AMCS
ACTIVITIES NEWSLETTER

Number 32 June 2009

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

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

This issue was edited by Bill Mixon, with help from Oscar Berrones, Yvonne Droms, Laura Rosales-Lagarde, Rodolfo "Fofo" González, and Al Warild.

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

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Front cover

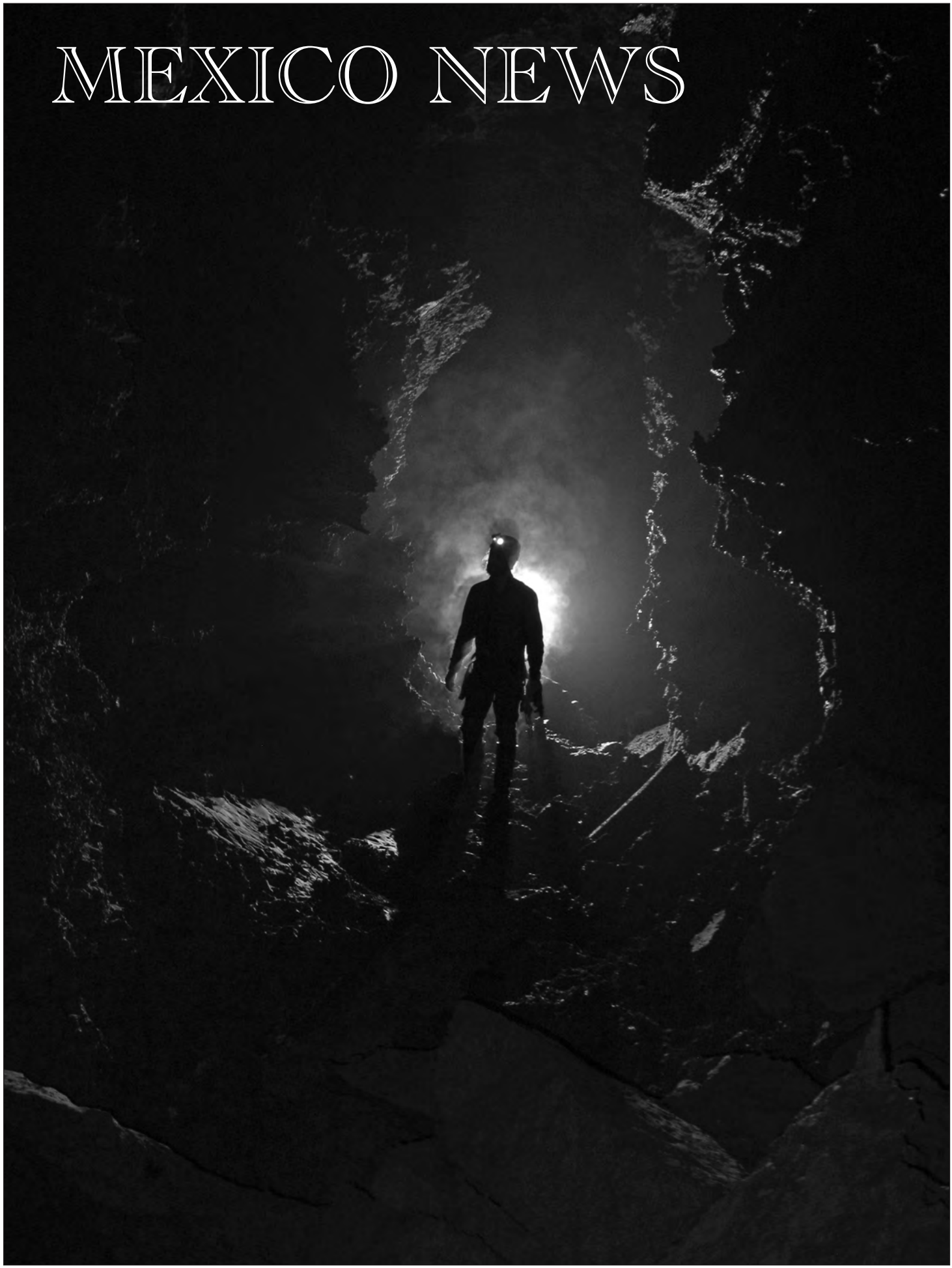
Vicente Loreto in El Boquerón de La Palma, Veracruz. Photo by Gustavo Vela.

Back cover

Hector Cahun, Adrian Martínez, and Tania Ramírez in one of the many entrances to Sistema Pool Tunich, Quintana Roo. Photo by Gustavo Vela.

CONTENTS

MEXICO NEWS



Guillaume Pelletier in Calle Sierra Negra, Akemabis, Puebla. *Gustavo Vela*.

MEXICO NEWS

Compiled by Bill Mixon

BAJA CALIFORNIA AND B.C. SUR

There is a short illustrated article on rock art at **Cueva San Borjita**, Baja California, and **Cañon de Santa Teresa**, San Francisco de la Sierra, Baja California Sur, at http://www.oztotl.com/ps/reports/CavePaintings.pdf. The article is by Peter Ruplinger. *Source*: Peter Sprouse.

CHIAPAS

Issue number 2, for 2005, of *Bolom: Revista del Centro de Investigaciones Frans Blom*, published by the Asociación Cultural Na Bolom in San Cristóbal, contains an article with maps of small caves around **Laguna Metzaboc** in northeastern Chiapas. The article is by members of Grupo Espeleológico Jaguar in Tuxtla Gutiérrez. The issue also contains an article on the rock art in those caves. A PDF file of the magazine is at http://www.nabolom.org/revista/BOLOM2.pdf.

Abstract: Bat Diversity in the **San Francisco Cave**, La Trintaria, Chiapas, Mexico. By Carlos Chávez and Anna Horváth.

Bats occupy a great variety of roost sites during their diurnal refuge, for reproduction and breading activities, like hollow trees, leafs, rocks, buildings and caves. The 45% of Mexican bat species (60 spp) use caves roosts like obligated or alternative cave-dwelling species. The San Francisco Cave in the municipality of La Trinitaria in the state of Chiapas, is considered one of the most important bat refuge in Mexico but there have not existed complete and actualized information about the bat fauna of this cave. We conducted a bat survey from January to October, 2005, in order to identify the bat species richness, relative abundance of each species and the temporal changes on diversity and utilization patterns of the cave. Bats were captured with mist nets at the cave entry during two nights in each month. Captured animals were identified and marked with temporal marks, and were released after taking standard body measurements, age class and reproductive data.

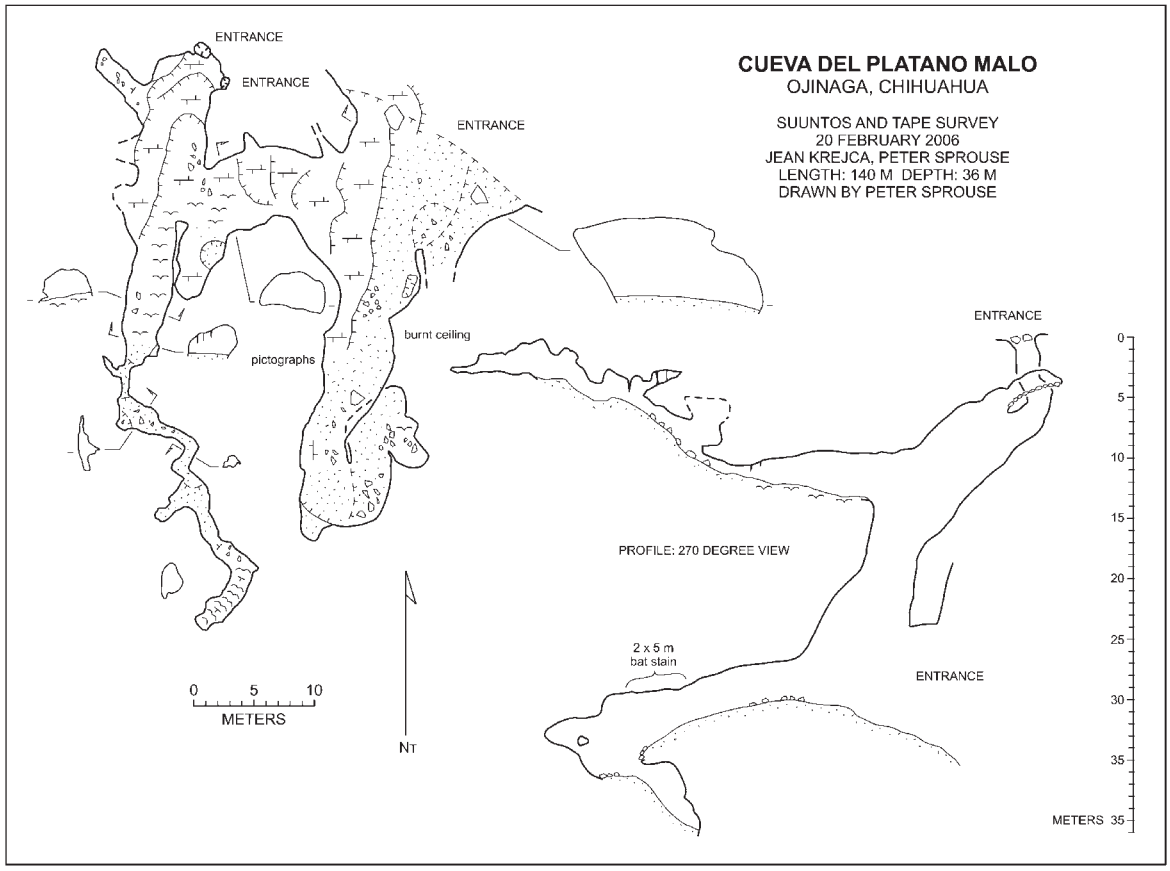
We captured 1035 individuals of 16 accumulated species from four bat families (Chiroptera: Mormoopidae, Phyllostomidae, Vespertilionidae, Molossidae). Richness varied among sampling months recording lower species number in February (7 spp) and higher richness in April (10 spp). Seven species (*Pteronotus parnellii, Artibeus jamaicensis, A. intermedius, A. lituratus, Glossophaga comissarissi, Desmodus rotundus, Tadarida brasiliensis*) are considered resident in the cave due to their stable presence in all the sampling months; this species have all their life cycle in this cave. The other species use the cave temporally like alternative diurnal roost or like reproduction site. Relative abundance was fluctuating, and we encountered breeding (pregnant or lactating) females in case of 12 species, which use the cave like a secure roosts in their breeding season. Our results affirm the high importance of this cave for bat conservation: 1) it is the most bat-diverse Mexican cave known at the time, basing on both richness and abundance; 2) in this cave roosts the unique known big colony of the migrating Mexican free-tailed bat (*Tadarida brasiliensis*) in South-Mexico with an apparently resident population; 3) Is a breeding refuge of almost 12 bat species. Also taking account the actual perturbation and contamination of the cave by the human activities is urgent to find out viable managing alternatives for the conservation of the San Francisco Cave.

Source: abstract for poster paper at the Ecological Association of America's 2008 Annual Meeting, http://eco.confex.com/eco/2008/techprogram/P12627.HTM.

An Italian-Mexican expedition to the **Sistema Río La Venta**, Chiapas, was held from April 5 to 16, 2009, directed by Tullio Bernabei. During this expedition thirty cavers from Italy, Romania, Spain, and Mexico participated in the 13-kilometer traverse of the cave, doing photographic documentation, exploration, and surveying of the passages found along the way. The nationalities involved shared the data obtained. The expedition was made possible thanks to excellent relations with the *municipio* of Cintalapa, and the expedition involved the local community by hiring local people for various tasks.

For years, the Associazione La Venta has been making the local community aware of the deforestation problem. Thanks to contributions from numerous sponsors, they have acquired some hectares of land to create a speleological reserve. Reforestation of this land, which contains dozens of cave entrances, has begun and will continue in coming years.

Source: Posts by Jorge Paz to the Iztaxochitla e-mail list, summarized in English by Laura Rosales. The Italian map of the cave from the early 1990s is in "Mexico News" in *AMCS Activities Newsletter* 23. A long


ENTRANCE
ENTRANCE
ENTRANCE
CUEVA DEL PLATANO MALO
OJINAGA, CHIHUAHUA
SUUNTOS AND TAPE SURVEY
20 FEBRUARY 2006
JEAN KREJCA, PETER SPROUSE
LENGTH: 140 M DEPTH: 36 M
DRAWN BY PETER SPROUSE
pictographs
burnt ceiling
ENTRANCE
PROFILE: 270 DEGREE VIEW
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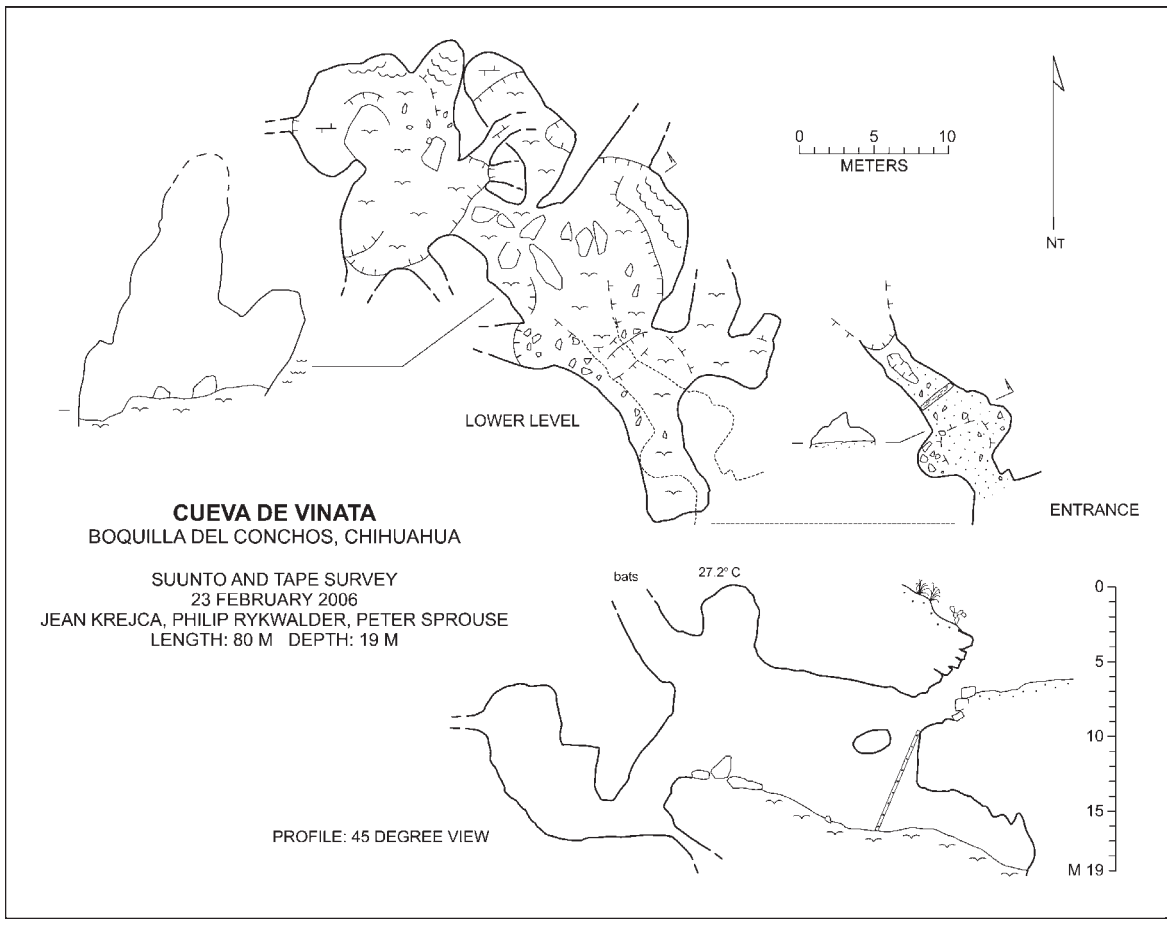
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BOQUILLA DEL CONCHOS, CHIHUAHUA
SUUNTO AND TAPE SURVEY
23 FEBRUARY 2006
JEAN KREJCA, PHILIP RYKWALDER, PETER SPROUSE
LENGTH: 80 M DEPTH: 19 M
bats
27.2° C
PROFILE: 45 DEGREE VIEW
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15
M 19

article on this latest expedition has been written by Jorge Antonio Paz Tenorio of the Grupo Espeleológica Vaxakmen to be published in *Kur*, the semi-annual magazine of the Associazione La Venta.

See also **Cueva La Joya** under Tabasco and item on Tláloc 2008 expedition under Puebla.

CHIHUAHUA

The naturally mummified remains of a human found in a dry cave in Chihuahua was found to have the bacteria *Helicobacter pylori* in its stomach. This bacteria is the main cause of stomach ulcers, and its discovery in the mummy dating from about 1350 shows that the disease was not brought to the Americas by European explorers. The lead author of the technical paper is Yolanda López Vidal of UNAM. *Source*: www.cosmosmagazine.com/news/2084/mummy-with-a-tummy-ache, citing an article in *BMC Biology*, abstract at http://www.biomedcentral.com/1471-2180/8/119/abstract.

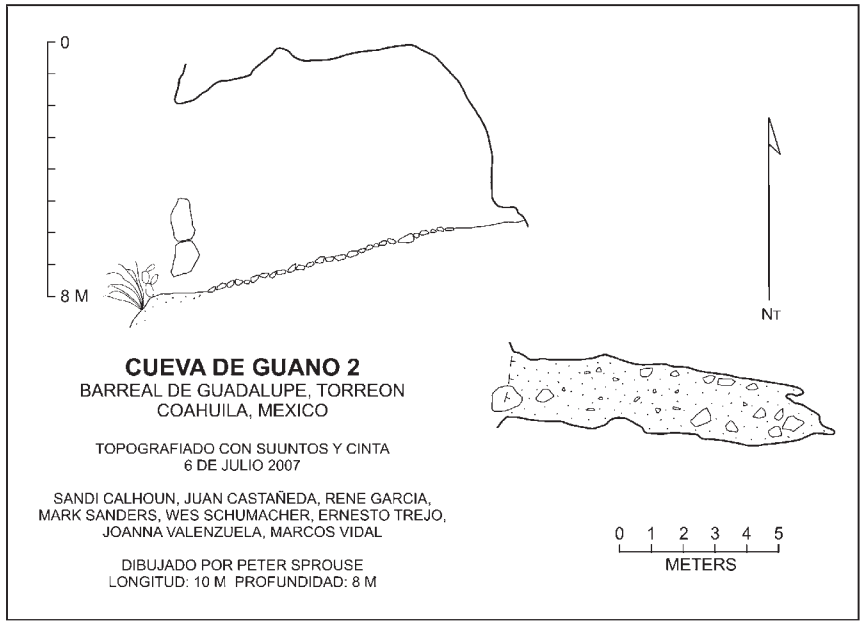
Cueva del Plátano Malo, Ojinaga, and **Cueva de Vinata**, Boquilla del Conchos, were surveyed during a trip reported in an article on pages 66–70 in *AMCS Activities Newsletter* 30.

