to rainfall than to the irrigation system outside. The irrigation ditch was in fact completely dry.

At a distance of 3 meters or so from

Sergi Gómez in a typical position in Chiquihuiton Fissure Cave. *John Pint.*



the subject, the Nikon D70 worked well with its built-in flash commanding SB 800 and 600 remote flash units. At greater distances, the remotes didn't fire, and we switched to traditional slaved flashes, with both the camera and its lens set on manual. The bulb setting on the D70 can only be activated by remote control (a problem remedied in the D70s), and the sensor faces forward, which could cause a problem in certain cave situations. According to my D70 mentor, Jesús Moreno, some clever folks have figured out how to program a TV remote to trigger the Nikon, greatly increasing the distance for turning "bulb" on and off.

We noted that there is still plenty of slime on the walls of this cave. We hope an expert will someday discover that this contains microorganisms that will cure man's intolerance for man or some other deadly disease. Fresh vampire guano was noted upstream, with light bat activity. A quick check downstream took us to a point where

we could hear the roar of wings in the distance. Knowing these were all friendly bats, we turned back, rather than disturb the colony.

On December 20, Pedro Fernández Somellera, Sergi Gómez, the entire Mohl clan, and I headed for Cueva Cuata or Tequilizinta with the goal of determining whether it really is a true lava tube. This cave is located 10 kilometers northwest of Amatitán in a cliffside overlooking the Río Santiago and was believed by members of a now possibly defunct religious sect to be one of seven places that will be spared when doomsday comes. We discovered a new and easier way to reach the trail to Tequilizinta, and, after some hunting, found our way to the cave. The altar is now covered by a layer of guano, but otherwise the cave looks about the same as it did when we filmed the five-



Mario Guerrero skirting a deep pit in Chapuzón, proving that the camera sometimes lies. (The pit is 1.5 meters deep.) *John Pint.*

minute Espeleoclub Zotz hit movie *Mud* some years ago. By crawling to the cave's delightful pool of vampire guano in water, we spotted small lava stalactites on the ceiling, which seems to prove that this is a genuine lava tube.

In December 2005, Pedro and Celina Fernández joined Susy and me in an attempt to reach Chiquihuitón Fissure Cave, located 53 kilometers northwest of Guadalajara just outside the town of Tequila. Our old route was no longer usable, as the orchard we formerly cut through was now locked up tight. We succeeded in finding a path that supposedly led to the cave, but had no time to check it out. A few weeks later, I returned with Sergi Gómez and Sonia Calvillo and followed the path about 250 meters north through an agave field sprinkled with big, black volcanic rocks. The sharp needles normally found at the tips of the agave's "leaves" had been thoughtfully trimmed, resulting in a pleasant, rather than painful, hike. But then we arrived at the bottom of an extremely steep slope that had to be climbed to reach the cave. At that



Sonia Calvillo in the river passage in Chapuzón. *John Pint.*

point, the path vanished completely. "Well," I said, "if we just head uphill, we are bound to intersect the old path. How could we miss it?" Unfortunately, this slope was all too close to 90 degrees and covered with a thick tangle of trees, weeds, thorns, and cacti that we slowly penetrated, groping for skinny *papelito* trees and pulling ourselves upward. Halfway up what seemed more and more like a wall than

a slope, we came to the conclusions that we were never going to cross the famous path and that we had no choice but to keep inching our way upward, sweating and cursing until we finally reached the top. When we did, I flopped down on my back, like a fish out of water, huffing and puffing for dear life.

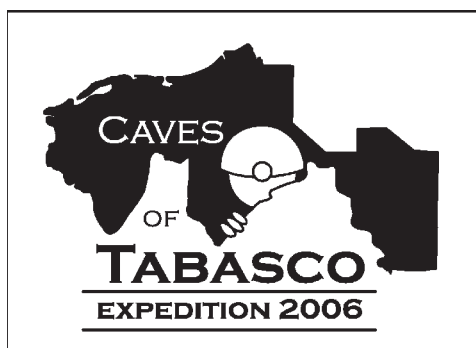
Then we soon found the cave, whose entrance is located just below a natural bridge known locally as El Arco.

Chiquihuitón is a complex fissure on several levels. We have mapped hundreds of meters of it, but there are still plenty of passages awaiting the measuring tape. The purpose of the visit was only to get the GPS location of the entrance and a few pictures of the long roots that hang down from the ceiling in several parts of the cave. We entered the cave by climbing down a little drop into a long crack and then crawling through a low spot out of which old air was blowing. Only a few meters inside, we came to the Ham Slicer, a vertical slot through which we used to pass in the old days. Ah, well, those days are gone for good: I couldn't fit. So Sergi got the best photos on this trip.

On the way down, we found, of course, the mislaid path. As we descended, we could appreciate the stupendous view from the ridge, including blue agave fields and *bonete* trees with their green, bomb-shaped fruits. And across the valley we could see a mighty waterfall, shooting out of a big hole in the cliff. This looks like a really challenging new cave. . . .

Espeleología en Jalisco 2005

Varias salidas de espeleólogos de Guadalajara son descritas. Encontraron una cueva pequeña, Cueva El Carro, en la base de la falda norte del Cerro El Tepopote. Visitaron de nueva cuenta la Cueva de Chapuzón para experimentar con fotografía de cuevas. Visitaron la Cueva Tequilizinta y encontraron evidencia de que es un pequeño tubo de lava. Ubicaron también una nueva ruta hacia la entrada de la Cueva de Fisura Chiquihuitón y tomaron sus coordenadas con un GPS.



TABASCO 2006

Vickie Siegel and Chris Amidon

The Caves of Tabasco Project has enjoyed nineteen happy years of exploration under the organization and enthusiasm of Jim Pisarowicz. The 2004–05 six-week expedition was packed with good finds (see *AMCS Activities Newsletter 28*, pp. 27–57) and, as always, ended with several leads still unchecked. When cavers from the 04–05 team expressed interest in returning, Vickie Siegel volunteered to put a trip together, and thus the Tabasco 2006 expedition was on. Shortly after Christmas 2005 the melee began. First Seth Spoelman, then Erin Niedringhaus, and finally Karen Henker flew into Austin to join Vickie in the last-minute packing and planning. We loaded up Vickie’s small Toyota with gear and people and hit the highway on December 30. After spending New Year’s Eve camped outside of Minatitlán, we arrived in the town of Tapijulapa on the first day of 2006. We ate lunch at the Restaurante Mariquita (Con Mirador) and chatted with José, the owner, who has been a local contact for over ten years. It was decided that we would set up a field house in the unfinished upper stories of José’s new house (also *con mirador*). The team grew when Chris Amidon, Neal Hines, and Ajax Dalman arrived from Minnesota and Laura Rosales bused down from Mexico City. What follows is a summary of our accomplishments arranged by area.

Puxcatán. Upon our arrival in Tabasco, we visited Peter Lord, a British ex-pat caver living in Villahermosa. Over a bottle of fine tequila he told us of some leads he had outside the small town of Puxcatán. We had

tried to ridgewalk in Puxcatán the year before, but had found the townspeople reluctant and wary, due to some archaeological artifacts that had been found in nearby Cueva de San Felipe. In our absence, Peter and Roberto Porter, another Tabascan caver, accompanied researchers from INAH to San Felipe to document the artifacts there. As a result of this successful venture, the community was much more welcoming to cavers, as we found when we investigated Peter’s leads. Over the course of several days we mapped Cueva de Domingo López and located another cave, Cueva de Fernando López. This area is very promising, and given the friendly attitude of the people of Puxcatán, we hope to return next year to survey Fernando López and do some ridgewalking.

Palo Quemado is a town equally as friendly and promising as Puxcatán. Jim and Neal visited the area in 2001 and

began a survey of Cueva de Chinin. After about 250 meters of surveying, they left breezy walking passage and didn’t manage to return before the end of the trip. Neal’s enthusiasm for this cave encouraged us to take a day-trip up to Palo Quemado. Laura, Neal, and a gaggle of shy yet feisty children relocated Chinin and found two additional cave entrances. Meanwhile, Chris, Karen, Ajax, and I surveyed Cueva del Águila, a cave we stumbled across, literally, on the hike. Working our way down through breakdown blocks, we found the apparent end of Águila to be a muddy room with airflow. We decided it was a digging lead for a future team and left it at that, but it did make us even more curious about the Palo Quemado area as a whole. Unfortunately, given the sporting nature of the road to Palo Quemado and the two-wheel-drive nature of my truck, we decided against a second trip this year.

Karen Henker on a bridge over the Río Oxolotan. *Erin Niedringhaus.*



vickie_siegel@yahoo.com

Thus, Chinin, the two new caves, and the numerous nearby caves the locals told us about all remain as future leads.

Graciano Sánchez. We spent one day checking leads around the community of Graciano Sánchez. Jesús Martínez and a local guide led us to a short cave we surveyed and named Cueva de los Cumpleaños, as it was Karen's birthday that day and Jesús's the day before. The local guide also led us to a spring emitting a slightly milky-looking water with a definite sulfur odor to it. This sulfur spring came out of a bedrock wall, but it appeared too tight to get into.

Poana. It was beautiful haystack karst like that of the Sierra Poana that inspired Jim to start looking for caves in Tabasco (see *AMCS Activities Newsletter* 16, pp. 30–37). Over the years several caves have been found in these hills, and 2006 was no exception. We started out with Cueva de los Dos Ojos, a pretty cave with two 2-meter-high rounded entrances side by side, about 2 meters up the cliff face. Ajax took the sketcher's position for her first time and did an awesome job. As the others surveyed Dos Ojos, I scouted around for more caves. Ridgewalking in Poana is simple—walk along the base of each haystack hill and keep your eyes open. In this particular hill, we found a cave entrance about every 200 meters. Caves in this area tend to survey out to a couple hundred meters and have smooth, scalloped walls that form rounded walking passage. We spent several days

surveying in Poana, mapping Dos Ojos, Cueva del Eco Pequeño, and Cueva del Escorpión. We left two entrances unexplored in this particular hill, and there are certainly more to be found in the surrounding stacks.—*Siegel*

Flor del Río is a tiny village of a dozen residents and a Seventh Day Adventist church. No roads wind up the valley. No electrical wires cross the mountains. To reach Flor del Río, we had to hike from the Río Tacotalpa valley up and over a thousand-meter mountain to the Río Amatán valley. The town was founded forty years ago by the Sánchez family, who created their own pleasant if modest existence.

On the day we hiked to Flor del Río, the sun emerged after days of rain, quickly heating up the previously chilly weather. Never again will I attempt a mountain hike with a heavy pack after six months of immobility. Nonetheless, Ajax, Neal, and I made it to Flor del Río, where Crispin and Natividad Sánchez, the landowners of the area, greeted us warmly with oranges fresh off their trees. They recalled Neal and me from 2005, when we made the same hike on an area recon trip. They gladly gave us food and would not hear of our



Karen Henker squeezes through an entrance to Cueva de Domingo López .
Vickie Siegel.

sleeping in tents when they had perfectly good beds and hammocks. We gratefully accepted, and it was a fortunate offer, as it rained savagely during our second night.

Cueva del Agua Fría, as the Sánchezes have named it, does not look like much at its entrance. At one time, the cave's entrance may have been larger, but now it is a squeeze between breakdown boulders, and if not for the stream flowing from the mountainside, one might never have known the cave was there.

In one nine-hour survey trip, Ajax, Neal, and I surveyed approximately 200 meters of cave in a single passage that alternated between swimming, walking, and crawling. The passage followed the stream straight into the mountain, oblivious to topography but not geologic structure. The steeply dipping limestone controls the cave's formation. The stream passage would switch between different limestone beds, but except for one large room called Lake Marimba, the cave never wavered from

Erin Niedringhaus, Peter Lord, Vickie Siegel, and Karen Henker hiking to Cueva de Domingo López. *Seth Spoelman.*





Karen Henker in an entrance to Cueva de la Dos Ojos. *Vickie Siegel.*

following the strike of the limestone. At the end of the day, the cave continued on multiple levels, following the stream deeper under the mountain.

Unfortunately, the rain over the night raised the Río Amatlán over two meters and flooded out any possibility of further survey. However, this rain event displayed the rapid response of the stream in Agua Fría to outside conditions. In a thirty-minute time period, the water depth in the cave decreased by approximately 15 centimeters. Before entering Cueva del Agua Fría, any prospective survey team must watch weather conditions closely, as there are numerous passages in the cave that will sump quickly should water levels rise.

Surveying in the cave was difficult because of water, mud, and the lack of solid footing, and more remains to be done. Even without the discovery of new passage on a different trend, we believe Cueva del Agua Fría could easily yield a kilometer of passage.

Agua Blanca. Cueva Magnífico, situated in the state park at Agua Blanca in the municipality of Macuspana, is a cave with two huge rooms, one with a

Neal Hines, Ajax Dalman, Chris Amidon, Vickie Siegel, and Karen Henker hiking to Flor del Río.

fallen stalactite the size of a car, the other with an amazing display of microcrystalline calcite called the Snow Cascades. We had surveyed in Magnífico in 2005, but ran out of rope and time. In order to return to the cave, we first had to find our way to it, which involved a march through the jungle. Our plans were nearly dashed when, after crossing the Agua Blanca river, we could not find the dry arroyo that had begun the jungle trek the previous year. It had rained so much recently that the previously dry arroyo was now filled with a stream. Once we discovered that, we next had to find where the trail split off from the arroyo, another time-consuming venture. If it were not for Vickie's insistence on using the geology and topography to our advantage, we might have given up, but by remembering a prominent

limestone wall, we found the old trail and made slow progress. After numerous detours, misdirections because of fallen trees, and much machete-wielding, we found the entrance of Cueva Magnífico two hours later than we had intended.

We made one overnight trip and one day trip into Cueva Magnífico. On the first trip, Ajax and Neal began mopping

up leads near the entrance. Vickie and I proceeded to lug rope to a drop at the end of the cave that had called to me for an entire year. After some nifty rigging by Vickie, we dropped the pit into a beautiful room we named The Royal Fountains. The long anticipation had paid off, as walking passage beckoned onward. Was this the prophesized connection to the large Agua Blanca system? We happily surveyed through the mud. Seventy meters later, the walking passage slammed shut, and expectation turned into despair. As quickly as the cave had opened up, it had ended, with no potential leads. For only 70 meters of cave, we lugged the rope through mud and crawls. The fickle finger of exploration struck again. By the time we returned to Ajax and Neal, sleeping comfortably at the bottom of the cave's first drop in the flickering light of a candle, exhaustion overtook us quickly.

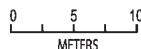
The return day survey consisted of mop-up with no new discoveries. Only two passages remain that have tantalizing cave beyond. One requires digging out a few inches to squeeze through a pinch in the deepest part of the cave. From the second, air rushes through a gap in dripstone through which no one can fit.

Cueva Magnífico has been surveyed to completion without significant damage resulting from digging or breaking. Its length is 1.1 kilometers. Though the

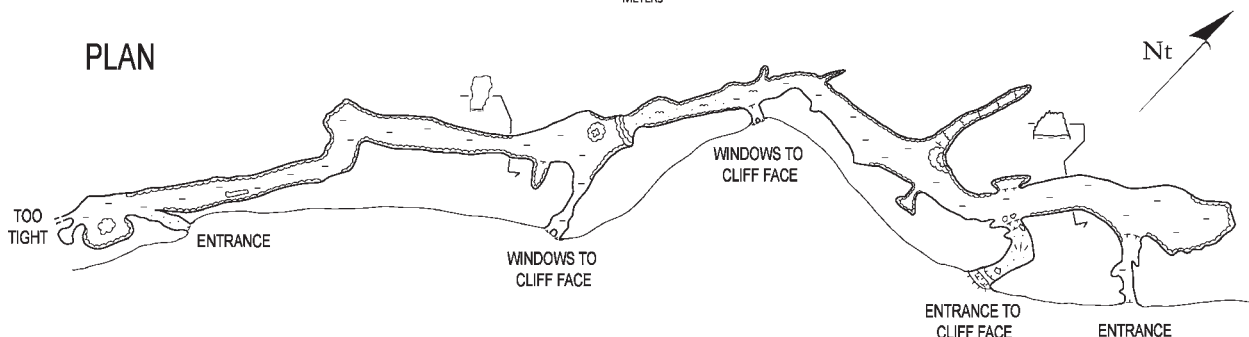


CUEVA DEL ECO PEQUEÑO POANA, TABASCO, MÉXICO

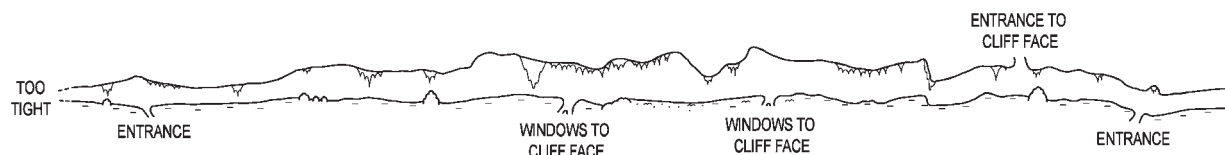
SUUNTO & TAPE SURVEY 16 JANUARY 2006
BY CHRIS AMIDON, AJAX, AND NEAL HINES
DRAFTED BY VICKIE SIEGEL, MARCH 2006
LENGTH: 134.9 m DEPTH: 5.2 m
UTM 15Q 0527059E, 1938886N, NAD27 MEXICO



PLAN



PROJECTED PROFILE 318°



tantalizing lead left from 2005 led to only 70 meters of passage and will no longer spark our imagination, we now know what lies at the bottom of that drop. Discovering unknown boundaries, whether a short length or a great distance, is what cave exploration is all about.—*Amidon*

Over the course of a month we worked in several different areas in the *municipios* Tacotalpa and Macuspana. With the assistance of British expat caver Peter Lord, our local guide Jesús Manuel Martínez, and Laura's fluency in Spanish, we surveyed in eight caves. In addition, we acquired numerous cave-location leads and established promising community and landowner relations around the Sierra Madrigal

and the Sierra Tapijulapa, areas that bear investigation in the future.