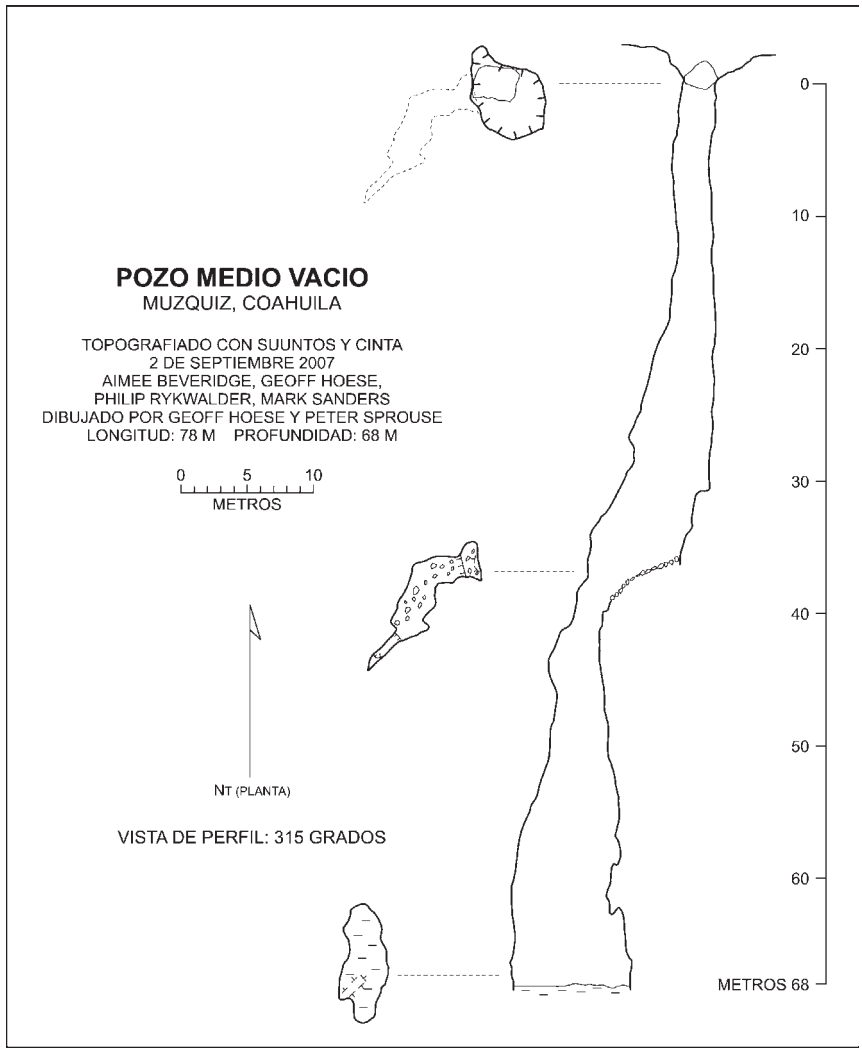
COAHUILA

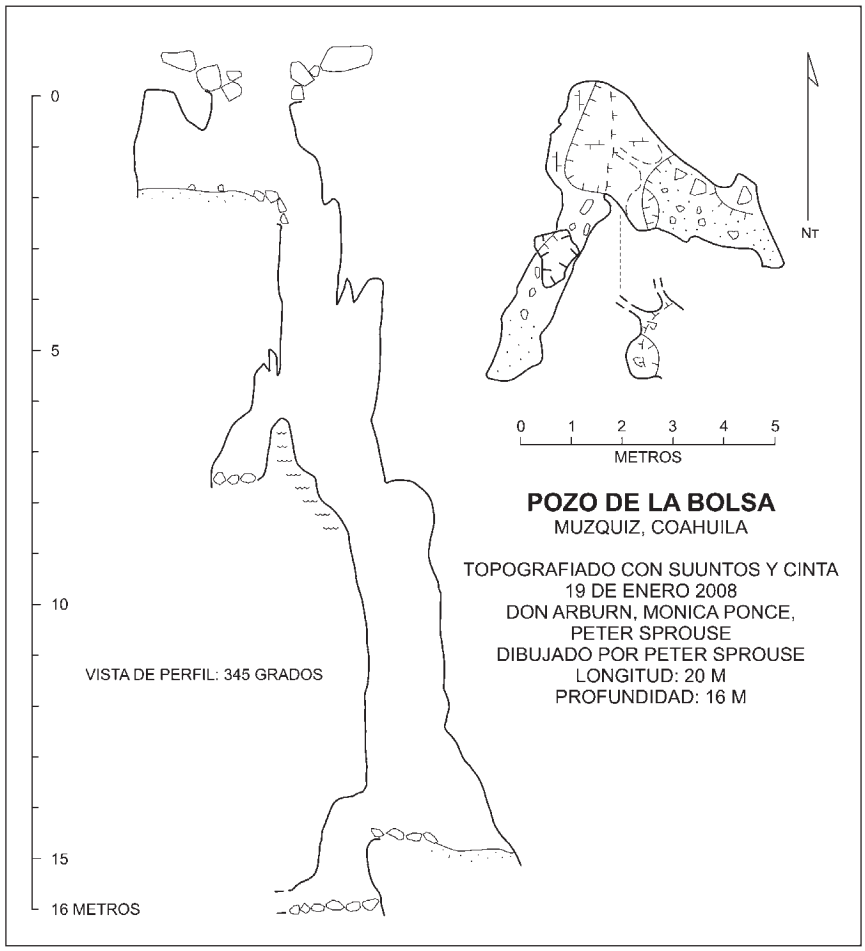
Cuevita del Borrego and **Cueva de Guano 2**, both Barreal de Guadalupe, Torreón, Coahuila, were surveyed during EspeleoCoahuila 2007. See page 7 in "Mexico News" in *AMCS Activities Newsletter* 31 for other maps from that event. **Pozo de la Bolsa** and **Pozo Media Vacío**, both in the Múquiz area, were surveyed during the trip reported in an article on pages 157–161 of number 31.

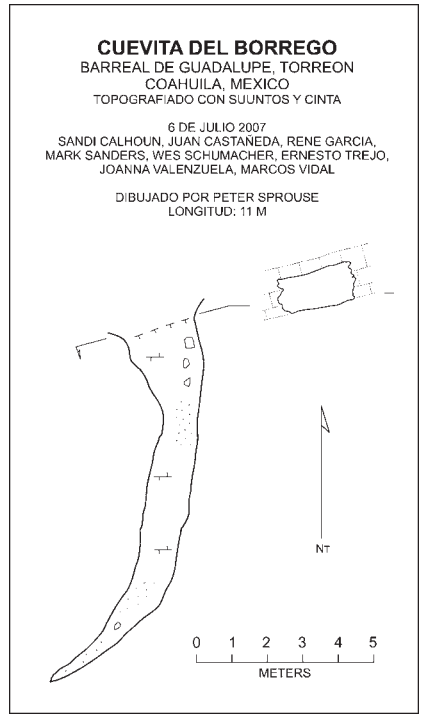
Abstract: 3D Data Collection for Characterization of Bat Habitat. By Aaron Addison and Peter Sprouse.

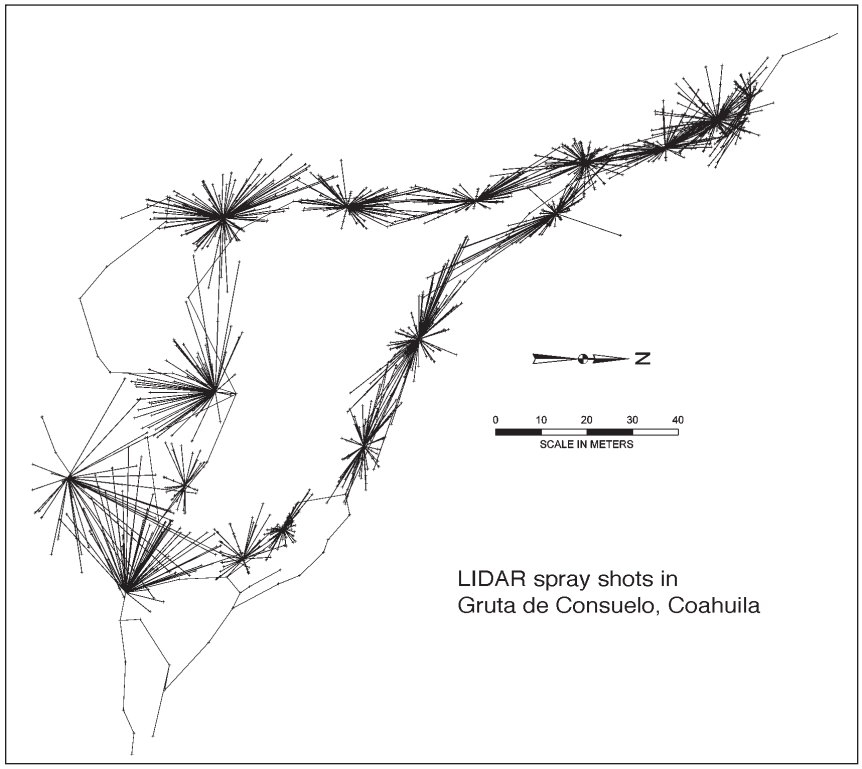
Ground-based LIDAR (Light Detection and Ranging) units currently are too costly and bulky for effective use in the cave environment. A tripod-mounted Impulse 200 laser rangefinder system allowed us to collect over 1,200 3D data points in just three days of field work. All











data points were entered into the WALLS cave survey program and exported to a GIS for creation of a 3D model of the cave environment. The finished product was viewable in both Acrobat 3D PDF format as well as Google's SketchUp software. Future projects include the ability to digitally transfer data while in the cave and incorporation of traditional survey techniques for fine tuning the 3D model.

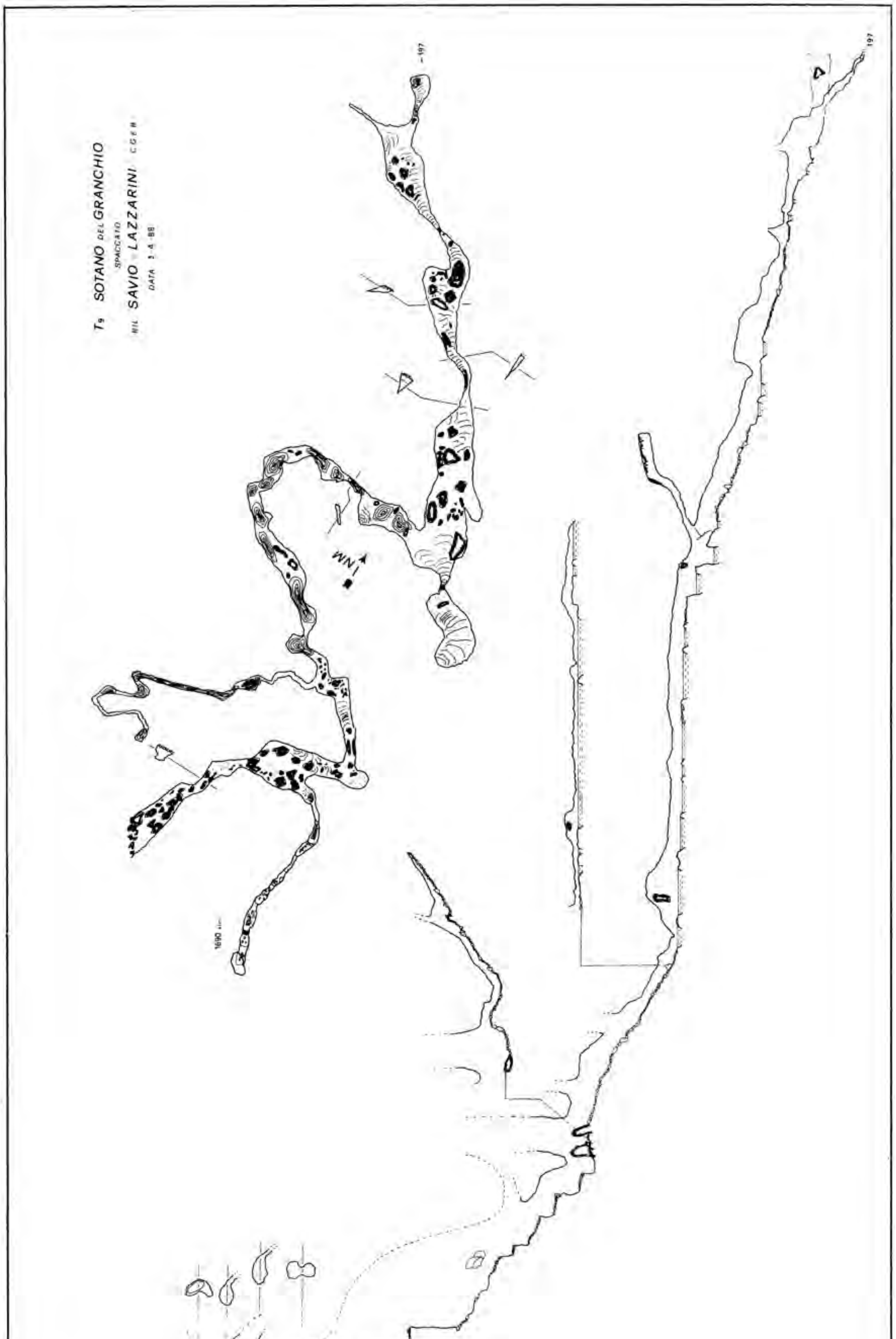
Source: Full paper is in *Proceeding of the 18th National Cave Management Symposium* (2007), pages 13–16.

GUERRERO

The table of caves explored by Italians in Guerrero during 1988 is from *Progressione* number 20, December 1988, as is the map of **Sótano del Granchio**. An article on the expedition appeared in *AMCS Activities Newsletter* 17, but the table there did not contain location coordinates, and the Granchio map did not have the profile. Neither version of the map has a scale bar; perhaps the scale can be inferred from the depth.

Abstract: Biospeleology of Juxtlahuaca Cave: 20 Years Later. By Gabriela Castaño-Meneses, José G. Palacios-Vargas, Elena Torres-Puga, and Marcos Mohar-Fresán.

The Cave of **Juxtlahuaca** is one


T9 SOTANO DEL GRANCHIO
SPACCATO
RIL. SAVIO - LAZZARINI
DATA 1-4-88
NM
1690 slm
197

of the most interesting cave systems in Guerrero State, Mexico. Because of the speleological formations, the archaeological ruins in this cave have been used as a tourist attraction, and they have many visitors each year, and it has been modified to make the access easier for the tourists.

A total of 99 species (including protozoa, arthropods and mammalian) was recorded from this cave during the studies performed during the 1980s. It included 40 new records for the cave and some new species for science.

After this period, the biospeleological studies were stopped, and to make the cave access easier for the tourist to visit, several works were done, including stairs, masonry, and the installations of electric wires to illuminate it. These changes have affected the natural conditions within the cave. Actually the electric installations are not in use any longer, but the wires have been there for the last 15 years.

NOME	SITUAZIONE		quota	prof.	lungh.
T 1	99°06'15"	17°29'03"	1670	17	48
T 2	99°07'52"	17°29'03"	1620	5	16
T 3	99°06'57"	17°28'59"	1630	23	245
Cueva Sacrificale	99°07'53"	17°29'03"	1620	14	100
Cueva de Teposonalco	99°07'25"	17°29'15"	1630	3	27
T 6	99°07'50"	17°29'04"	1630	11	20
T 7	99°06'55"	17°28'02"	1660	30	12
T 8	99°07'30"	17°28'57"	1635	3	49
Sòtano del Granchio	99°06'52"	17°28'02"	1690	197	700
Sòtano delle Liane	99°06'45"	17°28'37"	1710	238	492
Cueva de Aclitengo	99°08'48"	17°29'07"	1350	5,8	36
T 12	99°06'57"	17°27'48"	1700	19	13
T 13	99°08'02"	17°29'32"	1545	39	10
T 14	99°06'51"	17°27'44"	1740	26	8
Cueva dei Szinclan	99°06'52"	17°27'57"	1720	71	138
T 16	99°06'04"	17°27'37"	1700	19	9
T 18	99°06'52"	17°27'58"	1740	70	228,5
Cueva del Puma	99°41'32"	17°32'45"	2660	94	310
Resumidero de l'Agua	99°39'56"	17°31'46"	2580	180	375
Gr. a S del Cerro Prieto	99°39'49"	17°31'28"	2585	30	55
Resumidero del Mescal	99°38'32"	17°30'38"	2210	41	105
Resumidero dei Vampiri	99°40'01"	17°30'45"	2390	16	145
LP 1	99°39'04"	17°31'07"	2450	16	8,8

Because of the biospeleological importance of the cave and the changes it has had in the last 20 years, we decided to carry out new expeditions and to study the fauna and compare it with the information we have from the previous publications. The result is that this time we recorded 83 taxa from the cave, from which at least 55 are new records for the cave. These include one Nematomorpha (Gordioidea), one species of Schizomida (probably a new genus), one Amblypygi, five of Araneae, two Psocoptera, two Homoptera and one Neuroptera.

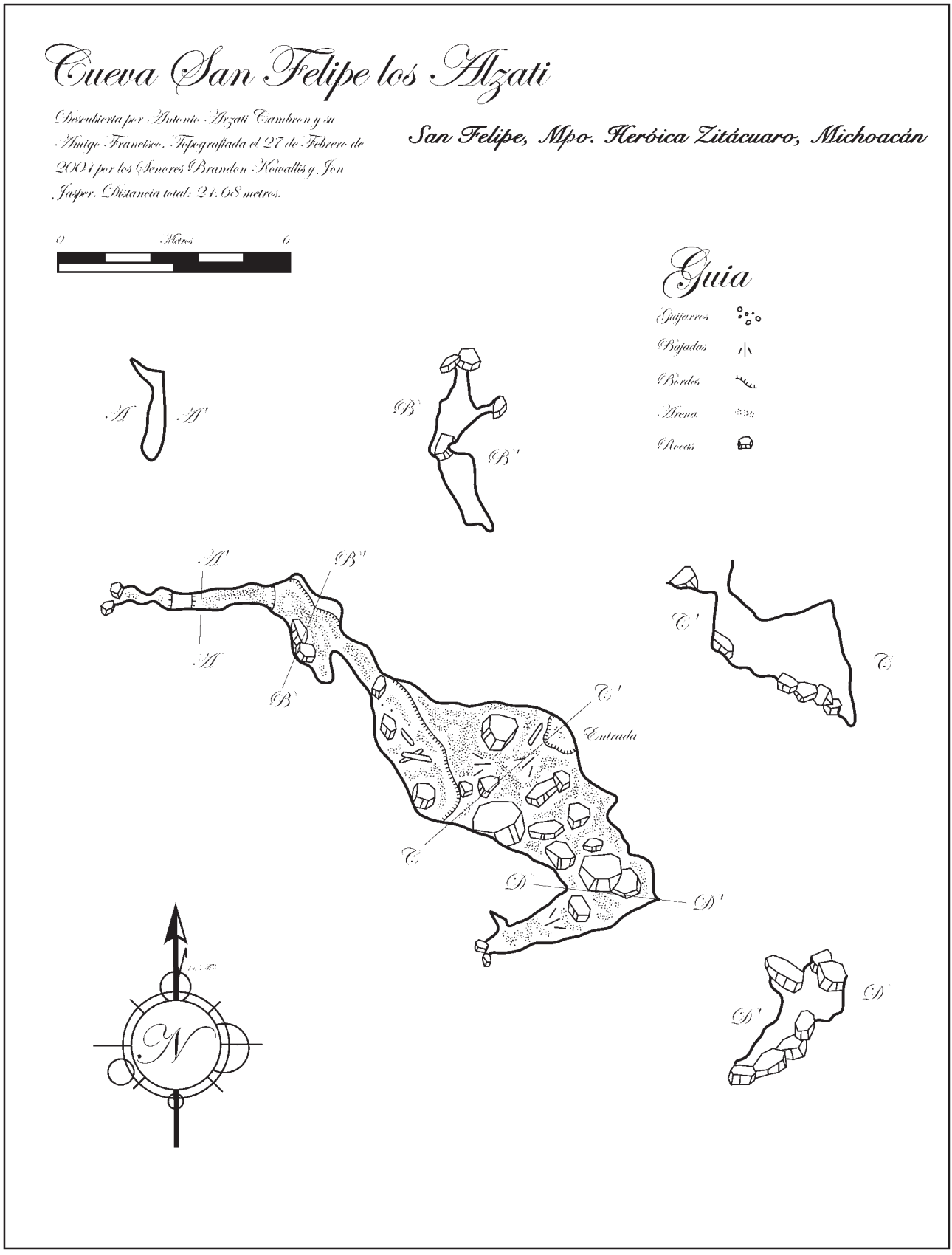
When we compare the current results with previous work, we can observe a reduction of the springtails and mites species, the total absence of ticks (*Antricola* sp.). It is to notice that the number of species of Chiroptera which visit this cave has also been reduced.