The Caves of Tabasco 2006 team express special thanks to Bev Shade, Philip Rykwald, and Bill Stone for the assistance and encouragement that made it possible for a newbie to lead this trip, and also to Jim Pizarowicz for introducing us all to this exciting project.

Tabasco 2006

La exploración de cuevas en Tabasco continuó en enero de 2006. La mayoría de las cuevas en la región son pequeñas, pero Cueva Magnifique, en el parque estatal de Agua Blanca, fue topografiada arrojando una longitud de 1.1 kilómetros.

HISTORY

A NINETEENTH-CENTURY VISIT TO
CACAHUAMILPA

This story of a visit to the Dos Bocas and Cacahuamilpa, Guerrero, is part of a section titled "Southern Tierra Caliente, Mexico," in Half Hours in the Far South: The People and Scenery of the Tropics. The book, with both authors and editor anonymous, is one of the series Half Hour Library of Travel, Nature and Science for Young Readers, and was published by Daldy, Isbister and Company, London, in 1878.

Accompanied by a goodly cavalcade of enthusiastic railroaders, the following morning (the 6th) we cross the bridge above the fall, and keep down the eastern bank of the stream, which seems to be considered the best. I find that my friend was not mistaken in his description of the plain. The river channel, or, as I will call it and its like for the future, "barranca," de San Geronimo, deepens two hundred feet in the next three miles, and the fall of the plain itself is very considerable.

Our friends proposed to accompany us to a little pueblo called Sumpahuacan, distant fifteen miles, and lying, at the extreme south-eastern edge of the plain, in a sort of cove. This we reach about mid-day, after passing one desperately deep barranca called San Pedro, which skirts the range on the eastern side of the plain.

As we canter up the further slope, we see a considerable commotion astir in the pueblo; and some of our party draw back, fearing a disturbance of some kind or another. I however, innocently cantered on with Q., into the little Plaza, where we were suddenly confronted by about thirty well-armed Indians, who halt us sharply, and in no civil way ask what the dickens we all

want. Before I have time to reply, however, they recognise Q.; and warm greetings take the place of a warmer but less pleasant welcome which might have ensued had I been accompanied by any one else. When I look back at our well-armed little troop, I can hardly blame their mistaking our errand.

The Indians, too, have a hearty welcome for railroad interests, which they show by preparing a sumptuous repast under the grand old ash-tree in the Plaza; and after dinner, when our friends leave us, provide us with a good escort and sure guides for the next fifteen miles.

With many regrets we say good-bye to the Indians, and part with our friends on the further side of the barranca, which we have to re-cross; and I must say I feel rather queer as I see them canter off across the plain.

My position is this: Myself and three servants, whom I feel I could depend on utterly, in a country new to all of us, inhabited by Indians who seem entirely at the beck and call of Q. Can I trust him? I was a good prize, I knew, which endangered still more my position. "Well, I'll try him at all events!" and giving a cigarette to each of our Indian escort, I pave the way to a long conversation about the troubles of the last revolution, as we make our way towards the junction of the barrancas de San Pedro and San Geronimo.

About half a mile from the junction, the trail we have been following strikes the edge of the San Pedro barranca again, which has now deepened into a chasm five hundred feet deep, dropping sheer down on our side, and bounded on the opposite side by the Range, which arises some four thousand feet above us.

An Indian trail three feet wide, with a perpendicular fall below, and where one false step would send one five hundred feet on to the jagged rocks of the stream-bed, is not an inviting field for soliloquy; but I could not help feeling awestruck at the almost inconceivable power which had, geologically speaking, in a few years hewn this chasm out of solid sandstone rock.

The first glance at the trail decides me that I would sooner trust my own legs than the horse's; and down I get, utterly regardless of the Indio's assurance that there was no fear yet, and relinquish my horse into the hands of one of them. My mozos do the same; but Q. says that his old grey went down it the last time at a hard-gallop, after an unpleasant encounter with the Government troops on the plain above. So giving him the rein, he lets the old horse pick his way down the zigzag path, over loose boulders, a sheet of sandstone worn smooth by the barefooted Indios, or—what is more dangerous than either—a rut worn through the sandstone a foot deep and a foot broad, through which a horse has not room to pass one foot before the other, unless he lifts them clean out of it.

Down we go, through shrubs, clinging here and there to the face of the cliff, till the sound of the water below us, scarcely noticed above, deepens into a load roar, and we find ourselves at the actual junction of the two barrancas, five hundred and fifty feet by my barometer below the plain.

Here the trail crosses the eastern barranca, which, owing to the previous night's rain, is in flood, and up to our horses' stomachs. We pass, however, in safety, with the exception of an Indio who chooses a line for himself, and in

jumping from one rock to another in mid-stream, slips, and if he had not been brought up by hitting one of the mozo's horses, would most probably have had his brains dashed out in the rapids below. But he joins in a good laugh at his own expense on the further bank, when I give him two dollars to get some more powder, as his own had been thoroughly soaked.

The trail now keeps low along the edge of the river. On our left hand the range rises in a perpendicular crag some three thousand feet high, from whose top a man might drop a stone amongst us. In all my mountaineering, which is not a little, I have never seen such a sheer wall.

Keeping down the bank of the river, or rather a long series of rapids, we came in a couple of miles to the junction of the barranca which we had been following with another coming in from the west; and on looking at the troubled hundred yards of water between us and the further bank, I feel my heart sink when Q. tells me that this is the only ford. But in spite of his advice to go back to Sumpahuacan, and cross the range to the east, I determined to get to the plain on the further side if possible.

The mozos make their preparations accordingly. They unpack the old horse, and repack very carefully. Fortunately, as will be seen hereafter, my body-servant is sharp enough to take my papers and maps out of the pack and strap them round his own shoulders, while we girth up our horses; and I put my barometer and watch into the crown of my hat for fear of casualties.

When we are all ready an Indio dashes in, and just manages to reach the point between the junction of the two streams. He says we can make it; and in another ten seconds Q.'s old grey is in the middle of it. Suddenly he makes a wild plunge forward, or rather under, which brings forth a gulp from his rider of mingled fear and cold water; but, thank goodness, the old grey has only hit a big rock, and scrambles out on the sandy neck, dripping, but none the worse, with the exception of Q.'s rifle, which as he had forgot to take it out of its holster, went right under water.

This served as a warning to me and the mozos to take ours in our hands, and I make my essay with a vengeance, as my horse, after refusing to go in for a minute or two, makes a sudden dive

into the water, nearly unshipping me. By dint of administering a gentle dose of the butt of my rifle under his ear, I force him up-stream, so as to avoid Q.'s dangerous rock, and land safely on the little peninsula. The mozos pass, one of them driving the old pack-horse in front of him, in safety.

Thinking it needless to make our escort wet themselves more than is necessary, I fed them, and said good-bye on the bank that we left, from which they have been intently watching our passage, and are now shouting advice to us as to the best mode of crossing the next stream, into which our guide rushes and comes out fifty yards down-stream, after rolling two or three times, with the pleasant news that it was half a yard deeper than the first one.

In goes Q., and about mid-stream the old horse is swimming, but gets out with a struggle. I follow safely, as does the first mozo; but judge of my horror on seeing the old pack-horse, who comes next in order, turn deliberately nearly in mid-stream! For a moment he keeps his feet, and then is swept down the rapid.

Fortunately the stream sets on to the bank on which Q. and I stand, and about fifty yards below the gallant grey straddles a rock sideways that was sticking up. No man knows how he kept his head above water for the thirty seconds which it took the other two mozos to get across and uncoil their lassos.

Entering the stream cautiously, one throws a lasso over the old horse's head, while the other makes two or three shots at one of his hind-legs sticking out of the water, which he finally catches. Putting their horses up-stream, they pull him from his rocky resting-place; but then, oh horror! his full weight being exposed to the force of the stream, the strain is so heavy on the lassos that the horses cannot find sufficient foothold on the rock bottom. Down goes the outside horse; and he and his rider scramble to shore as best they can, while the other one slips his lasso, preferring to lose it than to run the chance of losing his own or his horse's life.

But some horses were born to be



In the San Pedro barranca.

hanged, and not drowned. The old grey, after turning over three or four times, lands on a sandy promontory that juts out forty or fifty yards below; with, strange to say, both lassos on him. There he sits on his tail in the water, with his fore-feet out in front of him, staring round with the most comically bewildered look that can be imagined. And it is some time before we can induce him to get up and come on to the bank.

Here he is unpacked, and receives as hearty a benediction as men who find their clothes wetted, bread soaked, and whisky bottles broken, can be expected to give. Happily, I carry a pocket flask, which we now divide among the party; the guide and the mozo who has got ducked coming in for the lion's share.

Here first I become aware that twilight deepens on us; and by the time we reach the top of the barranca, seven hundred fifty feet above the stream bed, along a twin path to the one we came down, it is almost dark.

Ten miles to go, and mighty poor chance of supper; which we prove thoroughly two hours afterwards, when we find at the little rancho that the owner had been taken off the previous week by the Government troops, on suspicion

of having been connected with the stealing of a horse, and that his wife and family have been sorely straightened since for the means of sustenance. However, maize cakes, junket, and fresh milk are delicious when flavoured by that most excellent sauce of hunger.

After scattering some maize stalks, the only fodder we could get for our poor horses, who were thoroughly tired out by one of the longest and hardest day's work they had ever done, I roll myself in my cloak on the grass, and remember nothing till the sun wakes me next morning.

With a true Englishman's grunt, I cast off my blankets, and find the horses are greedily dispatching their morning meal of maize stalk.

After a hearty breakfast, the counterpart of last night's supper, we start along the plain, which here is a perfectly level expanse of grass, about two miles wide, bounded on the east by the barranca we crossed last night, and on the other side by a still larger one coming in from the north-west. Beyond the latter, a long range looms up, in which is the very valuable mining region of Tasco, from which the range takes its name.

We follow the plain down for the next ten miles, where it is shut in by two mountains, under which, to my intense surprise, I find the two barrancas disappear.

After an examination, I find that both of these barrancas have outlets, one to the right, and the other to the left of the mountains; but of very ancient date. The left hand barranca enters the mountain-side about a thousand feet below the level of the plain, about eight hundred feet below its old channel, which here strikes almost due north. As far as I could judge, through I could not get to it, the entrance to the tunnel is three hundred feet high by two hundred broad. The western barranca, I should fancy, was fifteen hundred feet below the level of the plain, but its own old channel is only about two hundred.

It is not very difficult to give the reason for this curious natural phenomenon, described at the close of the last chapter.

Countless ages ago, these two rivers, or barrancas, ran over the bed of trap which caps the plain. In an unlucky day for engineering they wore it through, and began eating their way

through the soft sandstone below it. For centuries they must have kept to their original channels on either side of the mountain, but at last the undercurrent of water began eating out an escape under the mountain, which escape it finally made about three miles below the entrance; with one noticeable fact, that instead of following more or less the direction of their old channels, the two streams converge under the mountain, and come out within fifty yards of each other on the further side.

After-explorations showed me that even the present mouth of the eastern barranca has been changed, for about a hundred yards from it, to the eastward, is an enormous cavern, now known as the cave of Cacahuamilpa, which has been traced back into the mountain for some two miles or more, but never, I think, to its very end. Of this cave Mr. Brantz Mayer says:—

"I was one of the last to leave the entrance of the cave, which hangs in a huge arch of sixty feet span, fringed with a curtain of vines and tropical plants. Our party preceded me by some distance along the road that descends rapidly for the first hundred yards. Each one of the guides, Indians, and travellers carried a light. . . . I lit my torch and followed.

"The first hundred yards brings you to the bottom of the cavern; and, if not warned in time, you are likely to plunge at this season of the year (September) up to your knees in water.

"You cross a small lake, and immediately before you, under the vast Gothic vault of the cave, rises a lofty stalagmite pillar, with a fringe falling from the top of it, which seems formed of the brightest foam congealed in a moment. A mimic pulpit rises from the wall, covered with elaborate tracery, and hard by an altar is spread with the fairest napkins, while above it depends a crystal curtain hanging in easy folds, each one of which flashes back the light of your torch as if carved from silver.

"We fastened the end of our twine to a pillar of the altar, and struck out westwardly in the direction of the cavern. After a short distance we turned slightly to the south, and passing down a file of rocks that had fallen from the roof, entered the second chamber.

Entrance to subterranean river.



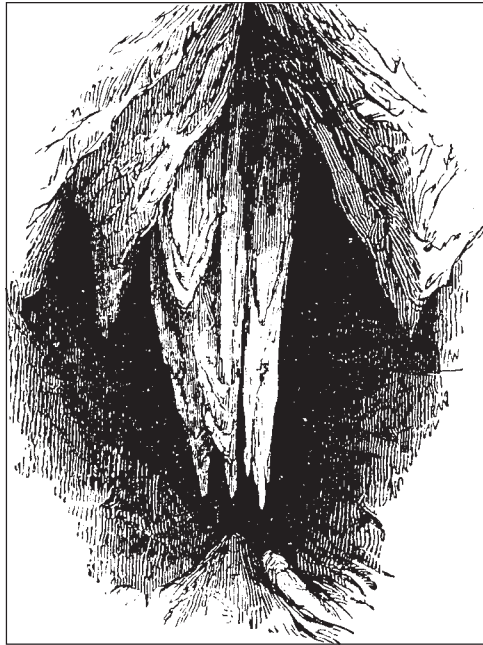
“In the centre of this a huge stalagmite has been formed. It is a lofty mass two hundred feet in circumference, surrounded from top to bottom by rings of fountain basins hanging from its sides, each wider than the other, and carved by the action of water into as beautiful shapes as if cut by the hand of a sculptor. An Indian climbed to the top of it, and firing a blue light illuminated the whole cavern. By the bright unearthly blaze every nook and corner became visible, and the waters and carving of this fountain-tower stood out in wonderful relief.

“We penetrated to the third chamber. Here there was no central column, but the effect was produced by the immensity of the vault. It appeared as though you might set the whole of St. Peter’s beneath it, with dome and cross (height four hundred and twenty-five feet). . . .

An Indian fired a rocket, which exploded as it struck the top of the immense dome, the detonation reverberating from side to side of the vault with the roar of a cannonade. A sheet of stalactite was struck, and it sounded with the clearness of a bell. . . .

“Beyond this chamber was a narrow path between the almost perpendicular rocks, and, as we passed, the guide crept through an entrance near the floor, and holding his torch aloft, displayed a delicious little cave, arched with snowy stalactites, in the middle rose a centre table, covered with the fringed folds, and adorned with goblin knickknacks. . . .

“Two rocks standing beyond this retreat are the portals of another chamber, groined like the rest in Gothic arches, with the tracery of purest stalactites, while its floor is paved all over with beautiful little globular



Rock-Curtain.

stalagmites. In a corner fountain we found the skeleton-head of a serpent.

“The path beyond this is nearly blocked up by immense masses that have fallen from the roof. Passing over these, you attain another vaulted cathedral, bright as the rest with flashing stalactites, while the floor is covered knee-deep with water. . . .

“We had now penetrated nearly five thousand feet in the interior of the earth, and the guides said that the chambers were still innumerable beyond. Persons have slept here and gone on the next day, but no termination has yet been discovered. . . .

“From this chamber we returned to the entrance by the clue of our twine.”

On leaving the cave and gaining the plain that lies to the south of it, we for the first time became aware

that we are in the Tierra Caliente. The sun strikes down fiercely on the lava that crops up through the soil; and a dull steamy brown grey mist rises off the plain, making a little patch of light green sugar-cane in the hacienda of San Gabriel, five miles away, look temptingly cool. But I have wandered from my railroad line in search of “the beauties of nature;” and I have to skirt the mountain due north again to regain it, at the further end of the old northern channel of the barranca.

After skirting the base for about five miles along the plain, I open on a sort of little oasis in the desert, formed by the river of Malinalco coming in from the north, which, just as it debouches from the mountains, opens out into an oval basin a mile and a half long, covered with sugar-cane, rice, and maize, the latter growing above the level of artificial irrigation; while the broad belt of

banana that skirts the river-banks forms, with its large pendant foliage, a beautiful contrast to the delicate spikes of the cane.

Here and there a ceiba or an ahua-huete rears its giant head a hundred and fifty feet above the stream-bed; and beneath its shade, and half hidden in orange groves, peeps out a little white house, with a broad verandah; and sometimes a dark spot among the bananas marks a coffee plantation.

Joyously we drop into the valley, forgetting the burning heat in the cool green foliage. Through the maize, and into the cane brake with its little ditches bubbling with the fresh clear water; and then we dive into the semi-darkness of the banana grove; the refreshing roar of the river deepening till we emerge into the bright sunshine on its bank.

Una Visita Decimonónica a Cacahuamilpa

Este relato de un viaje más allá de las barrancas de San Pedro y San Jerónimo y una visita a las Grutas de Cacahuamilpa fue publicado en 1878.

LOS AMIGOS DE LA GRUTA BUSTAMANTE 2006

Susan Souby

The annual Bustamante Project, sponsored by the Texas Speleological Association, took place on President's Day Weekend, February 17–20, 2006. This traditionally Labor Day project was rescheduled to February in 2005, and the cool weather was so favorable for work outside the cave that the same weekend was chosen for 2006.

Project leaders Orion Knox and Rune Burnett met with the mayor of Bustamante, José Baldemar Gómez Rodríguez (Balde), several months prior to the project date to discuss the status of development in the cave and its environs and the impact on the project. In 2002, then-mayor Norma Robles announced that the Mexican government had appropriated two million dollars for development of the cave for tourism. Each year since 2002 the project organizers have been reluctant to schedule the project in fear of having it halted by construction. So far, the only evidence of development has been the paving of the road from town to the Cono at the base of the mountain range, the restoration of the Cono as a restaurant, and construction of a picnic and playground area at the Cono. The development plan includes a tunnel as the main cave entrance, beginning up the trail from the upper parking lot and entering the cave on the east wall at the bottom of the steps in the entrance room. An improved trail and artistic lighting are planned for the entrance room. The road from the Cono to the upper parking lot will also have to be improved. This year the mayor assured Orion and Rune that even if construction on the road or tunnel had begun, it

ssouby@austin.rr.com

should not interfere with the project.

This year's effort was notable. The projects were extensive, covering both trails and road to the cave, the entrance to the cave, the entrance room, and deep into the cave. The improvements were quite visible. Projects included graffiti removal both outside and inside the cave, brush clearing along the road up to the cave, improvements to the trail from the upper parking lot to the cave, new steps to reach the cave entrance, lighting improvements in the first room, completion of the installation of a wooden bridge in the first room, and installation of additional directional and instructive signs. Sunday was reserved for wild cave tours and tours to local attractions and Monday for the mesal factory tour and drive home.

Most people arrived some time on Friday, February 17. Activity on Saturday started early, with coffee and pastries provided by Terry Plemons on the patio at the Hotel Ancira long before first light. Rae Nadler-Olenick and Alana Hussing set up a very organized registration at the Cono, with packets ready for pick-up by the sixty-three pre-registrants. An additional thirty-five signed up on-site, and nineteen members of Boy Scout Troop 133 from New Braunfels, who appeared, put in their day's work, and then returned home, rounded out the 117 volunteers.

Brush clearing. Terry Plemons organized the Boy Scouts from New Braunfels into two groups. One group cleared brush and picked up

trash along the hiking trail from the Cono to the cave. This was the first year of work on this trail, and Terry reported that the Scouts did a very good job carrying many bags of trash down to the Cono. Another group was dispatched to help both Joe Jones at the cave entrance and the Trail Tamers on the trail from the upper parking lot to the cave. Bill Bell put his ranch skills to work chain-sawing the limbs that had encroached on the road from the Cono to the cave. Sam and Diane Young lopped all the other brush, most with stickers, along the road. By the end of the day, vehicles could pass scratch-free down the road from the upper parking lot to the Cono.

Graffiti removal outside the cave. R. D. Milhollin and crew took on the

Charley Savvas and Kara Dittmer removing graffiti from breakdown blocks near the entrance to the Lake Room.

Anthony "Tone" Garot.





Orion Knox and Rune Burnett, the project leaders, with Michel Siffre and Jan Knox at the “Cono,” the building at the base of the road up to the cave. *Orion Knox.*

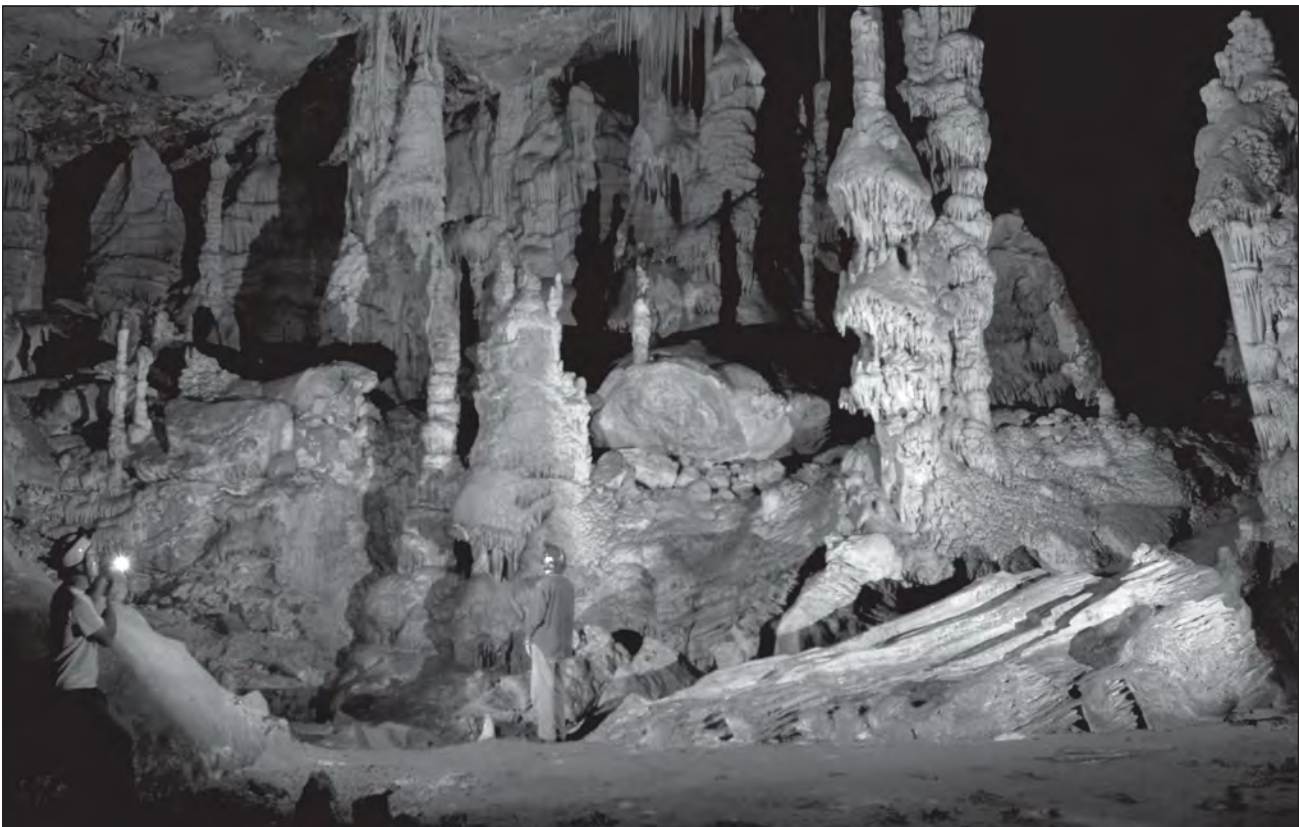
Jan Knox and Ray Ecklund among the formations in the Cathedral Room. *Orion Knox.*

difficult project of removing the sun-baked graffiti outside the cave. They worked on graffiti on both the trail from the upper parking lot to the cave and on the road from the Cono to the cave. Rune provided a box of assorted chemicals, and R .D. reported that the paint remover worked better than the volatile spirits. Even with the help of chemicals, a lot of muscle-powered scrubbing was required. R .D. happily reported that they were able to remove some of the most obvious graffiti on the road.

Trail building. Philip Russell, Dave and Linda DeGroot, and seven more Central Texas Trail Tamers continued their project, begun in 2003, to survey and re-route the approximately 300-meter-long steep, rocky trail from the upper parking lot to the cave. This year they rearranged the boulders on a particularly steep and difficult portion of the trail to form solid steps. The Boy Scouts helped groom the entire trail. They also patched a portion of the

trail where heavy rains had washed off the dirt. The progress was especially impressive to those volunteers who were in the cave all day; the route down from the cave was noticeably improved, compared to the route up just that morning.

Entrance steps. Joe Jones continued his project to improve the entrance to the cave. After the Boy Scouts finished grooming the trail to the cave, they helped Joe cut steps in the steep, at times slippery dirt slope down to the cave gate. At his direction, the Scouts cut trenches, placed and anchored with rebar 4-by-4-inch landscape timbers, and then back-filled and leveled each of the six new steps. Joe cut the timbers to fit on site, as well as drilling the holes for the rebar. The Scouts also cleaned out all the organic debris that had accumulated on the entrance slope. Within the last year vandals, frustrated at not being able to break into the cave, had piled rocks in front of the gate, effectively sealing the entrance. On a previous trip, Rune and Orion, along with members of an eco-tourism seminar they accompanied to the cave, had moved the rocks to the side of the gate. The Boy Scouts formed a bucket brigade and hauled the rocks away from the entrance. All in all, the entrance is much



Cat Kennedy carrying project materials up the trail to the cave.

Orion Knox.

easier and safer to traverse.

Lighting. This was a landmark project for Tom Brown and his expert electrical crew, which included Jan Knox, Paul Fambro, Ray Ecklund, and volunteers from the Bexar Grotto. All the glaring bare incandescent bulbs are now replaced with fluorescent bulbs in PVC light shades. The cooler-burning fluorescents save on electricity, reduce the heat in the cave, and prevent burning the PVC shades, while providing a warm glow to illuminate the formations. Orion conceived this project, and the first test fluorescents were installed at the Labor Day project in 2003. The crew also succeeded in repairing all the pigtails. With such a good crew working so efficiently, there was time for a trip to the back of the cave later in the afternoon.

Bridge. Orion Knox and Rune Burnett put the finishing touches on the bridge that they built during the 2005 project. This bridge has been in the planning stages for several years and is part of a series of bridges and elevated walkways that Orion and Rune have designed for the entrance-room trail. The necessity for a bridge at this steep, slippery spot was made evident during the 2002 project, when a tourist from Saltillo fell and broke her ankle while on a guided tour. This year Rune and Orion completed the handrails on the bridge.

Graffiti removal inside cave. Aimee Beveridge once again led her group of seasoned cavers to even farther reaches of the cave to remove the myriad types of graffiti. The Bexar Grotto, under the able leadership of Rob Bisset and Evelyn Mitchell, provided the majority of the muscle-power. With the Cathedral Room almost completely cleaned of graffiti, the group continued through the Cathedral Room to the Lake Room, cleaning graffiti from parts in between. Plastic and stainless steel brushes were quite effective in removing all but the most stubborn graffiti, and then spray bottles filled with cave water were used to wash down the formations. Charlie Savvas and Kara Dittmar led a group carrying battery packs and drills with stainless-steel



brushes to the breakdown blocks just outside the entrance to the Lake Room. They succeeded in removing all the big, black graffiti on the rocks, a seemingly impossible task. There was time after cleaning the delicate formations in the Lake Room for a group to venture farther down the trail for a quick visit to the Red Room.

The Bustamante project always attracts interesting and colorful cavers, especially the old-timers. This year was no exception. Michel Siffre, a French geologist/speleologist, returned to Bustamante for the first time since the 1970s. Michel is most well known among Texas cavers for a NASA-sponsored beyond-time experiment he did in Midnight Cave near Del Rio in 1972. He remained underground for 205 days, 177 of which were in isolation. He was connected to a battery of probes and electrodes to monitor his heart, brain, and muscle activity and to record his wake-sleep cycles. Logan McNatt and Pete Strickland were among the cavers who greeted Michel on his exit, as he was helicoptered away to NASA. They remained for several weeks to restore his campsite to its original condition. Michel was a delightful participant and entertained the participants with stories of his many international caving projects.

This year the weather forced the cancellation of two of the scheduled Sunday trips. Orion and Jan had flagged El Vallado Canyon, and Orion made available an excellent map with photos

and an explanation of the route for a self-guided tour of the canyon, but the weather was too cold and rainy to hike El Vallado Canyon or the Sierra de Bustamante Ridge. Orion also produced a detailed road log and a map with photos of the route to the Chiquihuitillos rock-art site. Some of the Trail Tamers, as well as Jim and Cat Kennedy and Orion, ventured to this prehistoric site to view the pictographs and petroglyphs. Pete Strickland and Justin Shaw rigged the Birthday Passage on Saturday in preparation for Sunday's sport-caving tour. The Birthday Passage is gorgeous, and it is inaccessible without the experienced and skilled rigging by Pete and his crew. Pete led a large contingent to the passage.

For the Río Candela trip, Terry Plemons led a caravan of ten vehicles from Bustamante to the square in Candela to meet the police, who arranged for a guide with a key. It was a short drive to the Parque Recreativo, a recently improved city park along the lovely Río Candela. The group spent about three hours enjoying the scenery, checking out caves, and hiking up the river. The group split, part hiking upstream along the river for a better view of the exposed bedding planes in the river and another group scrambling up the steep slope to a mine/cave complex. The mayor arrived just before the group departed and conducted a tour of another improved park along the river. It had numerous warm springs that had been channeled and directed to concrete pools. The city of Candela seems to be



Orion Knox, right, with the Trail Tamers at the base of the Chiquihuitillos Mesa rock-art site.

Orion Knox.

- Trail Tamers
- Graffiti Removal/Cave – Aimee Beveridge
- Graffiti Removal/Exterior – R. D. Milhollin
- Bridge Construction – Orion Knox and Rune Burnett
- Brush Trimming – Terry Plemons
- Lighting Improvement – Orion Knox and Tom Brown
- First Aid – Tom Brown
- Coordination with City – Orion Knox and Rune Burnett
- Banquet Coordination – Terry Plemons
- Door Prize Coordination – Whole Earth Provision Co., Susan Souby, Alana Hussing
- Cave Sign-In – Anne Souby
- Transportation – Jim Kennedy
- Upper Parking Lot Attendants – Walter Olenick and Vicki Brown
- Project Publicity – US, Aimee Beveridge and Rae Nadler Olenick; Mexico, Ramon Godina; web site, Orion and Jan Knox
- Side Trips:
 - Chiquihuitillo Rock Art Site – self-guided tour with map and road log produced by Orion Knox
 - Vallado Canyon – self-guided tour with map and guide produced by Orion Knox
 - Sierra de Bustamante Ridge Hike – Philip Russell
 - Sport caving, Gruta de Palmito – Pete Strickland
 - Rio Candela – Terry Plemons
 - Mescal Factory – Terry Plemons
 - T-shirts – Charlie Loving (design), Felicia Vreeland and Vreeland Graphics (printing)

taking the lead from Bustamante and developing its river for tourism. On their ride home, the group made one final stop at the *aguamiel* factory/store on the east side of the main highway just north of Bustamante. The owner gave a guided tour of his operation, topped off with an *aguamiel* tasting.

A substantial and delicious banquet was hosted by the Hotel Ancira in the dining room of the hotel. The group waited to start, anticipating an appearance by the mayor, but his return from Monterrey was delayed, and he wasn't able to attend the banquet. The volunteers reconvened on the patio after the meal, and almost everyone was awarded a door prize. The door prizes included books donated by Bat Conservation International, cave maps and photos of Bustamante provided by Orion, a watercolor of a Bustamante cave scene by Jan Knox, watercolors of Real de Catorce by Charlie Loving, and various items of gear and clothing

provided by Whole Earth Provision Co. and its suppliers, including Patagonia, Jansport, Gregory, Wigwam, Swiss Army, with the fun stuff demo'd by Joe Jones, including Camper Joe Bender, an Instant Mohawk, a Worm Ball, and Rocket Balloons.

All volunteers departed on Monday, stopping for Terry Plemons' now traditional tour of the mescal factory.

This year's project was very successful, completing many the major long-term goals, with the exception of graffiti removal deeper in the cave and on the road, leaving only some maintenance for future years.

Amigos de la Gruta Acknowledgements:
 Project Coordinators – Orion Knox and Bob 'Rune' Burnett
 Project Treasurer – Alana Hussing
 Registration – Rae Nadler Olenick
 Trail Improvement (outside cave) – Philip Russell and Dave DeGroot,

Bustamante 2006

El proyecto de la Texas Speleological Association en la Gruta del Palmito en Bustamante, Nuevo León, continuó con la limpieza de la cueva y mejoras en la bóveda de entrada de la cueva para los recorridos turísticos. Un total de 117 personas participaron removiendo graffiti, instalando escalones y mejorando el camino y la vereda hasta la entrada.

THE RETURN TO J2

Marcin Gala, Paweł Skoworodko, and Kasia Kędracka

This article gives reports from the Polish team in the 2005 J2 Expedition in the Sierra Juárez, Oaxaca. It does not attempt to report about the whole expedition and all its participants.

This is our fourth expedition with the US Deep Caving Team, all to the area of Cueva Cheve, the deepest cave in the Western Hemisphere. Slowly we are learning about the underground waters of the region. The leader is, as always, Bill Stone. In 2001, we explored the resurgence cave, Cueva de la Mano; in 2003, Cueva Cheve itself. In 2004, we started to work in a new sector, the mountain over the village of El Ocotil. We live in a tropical forest under a sky of leaves at an elevation of 2000 meters. There is no water here; we depend on what falls from the sky or is brought up by mules.

In 2004, we focused on surface exploration. We found eleven interesting entrances. One of them is J2. Initially it was very tight, so we called it Barbie. We thought it would end around every corner. But a succession of drops led us to a large 140-meter shaft. At its bottom, at -391 meters, a canyon began. Paweł Skoworodko and Artur Nowak, the last ones in the cave, ran for 200 meters and were stopped by a drop.

Paweł: The incredible thing is, the passages there are bigger than in

This article originally appeared in Polish in *Jaskinie* 4(41), 2005.

All photos by Katarzyna Biernacka and Marcin Gala, speleo.pl.

Gala: kasia.marcin@speleo.pl

Cheve, 20 meters wide, with waterfalls pouring in from every direction. And the airflow is so strong it rips your head off.

Their euphoria about the lead is enough of a motivation for us to return to J2 again in 2005. The expedition begins with riggering the upper part of the cave and surveying the last section.

Marcin: *Are these the passages like in Cheve? You could at least have surveyed that. . . .*

We begin exploration. Despite the fact that the euphoric stories from the year before had been hard to believe, the passage is in fact getting bigger and bigger. Trips from the surface make rapid progress. Below the large shaft, the cave is almost horizontal, but since there are no serious obstacles, we gained depth at a significant rate. After a week, we reach -735 meters and decide to install a camp.

Enrique Ogando, who is suffering from a knee injury and a can't join us in the underground camp: *I am very envious. I'm quite sure you will surpass a thousand. Just take enough ropes, so that you won't have to come out too soon.*

We set up camp in a large hall. A huge waterfall 15 meters wide would disturb our sleep, if we were not exhausted from the hauling. Tomorrow we will have another day of fairy-tale exploration.

In the morning, Greg Tunnock starts riggering, and Kasia Biernacka, John Kerr, and I survey. After three shots, Greg returns. That's it, a sump. The end.