Source: Full paper is in *Proceedings of the 14th International Congress of Speleology*, volume 1, pages 178–184, or on the proceedings CD at /FULL PAPERS/3 Full Paper.doc. Other Mexico-related abstracts from that 2005 congress in Greece appeared in "Mexico News" in *AMCS Activities Newsletter* 29, but I missed this one.

Last week Diana Tomchick, Emily Zuber, Charles Fromen, and I were caving together in the southern Mexico state of Guerrero. We took a tour of **Grutas de Juxtlahuaca**, a national park. I helped explore and map this cave in 1971, before it was a national park, and when there was a dirt footpath to it. This is a video of our cave guide, Andres Ortega, playing drapery formations like bongo drums. The Ortega family has guided people in this cave for more than fifty years. http://www.youtube.com/watch?v=r2ooZ6aDlXk. *Source*: 18 April 2008 e-mail from Bill Steele. See *Association for Mexican Cave Studies Newsletter*, volume 5, number 1, pages 39–42 and large, loose map of the cave (1974).

JALISCO

Cave divers R. D. Milhollin of Texas and Jeff Bozanic of California were called to Puerto Vallarta to help recover the bodies of some divers who were thought to have been trapped by the collapse of an offshore underwater cave.



Map by Brandon Kowallis, from http://www.brandonkowallis.com/Maps.htm.

Though local divers claimed to have seen caves on the steep wall of the ocean, it was immediately clear that there was unlikely to have been a cave there, and the divers had probably been caught by a large slump of the wall. Two dives to about 75 meters found no sign of either a cave or the divers. Source: *NSS News*, November 2008, pages 22–23, citing the August 2008 *Cowtown Underground*.

MÉXICO

On March 2, 2009, people from Cruz Roja and Espeleo Rescate México from San Luis Potosí and Querétaro were called in to help recover bodies from an artificial excavation under an old hacienda near San José del Rincón. Apparently two people were digging a tunnel looking for hidden treasure when they were overcome by fumes from a pump being used to dewater the tunnel. Four would-be rescuers were also overcome, making a total of six fatalities in the incident. *Sources*: Antonio Aguirre Álvarez and www.emsresponder.com/article/article.jsp?id=9088&siteSection=1.

NUEVO LEÓN

Abstract: **Soplo de Los Toros** Update: Caving in the Purificación Karst. By Mark Minton.

In December 2007 work continued in Soplo de Los Toros, a recently discovered deep cave in the Purificación karst of northern Mexico. On two prior expeditions we had explored the cave to 366 meters deep, with excellent prospects for continuing. This time the nature of the cave changed dramatically, becoming tight and sinuous. Three trips to the bottom managed to add only 94 meters of depth, pushing the cave to 459 meters deep. The narrow canyon continues and will be pursued later this year. Meanwhile, digging in a neighboring cave, **Pozo de Zorillo**, opened up a series of short drops with airflow. That cave was pushed to 83 meters deep before time ran out at another drop, and may connect to Soplo next trip. With any luck, Soplo will become the second-deepest cave in the Purificación area and deepest in the state of Nuevo León when we return in December 2008.

Source: International-exploration session abstracts in the program book for the 2008 NSS Convention. An article on the 2007 trip appears in *AMCS Activities Newsletter* 31, and an article on the 2008 trip appears in this issue.

There is a YouTube video of the **Nacimiento de Los Toros** taken during the 2008 Sistema Los Toros expedition (see article in this issue by Mark Minton) at http://www.youtube.com/watch?v=ulss_kJRZPA. *Source*: Bill Steele.

There is a five and a half minute YouTube video of the new tunnel entrance and the new show-cave trails in the entrance room of **Gruta del Palmito**, Bustamante at http://youtube.com/watch?v=3gMzjf460qw. This was posted to YouTube well before the official opening of the cave, described in an article in this issue. *Source*: Joe Ranzau.

One of the 2008 winners of a $50,000 Rolex Award for Excellence is Rodrigo Medellín, one of Mexico's leading authorities on bats. The award cites Medellín's efforts toward protecting the colony of Mexican free-tailed bats in **Cueva de la Boca**. *Source*: *Descent* 206, February-March 2009, p. 8.

There is a trip report in Spanish about a visit by the Monterrey Tec cavers to **Gruta del Precipicio** in March 2009 at http://www.oztotl.com/ps/reports/Precipicio_Marzo_2009.pdf. *Source*: Peter Sprouse.

The Mexican environmental conservation organization Pronatura Noreste has announced the purchase of a cave near Monterrey, Mexico, known as Cueva de la Boca. The objective of this ownership is to preserve bats and other species of high ecological value that inhabit the cavern. This means research projects will carry on, along with conservation efforts, while promoting ecotourism and environmental education.

In partnership with the Citizen Council for the Tourist Promotion of Santiago (Consejo Ciudadano para el Fomento Turístico de Santiago) and thanks to donations and a loan, Pronatura Noreste has been able to fulfill the dream of becoming owner of this environmental priority site, in order to place it under conservation. The property comprises 20 acres that include the cave and the land in front of it, where visitors will be able to learn about the environmental services bats provide to society.

Cueva de la Boca used to be home to one of the largest populations in the world of Mexican free-tailed bat (*Tadarida brasiliensis*), with some 20 million individuals. Unfortunately, due to human impacts, such as uncontrolled tourism, pollution, and vandalism (bonfires, fireworks, etc.), bat population has been reduced by more than 95% of its original size. Pronatura Noreste has been working on the site since 1999, with the obtaining of the mining permit, in order to prevent future guano extractions, and its associated disturbances. *Source*: from a press release at http://www.pronaturane.org/archivos/Cueva%20de%20la%20Boca%20Press%20Release.pdf.

OAXACA

For a week in October 2008, cave divers from several countries assembled in Austin, Texas, for training and practice with the new Poseidon Mark VI Discovery rebreather, a recreational rebreather that has just gone into mass production and is based in part on Bill Stone's design of the Cis-Lunar Mark V, as used, for example, during the 2004 Huautla expedition (see *AMCS Activities Newsletter* 21, pages 44–64). The new rebreathers are going to be used during the 2009 **J2** expedition, which will run from mid-March until the end of May. James Brown dove one 150-meter sump there in 2006, only to find another sump shortly beyond (see number 31, pages 49–51). For a publicity release about the 2009 J2 project, see http://www.usdct.org.

Abstract: A New Species of Cave Adapted Nicoletiid (Zygentoma: Insecta) from Sistema Huautla, Oaxaca, Mexico: The Tenth Deepest Cave in the World. By Luis Espinasa and Nguyet H. Vuong.

Anelpistina specusprofundi, n. sp., is described and separated from other species of the subfamily Cubacubaninae (Nicoletiidae: Zygentoma:

REBREATHER TRAINING FOR J2

Clockwise from upper left:

Participants: Back row Marcin Gala, Andrey Bizyukin, Fofo Gonzalez, Anthony Castro, Jose Morales, Bill Stone; middle row Heather Levy, Jon Lillestolen, Vickie Siegel, Jean Krejca, Yuri Schwartz, Matt Covington; front row Tommy Shifflett, Mark Stover. *Marcin Gala*.

Assembled Poseidon Mk VI Discovery rebreather. *Mark Stover*.

Fofo Gonzalez ready to dive. *Bill Stone*.

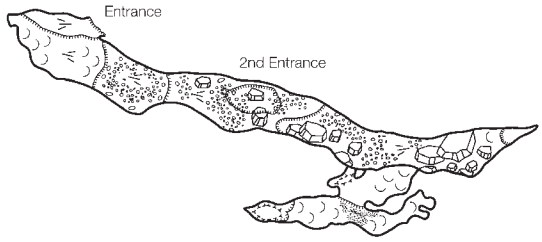
Rebreather diver submerging in Lake Travis at sunset. *Andrey Bizyukin*.

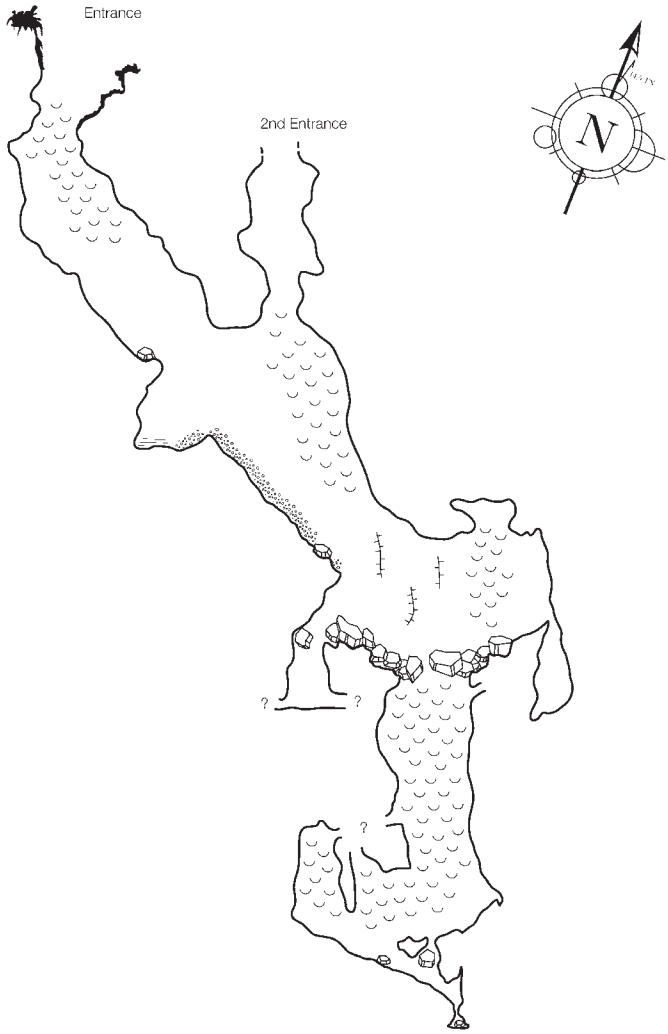
Vickie Siegel and Heather Levy prepare a rebreather during Lake Travis practice. The can at lower right contains the pre-packaged CO_2 absorbent. *Bill Stone*.

Osto Murciélago

Explored March 2004 by Jon Jasper & Brandon Kowallis.
Total Surveyed Length: 624 feet (190 meters)
Total Surveyed Depth: 172 feet (52.5 meters)

Mpo. Santa Ana Cuatémoc, Oaxaca





LEGEND

- Column
- Stalactite
- Flowstone
- Flowing Water
- Pebbles & Gravel
- Slope
- Ledges & Pits
- Mud
- Rocks
- Ceiling Domes & Ledges

0 feet 100

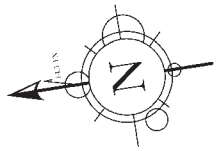
Cueva del Arroyo Desviante

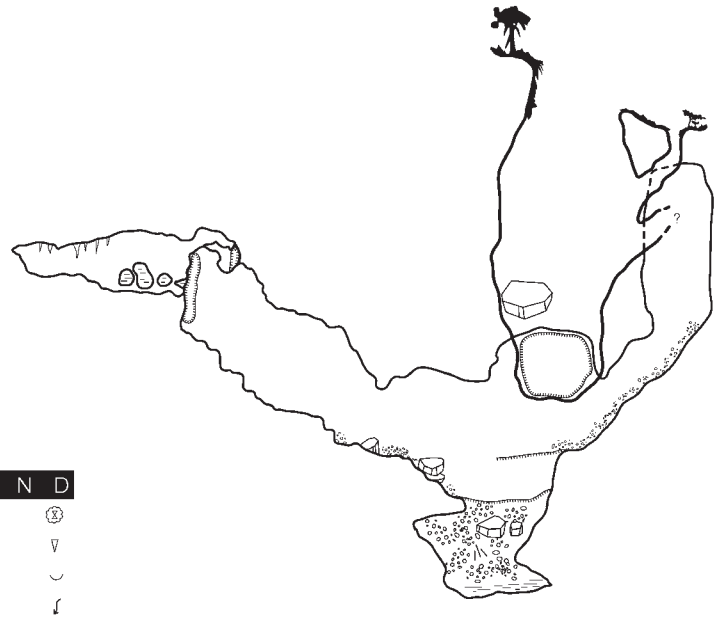
Explored March 2004 by Peter Hartley, Brandon Kowallis, Jon Jasper, and John Kerr

Mpo. San Franciso Chapalapa, Oaxaca

Cartography by: Brandon Kowallis

Total Surveyed Length: 624 feet (190 meters)
Total Surveyed Depth: 172 feet (52.5 meters)





L E G E N D

- Column
- Stalactite
- Flowstone
- Flowing Water
- Pebbles & Gravel
- Slope
- Ledges & Pits
- Mud
- Rocks
- Ceiling Domes & Ledges

Insecta). The specimens were collected in **Sótano de San Agustín** and **Nita Ka** (Huautla system) in Oaxaca, Mexico. This cave system is currently the tenth deepest in the world. It is likely that *A. specus-profundi* is the sister species of *A. asymmetrica* from nearby caves in the Sierra Negra, Puebla. The new species of nicoletiid described here may be the key link that allows for a deep underground food chain with specialized, troglobitic, and comparatively large predators such as the tarantula spider *Schizopelma grieta* and the 70 mm long scorpion *Alacran tartarus* that inhabit the bottom of the Huautla system.

Source: *Journal of Cave and Karst Studies* 70(2)73–77, August 2008.

Osto Murciélago and **Cueva del Arroyo Desviante** were surveyed during the 2004 Cheve-area expedition. A map of **Cueva Atanacio** by the same cartographer appears on page 130 of *AMCS Activities Newsletter* 28. These appear to be the only cave maps drafted from that entire expedition. *Source*: http://www.brandonkowallis.com/Maps.htm.

There is a long trip report by Tone Garot about caving in Oaxaca at http://utgrotto.org/TripReports/OaxacaTripReport.asp. This is the same trip that is described in Peter Sprouse's article in this issue.

Discover Magazine for April 11, 2008, contained an article on the longest underwater caves in Quintana Roo, describing the recent major connections. *Source*: *NSS News*, August 2008, p. 22. For AMCS articles about the connections, see *AMCS Activities Newsletter* 30, pages 39–42, and number 31, page 11.

For a week in October 2008, cave diNote from the ongoing 2009 **J2** expedition, May 5: Matt Covington and Marcin Gala spent five days in new Camp 4, beyond Sump 2, which had been lined with 9-millimeter rope and a telephone wire. They surveyed 830 meters of new passage, mostly looping, sponge-like, and muddy. They are pretty sure they have bypassed Sump 3, seen but not dove in 2006 (see *AMCS Activities Newsletter* 31, pages 49–51). A borehole ended at a flowstone wall, which was climbed and appeared to be choked. At a lower level, a 40-meter long lake ended at another sump that had stalactites underwater. This short 25-meter sump led to another 40-meter lake that appeared to continue underwater. Another dive team is planning to enter the cave and pursue these new sumps.

Members of the expedition also pushed **Last Bash**, found in April 2005 in the lower part of the J2 valley, close to its junction with Aguacate Canyon. It is currently 510 meters deep and going. It might connect to J2 around Camp 2A. *Source*: Marcin Gala.

Australian caver Al Warild was the recipient of the Australian Geographic Society's 2008 Lifetime of Adventure Award for his 40-year dedication to speleology. Warild participated in many expeditions to Oaxaca and Puebla over the years. Perhaps most notable were the Australian expeditions he organized to the caves of the Chilchotla area of Oaxaca, where several deep caves, including **Sonconga**, 1014 meters deep, were explored. See, for instance, *AMCS Activities Newsletter* number 16, pp. 21–29, number 18, pp. 40–49, and number 22, pp. 85–89. *Source*: The award was first called to our attention in *Descent* 205, p. 6. Or see http://editorial.australiangeographic.com.au/newsandviews/index_news.aspx?ID=71.

In late February and early March 2008, Swiss cavers returned to the Cerro Rabón. Among their accomplishments was pushing **Hard Rock Cave** to –830 meters. *Source*: www.cerro-rabon.org/2008/ (in French). There is a map of the upper part of Hard Rock Cave in the article on Cerro Rabón in *AMCS Activities Newsletter* 25, pages 21–33.

It is a sultry, hot afternoon in the jungle. The cave entrance looms open and inviting. A 6-foot fer-de-lance rests in the shade of the overhang. Gradually the afternoon quiet is interrupted by the muffled voices of approaching men. The men are dressed in elaborate costume with large feathered headdresses. They carry a litter with the royal body prepared for burial. Torches are lit. As the procession moves slowly into the cave, copal is burned in broken pottery sherds. The procession chants in solemn, reverberating tones as they move to the last great chamber. There the body is laid out and a ceremony follows. Pottery used in the ceremony is placed in niches in the wall. Ceremonial idols are left to guard the dignitary's remains through time. Only bats flutter through the dark, deserted passages for centuries until . . . .

In January 1976, cavers from Austin, Texas, on a trip decide to spend a few days in a remote area in the state of Oaxaca. Several interesting caves had previously been located in the area, and the jungle karst looked inviting. One evening, after a day of searching for new caves, the group settled in camp for the evening meal—except for Preston and Jim. Imaginations ran wild as to their whereabouts. Later, when they returned to camp, their faces told the tale. They had found a long horizontal cave well decorated with shields and gleaming white formations. But that was not all. Long walking passages led to a great chamber far back in the cave. There they found ancient pottery, stone and bone artifacts, and even a skeleton laid out in the center of the chamber floor. Jim christened the cave **Cueva de la Culebra**, meaning Cave of the Snake, because when he found it he disturbed a large fer-de-lance sunning in the entrance.

The next day the entire group rose early for a trip to map, photograph, and document the find. It was a trip I will never forget.

The main trunk passage was interrupted by a series of three pits that dropped about 4 meters into the lower section of the cave. It was necessary to carefully climb around these pits to continue down the passage. Just past the third pit, a ceiling entrance allowed light to enter the 3-meter-wide by 4-meter-high corridor. The corridor continued for over half a kilometer, becoming wider and higher. At intervals clusters of potsherds marked where whole pots had once sat. The corridor led to a

junction with a canyon passage 4 to 5 meters wide by 6 meters high. A climb was necessary to reach the canyon floor. The canyon continued 200 meters to an area where a small skylight allowed a weird glow to penetrate the darkness. There, almost a kilometer from the main entrance, broken pots, artifacts, and human bone gave silent testimony to prehistoric use of the cave.