The rest of the shift is spent mooning around the Great Hall, searching for a bypass. The next day we search the canyon above. Nothing. Where are those fairy-tale discoveries? Where is this thousand? Those on the surface do not know yet. Just a week of exploration has passed, and we have already finished the cave. Some people have not yet arrived. We leave the cave in grim moods. It is time to go back to surface work.

Bill Stone: *I have made my decision. We will have the diving equipment delivered from the States. Can you lend me the satellite phone?*

In only five days the diving equipment travels over 2000 kilometers. Our team is newly energized. We believe the cave will continue beyond the sump. The divers who will take the sump by storm are Alan Warild from Australia and Bill Stone. We organize a large team to take all the equipment down. Two people will remain at the sump to assist the divers. Kasia Biernacka and I will wait for news in the camp at -552 meters. Then we will organize a party from the surface for either hauling out the gear or exploration.

The preparations for the dive take about two hours. Bill will dive first; if the cave lets him through, Alan will follow. Bill submerges, but only for about three minutes.

Bill: *I traveled about 7 meters. Shallow, 4 meters. But a squeeze is ahead, and we will not fit through it.*

Meantime hours pass in the camp. Finally, we hear someone coming up from below.

Alan: *Good news! It does continue.*

Alan had taken all his diving equipment off underwater in order to pass the squeeze. He immediately emerged from the sump on the other side and ran down 200 meters of passage. So the cave definitely continues.

At the surface, the news raises hopes only briefly. What to do next? We are not prepared for long-distance exploration beyond a sump. But there was still a lot of time left. Alan proposes a solution.

Alan: *I think the water in the sump is blocked by some kind of dam. If we manage to disassemble it, we could lower the water level so that it would be possible to pass the sump with your head above water.*

Bill is at the camp by the sump, and we send John Kerr, our specialist at widening tight passages, to him. The only problem is that he is not a cave diver. Disappointment and silence rule the surface camp. Not really believing in the success of the work underground, we return to surface exploration. Meanwhile, Greg Tunnock and Alan Warild help John go through the sump. John spends twenty hours on the other side, working on the dam. At the same time, the Australians continue exploration beyond it. On the return, Alan freedives the sump, holding his breath. So then progress could become faster. The

following day, Kasia Biernacka and I reach the underground camp.

John: *I see almost no chance of opening up the sump this year. I am tired; I think I need to take a day off.*

But when the next morning I ask John to come with me to work on the sump, he happily reconsiders. The next three days are spent working together to lower the water level. Every morning and evening we go through the underwater squeeze, sometimes multiple times to transport equipment, though neither of us is a diver. Our insurance is Kasia and Bill waiting at the camp. We have radio contact with them. From the exit to the sump to the passage beyond is about 7 meters. This is the distance we needed to dig the mud and stones out of. Working sixteen hours a day in water up to our knees, we crush the blocks of stone and transport them farther into the cave. On the third day we are joined by Franco Attolini. At 9 p.m., I return to camp, finding Bill lying in his hammock.

Marcin: *We have opened the sump! Don't believe me? Look, my hair is dry.*

We had managed to lower the water level 2.5 meters, and we needed to



Kasia Biernacka in the underground camp.

widen the upper part of the squeeze. This does not mean that it can be walked through dry. In the narrow spot your helmet has to be taken off, and only your nose remains above the water.

It is worth mentioning here an innovative solution to charging the batteries for the drills. We did that using military lithium batteries. Such batteries are easily and cheaply acquired in the States, and they are high in capacity and light in weight. Alas, they cannot supply a high current, so they are useless for direct connection to the drills. So we are using a special charger to transfer charge from these to the drill batteries. One battery was sufficient to charge three drills, and charging took about three hours.

More cavers join us in the underground camp, and we all go into action. John and I take care of the rigging. Bart Hogan, Tommy Shifflett, Bill, Kasia, and Franco survey. We pass huge waterfalls, beautiful, clean canyons, and huge lakes, deep and 30 meters wide. After twelve hours we finally and with a sigh of relief look at the bottoms of our rope bags.

For most of us, this is the end of the expedition. Bill and Franco stay at the camp, and the rest of us leave the cave. Fortunately, Matt Covington, Jonathan Lillestolen, Kasia Kędracka, Paweł, and Artur remain in the surface camp, all of them full of energy and enthusiasm for exploration. Eventually, the cave reached a depth of 1101 meters. Its

John Kerr, Marcin Gala, and Bart Hogan charging drill batteries in the underground camp.





Kasia Biernacka and Paweł Skoworodko.

length is 5,944 meters. I am happy our crazy trip in 2001 has led to such a result. We have spent many wonderful moments in Mexico. We are like a family now. Other expeditions are still before us.—*Marcin Gala*

Artur, smiling, “Paweł, what now?” Paweł, his face expressionless, “What do you mean, what now? Let’s get packing.” The next day five of us, Kasia Kędracka, Artur Nowak, Jon Lillestolen, Matt Covington, and I, go into the cave. We take most of the remaining camp food and ropes with us. Only José Antonio Soriano stays above as a camp guard. Bill Stone and Franco Attolini are very happy to see us. They have both been underground for a week. Having prepared everything for the next day, we go off to sleep. We arranged with Bill that Artur and I will do the rigging, while the rest will take care of surveying the new passages. Kasia, after a few kilometers of surveying with Bill, says she doesn’t want to go to a surveying class once she’s back in Poland.

In the morning, squeaking, we put on wet wetsuits and go down to the sump that we have heard so much about from Marcin Gala. Eyes wide with fright, we descend into the dark waters. The stories seem to have been a little exaggerated. It is, though, a fact that the wind blows as if we were in a turbine. After some further crawling, we descend into a canyon with a river. I have never gone canyoning, but this is how I have always imagined it:

Marcin Gala in the sump.

rappelling down waterfalls, swimming, and tyroleans. My breaststroke proves to be very effective. We reach the limit of exploration and start to rig a large waterfall into a lake disappearing around a turn in the passage. Another two waterfalls lead us to a dry section. Now it is just like Cheve. Artur has gone over the edge. He has thrown away his rope bag and run on ahead. I could hear only his distant cries. Next time I see him, an hour has passed. His face is smiling, with eyes of a madman. We continue on together. I don’t think the survey party is going to reach us very soon. We leave cairns for them along the way.

Having walked for over twenty hours

through dry sections in a wetsuit, all I can think about is talc. Fortunately we have it in camp. Next time we should take clothes to change into.

Summing up, we went on three long trips beyond the sump, starting from the camp just above it. The smell of the sump in the morning is even better than an early start with coffee. But I think next year we should move our camp to the dry sections above the wet canyon. During this last camp the cave went on large but mainly horizontal. For me it was undoubtedly the most spectacular exploration in my life. We were discovering one huge section after another, separated by complicated breakdowns. We thought the last one would stop us for good. But the cave continues, and it does not seem likely to close down very soon. The farther you go, the bigger it gets.

We also encountered a peculiar formation that Kasia called black lace. It looks as if 90 percent of the rock corroded away and the remnants formed a black, lace-like structure resembling nerve tissue. Artur and I rappelled inside such a thing for the first time. You can’t walk on it, because it breaks. Your leg falls inside. You can’t aid-climb on it. Our experience from the jungle comes in handy—you have to cut a path through it.—*Paweł Skoworodko*



I told my parents and friends just before leaving for Mexico that I would always stay with a fellow Pole, since it was my first caving expedition. But when we joined the expedition, the camp was boiling with uncertainty, diving equipment was on the way from the States, and some people were getting impatient or even bored. And then Marcin Gala said, “Kasia, Mike will take care of you.”

Mike Frazier, an American caver whom I had met three months earlier in Poland, told me to pack my things, take my sleeping bag, and leave the camp in the forest behind—Goodbye Poles! I was not about to keep my promise. With Mike, Mark Wilson from Australia, Peter Hartley from Britain, Tjerk Dalhuisen from the Netherlands, and Tommy Dwyer from Ireland, I went down to the village of San Francisco Chapulapa. We called our team the US Shallow Caving Team, as opposed to the US Deep Caving Team. We explored a cave the entrance to which had been shown to us by the inhabitants of Santa María. We called it Ken, as a companion for Barbie, the unofficial nickname of J2. The entrance to Ken is situated at the bottom of a gigantic sinkhole, the sides of which are home to

exotic plants. Inside, it was really hot, especially as I was caving in a yellow “oil-cloth overall.” The mud stuck to our heads and toes, each puddle almost moved because of all the creatures dwelling in it, and white worms were met almost everywhere. The prizes for all this were dozens of beautiful formations and the fact that I have just gone down my first, if small, virgin shaft. Ken is a sequence of shallow pits, slopes, horizontal passages, and two large halls.

The exploration of Ken took us five days and concluded at a depth of 266 meters in a big hall the walls of which were covered with fantastic sculptures of mud.

While the diving was going on in J2, Mike, Mark, and I surveyed small Cueva Campana, 85 meters deep, which was discovered a few years ago by English cavers, but not surveyed. Killer bees in a hive 2 meters high hanging over the entrance had attacked the English and stopped their attempts to survey. We were luckier.



Tony Dwyer hauling gear through J2.

After a week, I returned to camp, the Polish language, and even greater excitement the source of which was, of course, J2.—Kasia Kędracka

Retorno a J2.

Algunos espeleólogos polacos de la expedición 2005 a J2 en Oaxaca describen sus experiencias personales, incluyendo el bombear agua del sifón y explorar y topografiar la Cueva Ken.



PROYECTO ESPELEOLOGICO PURIFICACIÓN, CAR CAPERS IN CHUPADEROS

Bev Shade

Nathan Parker, Mike Michael, JJ Noyola, and I left Austin Friday night, May 3, 2005. We drove to Laredo and camped just north of the border early Saturday morning. A light rain woke us two and a half hours later, so we got back on the road. We drove on to Monterrey, where we contacted Samuel Rodríguez Muñiz. He had to collect his gear across town, so we waited a few hours and then picked him up at the Monterrey Tec conference center. Minor confusion between the drivers and the navigator led to a very roundabout drive toward our destination on the west side of the Purificación area. We arrived at Zaragoza late in the evening and got a room at the Hospedaje San Francisco. After some late-night tacos, we were ready for a rest.

The next morning, May 5, Samuel and I set out to find the *alcalde* of Zaragoza to let him know we were caving in the area. Since it was Cinco de Mayo, there were parades and festivities all over town, and the *alcalde* was understandably busy. After a couple of hours, he had a few minutes to talk to us. We gave him some of the newer *Death Coral Cavers* and discussed what he knew of caves up in the El Viejo area. It was a very pleasant meeting, and he gave us official sanction to be caving in the area without any discussion of FM3s or other paperwork.

We promptly headed up the mountain, excited to be caving after all the delays. About halfway up the steep switchbacks to La Escondida, JJ's 4Runner quit running. We tried unsuccessfully for several hours to get it running. When it became apparent

that we would not get it fixed, JJ packed up a light bag and hiked back down to Zaragoza to find parts, probably from Monterrey or Laredo. Nathan and I loaded Mike, Samuel, and all of their stuff into my truck, and we continued on to camp at La Escondida, which we reached shortly after dark.

On the morning of May 6, Nathan, Samuel, and Mike got up early and visited some known caves close to our campsite, while I repacked the truck. Our plan was to camp near Margaras and try to hike to some reported high leads to the southwest. After breakfast, we continued the drive to Margaras, pausing at the turn to Cretaceous Park so that everyone could familiarize themselves with the road. Samuel hiked down the road a short distance to La Ciénega, where he found a stalled truck

in the road. A rancher from Zaragoza, Leonicio Francisco Reyna, had been visiting his ranch nearby, and his truck had broken down. It had stopped in front of a house belonging to Francisco Rosalés. The truck had a variety of problems, but the beyond-dead battery was the most pressing one. We were pressed into service to help, and eventually ended up putting my truck battery into the ranch truck and giving it a good push start. It worked, but replacing the battery in my new truck set off the factory car alarm. Never having had a car alarm, I did not know that they can usually be bypassed by a valet switch. After some efforts to bypass the alarm by pulling fuses, I left Mike, Samuel, and Nathan with the truck, a GPS, a topo map, and directions to do some ridgewalking, and hiked down to

Nathan Parker.



bev@purificacion.org

Cueva de la Pita

Chupaderos, Nuevo León
México

PEP 512

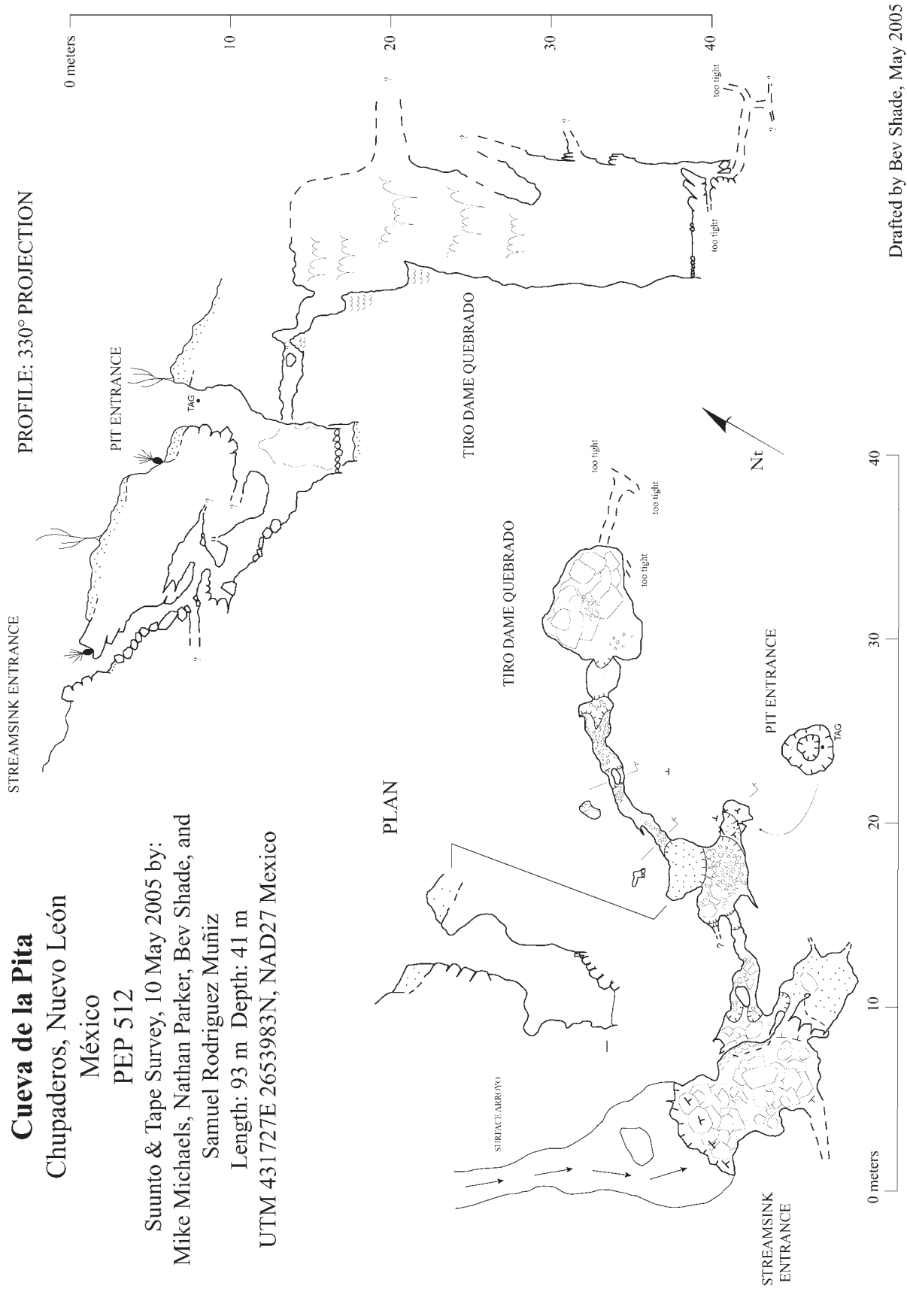
Suunto & Tape Survey, 10 May 2005 by:

Mike Michaels, Nathan Parker, Bev Shade, and

Samuel Rodriguez Muñiz

Length: 93 m Depth: 41 m

UTM 431727E 2653983N, NAD27 Mexico

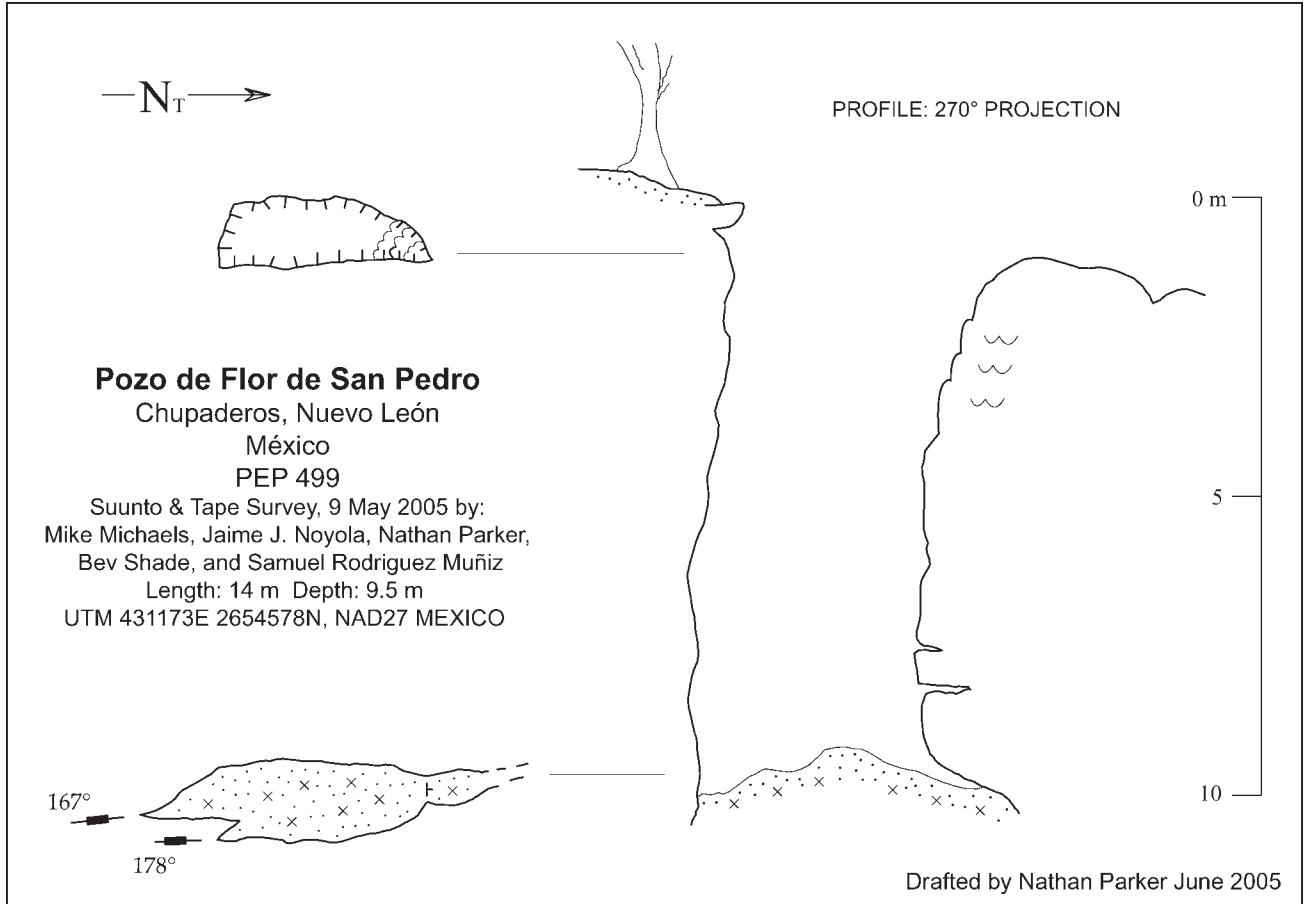




JJ Noyla rappels into Pozo del Arbol Llorón.
Bev Shade.



Bev Shade in Pozo de Flor de San Pedro.
Nathan Parker.



Car capers—Cavers do their part for landowner relations. *Bev Shade.*

Zaragoza, planning to take the bus to the border and hopefully meet someone who could bring my factory truck key with the alarm shut-off button.

Several hours into the hike down, I noticed that JJ's truck was not where we had left it, and there were some fairly bashed-up trees and vegetation nearby. I spent a few minutes looking downhill of its steep parking spot, wondering if perhaps someone had broken into the truck and rolled it downhill. I did not find any sign of JJ or his truck, so I kept walking. Several more hours got me to the base of the mountains and onto the flat section of road. I caught a ride with a local New Age medicinal plant herbalist named Javier Quintero,

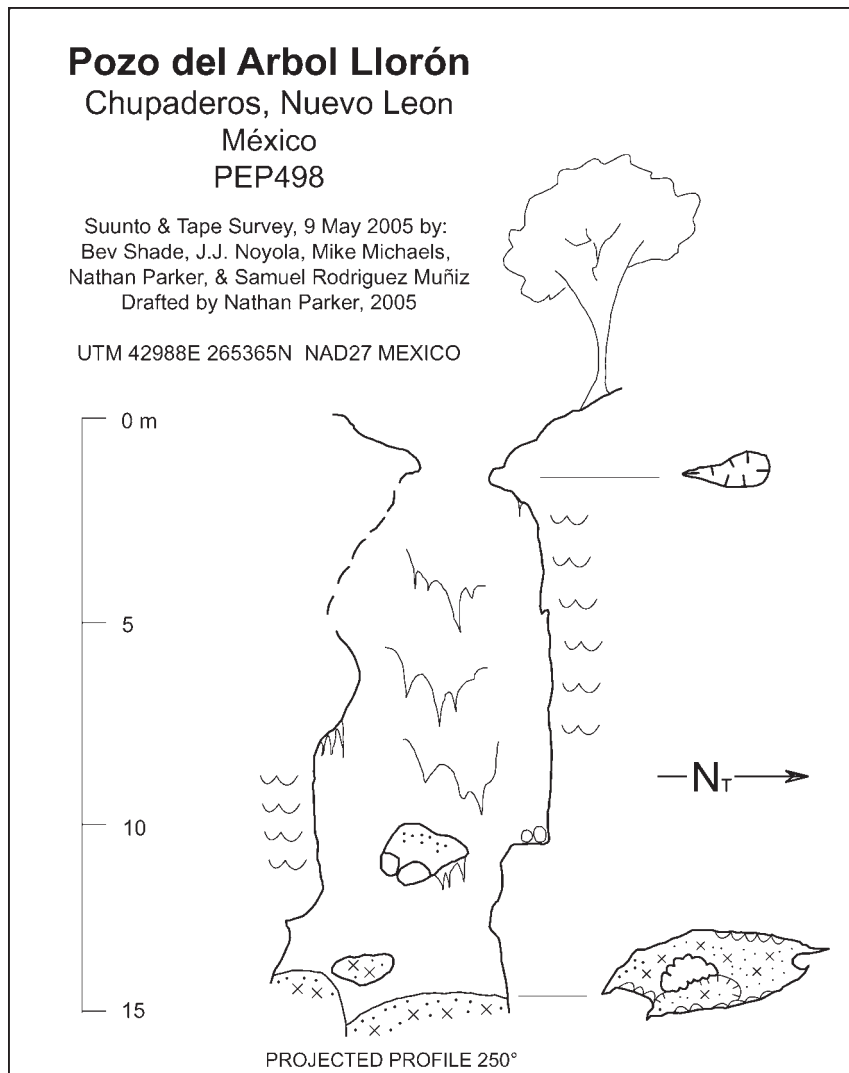


who had a great early '90s Toyota truck. He gave me a ride to the bus station, where I just missed the last bus out of town. I walked slowly back to the

Hospedaje, very tired from my fast hike down the mountain. Much to my surprise, in the courtyard of the hotel I found JJ's truck. And JJ. With help from a local tow-truck owner, he had gotten his truck down the steep mountain road, basically by tying trees to the back of it as a giant drag anchor and then coasting downhill using the emergency brake. His parents live close to Harlingen, and his father and uncle were coming to try to fix the truck or tow it home. My factory truck key and a better pair of hiking boots went on the overnight bus from Austin to San Benito, and they arrived with his dad the next day, May 7. We had a restful day of eating and watching DVDs on the laptop while we waited. The elder Noyolas arrived late in the evening with a big Suburban, a trailer, lots of 4Runner parts, and my truck key. They spent all of May 8 trying to fix JJ's truck, finally determining that the camshaft was seized up, among other problems.

Very early on May 9, JJ and I saw them off back to Texas with the 4Runner in tow, then hiked back up to El Viejo. On the way out of town, we got a ride from Javier Quintero, who kindly took us at least three-quarters of the way up the mountain, to La Escondida. We rejoined the rest of our group at La Ciénega in the afternoon, and got my truck started with no further problems. We surveyed a 15-meter-deep pit that Mike, Nathan, and Samuel had found near camp. Samuel named it Pozo del Arbol Llorón (PEP 498) for a nearby tree.

The next morning, we packed all five

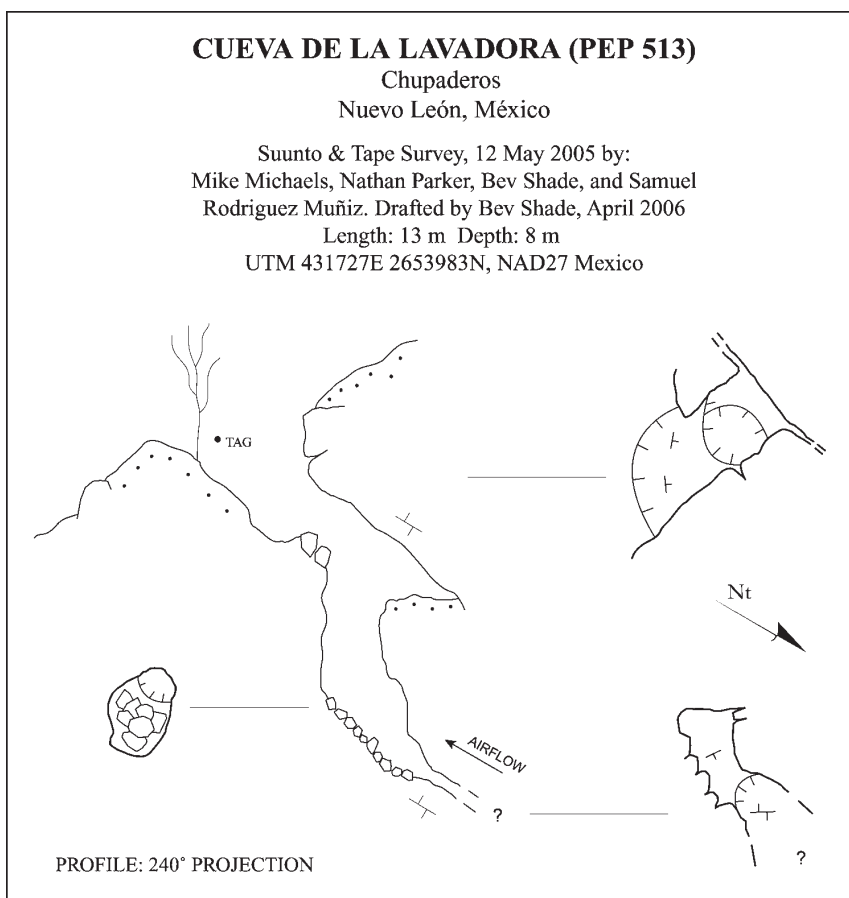


people and gear into my truck and moved camp closer to Chupaderos, where Mike, Nathan, and Samuel had found several other leads. On the way, we surveyed a small pit close to the road, with an entrance draped in the vines and white flowers of a plant called Flor de San Pedro. We named the 14-meter-deep pit Pozo de Flor de San Pedro (PEP 499). From camp, we hiked to another of their leads, Cueva de la Pita (PEP 512), and began exploring and mapping it.

On May 11, I went to finish surveying Cueva de la Pita with Nathan and Mike, while JJ and Samuel went ridgewalking to check some aerial photo leads east and southeast of La Escondida.

On May 12, I got up early and drove JJ back to La Escondida, so that he could hike back down to Zaragoza and take the bus to Harlingen to rejoin his truck. Then Mike, Nathan, Samuel, and I continued ridgewalking and checking aerial-photo leads. We surveyed Cueva de la Lavadora (PEP 513), a small stream sink that clearly takes significant water, but pinches into a grim bedding plane at the bottom. On our hike back, we got soaked by a heavy rainstorm that continued until about 8 p.m. Getting a fire started and drying gear took a long time.

We continued ridgewalking the following day, but did not find much. On May 14, we squeezed the four remaining cavers and their gear into my truck and drove down to Monterrey. We stayed in a house belonging to Samuel's brother. Mike, Nathan, and I got up early the next day and drove back to Texas.



Proyecto Espeleológico Purificación, Mayo 2005.

Espeleólogos se internaron en la zona oeste del área del proyecto Purificación desde Zaragoza, Nuevo León. Tuvieron muchos problemas con descomposturas vehiculares, pero de cualquier manera topografiaron algunas cuevas pequeñas.

HISTORY

THE GREAT SIERRA DE EL ABRA CAVING EXPEDITION

Richard G. Albert

Professor Robert W. Mitchell of Texas Tech University and others had been doing a considerable amount of work in the past several years on the caves of east-central Mexico, doing explorations of various kinds and especially studying the biology and hydrology of the area. They wanted to do some aerial reconnaissance to look for more caves and to study the surface drainage of water into these caves, so they had engaged me as the pilot to fly them around over the area to be studied. Bob and his group arrived in Alice Friday night, and spent the night in my home at 1800 Newell Street.

Saturday, 1-25-1969. This morning most of the members left in the Tech University Carryall towing the Jeep, headed for the border. In the Carryall were James Reddell, Bill Russell, Tony Mollhagen, Richard Smith, and Francis Rose.

The rest of us left in the early afternoon, driving 18 miles to the Kleberg County Airport near Kingsville, where we rented our plane, a Cessna 172, N46021. We took off, with several javelinas right beside the runway. On board the plane with me were Bob Mitchell and Tommy Albert, my number-one son, and we were to pick up Rose at Reynosa. The weather was fair, but there were many cumulus clouds that were rather low down.

We landed at McAllen to get aeronautical charts of Mexico, but were unsuccessful. They did say the weather outlook was good, although the visibility around there was decreasing. Then we flew across the river and landed at the Reynosa Airport, where we had to check in with the Mexican authorities and get the necessary paperwork done.

Here we found the Texas Tech Carryall waiting for us, which surprised us somewhat, since we had expected them to just leave Francis Rose there at the airport and drive on down.

Each one of us had to get a visa, and we also had to get an authorization to take the plane into Mexico. This was not very difficult, though a minor problem did arise when they learned that only three persons had arrived in the plane but four were leaving in it. They suspected us of illegally carrying paying passengers, and we weren't sure that they ever did understand that we just picked up one member of our group here.

We tried to get the aeronautical charts here, but again were unsuccessful. That wasn't so good, as the only other map we had was a regular road map. Well, we would have to make do with that.

Anyway, soon they said all was in order, and that we could leave. However, then another minor problem arose when the fat officious official came out and tried to stick two *turista* stickers on the inside of the glass of the plane. He tried several times to stick one on there, but it just simply would not stick, so he finally just gave us the two stickers and told us to keep them. Bob Mitchell laughed and said, "Just like a bunch of chickens!" because all he would have had to do was peel off a little thin layer of plastic from the sticker and it would have stuck on immediately.

We took off with Francis Rose now added to our passenger list and headed south. As we were flying along to the south, we passed the 15-mile Mexican immigration checkpoint on the

highway, and since we didn't see our Carryall-Jeep there, we figured they must have already passed that point. Later we saw them down the road, and we flew down to just above brush-top level just slightly to the left of the highway. We watched the people in the Carryall to see if they would see us. There was no mistaking when they did see us—they were suddenly all pointing at us and we could just see them saying, "Look! Look!! Look!!!" We talked a little by walkie-talkie with them, and then went on.

We learned later that they had had a slight complication when they had gone through the immigration checkpoint. All the papers seemed to be in order, and everything was going well until some official saw a walkie-talkie. He knew what it was, and some little furor ensued when they looked for the other one that must be there, but they couldn't find it. They just knew the good biologists were up to skullduggery of some sort, but they couldn't figure out just what. Finally, they did let the vehicles pass.

The weather down there was not so good as it had been in Texas. The visibility was not too good, and it was very cloudy, although the weather report and forecast had been good. We decided to fly right down the highway and make no attempt at any other navigation, since it might prove too hazardous under these conditions. As it turned out, this decision was a wise one, since the weather deteriorated more and more, until the ceiling was only a few hundred feet above the ground, and sometimes we were flying through rain and drizzle. Just north of Ciudad Victoria it got especially bad, and we had to fly down quite close to the ground.

Then as we reached Ciudad Victoria, it cleared up some, and we could even see some of the city underneath us. We followed the highway on to the south, and we wondered how we were going to get through the mountainous area that lay just ahead. This didn't turn out to be so bad, because the visibility improved some and we could see the mountains all right and flew on through the pass in the mountains to the south.

Just beyond Ciudad Mante, the highway went through a pass in a small mountain range, and this was our first view of the Sierra de El Abra. As we continued on southward, the light began to fade somewhat, as it was quite late in the evening by now. We flew down parallel to the El Abra, just to the west of it, and after a time flew over an airstrip on the Rancho San Ricardo. We had considered this as a possible place to land, but Bob said he thought there was another airstrip on down around Ciudad Valles somewhere. It was already quite late, but we decided to go to the city, since this Rancho San Ricardo was some 15 miles north of town, which we felt was too far for practical purposes.

We couldn't find any airstrip at Ciudad Valles, but Bob said he knew there was one at some hotel about five miles south of town right on the highway, so we headed out that way to look for it. We flew over something that looked like it ought to be a large hotel, but it turned out to be a rum factory. We flew a couple of miles or so farther south, but found nothing that looked promising, so we felt it would be much more prudent to return to the airstrip on the Rancho San Ricardo.

This was a somewhat uncomfortable 25-mile ride. It was getting quite dark, and the lights of the city were blinking up at us quite strongly now, so we couldn't see much of the ground. Besides that, our gas tanks were empty—the needles would just occasionally quiver a little, which was considered a bad sign. We flew directly over the highway, so that in case the engine stopped we could at least have a good chance of landing on the pavement, but we hoped it wouldn't be right in the middle of a Mexican bus. We could just barely see the lighter line on the ground that we figured was the highway.

We were sitting up on the edge of our seats, not daring to put our full

weight down, when we saw the light area on the ground that we figured was the San Ricardo airstrip. We came around over the southwest end of it and landed, and sure enough, it was the San Ricardo airstrip, and we were down, safely, at 7:50 p.m. We taxied past some sleeping cattle, reached the ranch buildings on the northeast end of the runway, and cut off the engine. We had made it, although it was quite dark. We had flown 4 hours today.

We talked to the people at the ranch headquarters, who said that it was all right for us to land there and also to leave our plane there, but that they had no gas available there at all. We wondered how we were going to get to town, but this was solved for us when some kind gentleman offered to drive us down. Naturally, we could not hurt his feelings by refusing, so we piled in and were soon in downtown Ciudad Valles. We stopped at the Hotel Casa Grande, where Bob preferred to stay when he was in this area, and soon had rooms for the lot of us. Later that night the Carryall towing the Jeep arrived, so we were all together once more.