We saw broken sherds and gleaming white projectile points. Small bone tools lay scattered on the floor. A small black figurine with puffed cheeks and an elaborate feather headdress guarded the passage. In the center of the floor was the fully articulated skeleton of the individual laid to rest there. No jewelry or adornment accompanied the body, but nicely decorated pottery was nearby. In a niche was a superb clay vessel decorated with an incised flower design. The pot had a handle and spout shaped in the form of an animal. An unforgettable red clay figurine lay on the floor. The figure was unique, having only one arm, odd decoration, and a plug in his mouth. Only the ancients who placed him there knew what he meant.

Hours were spent drawing, photographing, and mapping the cave and burial chamber. No artifacts were removed or disturbed. We respected the prehistoric people by leaving everything as we had found it. After hours we made our way back to camp. It had been an unbelievable trip into the past.

Back in Austin, hours were spent in the Latin American Library at the University of Texas searching for details of the origins of the artifacts. No real conclusions could be drawn, but after consultation with a MesoAmerican archaeologist, we attributed the burial material to the Mazatec culture, who inhabited the area before contact times.

The cave is still a mystery.

Source: Article "Cueva de la Cuebra—An Ancient Burial Cave" by Nancy Boice, in the book *Birmingham Grotto 50th Anniversary, 1958–2008*, pages 31–32. It appears in that book under 1981, so the article probably first appeared in the *Birmingham Grotto Newsletter* for that year. There is a very brief mention of the cave in a short trip report in *AMCS Activities Newsletter* 5, page 20, January 1977.

Sistema de los Tres Amigos, Mpo. San Bartolomé Ayautla, is currently 7474 meters long and 659 meters deep. There is an article on the winter 2007–2008 trip in this issue. Earlier articles are in *AMCS Activities Newsletter* number 27, pages 31–37, and number 29, pages 60–63. *Source*: Randy Macon.

Abstract: The Pictographic Assemblage from the **Colossal Natural Bridge** on the Ndaxagua, Coixtlahuaca Basin, Northwestern Mixteca Alta of Oaxaca, Mexico. By Carlos A. Rincón Mautner.

Few Mesoamerican caves present an assemblage of rock paintings of such quality, variety of styles, and from so many different time periods as those found on the walls of the tunnel under the Colossal Bridge on the Ndaxagua, in the northern Coixtlahuaca Basin of Oaxaca. The assemblage from El Puente constitutes a remarkable record of ritual cave use and native cosmology that includes pictograms that possibly correspond to the poorly documented Archaic Period, the Late Formative, and the Classic through the early Post-Classic Periods. Painting and drawing on this cave's walls ceased during the Late Post-Classic Period, by which time the Basin's inhabitants revered this landform as central to their cosmogony and to the establishment of the principal dynasty of rulers, appropriating and reinterpreting its painted legacy as their history. This article describes the unique landform and the pictograms found in its interior, provides interpretations for them, and refers to the continuity of themes in some of the paintings, and to the changes in notation over the course of approximately 3,000 years.

Source: *Ketzalcalli* 2, 2005, downloaded (warning: 90 MB) from http://oztotl.com/maya/Ketzalcalli-2005-2.pdf.

PUEBLA

In April 2007, Mexpé saw nineteen participants from Quebec, France, Spain, Mexico, and Australia return to the Sierra Negra, and over 10 kilometers of new passages in new and existing caves were surveyed. **Sistema Tepepa** passed the 28-kilometer mark when yet another entrance was discovered. **Sistema Brumas Selvatica** was extended to 8,870 meters (still 473 meters deep) through new entrances, some of them bringing the cave closer to **Sistema La Ciudad**, but no connection was made. Sistema La Ciudad now reaches 7,828 meters (still 299 meters deep) after its southern trunk passage, which had been left unexplored due to lack of time in 2006, was explored for over 1 kilometer to breakdown. This major trunk passage, no longer active, proves that water that flowed in the entire area used to come from farther south than previously imagined.

A new cave, **Pozo Chingon**, with a 115-meter entrance pit, ended at –154 meters. **Tres Quimeras** cave, which had been briefly seen the year before, was pushed for 2.1 kilometers of active streamway to –513 meters, and it goes. Difficult and scary moments were had around –200 to –300 meters, where the rotten rock wouldn't hold any anchors we could throw at it. A resurgence some 800 meters lower than the entrance was seen, and it is believed that it could be connected to Tres Quimeras.

Another new cave, **Cueva del Vigésimo**, named for the twentieth anniversary of the Mexpé project, quickly yielded kilometers of subhorizontal and dry trunk passages before it started going down towards Sistema Tepepa. There was real hope for a connection, but a sump stopped the exploration at –279 m after 3.7 kilometers of passages, just meters from Sistema Tepepa.

In March-April 2008, fourteen cavers from Quebec, France, and Spain took part in another Mexpé expedition to the Sierra Negra. While looking for a way to connect Sistema Tepepa to Cueva del Vigésimo, Sistema Tepepa was extended to 28,564 meters (still 899 meters deep), but no connection was made.

We also tried connecting Sistema Tepepa to Sistema Brumas Selvatica through a new entrance discovered the year before. Its location, just between the two, and the fact that

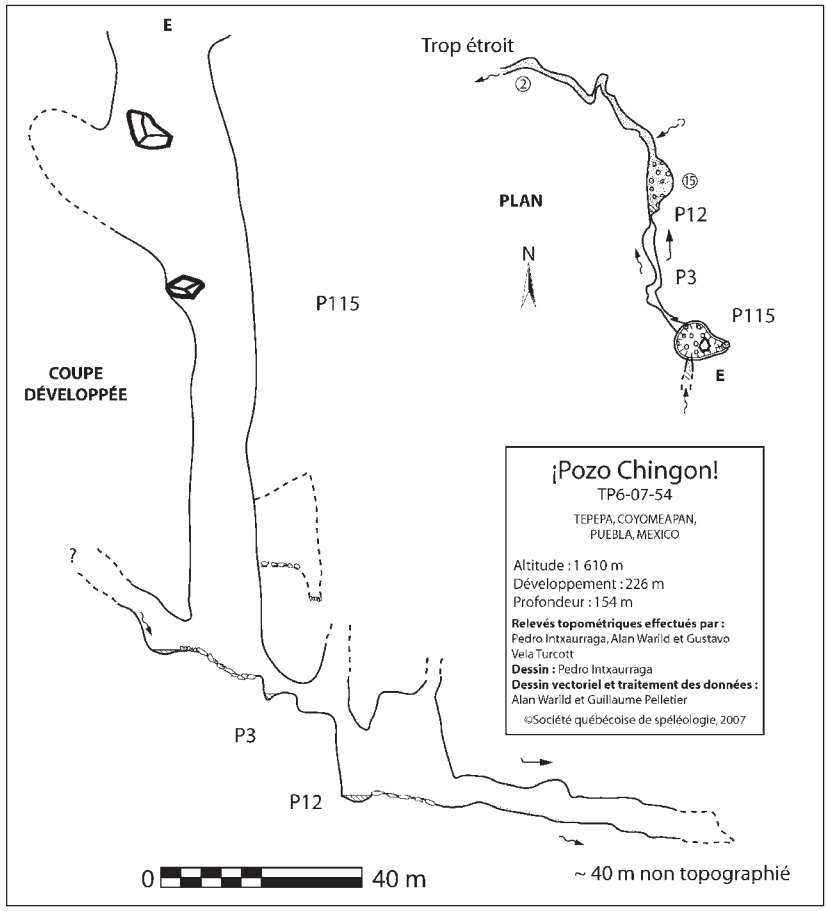
it was blowing significant amounts of air gave hope, but no connection was made, as the cave ended in breakdown and tight fissures at –228 meters, with 703 meters surveyed.

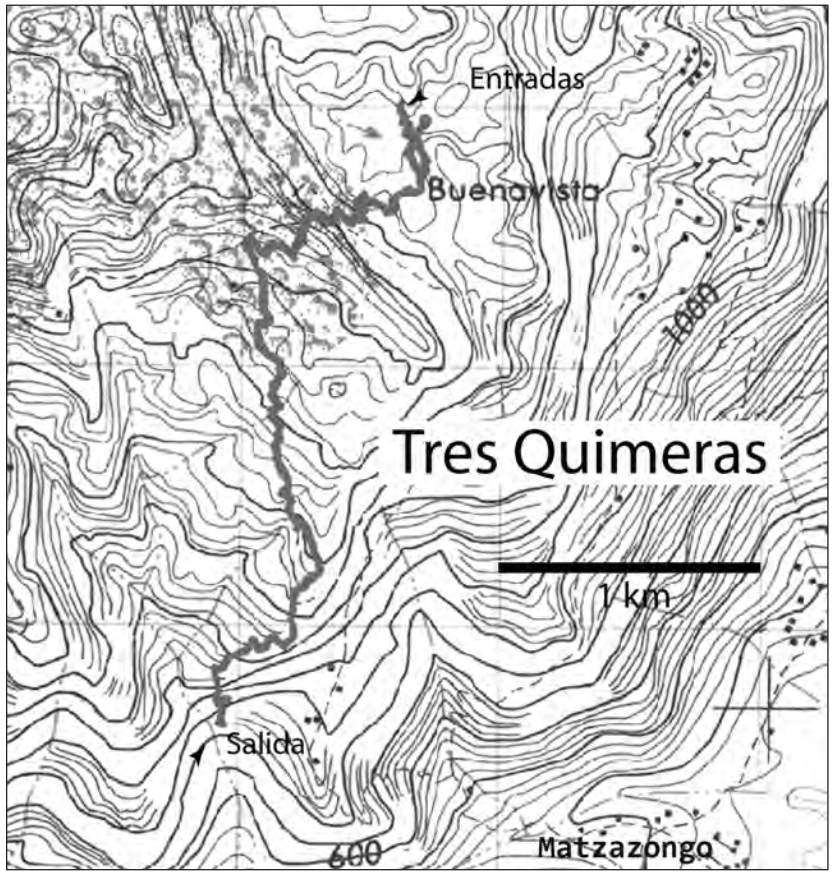
As several leads had been left in Cueva del Vigésimo, a return was in order. Unfortunately, all leads ended just meters from where we had left them. Luckily, a new entrance was discovered far from the existing one, with over 2 kilometers of passages to the connection, mostly in a sub-horizontal passage parallel to and immediately above the already known fossil passages surveyed the year before. Only some 50 vertical meters separate the two major trunks. Cueva del Vigésimo is now 6,137 meters long and 333 meters deep.

The April 2009 Mexpé trip was focused almost entirely on finishing the exploration of Tres Quimeras, which had remained untouched the previous year. It had been left, two years previously, with a huge, going, active passage. In order to make safe passage through the rotten-rock sections, 20-centimeter rods were glued in as anchors, which proved to be very effective. Once the previously explored section had been rigged, exploration began. Trips into the cave increased rapidly in duration, and after a few days it was decided that bivouacs were the way to go. Trips would go in to the extent of previously explored passage, rig and survey as much as possible that day, and return to one of the few flat areas to sleep. The teams would wake up late the next day and leave the cave.

In parallel with this, the presumed resurgence was visited, and the rock face was climbed to enter the gaping entrance some 15 meters above. After two climbing trips and one survey trip, the resurgence team ran into a flag left some twelve hours before by a push team coming from above. The connection gave a 786-meter depth to the cave. A few days later, an upper entrance was explored, yielding a connection and a new depth of 815 meters and a total length is 5,212 meters. Tres Quimeras is now the second deepest traverse in Mexico.

On the final days of the expedition, **Sótano del Centro** was descended.

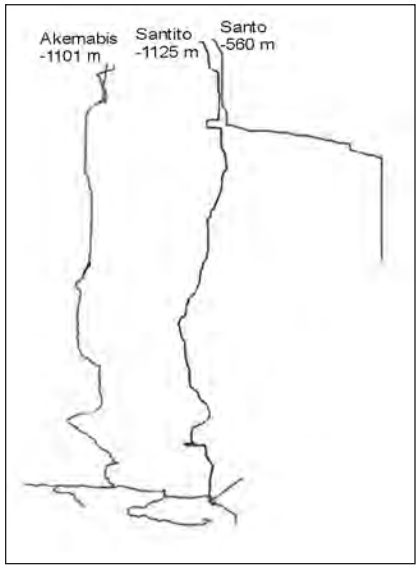




It has a 117-meter-deep entrance pit with little more at the bottom, except a digging project with lots of air. This pit is located right in the center of the village of Tequistepec, and it unfortunately serves as the local dump. Exploration was not pleasant. *Source*: Chris Chenier.

Thirteen cavers from six countries, with the largest number, five, from Mexico, held their expedition Tzontzecuiculi 2009 in the Ocotempa area from February 27 through March 27. They continued the exploration of **El Santito**, which was explored to –527 meters in 2008 [see article about Akemabis in this issue]. In a few trips from the surface, they rigged and surveyed to –1035 meters. After putting in a bivouac at –918, further exploration made a connection at –1127 meters with **Akemabis** in the Las Tripas de Pinto area, 1092 meters below the Akemabis entrance. The combined system, now named **Sistema Nogochl**, is 1182 meters deep and 6307 meters long.

A higher entrance, **Totozil Chichiltic**, was found to **El Santo Cavernario** [see article in *AMCS Activities Newsletter* 31, pages 27–36], making it 667 meters deep and 2532 meters long. **Altepetlacac** (Paisano) Cave high on the mountain was pushed to –316 meters, with going leads. *Source*: announcement from Franco Attolini, Gustavo Vela, and Al Warild. Articles on the expedition are at http://www.explos.org/blog/labels/Speleologie.html (in French) and http://impreso.milenio.com/node/8554120 (in Spanish).



Last April, Tláloc 2008 came to an end. This caving expedition to the states of Puebla and Chiapas was composed of Italians from the regions of Sicily and Lombardy, as well as Mexicans.

In the state of Puebla, prospecting continued in the municipality of Hueytamalco in the vicinity of the village of Atepetaco. This region, already the objective of two expeditions (1998 and 2002 [see *AMCS Activities Newsletter* 27 pages 25–26]), was very fruitful: checking previously identified locations led to the discovery of numerous caves, among which were **Cueva del Viento** and **Cueva de Mamma Mia**, both of majestic dimensions and containing noteworthy streams. Connecting the two caves created a system approximately 5 kilometers long, with three entrances. The main objective, the connection between this system and the **Resumidero de Miquizco** (almost 2 kilometers long and with three entrances [see map in *AMCS Activities Newsletter* 28, page 8]), failed by just a few meters, but of course it's just a question of time. A connection would make possible a spectacular through trip from the main insurgence to the resurgence.

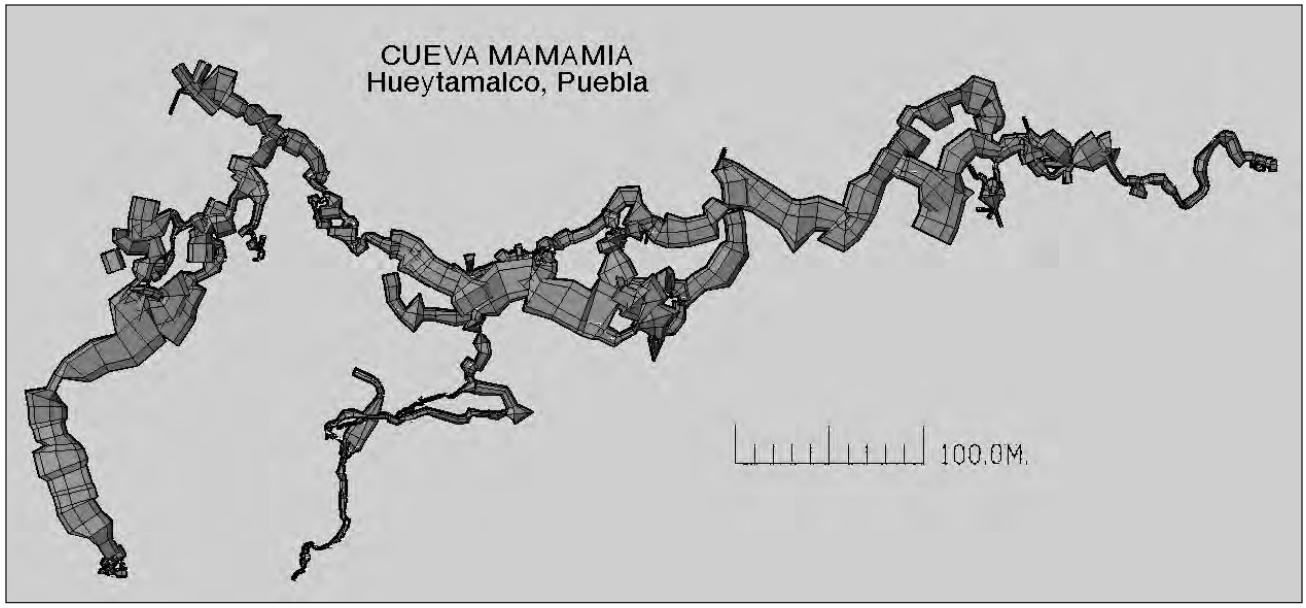
Also surprising is the biospeleological aspect: the zoological diversity (including fish and crayfish) is incredible. This is probably due to the water courses alternating between being under and above ground, as well as to the imposing size of the insurgences, which can accommodate logs of considerable dimensions and thereby guarantees a large intake of organic material.

The exploration of **Sótano de los Cochinos**, upstream and downstream, added up to a length of about 1 kilometer. Various other "minor" caves were also sketchily explored: **Huertas Tri**, **Cueva Gloria**, **Enchonada**, and others that seem to offer interesting prospects. Many identified locations are waiting to be verified, and their descriptions are very enticing.

Entrance pit to Totozil Chichiltic, Puebla. *Gustavo Vela.*

The success of the reconnaissance and explorations lengthened the stay in Puebla, thus shortening the scheduled stay in Chiapas. Here, with the Comitán group, an interesting pit was explored, stopping at –80 meters after the team ran out of rope (since almost all of the rope had already been sent to Mexico City). At the end of the expedition, reconnaissance by means of a Cessna piloted by Omar, president of the group, revealed a spectacular view of a series of majestic pits in the southeast of Chiapas, near the border with Guatemala. Extremely difficult access by ground has impeded exploration of these pits, with the only exception being a pit of more than 210 meters depth, which unfortunately was blind.

Participating groups: Speleo Club Ibleo (RG); Gruppo Speleologico Belpasso (CT); Gruppo Speleologico Bergamasco Le Nottole (BG); Gruppo Grotte Milano CAI-SEM; Gruppo Grotte i Tassi (MI); Speleo Club Orobico CAI (BG). As for Mexican participation, various members of the URION group were present. Jorge Rueda Higareda's help in

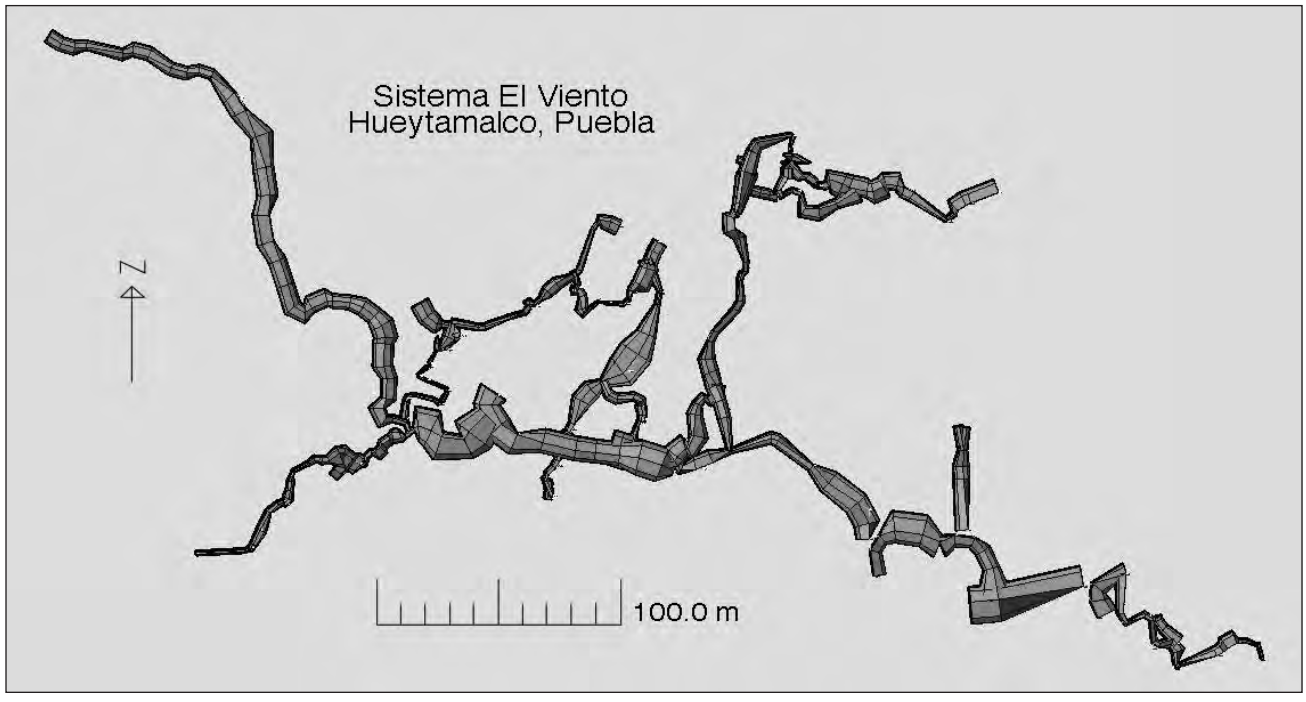


the organization of this expedition was invaluable. The expedition was sponsored by SSI, UMAE, ESRL, and FSRS.

Source: Article "Ottimi i risultati della spedizione Tláloc 2008," by Giorgio Pannuzzo, in *Speleologia* 58, pages 78–79, 2008. Translated from Italian by Yvonne Droms.

During 6–19 April, members of Grupo Espeleológico Chicomóztoc conducted their Expedición Sierra Negra 2009 to the vicinity of La Cumbre. Six entrances were located, but only **Pozo 3 and 4** were explored. Pozo 4 has an entrance drop of 39 meters, and continues down two more pits to the Falla de las Gárgolas passage, where there were two pits, the left one, 22 meters deep, being the main route that led to more than 300 meters deep. At –270 meters, a major collapse took three days to penetrate, but led eventually do an estimated depth of 400 meters, 320 meters of which was surveyed. The cave is difficult, with some narrow passages and places where the poor quality of the rock made rigging difficult. Most of the rigging was done using a battery-powered hammer drill and 9-millimeter rope. The entrance to Pozo 4 is at 1518 meters elevation.

Pozo 3, located no more than 20 meters from the entrance to Pozo 4, begins with an entrance pit of 50 to 60 meters. Beyond its third pit, the cave becomes similar in nature to Pozo 4. *Source*: 21 April 2009 post to Iztaxochitla e-mail list by



Omar Hernández. See also http://montanismo.org/articulos.php?id_sec=6&id_art=2652 for original Spanish text and some photos.

On April 18 and 19, 2009, nine cavers from CEMAC Veracruz and the town of Xalapa, Veracruz, participated in Expedición Hueytamalco to mountains in northern Puebla. They visited **Cueva de Mamma Mia**, a sub-horizontal limestone cave discovered and explored in 2008 by an Italian-Mexican expedition. They also explored **Cueva del Viento**. Both caves are maze-like, with meandering or fracture passages, crawls, and pits. *Source*: E-mail from Guillermo Gassós, summarized in English by Laura Rosales. The cave names have been changed here to agree with the Italian's item above in this section.

Regards 69, December 2008–January 2009, magazine of the Société Spéléologique de Wallonie, Belgium, contains a long article on the Groupe Spéléo Alpin Belge's 2008 expedition to the Zoquitlán area in Puebla. A short article on the trip appears on pages 162–163 in *AMCS Activities Newsletter* 31. The maps here of **Cueva Robert** (probably the same cave as Cueva Roberto in the AMCS article) and **Cueva Tepetzala** are from that *Regards* article.

Undeterred by the fracas resulting from a rescue in **Alpazat**, Cuetzalan, in 2004 (see *AMCS Activities Newsletter* 28, pp. 155–167), British cavers are hoping to return. Planning for an expedition is underway by Steve Whitlock, stephen.whitlock654@mod.uk. *Source*: *Descent* 206, February/March 2009, page 27.

Sous Terre, magazine of the Société Québécoise de Spéléologie, 2(1)19–21, fall 2008, contains an article by Guy Cadrin on the revision and correction of the SQS's map of **Las Brumas**, Mpo. Santa María Coyomeapan. The emphasis in the article is on the software used in drafting the map. Las Brumas is part of **Sistema Brumas Selváticas**; see *AMCS Activities Newsletter* 31, pages 125–130, where very small-scale plan and profile of the system appear. A foldout map of the **Gimnástica Selvática** part of the system, as of 2002, before the connection, appears in number 27, page 41.

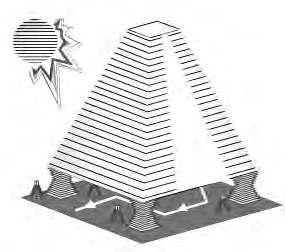
Despite the fact that **Akemati**, **Ocotempa**, and the **H31-H35** systems, explored by the Groupe Spéléo Alpin Belge in the late 1980s, have been on the AMCS deep caves of Mexico list for many years, we did not publish real maps of any of them until the Akemati profile map was included in an article in the last *AMCS Activities Newsletter* (number 31, page 32). We print here the Belgian's profile map of Ocotempa (compare to the line plot in *AMCS Activities Newsletter* 17, page 78) and plan maps of both Akemati and H31-H35, all from *Regards* 9, 1991, where they were loose maps included in the issue. The area profile is from page 42 of the same magazine.

QUINTANA ROO

As of May 2009, the longest underwater caves in Quintana Roo are:

Sistema Ox Bel Ha	179,978
Sistema Sac Actun	168,959
	(170,998)
Sistema Dos Ojos	62,209
	(62,252)
Sistema Toh Ha	27,629
Sistema Aktun Hu	24,913
Sistema Naranjal	24,324
Sistema K'oox Baal	20,087
Sistema Tux Kupaxa	15,144
	(15,917)
Sistema Ponderosa	15,019
Sistema Camilo	10,752

Lengths are in meters, with complete cave lengths, including dry portions, in parentheses where appropriate. *Sources*: Quintana Roo Speleological Survey at http://caves.org/project/qrss/qrlong.htm, /qrdry.htm.



Quintana Roo Speleological Survey

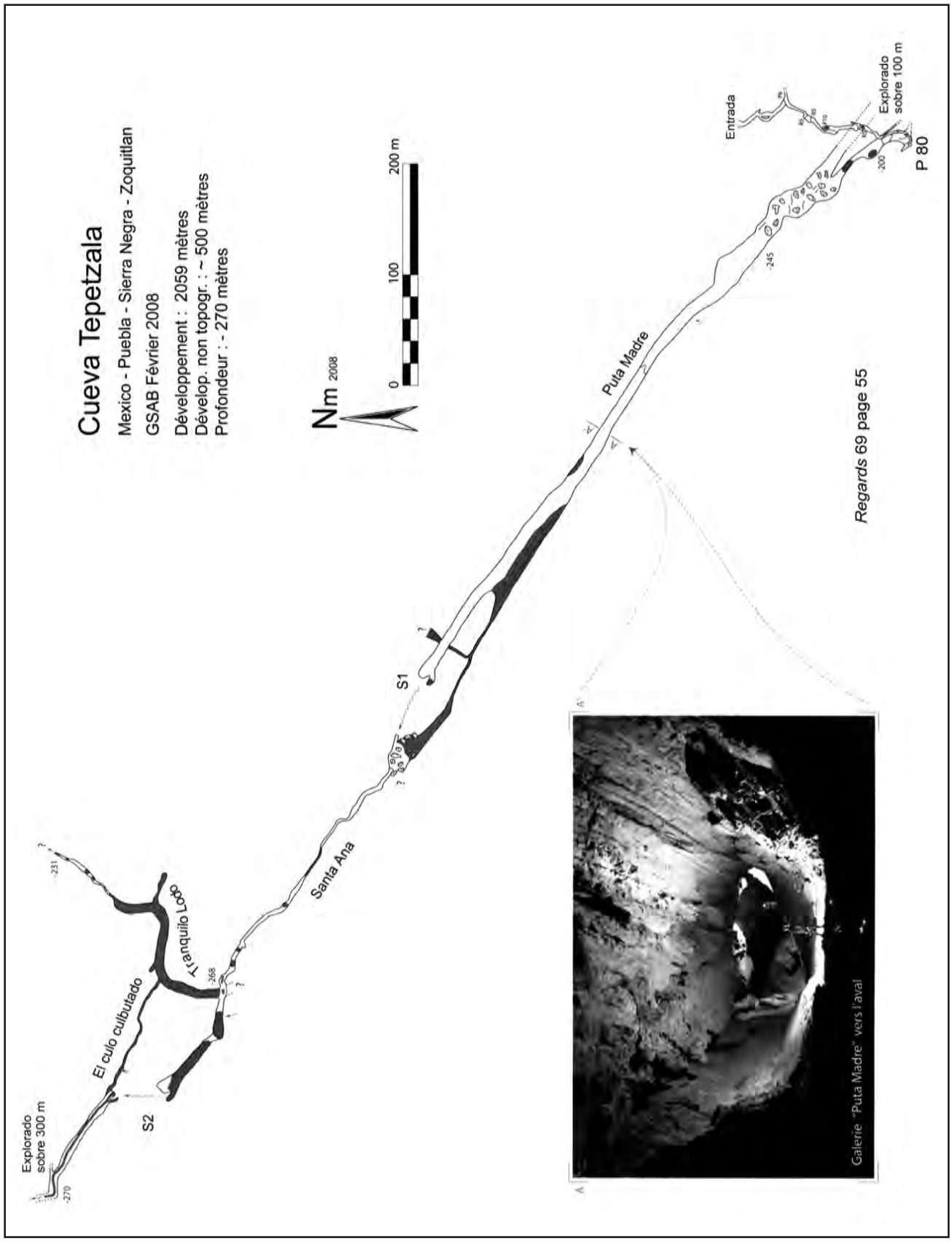
Divers from the Czech Speleological Survey resurveyed **Sistema Tux Kupaxa** in early 2009. Connections were made to **Sistema Sac Xiqin** and **Cenote Coop One**. The current length of the system is 15,917 meters, of which 15,144 are underwater cave. *Sources*: http://caves.org/project/qrss/new.htm, /qrdry.htm.

Gustavo Vela and others have surveyed **Sistema Pool Tunich**. This is by far the longest dry cave in Quintana Roo, with a length of 12,038 meters, which would put it in the top ten in an overall QR long-caves list, wet or dry. The cave is 26 meters deep. *Sources*: http://caves.org/project/qrss/new.htm, /qrdry.htm.

Lists of the longest and deepest underwater caves in the world, edited by Oliver Knab, are available at http://www.plongeesout.com; select Siphonométries, then Monde. The most recent list is dated September 2008. Among the longest underwater caves, nine of the top ten are in Quintana Roo, as are fifteen of the top twenty and twenty-two of the forty-two known to be longer than 5000 meters.

Issue number 3, for June-September 2007, of *PlongeeSout'Mag*, a free international cave diving magazine that can be downloaded from www.plongeesout.com, contains two articles on cave diving in Quintana Roo. The first is an article by Sergio Granucci of the Labna-Ha group on **Uchben Bel Ha**, a cave some 1400 meters long north of Playa del Carmen (pages 4–8). The second is about the January 2007 connection between **Nohoch Na Chich** and **Sac Actun** (pages 28–30). This article is uncredited, but the text is the same as that in Steve Bogaerts's sidebar on page 41 of *AMCS Activities Newsletter* 30. Both articles are highly illustrated in color. (This magazine is recommended to anyone interested in cave diving. The PDF files are very difficult to print, however.)

There will be a symposium titled Anchialine Ecosystems: Reflection and Prospects, sponsored by the


Cueva Tepetzala
Mexico - Puebla - Sierra Negra - Zoquitlan
GSAB Février 2008
Développement : 2059 mètres
Dévelop. non topogr. : ~ 500 mètres
Profondeur : - 270 mètres
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El culo culibutado
Tranquilo Lobo
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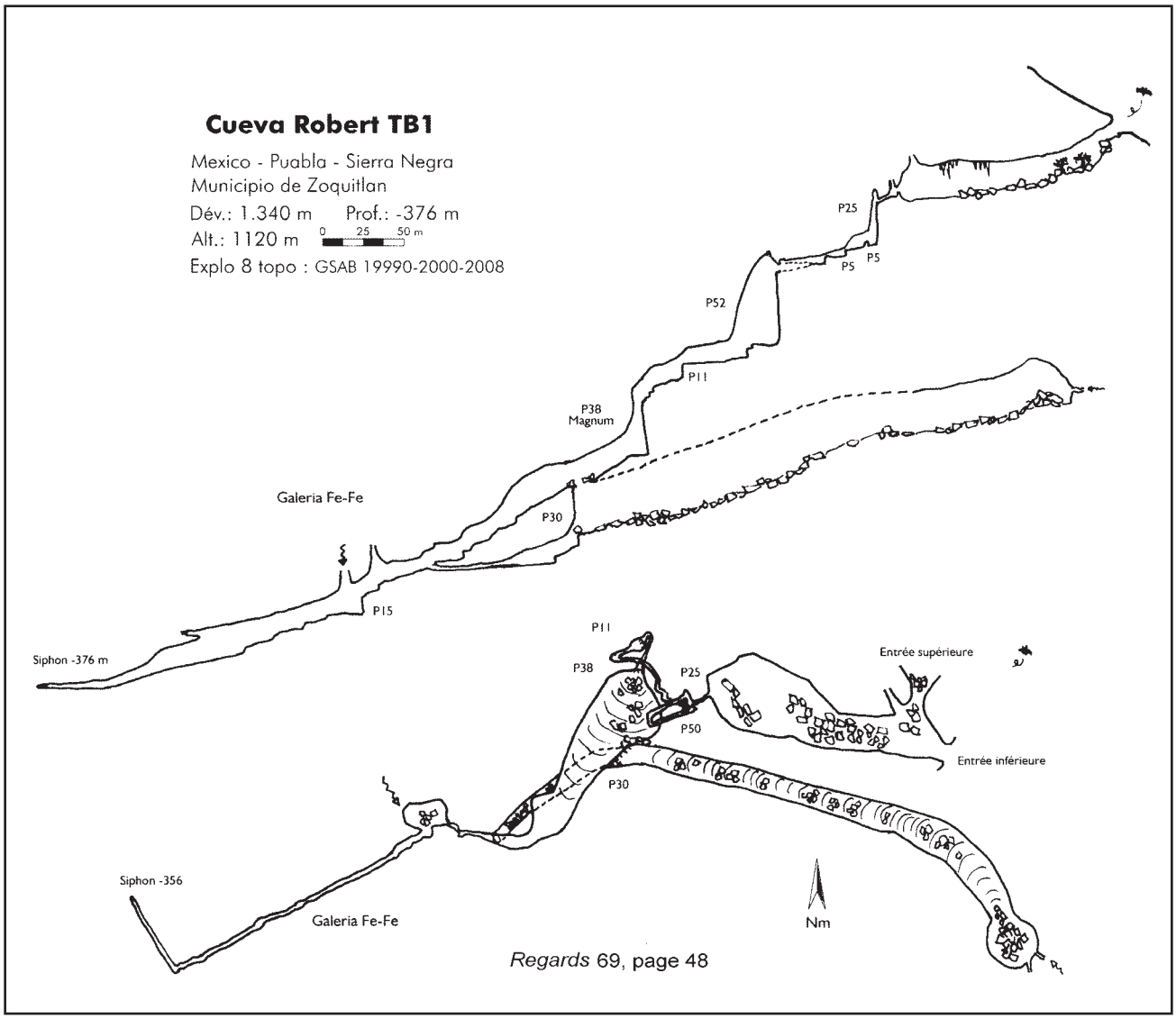
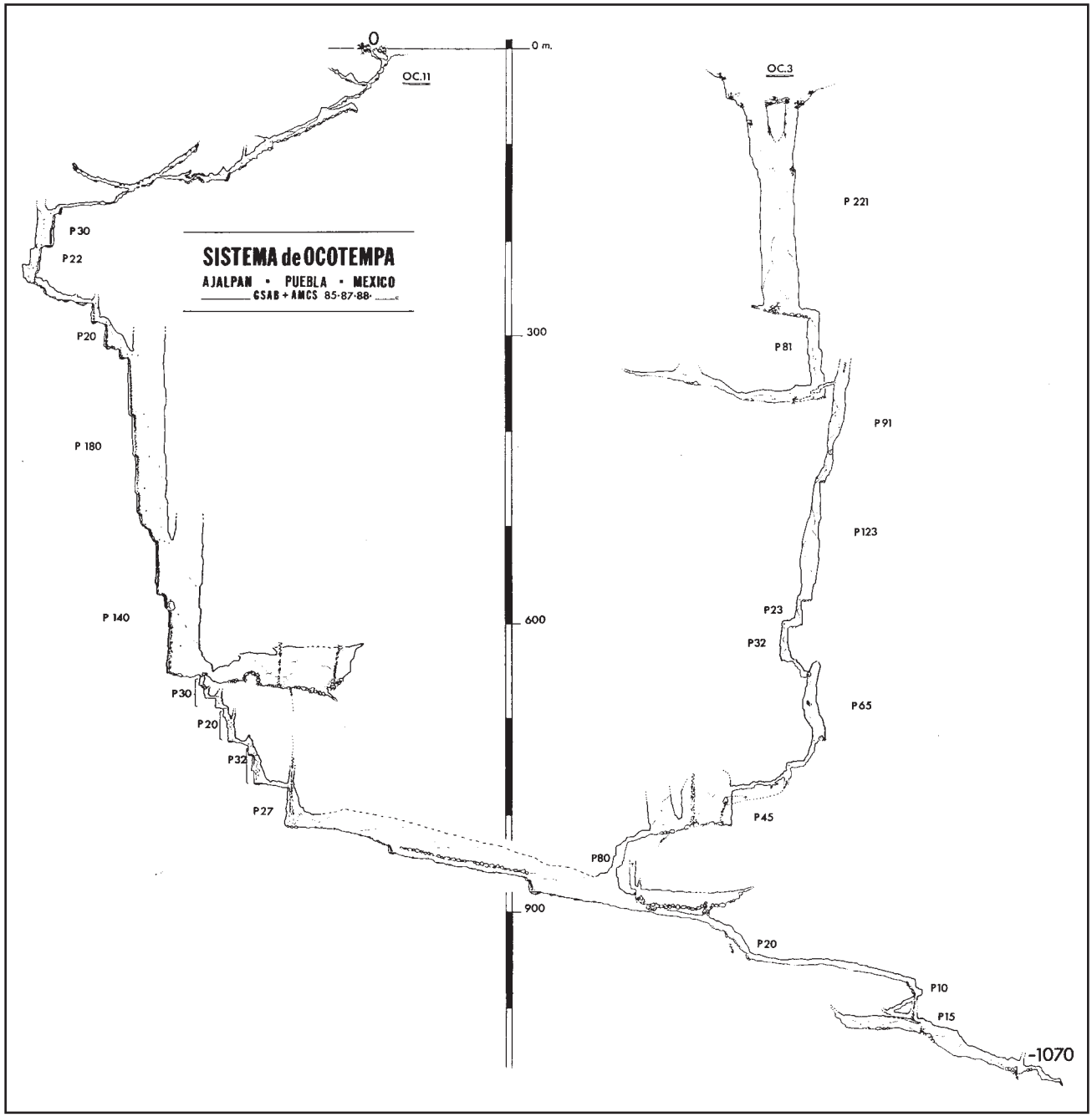
P 80
Regards 69 page 55
Galerie "Puta Madre" vers l'aval