Sunday, 1-26-69. This morning Bob Mitchell, Bill Russell, Francis Rose, and I went east out of Ciudad Valles, across the Sierra de El Abra, to the town of Tamuín, where we bought five gallons of aviation gasoline at the airport on the north side of town. Then we drove on back around through Ciudad Valles and up to the Rancho San Ricardo, where we gassed up our plane and felt much relieved that we now had a little gasoline. We took off without difficulty, and made a couple of brief circles, but then flew on over to the Tamuín airport to gas up. We had to fill out some papers there and pay an airport tax, because we had landed there. It was really much more comfortable now that the gas gauges read full.

We took off once more, and we cruised around over the south portion of the Sierra de El Abra. This is a 100-mile north-south mountain range that is perhaps 10 miles wide at its widest part. It is composed of rather hard limestone laid down in the early Cretaceous period as a reef in an ancient sea, and it has been raised up as an anticline to its present elevation above the surrounding terrain. The west slope is quite gentle and merges gradually into the

rather broad north-south valley to the west, but the east slope is a cliff that drops quite precipitously some 1,500 feet to the broad coastal plain that extends all the way to Tampico on the Gulf of Mexico. Its highest point is at about 2,700 feet, near the northern portion of the ridge, and from this it slopes very gradually southward to disappear as it dips under the Río Tampaón some 10 miles south of Ciudad Valles, though two small green, low hills just south of the river are considered to be also a part of the El Abra. The surface of the mountain range is rather level in that it is, in the manner of a new range of mountains, not cut up into ravines, though the surface is pocked with numerous comparatively small shallow depressions or sinks that have no outlet. It is crossed by two water gaps where ancient streams had cut across, though neither stream is present at this time. Both of these are called El Abra (The Pass), and both are crossing places for highways, one from Ciudad Valles to Tamuín and one from Ciudad Mante to Antigua Morelos. The north portion of the range gradually slopes downward as it angles a little to the west. At a point just about west of Ciudad Mante it is crossed by a third water gap, but this one still contains the stream, the Río Comandante. The ridge very gradually slopes downward for a few more miles to its lowest point, where it ceases to exist as the Sierra de El Abra. The ridge continues on, until it becomes the high mass of the Sierra de Guatemala, a very rugged mountain complex just northwest of Ciudad Mante.

The limestone must be very porous, since when it rains there is practically no runoff from the top of the mountain range. The water sinks down through the cracked rocks and disappears, to emerge again as springs or rivers which are called *nacimientos* (births) by the Mexicans. We flew over one of these, the Nacimiento del Río Choy, where the river emerges from a large cave at the bottom of the east face of the range just north of the southmost water gap and is crossed by a railroad bridge half-way up the face of the cliff just above the emergence. Farther south, on the other side of the Río Tampaón and on the northwest side of one of the small green hills that is the end of the Sierra de El Abra, was the Nacimiento del Río Coy. Both these rivers flow down some 20

kilometers before joining the Río Tapaón. Another resurgence is called the Fuente de Taninul, and emerges from a cave in the east face of the El Abra just a few miles north of the Río Tapaón. The Hotel Taninul was built at this spring and was a classy joint for rich gringos.

Then we went looking for sótanos. A *sótano* is the Mexican name for a pit cave, which is a cave that opens as a deep vertical pit that goes straight down for perhaps several hundred feet before it branches out in some direction. A cave that one can walk into horizontally is called a *cueva*. These sótanos are strange creatures. These deep pits are almost always found in the bottom of an arroyo. The sótano has captured the stream that used to run down the arroyo, and so this stream, instead of running its usual course to join some river that goes to the sea, now loses itself in the earth's innards. Each sótano is, therefore, the focal point of a small drainage basin of some size.

We cruised around over the area for approximately 20 miles north of Ciudad Valles and found several of the known sótanos in this area. Near the town of Los Sabinos we found Sótano del Tigre, Sótano del Arroyo, Sótano de la Tinaja, and Cueva de Los Sabinos. Then, a little farther southeast than the Sótano del Arroyo, we found a spot in another arroyo that looked suspicious and, flying low over it, saw that it was indeed a sótano, a new and undiscovered one. We circled around over this several times, and we could look way down into a yawning pit. Then nearby we saw another one, so here were two brand new sótanos. They were near a small square field that had a single Mexican sabal palm tree growing near its center with a burro beside it. We were elated at this find, especially since these sótanos would not be very hard to get to.

We went on up the principal part of the Sierra de El Abra itself just east of there and cruised around for a while, looking at the many sinks over its surface. There was a cement factory off the east face of the El Abra several miles north of the water gap, and we went on up north of it for a distance of about five miles. Suddenly, on the top of the El Abra but only about 200 yards from the east face, we looked into a gaping hole, with only blackness down below the rocky entrance. Only about 50 yards

west of it was another similar sótano, and both of these were different than the others we had seen in that these were not drainage sites for captured streams. These also were two unknown caves, new discoveries due to our flying.

After we had flown for 2.5 hours, we returned and landed. We learned that the Rancho San Ricardo was no longer called that, but was now the Ponciano Arriaga, since it had changed hands. The men at the airstrip were just as nice as could be, but they said that for continued use of the airstrip we would have to get permission tomorrow from the office of Sociedad Local de Crédito Ganadero, in downtown Ciudad Valles. While we had been cruising around today about five miles south of Ciudad Valles, we saw an airstrip with a couple of planes sitting on it, right behind a building that was the Hotel Covadonga. This was what we had been looking for, and it was only about two miles south of the rum factory we had at first mistaken for the hotel. We resolved to move our base of operations down there, where we would be much closer to town and it would be so much handier. Tomorrow we would do so.

While we had been flying around enjoying ourselves, the rest of our group went down in a cave to look around. These were James Reddell, Richard Smith, Tony Mollhagen, and Tommy Albert. This cave had first been known as the Sótano de Montecillos because it was near a small village of that name, but it had been named in error. The natives in the vicinity all called it Sótano de Pichijumo, and since there were other sótanos in the vicinity of Montecillos, it was felt best not to have it known by this name. The name change to Sótano de Pichijumo would be duly made in the literature.

Monday, 1-27-69. This morning the same four of us flew up along the east face of the El Abra cliffs, mainly to count and map resurgences at the base. We also saw the openings of several caves in the face of the cliff on about the north third or fourth of the ridge, where it bends slightly to the left, and along about here we crossed from the state of San Luis Potosí into the state of Tamaulipas, to the little town of Quintero nestled right against the foot of the cliff not far southwest of Ciudad Mante. Directly opposite the last street

on the south side of Quintero, but up on the top of the El Abra, we found a rather large pit with a not very deep bottom that was covered with very lush vegetation, such as elephant ears and bamboo. Only a few hundred yards away we found another such pit, but they looked as though they would be quite hard to find while on the ground.

We flew to the west of the Sierra de El Abra now, and there found that the broad valley that extended northward on the west side of the ridge of the El Abra now played out and stopped abruptly at some low hills that extended on northward and gradually went up into a great mountain mass, the Sierra de Guatemala. There we flew over a large sótano known by the very gringo name of Bee Cave. This sounded like a lousy name for a Mexican cave, and Bob said he was thinking about changing the name to Spanish, Sótano de las Abejas.

While we were flying around there, we went about a mile or so to the northeast of Bee Cave, and there flew over some of the very roughest country that any of us had ever seen. Here the limestone had been crosshatched, as it was split by a number of cracks, about equally spaced in both directions, with the portions of rock in between coming up to sharp little peaks in the middle. The size of each of these little squares of rock could not be very well determined, but it appeared to be several feet. The cracks in between were wide enough for a man to walk in, and we thought it would be well-nigh impossible for any man to walk across country such as this. In some areas this rock was quite bare of vegetation, but in other areas some brush was growing, as well as the large nettles known as *n:mala mujer* and large numbers of agaves, cycads (*Dioon edule*), terrestrial bromeliads (*Hechtia*), and a few cacti, giving the whole a rather weird appearance.

This was really a spectacular site for us, and we snapped some pictures of it. Toward the east side of this formation (known as karren) we found a new sótano.

From this exceedingly rough limestone we flew eastward to cross what was now the Sierra de Guatemala right at a point where an old, dry water gap cut across it, and then were over the broad plain on which is situated Ciudad

Mante. We landed at the airport on the west side of town, on a strip that may possibly have been paved at one time, but which now had some gravel and a number of chuckholes in it. After some discussion, the people there at the airport decided they had fuel for the plane, so we refueled. We found that we did not have to do any paper work there or pay any airport tax, but a man with a pistol came around to collect a donation for the maintenance of the airport, so we donated ten pesos.

We hitchhiked a ride into town and walked around there for a while. We looked over the plaza and then lay down there to rest. We bought a sack full of tangerines, which we ate to help quench our thirst. They tasted very good.

We took a cab out to the airport, and took off. We flew on down over the top of the Sierra de El Abra to see what the surface looked like, and to look in a lot of the sinks to see if they might lead into sótanos below. However, these sinks were usually so full of green vegetation and vines, in sharp contrast to the desert appearance around them, that we could not see the bottom at all. These sinks were really beautiful, and we just knew that each one of them must harbor a jaguar, comfortably hidden away in this tangle of green vegetation. Jaguars were certainly present in this country, and we longed to see one. We all wanted very much to go into one of these green sinks, but no one wanted to go in without a rifle.

About a third of the way down the mountain range, we found a truly enormous pit, several hundred yards long and perhaps one or two hundred yards wide. Its south end and east side were great limestone cliffs that had been undercut, with perhaps some caves, though we could not be sure we saw them. At the north end there was vegetation growing on the very steep wall, but it looked possible for a man or beast to perhaps climb up or down in this area. The bottom was covered with the greenest, lushest mass of vegetation you could imagine, bamboo and vines and other things, and we knew it must be just full of jaguars. We circled this and flew over it several times, taking pictures. We called this the Caldera, because it was so large.

Rose said he thought he had seen something that looked like the entrance to a sótano down somewhere near the

southwest end of the airstrip at the Rancho San Ricardo, so we now flew over that area. Sure enough, there was a large or, rather, deep fissure that looked awfully black inside, right on the end of an arroyo that made a wide sweep around to the west and then ran east in a straight line paved by white, broken rocks right up to the sótano entrance, which was situated beside a single tall palm tree. We noted where it was and resolved to go into it as soon as we could. We searched in this area some more, and just to the west-southwest of this new sótano we found another very large hole right in the bottom of an arroyo, again with a single tall, slender palm tree beside it. Then about three miles south of the first one we found yet another arroyo, also with what appeared to be a large sótano. These three were all new and unknown, just discovered today. It looked as though our having the plane was really paying off.

We changed airports today and relocated down at the Hotel Covadonga, where gasoline was available. We had flown 4.3 hours today.

The other four members of our group had gone to other caves during the day. First they had gone to the Cueva de Los Sabinos, a very nice cave where they had captured three types of bats—vampires or blood eaters, pollen eaters, and fruit eaters. Then they went to the cave at the Hotel Taninul, which was also interesting.

Tonight we decided we would go to the fissure sótano that Rose had first seen near the end of the Rancho San Ricardo runway, so we went looking for it. We parked beside the highway, followed a fence line in until we reached the creek that we had seen from the air, and then tried to cut across to where we knew the sótano was. This all sounded all right, but it just didn't work out. The brush was very dense, and we took turns going up ahead breaking trail for the rest. We went crashing around out through that thorny mess for about an hour, but of course never did find the sótano. It was impossible to see anything at all, and one could not get through the very dense tangle of thorny brush without bulldozer effort. There was some prickly pear mixed in with the brush, which didn't help matters any. It was also thickly sprinkled with *carnisuelo*, the bull-horn acacia (*Acacia cornigera*) that had a positively

ghastly collection of very sharp thorns to puncture us. As if that were not enough, when we were stabbed by the thorns, the millions of little black ants that lived in the hollow thorns would rush out and bite us. We came back down to the creek several times, but could not get anywhere else. We very wisely decided to give it up until sometime in the daytime, when we were sure we could find it.

Tuesday, 1-28-69. Rose decided to stay on the ground today, so Bob and Bill were my only passengers as I flew up northward again, past the Rancho San Ricardo airstrip. Up about 60 kilometers north was the little town of El Venadito (the Little Deer), and somewhere east of there was the Sótano de El Venadito, one that was supposed to be very impressive. It was a little difficult to find, since it was tucked away down in the bottom of a ravine on a hillside, but eventually we did find it. The arroyo went right into a yawning pit at the base of a cliff, and there it disappeared. This was a rather important sótano, since there were not many of them up in this area.

We cruised around up over the Sierra de El Abra again, mainly looking at the different sinks and wondering at the lushness and green therein. We counted twenty-four large sinks, plus many more smaller ones.

By the time we approached Ciudad Valles we were down near the highway again, though still several miles from the town. We saw the Carryall going along, so we buzzed Francis Rose and Tony Mollhagen, hoping that they would get the idea that they were to come down to the Hotel Covadonga and pick us up. They indicated by sign language that they understood. By the time we landed, we had flown 4.8 hours today.

As Rose did not fly today, he and Tony tried in daylight to get to the sótano we had not been able to find last night. They had found it all right, but it had not done much good, since they had gotten down only to a small ledge about a hundred feet down. There was another deep drop there, and they did not have enough rope to go farther.

Tommy, James, and Richard had gone into Sótano de la Tinaja, a quite large and well-known cave. Tommy had flung a rock and managed to knock

down a vampire bat from the ceiling, so that was captured.

We always ate at the Restaurante La Condesa, right on the plaza that was right on the edge of the Río Valles. The food there was good, but the waitresses were not. We would all sit down and order something from the menu, and then always wondered what we would get. Sometimes it was what we had ordered and sometimes it was not, but we learned to eat and not complain too much about it. The waitresses never wrote down anything, and never remembered it either. It was always sort of an adventure to go in there.

Wednesday, 1-29-69. We did not fly today. Bob, Francis, Tommy and I went to the new sótano that Francis and Tony had been to yesterday, and we were determined to go down into it, since we had surely brought along enough rope. We walked through the brush and wondered that we had gotten as far as we had Monday night. The very thorny brush was very dense and had several different acacias growing in it. There was the carnisuelo and also the very common huisache (*Acacia farnesiana*). Another common one was the black brush (*Acacia rigidula*), also very thorny, but now blooming with very sweet-smelling, cream-colored flowers.

We found the sótano all right, and it was an impressive sight to see this gash about 30 feet long and 15 feet wide opening down into what seemed like the very bowels of the earth, a great deep dark hole. The rope was tied off to a tree on the west side, and Bob went down first. I was elected to go next, and since this was my first experience going down into a sótano, I was a bit uneasy. Of course, I knew it was perfectly safe, as Bob had just gone down the rope and had survived, but still, when it was I who was going down over the edge of that rock into that hole, hanging only by what appeared to be about a number-8 thread, I wasn't so sure I wanted to go. However, they didn't have to stomp my fingers too hard to make me turn loose of the edge of that ledge, and I went over and began the descent. A nylon belt seat had been wrapped around my bottom and held with a D-ring, to which were attached a pair of carabiners or descenders—two things like stud links of chain through which

the rope ran and thus slowed the descent, and the rate of the descent could be controlled by manipulation of the rope below the descenders. However, I was having trouble descending, since in their effort to make me feel secure, my friends had had me sling the end of the rope around my body and over my shoulder as well, so I could hardly make it go at all. If I did nothing, I didn't descend, so I had to feed the rope around me and push it through the descenders so it would go. It seemed like it took me an awfully long time to get down into that sótano, where Bob had gone down in just a minute. Of course, he knew what he was doing, and I didn't.

About a hundred feet down we found we were on just a little ledge, with no place to go except down. About 10 feet to the south, there was a large green rock over which we had to go to descend any farther. We could look up from there and see daylight, so if we had just started down at a point about 10 feet farther south from where we had, we would have gone straight down without touching this ledge at all. The rope was thrown down, and Bob went down, no doubt expecting me to follow. I looked upon this whole affair now with considerable trepidation, because it was an awfully green and slippery rock to go over. It was not without misgivings that I attached my descenders to the thread once more and forced myself to slowly slide down the slippery rock and dangle out in space.

I now forced myself to look down for the first time, and it almost made my heart leap into my mouth. There was a very black vertical shaft extending to what seemed like an endless distance below me, and I wasn't sure that my headlight would reach the bottom. I could see a tiny firefly flitting around down there that was Bob's light as he walked around looking the place over. However, I had committed myself, it was impossible to go back up, so I must continue down. This time, I did not have the rope all wrapped around me and over my shoulder, so I went down much faster. I found I was able to control my rate of descent very well without any difficulty at all, and even sort of enjoyed going down this drop, which was 160 feet from the big green slippery boulder up above.

Soon Tommy and Francis also arrived

upon the scene, and we found ourselves in a small room that appeared to go nowhere. However, up some 12 feet above us was a small ledge, which Bob explored and said that it looked like it went somewhere. Bob had gotten over to this ledge by climbing up on top of a rock and swinging across on the rope that hung down into the pit, so I thought I would try it. I climbed up to the rock too, and was all ready to swing across like Tarzan, but discovered that the rope had a large amount of elasticity in it. I tried to put all of my weight on the rope, but it just stretched, and I was still on my rock. I pulled out all the slack that I could, and then when it seemed to be pretty tight and it was almost pulling me off the rock, I felt I was ready to go.

"Ready or not, here I come!" I said, and jumped. Something seemed to have gone wrong, because my calculations as to the elasticity of the rope had been off somewhat, and instead of swinging across up onto the ledge, I swung across and crashed right into the rock face just below the ledge. This kind of jarred me some and took a little hide off my left elbow, but it really didn't hurt too badly, and after due exertion I was able to get on up to the ledge with Tommy pulling on the rope to help me.