Regards 69, page 48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SISTEMA de OCOTEMPA
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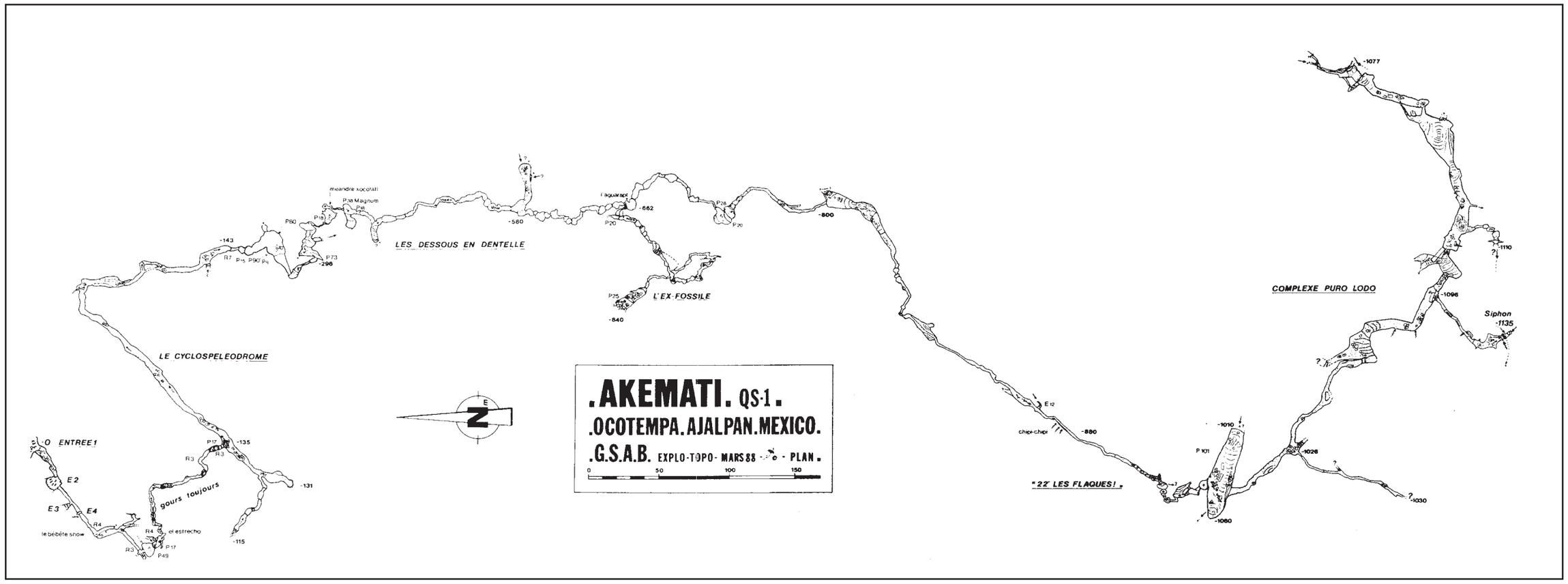
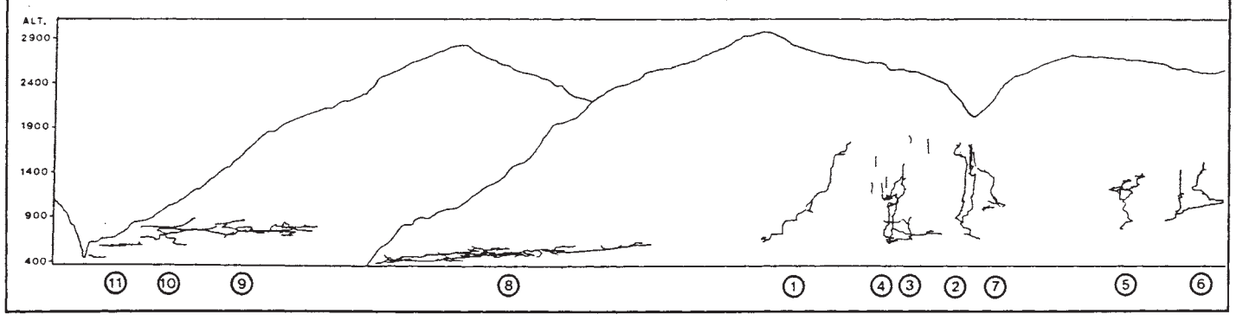
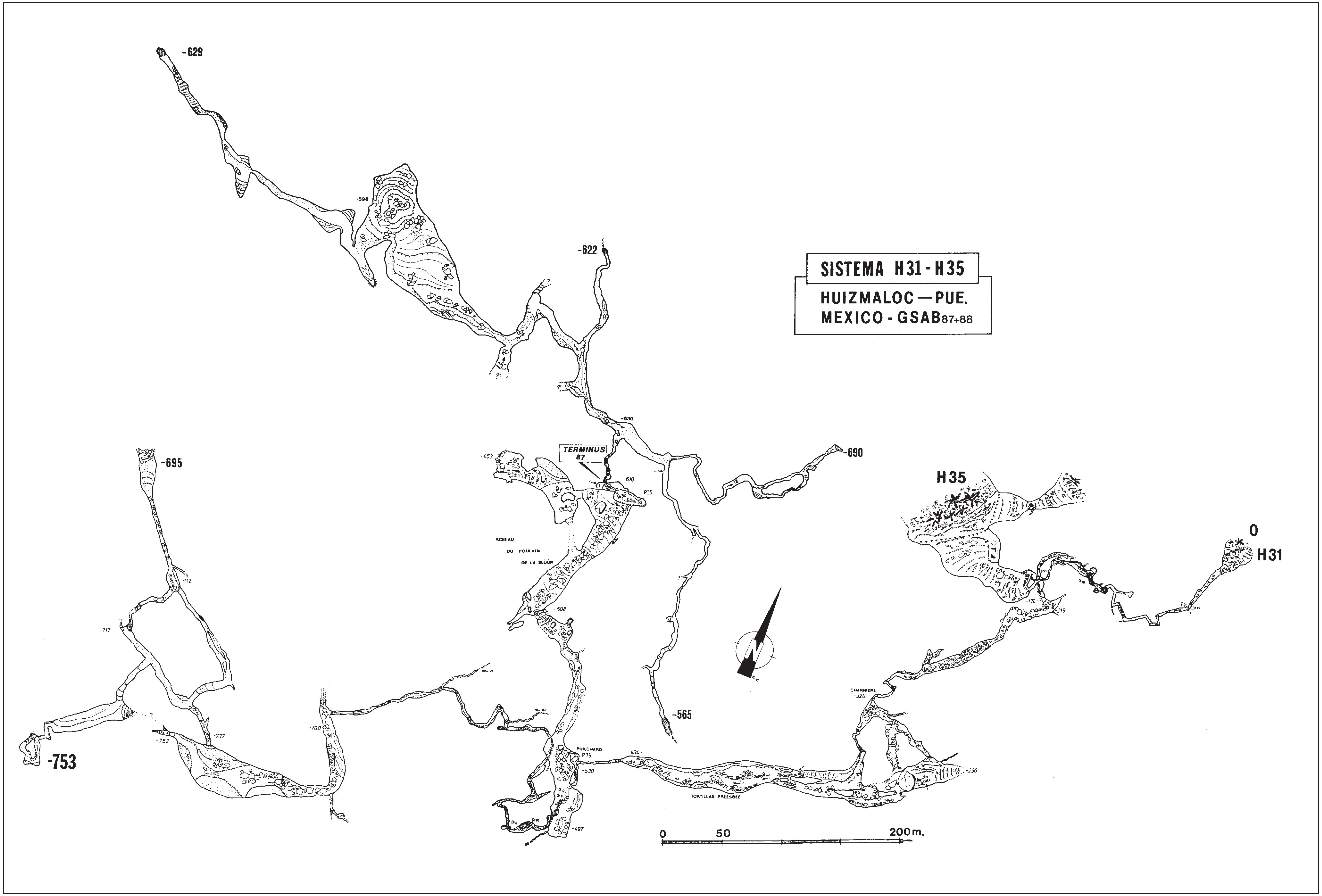


	NOM	PROFONDEUR	DEVELOPPEMENT
1.	AKEMATI	-1135m	3750m
2.	SISTEMA DE OCOTEMPA	-1070m	4720m
3.	SISTEMA H31-H35	-753m	5745m
4.	AZTOTEMPA	-700m	4000m
5.	SISTEMA ATLALAQUIA	-623m	4530m
6.	MEANDRE QUI TRAVERSE	-588m	2500m
7.	SISTEMA HU3-HU4	-430m	1300m
8.	COYOLATL	+240m	19000m
9.	ATLIXICAYA	232m (-140,+92)	11120m
10.	CUEVA XANTILCO	-161m	801m
11.	CUEVA DEL RIO TOPIZATL	50m (+33,-17)	1290m




SISTEMA H31 - H35
HUIZMALOC — PUE.
MEXICO - GSAB87+88
-629
-598
-622
-630
-690
TERMINUS
87
-453
-610
P35
-695
H35
0
H31
P12
-717
-508
-565
CHARNIERE
-320
-700
-737
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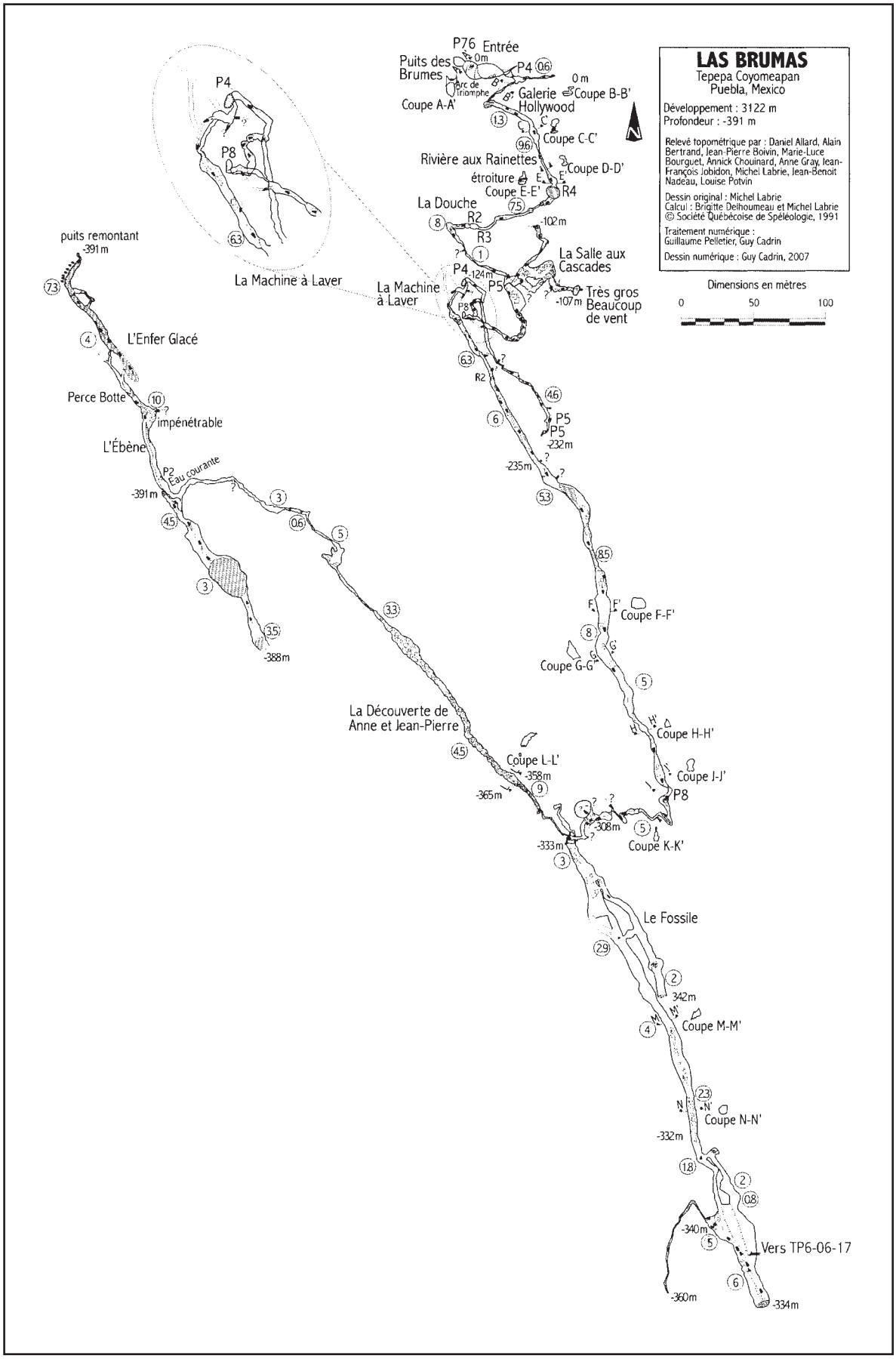
-753
PUILCHARD
P75
-434
-530
-296
TORTILLAS FREESBEE
-497
0
50
200m.


LAS BRUMAS
Tepepa Coyomeapan
Puebla, Mexico
Développement : 3122 m
Profondeur : -391 m
Relevé topométrique par : Daniel Allard, Alain Bertrand, Jean-Pierre Boivin, Marie-Luce Bourguet, Annick Chouinard, Anne Gray, Jean-François Jobidon, Michel Labrie, Jean-Benoit Nadeau, Louise Potvin
Dessin original : Michel Labrie
Calcul : Brigitte Delhoumeau et Michel Labrie
© Société Québécoise de Spéléologie, 1991
Traitement numérique : Guillaume Pelletier, Guy Cadrin
Dessin numérique : Guy Cadrin, 2007
Dimensions en mètres
0 50 100
P76 Entrée
0m
Puits des Brumes
Arc de Triomphe
P4
0 m
Coupe A-A'
Galerie Hollywood
Coupe B-B'
Coupe C-C'
Rivière aux Rainettes
Coupe D-D'
étroiture
Coupe E-E'
R4
La Douche
R2
R3
-102 m
La Salle aux Cascades
-107 m
Très gros Beaucoup de vent
P4
-124m
P5
P8
La Machine à Laver
La Machine à Laver
P8
puits remontant
-391 m
L'Enfer Glacé
Perce Botte
impénétrable
L'Ébène
P2
Eau courante
-391 m
-388m
R2
P5
P5
-232m
-235m
F
F'
Coupe F-F'
Coupe G-G
La Découverte de Anne et Jean-Pierre
Coupe H-H'
Coupe L-L'
-358m
-365m
Coupe J-J'
P8
-308m
Coupe K-K'
-333m
Le Fossile
342m
Coupe M-M'
N
N'
Coupe N-N'
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Vers TP6-06-17
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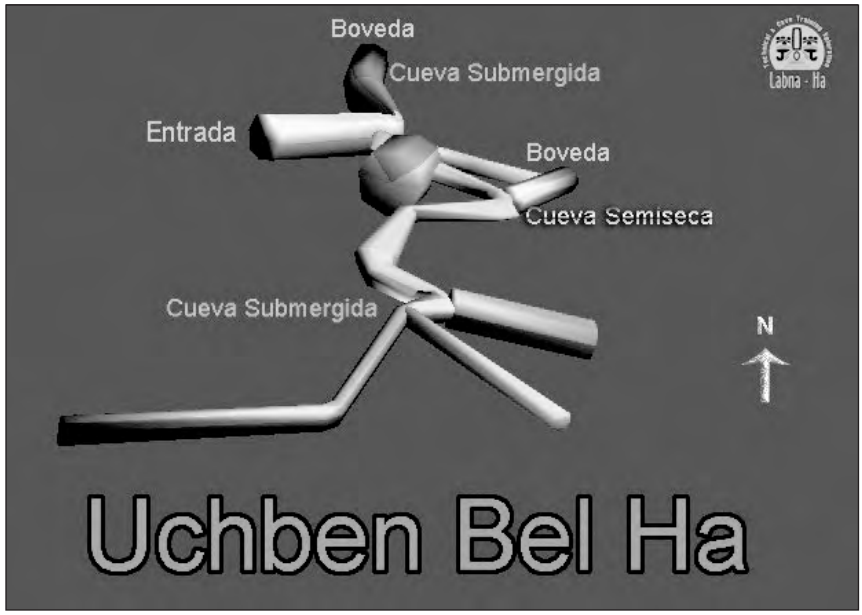
-334m



Karst Waters Institute (U.S.) and the Mediterranean Institute for Advanced Studies (Spain), from 17–20 November 2009 in Mallorca, Balearic Islands, Spain.

"The idea of the symposium is a simple one: to examine what we know and what we can infer about the environment, ecology, biodiversity, and evolutionary history of anchialine ecosystems in order to provide a focus for the development of interdisciplinary research. This work is scattered through the literature of different disciplines, and we think that there is much to be gained by bringing together leading researchers that work on various aspects of anchialine ecosystems. The presentations will be grouped around six themes, which have a strong interdisciplinary character: geology, hydrology and hydrogeochemistry; habitats and water quality; microbiology and ecosystem processes; evolutionary history, historical biogeography and molecular phylogenetics; and biodiversity and conservation." There is expected to be a strong representation of papers about Mexico, because of the large amount of research being done in the anchialine cave environments along the coast of Quintana Roo. For further information about the symposium, see http://imedea.uib-csic.es/anchialine-symp/. *Source*: Patricia Beddows.

Abstract: *Barbouria yanezi* sp. nov., a New Species of Cave Shrimp (Decapoda, Barbouriidae) from Cozumel Island, Mexico. Luis M. Mejía, Esteban Zarza, and Marilú López.

A new species of the genus *Barbouria* from Cozumel Island, Mexico, is described. The new species, *Barbouria yanezi*, is similar to *Barbouria cubensis* in exhibiting a cornea narrower than the eyestalk, and in its telson ornamentation, but differs from the latter species in the number of rostral spines, the proportions of the scaphocerite, the relative proportions of the carpus and propodus of the first and second pereiopods, the relationship between the appendices masculina and interna, and in size: it is larger than *B. cubensis*. The geographical relationship between the species is discussed.

Source: *Crustaceana* 81(6):663–672 (2008).

Abstract: Echinoderms in an Anchialine Cave in Mexico. Luis M. Mejía-Ortíz, Germán Yánez, and Marilú López-Mejía.

Five surveys in an anchialine cave from Cozumel Island, Mexico, were made in order to determine the diversity of invertebrates, especially of the phylum Echinodermata. **Aerolito** sinkhole (cenote), with an open coastal waters connection, was explored and the organisms were sampled by hand. The abiotic parameters (conductivity, salinity, oxygen, temperature, light and pH) were also measured. We identified three main classes of echinoderms from this cave. The first class is Asteroidea, located below the halocline in marine waters (37 ppt) at 256 m from the entrance and at 45 m from the entrance in marine waters. The second class is Ophiuroidea, located below the halocline in marine waters at 40 and 336 m from the entrance, and the third class, Echinoidea, is located in marine waters 60 m from the entrance. Only the asteroid species shows a depigmentated body; it is the unique species not found outside the cave. To date, only few species of Holothuridae have been reported from caves. We discuss the colonization and adaptations to cave life these animals show.

Source: *Marine Ecology* 28(suppl. 1)31–34 (2007).

Abstract: Inventory of Surface Karst Features of the Caribbean Coast of the Yucatan Peninsula. By Patricia A. Beddows, Kirstin H. Webster, and Simon M. Kras.

The Yucatan is an expansive karst peninsula devoid of surface rivers. Instead, shallow flooded cave systems flow at rates of 0.5–2.5 km/day, discharging to coastal springs. Development plans along the Caribbean Coast (south of Cancun) include several new cities of >200 000 inhabitants. While groundwater remains the only potable water source, the distribution of the caves is incompletely known particularly in areas distant from the limited road network. Access to the caves is through collapse sinkholes, locally called cenotes, which often directly overly the cave systems. Cenotes and dissolution depressions may therefore serve as surface proxies for the underlying cave systems. However data on these surface karst features also remains limited and dispersed. With the goal of ultimately establishing a GIS based karst inventory, we are working towards establishing a standardized data collection methodology that may be employed by local persons, tourists, and visiting college classes hosted at NGO's with whom we are working. The data collection methodology therefore needs to be rapid, applicable by persons of

diverse backgrounds and with limited prior experience in the area or in karst terrains in general, and provided in both Spanish and English. A 3 page data collection form has been created, and this is supported by a 10 page orientation guide including instructions and examples of field sketching, a field picture guide, and inventory sheets for GPS coordinates and photographs. While developing these materials, data have been collected on 50 dissolution shafts and depressions, 12 cenotes, and 4 rock shelters, all in the course of 1 month. The next stages in this program will be data collection by volunteers who were not directly involved in the methodology development so that the materials may be further advanced based on independent user feedback, and development of a web portal for centralized data delivery and archiving. Once established, this program will also provide direct educational experiences beyond georeferenced data acquisition, through education modules aimed at senior high-school and college levels on the surface and subsurface hydrology of this world class cenote karst landscape.

Source: Paper 88-2 at Geological Society of America 2006 Philadelphia Annual Meeting, http://gsa.confex.com/gsa/2006AM/finalprogram/abstract_115517.htm. This paper is similar to an article in this issue.

Abstract: The Quintana Roo Speleological Survey: Recent Explorations in Dry and Underwater Caves of Quintana Roo, Mexico. By James G. Coke IV.

The Quintana Roo Speleological Survey supports conservation, safe exploration, and confirmed survey documentation of the caves in Quintana Roo, Mexico. The present study area incorporates 8500 square kilometers in eastern Quintana Roo. Over 44 kilometers of cave survey is reported for the preceding year. Our area of interest contains 169 independent underwater caves (729 kilometers of surveyed passage) and 22 independent dry caves(12.3 kilometers of surveyed passage). Over two hundred collaborators have contributed raw survey data to the database, establishing one of the largest archives of underwater survey data in the world. Current investigations of underwater caves south of the town of Tulum continue to support an aerial geomagnetic survey of the fresh-water aquifer. Explorations north of Tulum in **Sistema Actun Hu** and caves inland from the town of Chemuyil support this component of the aquifer. Dry-cave exploration under a Pleistocene ridge common to the area is producing exciting results. **Sistema Tixik K'una** is progressing south along a large fracture toward another dry cave. In the northern area, a connection between Tixik K'una and two terminal sumps in **Sistema Xunaan Ha**, a sizable underwater cave, is imminent. Explorations in both areas of the dry cave continue.

Source: International exploration session abstracts in the program book for the 2008 NSS Convention. An article and map for Tixik K'una appear in *AMCS Activities Newsletter* 31.

Abstract: Paleoenvironmental Evolution of **Cenote Aktun Ha** (Carwash) on the Yucatan Peninsula, Mexico and its Response to Holocene Sea-Level Rise. By J. J. Garbiel, E. G. Reinhardt, M. C. Peros, D. E. Davidson, P. J. van Hengstum, and P. A. Beddows.

A 61-cm core was obtained from 4 meters below the water table in Cenote Aktun Ha, on the Yucatan Peninsula, Mexico. The cenote is 8.6 km from the Caribbean coast, and its formation and evolution have been largely affected by sea-level change. The base of the core dates to 6940–6740 cal yr BP, and overlying sediments were deposited rapidly over the subsequent ~200 years. The pollen record shows that the cenote evolved from a marsh dominated by red mangrove (Rhizophora mangle) and fern (Polypodiaceae) to an open-water system. These vegetation changes were controlled by water level and salinity and are thus useful indicators of past sea level. At the base, the $\delta^{13}C$ isotopic ratios reveal the influence of terrestrial vegetation (–29‰), but shift to more negative values up-core (–33‰), indicating an influence from particulate matter in the flooded cenote pool. Although microfossil populations were nearly absent through most of the core, the microfossil assemblage in the upper 6 cm of the core is dominated by juvenile *Ammonia tepida* and the thecamoebian genus *Centropyxis*. These populations indicate open-water conditions in the cenote and a major environmental shift around 6600 cal yr BP, which is related to sea-level rise in the Caribbean basin. These data fit well with previously established sea-level curves for the Caribbean Sea. Our reconstruction of the environmental history of Cenote Aktun Ha helps elucidate the floral and hydrological history of the region, and highlights the utility of cenote sediments for studying the Holocene sea-level history of the Caribbean Sea.

Source: http://adsabs.harvard.edu/abs/2008AAGUFM.A53E0326G. (American Geophysical Union Fall Meeting 2008, abstract #A53E-0326. This paper has the same authors and title as a 2009 paper in the *Journal of Paleolimnology*, not available free online.)

Abstract: Foraminifera and Testate Amoebae (Thecamoebians) in an Anchialine Cave: Surface Distributions from Aktun Ha (Carwash) Cave System, Mexico. By P. J. van Hengstum, E. G. Reinhardt, P. A. Beddows, H. P. Schwarcz, and J. J. Gabriel.

Surface sediment samples from **Aktun Ha** (Carwash) Cave System, Mexico, were analyzed for microfossils, carbonate isotopes, and organic matter content. Saline water flooded the cave during the Sangamon Interglacial highstand (124–119 kyr), hosting a marine assemblage dominated by saline foraminifera *Bolivina* sp. (73%) and *Elphidium* sp. (11%) with a mean $\delta^{13}C$ = –5.5% and a mean $\delta^{18}O$ = –2.7%. This assemblage was found distal to sinkholes (>75 m upstream, >150 m downstream) and in yellow–orange sediment (mean total organic carbon [TOC] = 3.6%). Late Pleistocene (95–15 kyr) sea level fall reestablished vadose conditions in the cave, allowing for localized speleothem (flowstone) to seal in the marine assemblage. Holocene sea level rise completely reflooded the cave with freshwater by 6.5 kyr,

providing a suitable habitat for a freshwater assemblage of living testate amoebae *Centropyxis aculeata* (≈38%), *Arcella vulgaris* (≈10%), and the foraminifer *Ammonia tepida* var. juvenile (≈35%), with a mean $\delta^{13}C$ = –10.8% and a mean $\delta^{18}O$ = –4.9% on the ostracod *Cytheridella ilosvayi*. This assemblage was found proximal to sinkholes (<75 m upstream, <150 m downstream) and in black to brown sediment (mean TOC = 17.5%). Foraminifera and testate amoebae colonize aquatic cave environments, respond to physicochemical conditions in the cave similarly to other coastal settings, and thereby provide promise for the application of protists as proxies in flooded caves.

Source: *Limnology and Oceanography* 54(1)391–396, 2009; PDF at http://earthsciences.dal.ca/people/graduate_students/images/van_Hengstum_et_al_2009_LO.pdf.

Abstract: Thecamoebians (Testate Amoebae) and Foraminifera from Three Anchialine Cenotes in Mexico: Low Salinity (1.5–4.5 psu) Faunal Transitions. By P. J. van Hengstum, E. G. Reinhardt, P. A. Beddows, R. J. Huang, and J. J. Gabriel.

This study presents the first systematic documentation of thecamoebians and foraminifera in anchialine cenotes (sinkholes) from Quintana Roo, Mexico. Thirty-three surface sediment samples (upper 5 cm) were collected from cenotes **Carwash** (1.5 psu), **Maya Blue** (2.9 psu) and **El Eden** (>3.3 psu). Q-mode cluster analysis of the faunal distributions isolated four low-diversity (Shannon diversity index 1.0–1.5) and salinity-controlled assemblages. Assemblage 1 (1.5 psu) is dominated by the thecamoebians *Centropyxis aculeata* ''aculeata'' (53%) and *Arcella vulgaris* (21%). Assemblage 2 (2.9 ± 0.2 psu) is dominated by *Centropyxis aculeata* ''discoides'' (41%) and *Centropyxis aculeata* ''aculeata'' (27%). Dwarfed (~50 mm) *Centropyxis constricta* ''aerophila'' (20%) with an autogenous test and *Jadammina macrescens* (29%) dominate Assemblage 3 (3.4 ± 0.2 psu). Finally, *Ammonia tepida* (51%), *Tritaxis* sp. (29%) and *Elphidium* sp. (11%) dominate Assemblage 4 (3.7 ± 0.4 psu). Thecamoebian and foraminiferal populations in the subtropical cenotes are distributed according to salinity variations as found in other temperate paralic systems. The centropyxid taxa trended towards ecophenotypes without spines with increasing salinity, and dwarfed and autogenous-shelled *Centropyxis constricta* ''aerophila'' were determined as the most euryhaline thecamoebian, persisting at the ecological boundary of the group (~3.3 psu). Importantly, the transition from a thecamoebian-dominated assemblage to a foraminiferan-dominated assemblage occurs at a salinity of approximately 3.5 psu.

Source: Full paper in *Journal of Foraminiferal Research* 38(4)305–317, 2008. PDF at http://earthsciences.dal.ca/people/graduate_students/images/van_hengstum_et%20al_2008_JFR.pdf. (Psu is an abbreviation for practical salinity units.)

Two weeks ago at the World Congress of Archaeology in Ireland, the discovery of "Eva of Naharon" was announced by a spokesman for paleontologist Arturo González. The remains were located in clear water in a cave located 44.5 (~27 mi.) kilometers to the southwest of the town of Tulum, in the Orange Grove Cave System.

In this place, explained the paleontologist, was the partially complete skeleton of a woman between thirty and forty years of age, 1.41 meters (about 4 ft. 7 inches) tall and weighing about 53 kilograms (117 lbs.).

From the bones in Naharon (Najaron), a ^{14}C date was obtained, through accelerator mass spectrometer (AMS) techniques, which gave an age of 13,600 years.

González explained that the collagen found in the bone cavities was in poor state of preservation. Thus the specialists at Oxford University and University of California Berkeley had to work with little material obtained from the bones, which had remained under the water for more than thirteen thousand years.

"We did not know that Ice Age man had left us in Tulum the funeral testimony of a woman who died at age forty-five and has an antiquity of 13,600 years," added Arturo González.

The discovery was not fortuitous, but is part of the work on the Archaeological Atlas Project in the region. The entrance was accessed through a natural well (cenote) of 30 by 45 meters in diameter. The human bones were located 368 meters from the entrance, also called Naharon, at a depth of 22.6 meters.

In reference to this finding, the anthropologist Concepción Jiménez indicated that until a few years ago the oldest human remains in the Americas were those of the "Mujer de Penon" (Woman of the Rock Baths), dated to 12,600 years old eight years ago, in 2000, by the ^{14}C method. It was remembered that that woman's bones were found in an unarticulated state when Mr. Tereso Hernández dug a well in his property in the Mexico City.

In the grand scheme of things, Arturo González indicated that more archaeologists, biologists, and paleontologists interested in the study of the origin of the man are needed.

Source: English translation by Bruce Rogers at http://archaeologica.boardbot.com/viewtopic.php?t=1914&highlight=naharon+eva of Milenio online November 2008 article by Leticia Sánchez at http://impreso.milenio.com/node/8090751.

Richard Wylde and Fred Devos surveyed **Cenote Minotauro**, 5 kilometers south of Puerto Aventuras, during the period from November 2006 to December 2008. Surveying underwater caves is not easy; thirty-three dives were made for just the part of Minotauro upstream from the entrance. Statistical estimates of the accuracy of such surveys can be made using probable errors of 2 feet in distance measurements and 5 degrees in azimuth estimates. A few closures made by transporting GPS equipment underwater to alternate cenote entrances, where it was used to pinpoint their locations in the jungle, indicate that the error estimates are approximately correct. *Source*: *Underwater Speleology* 26(2)2–29, April–June 2009.

The diving group DIR Mexico has a number of articles on cave diving in Quintana Roo on its web site.

The articles date from 1997–2003. See http://www.dir-mexico.com/articles.htm.

One of the 2008 winners of a $50,000 Rolex Award for Excellence is Arturo González, whose multi-disciplinary team has been examining human skeletons found in underwater caves. *Source*: *Descent* 206, February-March 2009, p. 8.

SAN LUIS POTOSÍ

The Mexican-Norwegian Golondrinas 2009 Expedition was a joint trip between the Asociación Potosina de Montañismo y Espeleología, seven Norwegian cavers (from the Troglodytt club and unaffiliated), two people from Sociedad Mexicana de Exploraciones Subterráneas (SMES) in Mexico City, and me from New Mexico. It was Stein-Erik Lauritzen's idea to go to **Sótano de Golondrinas** to make a LIDAR scan and a 360-degree panorama photograph of it. The main purpose of this photograph was to provide more information about its origin and help to guide further research in collaboration with different Mexican institutions. Of course such a picture should also be of enormous value in sharing the experience of descending Golondrinas with the numerous visitors who are already attracted to the site. This image will also help the local and state authorities to publicize and preserve the Natural Protected Area in which the pit is located. The other participants were: Miguel Blanco, Cyntia Chinchilla, Yazmín Ávila, Jorge Landeros, Salvador González Murillo, Sergio Sánchez-Armass, Luis Manuel López Romero, Eleazar, Homero, Roberto Legaspi, Ivan Soberón Azuara, Claudia Arriaga, Ricardo Peralta, Hugo, Daniel Ibarguengoitia, Alfredo Silva, Enrique Mancera, and Osvaldo Alvarado from APME; Stein-Erik Lauritzen, Walter Wheeler, Tim Redfield, Oyvind Hammer, Kenneth Mjelle, Simon de Villiers, and Hallgeir Revhaug from Norway; and Ruth Diamant and Vicente Loreto from SMES.

We were not aware of legislation approved in 2008, by which we needed to notify the Secretaría de Ecología y Gestión Ambiental to do the photographic work we planned to do on the pit. The SEGAM person responsible of the area kindly told us the procedure to follow to obtain the permit. So we drove to Aquismón, the closest town with Internet and fax services, and followed the instructions. For further information, see Chapter IV, page 39, in the regulations that can be downloaded, by going to www.segam.gob.mx/main.html, selecting "Ley de Transparencia" at the left, selecting "Leyes y Reglamentos" in the block of choices partway down the page, and, after the submenus below load, expanding "Leyes y Reglamentos," then "Reglamentos," and selecting the PDF "Reglamento de la Ley General del Equilibrio Ecológico y la Protección al Ambiente en Materia de Áreas Naturales Protegidas"; the direct link to get this contains about three hundred characters.

After waiting for a little bit, we were authorized to proceed, and off we went to take the picture we wanted. Following the local rules, the ropes were lowered in the morning after we got permission from the Unión de Guadalupe local authorities and raised when they told us to. These rules are intended to keep the pit free of any obstruction to the birds. The timing cannot be stated exactly, because the birds decide when to enter or leave the pit depending on the weather.

The excellent coordination and preparation by Miguel Blanco and the other members from APME made it possible for most of us to go down the pit. Cyntia's and her helpers' excellent culinary abilities made it possible to eat *enchiladas potosinas*, hamburgers, or other great dishes after climbing out from the pit. Overall it was a great experience: an impressive pit, good friends, and the plus of good food. We look forward to the next trip.

Source: Laura Rosales-Lagarde.

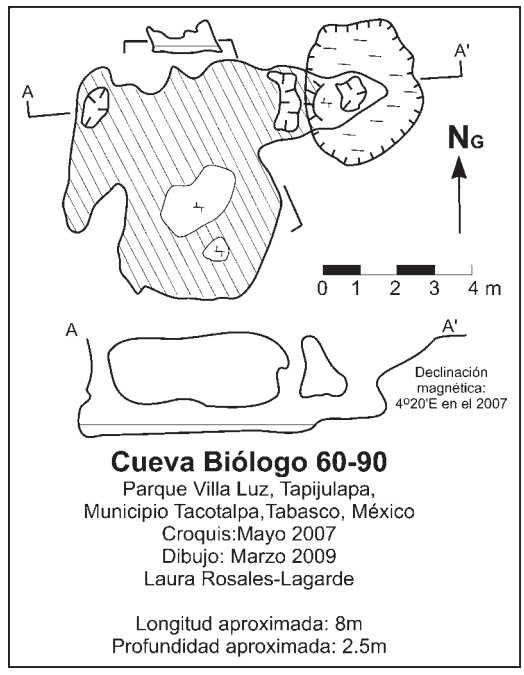
See also abstracts about the cave fish *Astyanax mexicanus* under Tamaulipas.

TABASCO

As part of my PhD research, in 2007 I looked for caves with H_2S-rich springs besides **Villa Luz** (a.k.a. Cueva de las Sardinas) and **Luna Azufre**.