Then we went exploring. You know, there are not many places left in this world where man has never trod, and here we were in one of them. This was a completely virgin cave, no one had ever set foot in it before, and here we were, treading where none had trod before. The thrill of adventure and conquest was felt by all.

The first thing we found was a dead indigo snake, quite ripe. It was a short distance away from the bottom of the pit, and had apparently fallen or had been washed down into the sótano. Surely some creatures must fall into these sótanos and become casualties, and here was one of them.

The passages seemed to be rather extensive, and were littered with a considerable amount of trash, sticks, and even larger pieces of wood that had been washed down by the floodwaters. Some distance along a passage, a large tree trunk had become jammed crossways, and behind this had been caught a great deal of debris, so as to make a perfect underground dam. It seemed so odd to see that there so far underground.

There were rooms and passages in

all directions, it seemed. We came into one room only about 35 feet in diameter, but it appeared to be about 100 feet high, and a large flat rock was lying right in the middle of the room. We shone our lights up along the walls of this room, and there were numerous formations that appeared like little balconies, rather like box seats at an opera or such, at several places up in the wall. From these formations white flowstone had formed, going down in wavy patterns and lines extending on down to the floor. It was quite beautiful, and we all admired it greatly. And we noted, stuck on the walls even up to 50 feet high, several sticks that had been left there by receding waters. We certainly hoped that no flash flood would come while we were in there. These floods must really be terrific to leave debris so high up, and also to wash great tree trunks around way down there.

We found no water here, so we went down another pit Bob found, a drop of about 50 feet. Some distance along a passage from this point we found some pools of water, and in this water were fish. These were not the blind cave fish that Bob had hoped for, but were rather gray in color and had eyes—the surface form of the fish that had become cave adapted and lost its color and eyes to become the blind cave fish. These were surface forms, and had obviously been washed down here from the top, and it seemed rather strange to find them here, 310 feet or more below the surface of the earth. We caught some of these in nets and put them into plastic containers we had brought along, and so had us some fish, even if not the blind fish. We also collected some white cave isopods there, looking very much like our sow bugs, of two different species. We also found several rather large brown millipedes, which we collected. I found six of these on one small rock perhaps 10 inches in diameter that was just above the surface of the water. Why these six were on that one rock I could not quite understand.

It was about time to get back out again, so we started up. The 50-foot climb wasn't so bad, but after getting up to the top it was hard to get out of the pit. Bob had tied the rope off to a stone column right at the edge, so it was rather difficult to get up over the edge. However, this was only a minor difficulty.

Soon we were back on our 12-foot ledge at the foot of the entrance drop. It would take us some time to get out of there, because only one man could climb out at a time, and the climbing out went quite slowly, not at all fast like the descent. Bob climbed on out first, and he seemed to go up rather easily, followed by Tommy. Next was my turn, and I wondered just how easy that would be. I needn't have wondered, because it really wasn't very easy. Ascending is done by a pair of Jumar ascenders, a couple of metal things that are applied to the rope and which will slip upward on the rope, but will not slip down on it at all, but grip it very securely. One of these ascenders is fastened by a rope or web strap of some sort to the seat, and the other had a longer strap on it that was looped about the foot. Thus, the strength of the leg was used to move up about a foot or a foot and a half, after which the seat ascender was then moved up as high as it would slip. The person climbing sat down, and all his weight was supported by the seat ascender and the foot ascender was slack, so then when the knee was bent the foot ascender could be slipped up the rope for another foot or foot and a half. Then the person stood up on the foot ascender again, and then slid up the seat ascender, and so on, thus gradually climbing out. It was infinitely easier than trying to climb hand-over-hand up a thin rope, but it was still hard work, and frequently I had to sit down in the seat and just hang there to stop and rest.

I wondered how I would do if my light went out, so I turned my light out and climbed up for a distance in total darkness, and it seemed to work fairly well. I concluded that I would be able to get out in the event of such a catastrophe.

The going was slow. In the first place, I had to climb for 10 minutes before I ever got off the floor. The rope was quite elastic, and I had to climb for a number of feet in order to get all the stretch out of the rope before it would actually support my weight up off the floor. I worked for a while and sweated quite abundantly, rested awhile panting, and then climbed some more. It took me 43 minutes to climb that 160 feet up to the top of that slippery green boulder, and it appeared to me that I never was going to make it. However, I

eventually did, and when I had gotten my ascenders off I hollered down to Rose that I was off the rope, so he could now start up.

I now started up the last 100 feet to the top, after I chased a small leopard frog around this little four-foot wide ledge I was on. I never did catch it, so I went on up. This went much faster than the other, and I could look up and see a bright moon about two-thirds full centered in the opening up at the top of the sótano. It was getting to be rather late at night, but of course down in a cave we had no concept of whether it was daylight or dark.

My hands had gotten very raw, and I had rubbed a blister in the climb up. I had not had to pull myself up on the rope, but whenever I straightened my leg I tended to fall backward, so I had to hold onto the rope to keep myself more or less vertical. Fortunately I had a big red handkerchief in my pocket, so I used this inside my hand as padding against the rope, and this worked much better. Perhaps not quite as well as a pair of gloves, but still quite well.

Eventually I reached the top, where the rope went over the edge of the entrance, and found that here another problem arose. How was I going to get up over the edge? I couldn't very well slide my ascenders up the rope where it was tight against the corner of the ledge with my full weight on it, but I certainly had to get out some way. I tried to pull the rope away from the rock, and promptly had my finger caught behind it, with my whole weight resting against it. This was not a very comfortable situation, but after duly groaning and muttering I was able to remove it from that painful position, and then gradually got up above the ledge and on out. It was a relief to be able to lie down on the rock near the entrance and relax a bit.

I thought Rose came up rather rapidly behind me, and after he came out we learned the reason. He said that while he was standing down there on that bottom ledge while I was climbing up 160 feet to the big slippery green boulder, he was in total darkness and imagining all sorts of things. He just knew that he could hear some monster almost breathing down his neck, some great big something with great big yellow eyes and long sharp fangs, and he was very ready to get out of there and

come on up.

We gathered all our gear together, and found our way on back to the car, still using our headlights so we could go along up the bottom of the arroyo to the power line, follow it back over to the fence, and then follow the fence to the car. It was a very good experience, and I very thoroughly enjoyed it at least three times as much as anybody else.

James, Tony, and Richard had today driven up in the Jeep and entered the Sótano de El Venadito and gone down into it. They had searched, but had not been able to find any fish that were critical for Bob's work. Somebody had once brought three blind fish out of this sótano and had sent them to Austin, but they had gotten lost, so there was now no positive record of them. On the way back the lights had gone out on the Jeep, so they had driven all the way back to Ciudad Valles with only a caving headlight to warn approaching cars of their coming.

Bill had not gone into any of the caves today, but had walked the Leon García area, a small village not far from Los Sabinos. Bill was making notes and observations on the geology of the area, and he was talking to the natives to see what he could learn about the sótanos around there. He learned that the one we had just been to was in the Arroyo de Yerbaniz, so therefore it was named the Sótano de Yerbaniz. The one southwest of there was called the Sótano de Matepalma, and the one south of it was called Sótano del Japonés. The two new ones we had found on the east side of the highway, southeast of the Sótano del Arroyo, also were known to the natives and had names. The one farthest to the southeast was called the Sótano de la Palma Seca, while the other one just northwest of it was called the Sótano de las Piedras. There was also another one there, a smaller one still farther to the northwest and near the Sótano de las Piedras, which was called the Sótano de Jos.

Thursday, 1-30-69. Bill and Bob and I went flying again, this time flying south to where the Río Valles joined the Río Tampaón, at the southwest end of the Sierra de El Abra, only a few hundred yards west of the highway bridge at El Pujal. We flew on over the Nacimiento del Río Coy, and then headed southwesterly to the village of

Aquismón. Here began a series of mountain ranges to the west that we wanted to cross. We flew through a pass in the first range of mountains, and beyond that there were a few foothills that were really the beginning of the next range, where the pass was much higher. I circled a couple of times to gain altitude, and then went through that pass into a fairly large but still somewhat rough valley beyond. We flew around this for a time, looking at some large sinks and possibly caves in the basin at the south end of the valley, and then we flew over a small village where apparently the entire populace turned out to stand there in the town plaza and stare up at us open-mouthed and wide-eyed. We wondered how many of them had ever seen a plane before. We knew we were getting into rather wild country, as this was the home of the Huastec Indians, and here they still speak Huastec, and it is unusual to find someone who can speak Spanish. This village was Tamapatz, on the south slope of a rather high mountain that still towered up above us, but situated on the flat top of sort of a little peak. We flew around on the east side of it, and there, up ahead, loomed the opening to a sótano.

"There's the Sótano de las Golondrinas!" announced Bob. This sótano is world-famous because it is the longest straight entrance drop in the world—1,094 feet straight down, without ever touching the side. The opening is not so large, but it domes out, slopes outward and downward from the entrance, so that the bottom covers an area of five acres. Everyone has heard of Golondrinas, and it was most interesting to see this natural wonder. We flew directly over the mouth of it, and it sort of unnerved me to look down into that enormous hole filled with awesome blackness. We made several passes around over this, taking pictures and just staring open-mouthed. We even saw a number of little birds flying around inside, the birds that give this sótano its name. Actually, these are white-throated swifts and not swallows, but the Mexicans call them swallows (*golondrinas*). These birds must be very poor parents, as what loving father and mother would raise their little family in a mud nest plastered to the side of a sheer undercut cliff face, and then when the young learn to fly, their very first step is 1,000 feet straight down?

We circled around in the valley some more, and over about two or three miles east-northeast of Golondrinas we found three other sótanos, all very close together, no more than a hundred yards or so apart. These also were brand new, completely unknown. These were all three situated on a little knoll, though one was on the southwest side of it, but these, like Golondrinas, were sótanos with no water drainage into them. [These pits are now known as Sótano de La Linja, Sótano de las Espeleólogos Perdidos, and Sótano de la Huasteca.]

There were quite a few clouds around, and some of these were quite low, at times even obscuring the top of the ridge directly east of these three new sótanos. On one of the passes by these three sótanos, we were headed due east directly at the ridge, and Bob and Bill were photographing out the left side of the plane. I had planned on flying straight east through a little notch in the edge of the ridge, but by the time I looked up again, clouds had formed, and the little pass was just barely visible, if at all. I decided I had better turn around, since there still seemed to be room, so I swung around to the left. Bob looked up ahead just as I turned and we disappeared into the cloud.

"Richard, we're going to fly right into that mountain!" exclaimed Bob, and looked at me kind of hard. He had looked up just in time to see the mountain disappear behind the cloud that we had disappeared into, so he was perhaps understandably worried. However, I thought I had everything all figured out, though just the posing of the question did make me wonder a bit. I held my course in my left bank and turn in the cloud, and soon, sure enough, we emerged, with the mountain dropping off to the right and behind us. Bob Mitchell was quite relieved to see this.

We now headed around to the north and then the west side of the large mountain just west of Golondrinas, and here found a nice long, straight little valley that we followed for some 15 miles. Then the mountains began to get more and more rugged, and we began to climb higher and higher in order to stay above the ground. We got up to 7,500 feet, and Bob began to get worried. He didn't like it up there and wanted to get out of there. I said okay, we'll go right around on the south side of the mountain west of Golondrinas,

as we could see over into that valley from where we were. There were a few clouds where we were, but they were quite numerous over toward the east, including hiding the peaks of some of the mountains between here and there. We wanted to explore that area anyway, so I was going to head right straight across there into that valley, but Bob said hell no, I won't go; those clouds could come down any time and sock us in solid, and we'd be screwed. And I guess he was probably right. Anyway, we retraced our steps up the long little valley, and then we flew about 10 miles north of there to find the deep, narrow canyon of the Río Santa María as it found its way rather laboriously eastward through the mountains on its way to the sea. We followed this downstream for a while, taking some photographs in all directions.

"Look at that waterfall!" exclaimed Bob. Sure enough, there was one of the most beautiful sights we had ever seen. The Río Ojo Frio (or maybe it was the Río Gallinas) was coming down from the northwest. It flowed and gracefully turned to the right around a little hill, and headed through some green pools straight south, directly at right angles to the Río Santa María. It leapt off a cliff that appeared to be several hundred feet high and fell in shimmering silver streams directly into the gray waters of the Río Santa María far below. The Río Santa María was in a steep canyon, and the opposite, or south wall of this canyon was covered with a thick verdant carpet of moss, as it was kept wet constantly by the spray of the beautiful falls. It was all completely virgin, with no hot dog stand or other junk to clutter up the truly enchanting scene. [This was Cascada Tamul.]

After circling for a time we continued on down the canyon, and about a mile downstream we found a resurgence on the left bank just above the canyon floor. Actually, there was no floor to the canyon other than the river itself, but this fairly large spring gushed forth out of a patch of lush vegetation and tumbled down in a short cascade of white and green to add its waters to the Río Santa María. It would have been very nice to be closer and get better pictures, but even I was not so foolish as to fly down into that deep, narrow canyon and find myself with no way to get out.

A short distance beyond, the river crossed a broad cultivated valley in a wide meander to the north, where it was joined by a river coming down from the north, the Río Tanchachín. There now remained only the high ridge of the Sierra de la Colmena to cross before reaching the coastal plain, and the river did so through a very well defined and conspicuous water gap. This was a deep cut perhaps a third of a mile in length, but with the very steep walls some hundreds of feet high, a rather spectacular sight. It was possible to look through the mountain range straight from one side to the other, and it was quite impressive. The river entered flowing white over a mass of extremely jagged rocks in its bed, and then near the east end of the water gap it disappeared under a natural stone bridge, the Puente de Dios, that went from one side of the canyon to the other. Right at the river's exit point from the water gap, there appeared to be a resurgence from the south side, as there was a pool of clear water in that side of the river. This was the Nacimiento de Agua Clara. We flew through this water gap a short distance below the top, but with a comfortable margin of several hundred feet from each wing tip to the canyon walls.

Then we were over the broad, flat, and intensively cultivated coastal plain, where the river meandered onward to the east to El Pujal, which we could see not too far away, with a highway bridge across it. Somewhere along here the river changed its name to Río Tampaón, but no one seemed to know where. Perhaps it was at its emergence from the water gap. Anyway, it seems to be certain that it is the Río Tampaón just west of El Pujal, where it is joined by the Río Valles from the north. Some hold that at the junction of these two rivers it becomes the Río Tamuín, and remains so in its course to the sea, but others maintain that it continues as the Río Tampaón for some miles and changes its name to the Río Tamuín somewhere nearer the coast. Who can tell what a river is named in Mexico? Some maps say one thing, some another, and the natives along the banks may have several different names for the same stream. Like the river that makes the beautiful waterfall into the Río Santa María—some say it is the Río Ojo Frio, while others maintain it is the Río Gallinas. Probably it is both. One can-

not be too specific about river names in Mexico.

When we landed at the Hotel Cova-donga, we had flown exactly 4 hours.

Francis and Tommy went to the Sótano de la Palma Seca and to the Sótano de las Piedras. They went to the general vicinity, but of course did not know how to get directly to the sótanos, so they asked a man who was plowing a field with an ox. This man was very accommodating, and he put his ox away so he could come along and show them the way. When they reached the sótanos they found their rope was too short, so they did not get to go in anyway.

Richard, James, and Tony went surface seining, catching a number of fish.

This evening at the Restaurante La Condesa we met another group of cavers, seven people from the University of Texas. Several of them were known to members of our group, so that, plus a common ground of caving, of course made us bosom buddies almost at once. This group was staying at the Hotel Jardin at the northwest corner of the plaza. Later another group of cavers also came in. Both of these other groups were just spelunkers, and were not doing formal research work on caves. However, spelunkers or amateur cavers have contributed a lot to cave exploration and general knowledge.

Tonight James, Tommy, and Tony went down to Cueva Chica, only a very short distance north of El Pujal and east of the highway, where they strung a Japanese mist net across the entrance of the cave and netted bats as they came out. They caught six different species, which made a total of eight different species that had ever been taken from this cave. One of these caught tonight was a naked-backed bat, and that was the very first record ever of this bat from the entire state of San Luis Potosí. This is a very strange-looking bat, and has no hair at all on its back. Inspection revealed a very odd arrangement of its wings, quite unlike that of any other bat. The wing bones come out of the side of the body as they normally do in a bat, but the wing membranes, instead of coming out from each side of the body the way they do in all other bats, in this species come out at the midline of the back, where they were attached to the spinous processes of the backbone. This of course gives the back the

naked appearance, since it is completely composed of the wing membrane. These membranes can be lifted up, and underneath can be seen the true back, which is normally hairy. A very nice record and specimen for our group. Tony skinned out a number of the bats they had caught, and spread them out on a box with pins until they dried.

Friday, 1-31-69. This was a no-fly day again. James Reddell drove four of us over along the field that the man with the ox had been plowing and let us out as far as he could drive. Then he turned around and drove back, saying he would return for us later. Francis Rose was our guide, since he had been there yesterday, and he now took us down through the brush along some little trails that were scarcely visible. Bob Mitchell and I were along, as was Bill Elliott, a good caver friend that Bob had recruited from the University of Texas bunch.

Shortly we reached Sótano de la Palma Seca, surrounded by jungle growth that nearly obscured it. Right beside the entrance was a huge tree, known as a *soyate* in this area. This strange monocotyledonous plant is very common in this area and grows from a big base five or six feet in diameter that rapidly narrows to a foot or so only about six feet above the ground and then divides into a number of branches, each ending in a tuft of long, narrow leaves approximately three or four feet long and maybe an inch wide. This is a *Beaucarnea*, probably *Beaucarnea recurvata*, a plant that is available in the nurseries in Texas and is usually called a pony-tail. We looked around and decided that this soyate was probably the best place to tie off. So Bob tied the end of the rope off on the soyate, hooked his descenders onto the rope, descended about 10 feet to where the main ledge was, and looked over the edge.

"Wow!" he hollered. "What a hole! Boy, are we going to need a finger-stomper here." Then he disappeared from sight. In a short time we heard him holler "off rope," so we knew the rope was ready for the next man.

My turn came next, so I fastened my descenders on and backed down to the ledge. I looked down just to see what it was like, and peering into such a yawning abyss was enough to shiver

anybody's timbers. I saw what Bob meant, as the sight certainly did make me want to hang on to the edge of that ledge. No man in his right mind would do such a ridiculously foolish thing as going down into such a pit trusting everything to the integrity of that 7/16-inch rope. However, I forced myself to go over the edge and started down.

Once over the edge, it wasn't bad at all—in fact it was downright enjoyable. That's kind of the way a parachute jump is, too. This was a very green sótano, and the walls where I touched them were slick as glass. It was a drop of 135 feet down through this deepening green gloom, until the boulder-strewn bottom was reached, the bottom on which mortal man had never before set foot until this day. We walked in a southwesterly direction down a slight incline for perhaps a hundred feet, and there found a large pool of water, complete with blind cave fish. It was quite unusual to see them so soon. This was my first time to see cave fish in the wild, and I made due note of it. We caught a number of these fish, and put them in plastic gallon bottles to take back up to the top. It seemed quite strange to find the cave fish here, so close to the entrance drop that we could see light from where they were.

Just to the east was another room, also with a pool that contained blind fish. Over this room there were a number of vampire bats in recesses in the roof and sides, and since light disturbs vampire bats very quickly, many of them were soon flying around through the air. I photographed a number of them on the wall and ceiling, but this was quite difficult to do since they would not stay put long enough. I was warned to be very careful of them, since they are great carriers of rabies. I was able to catch one and put it in a small bag to take to the surface.

Neither of these rooms apparently extended in any direction. The first and larger one that we had entered might have had a passage going to the west, but if so it was under the water, and we were not equipped to go submarine.

Back at the entrance, we sat around on the boulders for a while, rested, and enjoyed the view looking up out of the shaft. It was a long view up to the top, and on the wet, mossy green walls the light overhead was a very pretty view. There was a lot of water vapor in the

air, in fact like a small cloud in the shaft up above us.

"Good gosh, look at that!" exclaimed Francis, as he pointed to a large boulder that up to a second before had been only about three feet from me. We looked, and there was a fer-de-lance, the most dreaded poisonous snake of all Mexico, coiled up on the boulder looking at us quietly. We had intruded upon his privacy, but he said not a word. We gathered around and looked at it with interest. It was a beautiful snake about four feet in length, with the markings quite clear on its body, though it was starting to shed, and the old skin of the head had folded back onto its neck. It stuck out its tongue occasionally as snakes are wont to do, but it made no effort to crawl away. It looked somewhat thin, as though it might have been here some time after having fallen down from up above, and it would surely die here of starvation or drowning after a heavy rain. We wanted to take it back with us, but we had no suitable sack to carry it in, so we did not catch it. Instead, we took a number of photographs and left it as it was.

Now we had to climb out. This was not such a hard task, and it seemed to go much easier than the ascent out of Sótano de Yerbaniz. Of course it was work to climb, but it wasn't really bad at all, and I made the 135 feet in fine shape. Naturally, it didn't bother any of the others either.

I was the first one up, so I looked around to see what I could see. A brown jay flew across over the sótano, as did a lineated woodpecker. I chased some sort of goatsucker up in the heavy brush of the arroyo, but I could not see it well enough to identify it or tell very much about it. It was probably a pauraque. There were several kinds of orchids and bromeliads on the trees around us, and I wanted to take some of these back with me, but did not have room. I noticed also that there was quite a bit of long slender cactus growing around there, one of the kinds that blooms at night and that I had in my collection at home, but I did not know the name of it.

When everyone was out, we put all our things together and went on. Francis had learned well the day before, and he led us directly along a trail over to the Sótano de las Piedras. Here we rigged up for descent, and I tied off the line to a tree, using a water bowline, but Bob

wasn't acquainted with this knot, and he changed it to a plain bowline. He said a bowline had never failed him, and he did not want to try a new knot now.

The Sótano de la Palma Seca had been a new virgin cave, one never before entered by man. The Sótano de las Piedras was also, and now I was the very first one to go into it. Or rather, I started to go into it. There was a series of small ledges to go over before actually starting the drop, and when I got to the last ledge, I let more slack up on the rope, but I wasn't going down. I found I was hanging on the edge of the ledge with my descenders caught in a small crack in the rock. I could not go up and I could not go down, so there I hung. I knew that it would be a relatively simple matter for me to jerk suddenly on it, and it would come off, but I also knew that this would give me a jerk when I fell about a foot, and I could just not force myself to do this. I had to call Francis down to kick me off, which he did, and I did catch my breath at the sudden short drop and jerk to a stop. However, all was now well, so I went on down. The drop was about 80 feet, and about a third of the way down there were some rooms opening off to the southeast, but though they were large, they did not appear to go anywhere.

When I set foot on the boulder-strewn floor, I looked around and realized that no man had ever set foot there before, and I was seeing things that had been here for generations but yet had never before been seen. Soon the others joined me, and we went down to the south along a rather large passageway, where we found some dips in the floor and some large logs to climb over.

Suddenly, there in a part of the floor where there happened to be an area of dry mud, I found another fer-de-lance, coiled up very neatly into a little saucer-shaped arrangement. This was a little one, only about two or maybe two and a half feet long, but it appeared to be in better color than the other one, and it was not shedding. We resolved to catch this one, but we left it alone for the time being while we went on up ahead. About 100 feet farther along, we came to a good-sized pool of water, and here were some cave fish. Some of these were quite large, and they were also quite plentiful, so that we had no trouble at all catching enough for our needs.

We came to one spot where our

passage was blocked by a deep pool of water with no way around. However, we wanted to go on beyond, so we took our clothes off and swam on across. The swim in the cold water was indeed refreshing, and on beyond we went along for some distance more, finding cave fish in a number of pools. The large passages seemed to go on and on.

It seemed as though the cave would be contaminated by outside influences when the floods brought all the dirt and debris into it. But actually that is what made the cave alive. All these creatures down here in the cave have to live on something, and of course they must live on organic matter. When it floods and all this stuff is washed into the cave, it is like bringing in a new supply of groceries for the table. These floods must come and furnish food for the cave, for otherwise the cave would die.

We looked around some more, and found that this rather large passage continued on for an undetermined distance. We did not explore very far, but returned toward the entrance. I stopped to photograph the little fer-de-lance, and then captured it by suddenly putting my hand right down on it so that I pressed the head down to the ground. It was then a simple matter to get my finger around the neck and stuff the snake into my sock that I had removed, after which I went on to the entrance.

We all climbed out without any undue incident and in rather short order, since it was only about 80 feet to the top. Most of the time we were swinging out in the open and could not touch the wall, so we felt more than ever dependent on our little thread up above us.

As we were getting our gear ready to march off again, we heard a little popping noise out in the jungle, sounding off intermittently and seeming to come closer. Then we saw two gringos come walking up, and who should they be but Bill Russell and Tommy Albert. They were in the vicinity doing some ground work on the geology and geography of the area and just dropped by to see how things were going. They happened to find us just as we were leaving the cave. Each of them was carrying a small stick, and the popping sound we heard was made when they hit their pants legs rather sharply with the stick. No, this was not to scare the lions away, but to keep the ticks away.

This area around there was very heavily infested with *pinolillos*, very tiny little ticks that made up for their small size by their very great numbers. Sometimes an area several inches in diameter on the clothing would be completely covered with these little *pinolillos*, as they got on when the host passed leaf or twig on which they were crowded awaiting just such passage. However, they could not hold on very tightly, and when the clothing was popped with a stick, almost every last one of them would fall off. The natives around here did this all the time, and the green gringos were not so dumb that they could learn nothing from the natives. Every night we always had some of these *pinolillos* on us anyway, but a shower would wash most of them off. Those that were not washed off would crawl around on the body, where we could feel them, but often they were so extremely tiny that we could not see them except with a magnifying glass. Some were large enough to see with the naked eye. They did not seem to attach too readily, but when they did, it caused an itching spot.

Bill and Tommy walked us part way back to where our Jeep was supposed to be, but then they went on their way. Francis was our fearless guide back toward the Jeep, and he did very well, only got mixed up once. That was quite good for having been in this area only once before in his life. We were trying to hurry, since it was getting rather dark now, though the almost full moon was rising in the sky and would give us some light. James was there with the Jeep all right, but he had been waiting for a time, and had walked part way along the trail toward the sótanos. He had just about made up his mind to return to the Jeep and leave, when he heard voices, so he waited for us. We thought that was very nice of him.

Bob drove the Jeep back over the very rough road, and we riding in the back seat had to hang on to keep from sustaining bodily harm in some way. He said the Jeep had never been turned over, but it must have come very close tonight, because once we were leaning over toward the right so far that it seemed surely it would be past its center of gravity, Bob made those in back get out so that it would not turn over. Then as we bounced along a short distance farther, the lights went out, so we had to finish the drive back nearly

altogether by feel. And we drove the several miles into Ciudad Valles using our cave headlights to warn other cars.

Bill, Tommy, James, and Richard had used the Jeep during the day to drive up the road to Cueva Pinta, a straight, very rough trail of some six miles that extended to the east to a cave directly in the side of the Sierra de El Abra. Since this was a *cueva*, it could be walked into, and no gear was necessary. In the debris on one side of the cave, they found a human tooth. During the drive they spotted a boa near the road, and Tommy jumped out and caught the nice five-foot specimen. He now showed it to us, and it was indeed a very fine snake, with the very conspicuous blue iridescence of the skin. They drove farther, and talked to some men they chanced to meet along this trail. These men said that boas were common here, and several could be caught almost any night. Tommy asked if there were *martas* (kinkajous) around there, and the man said yes, there were quite a few. However, the custom was to kill them whenever possible, because they ate the tongues out of cows. I wonder how such a foolish story got started? A more completely harmless and cuddly little creature would be very hard to find.

They also asked a man if there were sótanos in the area, and the man said oh yes, lots of them. Well, were there any right around here? Oh yes, there were. Well, would you show us one? Yes, of course, and he led them about a couple of hundred yards through a grove of soyate trees to a very fine deep sótano. It apparently had no name.

We also learned that Tony and the other six of the U.T. bunch (including the one girl in the group) had gone back to the Sótano de Yerbaniz. Lo and behold, they had gone down and found cave fish, which we yesterday had not been able to do. However, they must have gone down a little deeper in a slightly different area than we did, since it was a rather complex cave. They had gone down a total of four drops to find these fish, and they brought back a good collection. The girl had gone down only two drops, which was 260 feet, and they said she was a good caver, but when the bats began to fly she sure was worried about them getting into her long hair.

As we were walking down the street to the restaurant tonight, the topic of

conversation drifted to how muddy and dirty caves are, and hence how scroungy cavers always look. For some reason, they singled out James Reddell and began to talk about him and how dirty he was. Someone said that James was so completely scroungy that of all the people he knew, James was the only person who could go into a cave and get the cave dirty. At that, James turned around and gave the speaker a dirty look.

Saturday, 2-1-69. This morning the topic of conversation drifted around to the use of caving gear, and especially to the position of the ascenders. Some people believe that the position of the two ascenders on the rope should be with the foot ascender above the seat ascender, while others hold that it is better to have the seat ascender over the foot ascender. Bill was rather definite in the way he wanted it, and he said that's the way God made us, to use the foot ascender over the seat ascender.

We were due to leave today, but Bob decided he didn't have enough fish out of Sótano de Yerbaniz, so he asked for volunteers to go back into that hole again and get some more. Tommy and I had to leave and fly the plane back today, so we couldn't go, and no one else much wanted to volunteer either, since it was a long hard pull and everyone seemed rather tired. However, he got Bill to go with him, and they drove off up the road in the Jeep to get more fish out of the Sótano de Yerbaniz.

The others drove us out to the plane at the Hotel Covadonga, where we gassed up and made ready to leave. We decided to look at our boa again, so we put it out on the ground, and admired it for a time. I decided I needed some pictures of it, so I broke out my camera and took a number of shots of different poses.

We took off, and I showed Tommy some of the things that we had been seeing from the air while he was down on the ground. We flew over several sótanos he had been into, and he said they sure did look different from up here. It is an entirely different perception of what's down on the ground when one can see it from the air.

I knew he would be very interested in seeing the Sótano de las Golondrinas, so I headed over to Aquismón to go on across the mountains there. However,

the clouds were too low, and I did not feel it wise to try to go over the mountains when only a little crack at the very bottom of the pass was visible. We flew on north up the range, and by the time we reached the water gap of the Río Santa María the clouds had thinned out considerably, so we flew through that and Tommy had a real good look at the canyon. Then a short distance farther I showed him the spectacular waterfall, and he was very duly impressed. It was indeed a beautiful sight.

I then aimed the plane south, into the valley that contained the hole in question. There were some clouds in it, but it appeared that I could get in all right, so we flew on down near the mountains on the east side of the valley and over the three new sótanos that were right close together. He thought they looked very good. Then, I circled around under the clouds to the south of the valley and headed up the west side, but I was wondering whether or not we would get to see the great cave after all. There was a cloud bank in the area right where the sótano was, and it might keep us from it. As we got closer, the open mouth of Golondrinas came into view, and I pointed to it and asked Tommy what he thought that was. He looked, and a broad grin came on his face as he said, "Golondrinas!" He knew of this very famous cave, and he had seen pictures of the entrance, so he knew right away what it was.

The clouds were down on the ground just to the left of the sótano and very close to it, and right over the sótano they appeared to be only about 50 feet or so above the ground. A very tight squeeze, but I thought we could make it. I headed right over the cave, and we looked right down into the black depths. "Gosh!" said Tom, and he was very much impressed. He also saw the white-throated swifts or *golondrinas* flying around inside the entrance. Once we had gotten on across it all right, we continued on our way, as I did not think we should mess around and try to make another pass over it in these conditions.

We went on over to the Sierra de El Abra and along its top, looking at the large sinks and some of the sótanos we had found there. Up toward the north part of the El Abra, I knew we were coming to the tremendous sink, the Caldera, but I said nothing to Tommy about it. We were flying quite low, and

I arranged to pass just to the left of it, so it would be on Tommy's side. Soon I spotted the edge of it up ahead. "¡Caramba!" exclaimed Tommy. He was certainly much impressed by this also, and we made several passes over it, looking at the undercut south end and also at the huge trees growing on its floor, trees whose tops reached only about half way to the top of the sink. We wondered some more about the jaguars that must surely be in there.

We also flew over Bee Cave in the foothills of the Sierra de Guatemala, and then over that exceedingly rough grunge just east of it. Tommy seemed to think it was just as rough and uninviting and attractive as I did, and we had to take another picture of it.

We landed at Ciudad Mante to refuel, as we were sure we would not have enough to get back home on. We had to pay the guy at the airport another ten pesos for "donation" for maintenance of the airport, but I guess that wasn't too bad. After all, it was only eighty cents.

We now headed northeastward, and after some miles of desert we began to get into a rather large mountain mass, the Sierra de Tamaulipas. This was quite rugged, and showed us some rather spectacular scenery, too. The peaks got higher and higher, and we had to get up to 6,000 feet in order to clear all of them. There was one high mesa in the middle of the mass, a high flat

area topped by a caprock that was broken in the edges into high palisades which looked very pretty. The flat top had several small lakes on it, and there were also some people living here.

On the north side the land dropped down into more desert and was very rugged and characteristic of a mature mountain system, worn down into deep ravines that were just beginning to meander and get some width to them. Still farther to the northeast, we came over a large river, the Río Soto la Marina, which opened into the Gulf of Mexico right at the point where we hit the coast. Here we turned due northward, just as the sun was setting in the quite nice display of red and yellow color and shades of pink and purple.

We cruised on over the broad barrier beaches and the endless expanses of tidal mud flats behind them, but of course soon could not see them because of darkness. Eventually we were able to pick up the Brownsville radio up ahead, and then found that city and its airport all right, where we landed.

We had to go through customs and immigration here, and everything seemed to be in order except for our vampire bat. They said it was positively *verboten* to bring any vampire bat into the United States. A number of phone calls were made and different officials in different places talked to, and finally we had to kill the bat by sticking it into a bottle of alcohol, and then they said

it was a preserved specimen so they would let it pass. It kind of hurt us to kill this vampire bat, especially since its last meal had been my blood. I had bought a syringe in Ciudad Valles and taken 10 cc of blood out of my arm vein with which to feed it.

We were finally cleared, so we took off again, heading northward into the darkness. Tommy did most of the flying here, but he didn't seem to like it too much, and it especially bothered him when clouds and fog began to form and he couldn't see very well. We had received radio information that the weather was fine, but it was certainly rather bad along here, and the last 50 miles or so we flew quite low, just barely under the clouds and only several hundred feet above the brush. When we landed at Kingsville, the airstrip was still visible, but there were clouds directly on the ground all around it, and if we had been only a few minutes later, surely it would have been socked in solidly, and we would have been caught without a perch. We had been flying 6 hours, which made a total of 25.6 hours for the expedition.

We unloaded the plane, got in our car, and drove the short distance on up to Alice. This had been a very memorable and, we felt, worthwhile expedition, one that we had enjoyed and one in which a rather considerable amount of knowledge had been gained.

La Gran Expedición a la Sierra de El Abra

Durante un viaje en 1969 para estudiar cuevas y recolectar especímenes biológicos, se utilizó un aeroplano para buscar cuevas en la Sierra de El Abra, San Luis Potosí y Tamaulipas. Dos cuevas nuevas fueron descubiertas y exploradas, y muchas otras posibles cuevas en la parte superior de la sierra fueron ubicadas.



Photo

FIG. 29. CAVE EXPLORER, WITH GAS LAMP

W. Burrows.

from *The Complete Hill Walker, Rock Climber & Cave Explorer*, by W. T. Palmer, F.R.G.S., published by Sir Isaac Pitman & Sons, London, in 1934.