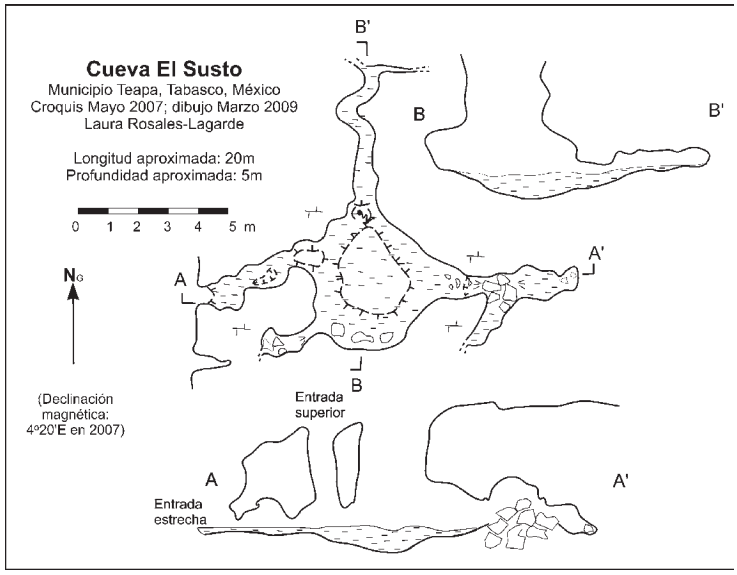
Cueva Biólogo 60-90 is a tiny cave located in the Villa Luz Park. The water in it has a brackish composition, but no H_2S, at least when we visited it.

Carlos Mario Esquivel González, a guide at Grutas de Cocona, and Gilberto Aguilar took me to the farthest east mogote from the Cocona Range. Despite my skeptical attitude, we arrived to a small cave entrance with white water and the characteristic H_2S smell. Not having a gas monitor, we decided to wait before entering. Nevertheless, while looking for other possible entrances, a big rock almost fell on Gilberto. This gave the name to **Cueva El Susto**. The name was reinforced when I visited the cave again, accompanied with Louise Hose, Sharmishtha Dattagupta, and Dan Jones. After Dan and I tried to squeeze through a crawl with water and grey mud, the H_2S concentration went up to 140 ppm, probably from our stirring up the mud. The exploration of the cave was stopped again. The third time we went, we got the surprise of finding the cave stream dry. Probably due to the dry season



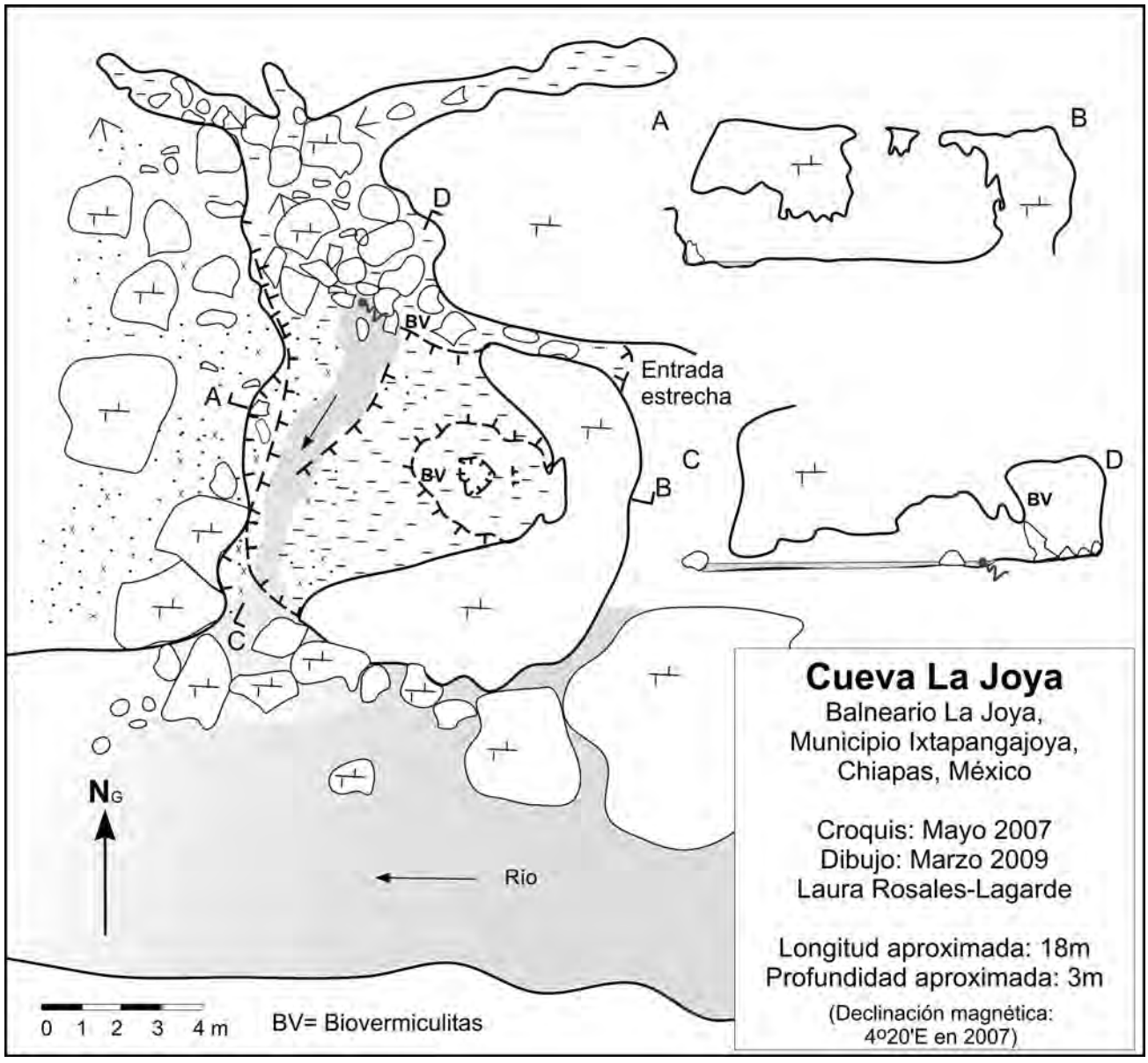
Cueva Biólogo 60-90
Parque Villa Luz, Tapijulapa,
Municipio Tacotalpa,Tabasco, México
Croquis:Mayo 2007
Dibujo: Marzo 2009
Laura Rosales-Lagarde

Longitud aproximada: 8m
Profundidad aproximada: 2.5m



(April), there was only a whitish-green pond left outside the cave. This time Penelope Boston, Andrea Martín Pérez, Mike Spilde, and Blair Stevens were with me, but after sinking in grey, sticky, knee-deep mud, only Mike stayed afloat while I crawled in the possible leads. The cave, although small, has selenite, gypsum paste, Ragu paste, and fish. ("Ragu paste" is a red corrosion residue, named for a resemblance to a spaghetti sauce.)

Cueva La Joya at La Joya Spa, Ixtapangajoya, Chiapas, looks like a huge boulder separated from a cliff, according to Louise Hose. Even so, it has a small low-H_2S spring flowing from it and highly corroded limestone leading to a skylight. Due to its position close to



a river, it has flood debris up to one meter high, but it still has selenite crystals, biovermiculations, Ragu and gypsum paste, and even tiny snottites. A small fruit-bat colony and several spiders live in this cave.

None of the caves we found so far has the high, constant H_2S concentrations and the high diversity of life that Cuevas de Villa Luz or Luna Azufre contain. This is perhaps due to their smaller size, their location in small, highly eroded blocks of limestone, or their low elevations subject to possible flooding. We know now that the more we look, the more caves with H_2S-rich springs will be found in the area to be explored and mapped. *Source*: Laura Rosales Lagarde. (The arrows on the maps are true north.)

TAMAULIPAS

On April 1, 2009, I recovered another body from a pit in the area of El Cielo. Guillermo Berrones Córdova, a 44-year-old man from Alta Cima, disappeared on March 21, and relatives and friends had been looking for him since then everywhere in the area of Alta Cima, Gómez Farías, and Mante, checking for him at police stations, hospitals, bus stations, etc., to no avail. Friends and relatives, after several days of making inquiries, found out that he had been last seen leaving the village of Alta Cima following the old lumbering road toward the town of Gómez Farías. Guillermo's brother and some friends started to wonder if he could have fallen into the pit beside the old Gómez Farías–Alta Cima lumber road some 200 hundred meters beyond the junction to Rancho del Cielo. In 2004, we had recovered the body of a local from Alta Cima at this pit [see "Mexico News" in *AMCS Activities Newsletter* 31 or *NSS News*, May 2007, part 2, "American Caving Accidents 2004–2005," page 37], and I had fenced this pit off since then in order to prevent more locals/tourists falling into the pit. Guillermo Berrones had sold all his cattle about three weeks before and was supposed to have money with him, but since then some locals said that he had apparently been drinking almost every day; that is why his brother and friends thought he could have had an accident on his way down to Gómez Farías. Another local told me that they had seen a psychic or clairvoyant from Llera, and that this woman had told them that Guillermo was dead at the bottom of a pit very close to the town of Alta Cima.

Finally, on March 31, ten days after Guillermo had disappeared, friends from Alta Cima contacted me by phone and asked me to check the pit where I had previously recovered the body of Cornelio García. I contacted the fire department in Mante and asked the chief to provide me with a few of his more experienced men and the Stokes basket, and I also contacted Gerardo Moctezuma Garcés, Arturo Gutierrez Reyes, and Rodolfo Huerta Camarillo, members of Grupo Espeleología Mante. We got all our caving gear as well as the fire department's equipment and at about 4:00 p.m. we headed for Gómez Farías, where we were joined by several locals from Alta Cima. We drove on the old lumber road to Alta Cima until we got to the pit, **Sótano de Cornelio**. I went into the 40-meter pit and found no one at the bottom. When I got out of the pit it was already dark. The locals of Alta Cima asked us to check another roadside pit farther up the road, but looking from the top of the pit we could see that there was no body there either. After we had spent an hour or so talking with the locals, Martín García of Alta Cima came to see us and said that during that day he had passed a pit beside a trail on the eastern side of the village very close of where we were, and that it smelled really bad. We went to check it at about 9:00 p.m. Grupo Espeleología Mante rigged the pit, went in, and discovered the body at the bottom of the pit. We could not see the body from the top, because the cave has a 15-meter-deep entrance pit, beyond which two short, steep slopes with lots of loose rocks and soil lead to another 15-meter-deep free drop (total depth is 30 meters). I rigged the cave, installing a deviation at the top of the entrance pit, another deviation at the bottom of the entrance pit, and a bolt/deviation/pulley at the top of the second drop. I also relocated most of the loose rocks, and my friends from GEM set up a traverse line at the top of the entrance pit, with another pulley at the center of the entrance. We lowered the Stokes basket to the bottom of the pit next to the body, and two members of the fire department packed the body in a body bag and the basket. We ascended first, checking that the basket would not get stuck, and finally the basket was pulled out of the pit at about 5:00 a.m. The Ministerio Público and police officers were already there to attest the death of Guillermo when the basket was pulled out of the pit. After ten days inside the pit, the body was in very bad shape. We left Alta Cima at about 6:00 a.m. and got back to Mante at about 8:00 a.m. The recovery took 7.5 hours.

This pit is located some 300 meters north of the old lumber road from Gómez Farías to Alta Cima, following a trail that leaves a fenced-off clearing some 60 meters before the first house of Alta Cima. It is now named **Sótano de Guillo** after Guillermo. The psychic is said to have described the barbed wire and the fence next to the road and the trail leading to the pit.

I knew Guillermo Berrones. He was single, and he was a quiet and nice man. I am surprised and very sad that he ended like this. It is very strange he had apparently committed suicide jumping into the pit, but also a murder is suspected because of the money he had with him after selling his cattle. *Source*: Jean Louis Lacaille Múzquiz.

Ian Reichert-Watts has provided "skinned" versions of the 3-D sonar images of three of the sinkholes at **Rancho la Azufrosa**, Tamaulipas. The images do not have a common scale; the underwater part of Zacatón is 319 meters deep. The cenotes were mapped during the DEPTHX project in spring 2007. See the article in *AMCS Activities Newsletter* 31, pages 97–105, about the project for the point-cloud images and the relative size of the pits.

Abstract: Mammoth Discovery: Paleontological and Geophysical Evidence for Timing and Sequence of Karstification at Sistema Zacatón,

Mexico. By Marcus O. Gary, John M. Sharp, Jr., Todd Halihan, and Juan Alonso Ramirez Fernandez.

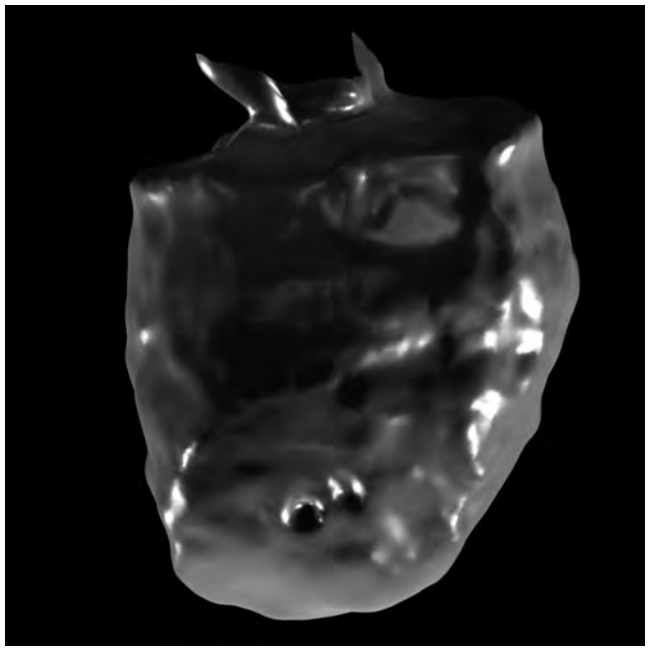
Defining the timing of karstification in a specific geologic setting is often a challenging task. Isotopy, sediment deposition, paleontology, geologic super-position, and geomorphology are among the tools used to provide clues for understanding when a particular karst system formed. The cenotes of **Sistema Zacatón** are perhaps the deepest underwater shafts. The period of their formation had been constrained to only within the last 1.5 million years, when volcanic activity dominated the nearby landscape. The sinkholes are hypogenic—formed by volcanic gasses. Following the opening of many sinkholes in Sistema Zacatón, a secondary phase of travertine deposition sealed expansive water-filled voids beneath a 2-to-5-meter-thick crust of rock, as demonstrated by electrical resistivity data and cave diving. In June 2006 while conducting geophysical surveys of some of the sealed cenotes, vertebrate fossils were found in travertine, previously mapped as Cretaceous limestones, adjacent to the sinkhole **Poza Seca**. These fossils have been identified as belonging to the genus *Mammuthus* by the molar and tusks that were located. The significance of this discovery relates to the lithology of rocks that pre-date sinkhole development to the surface and subsequent collapse. The fossils are lithified in dense travertine deposited by hydrothermal springs, and the sinkholes and dry caves in the system have formed within this travertine, thus major dissolution and collapse episodes at Sistema Zacatón must have occurred coincidentally or following this travertine formation. *Mammuthus* distribution in Mexico is predominant in the late-Pleistocene, as recent as 10,000 years b.p. The identification of these fossils may provide accurate timing of the formation of this impressive karst system.

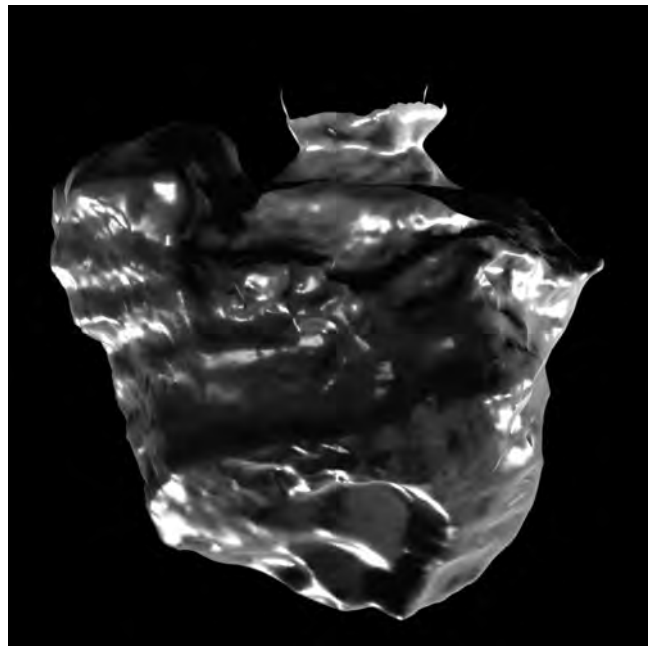
3-D models of Cenote Zacatón (above), Cenote Caracol (below left), and Cenote La Pilita, Tamaulipas. *Ian Reichert-Watts.*

Source: Paper presented April 2007. http://gsa.confex.com/gsa/2007SC/finalprogram/abstract_120214.htm; *Geol. Soc. America, Abs. with Programs (South-Central Sec. Mtg.)*, v. 39, no. 3, p. 28.

Abstract: Volcanogenic Karstification: Implications of This Hypogene Process. By Marcus O. Gary and John M. Sharp, Jr.

Hypogenic karst forms from water in which the aggressiveness has been produced at depth, independent of acid sources at or near the surface. Numerous geologic conditions facilitate a setting for hypogenic karst processes to evolve, including the interaction of igneous rocks and groundwater in carbonate rocks. Hydrothermal, deep-seated karst is documented, but the mechanisms are not always applied in geologic evaluations. Volcanic activity provides conditions that can rapidly dissolve large voids deep below the Earth's surface. Volcanogenic karstification relies on four components to initiate and develop deep, subsurface voids: 1) thick carbonate strata, 2) preferential groundwater flow paths (fractures), 3) volcanic activity that





releases acids, and 4) flux of groundwater through the system. The order of occurrence (from 1 to 4) is critical to develop the karst. Components 1, 2, and 4 are common to almost all karst, but component 3 can accelerate dissolution processes. High fluxes of carbon dioxide and/or hydrogen sulfide from volcanic rocks create hyper-aggressive subsurface conditions that rapidly dissolve carbonate rocks. Volcanogenic karstification has produced the Earth's two deepest underwater cave systems, Pozzo del Merro (Italy) and **Sistema Zacatón** (Mexico). Studies of these processes require evaluation of systems currently active on or near the surface (directly accessible by humans or robots). Volcanogenic karstification can produce deep solutional porosity and high permeability where older carbonate rocks are juxtaposed to younger volcanic rocks.

Source: http://a-c-s.confex.com/crops/2008am/webprogram/Paper49770.html; *Geological Society of America Abstracts with Programs, 2008 Joint Annual Meeting, Houston, Texas*, p. 343.

Abstract: Shh and Forebrain Evolution in the Blind Cavefish *Astyanax mexicanus*. By Sylvie Rétaux, Karen Pottin, and Alessandro Alunni.

The blind cavefish and its surface counterpart of the teleost species *Astyanax mexicanus* constitute an excellent model to study the evolution of morphological features. During adaptation to their lives in perpetual darkness, the cave population has lost eyes (and pigmentation), but has gained several constructive traits. Recently, the demonstration that an increase in Shh (Sonic Hedgehog) midline signaling was indirectly responsible for the loss of eyes in cavefish led to new ways to search for possible modifications in the forebrain of these cavefish, as this anterior-most region of the vertebrate central nervous system develops under close control of the powerful Shh morphogen. In this review, we summarize the recent progress in the understanding of forebrain and eye modifications in cavefish. These include major changes in cell death, cell proliferation, and cell migration in various parts of the forebrain when compared with their surface counterparts with eyes. The outcome of the modifications, in terms of neuronal circuitry, morphological, and behavioral adaptations are discussed.

Source: http://www.biolcell.org/boc/100/boc1000139.htm. The full paper appears in *Biology of the Cell* number 100, pp. 139–147.

Abstract: Restoring sight in blind cavefish. By Richard Borowsky.

Twenty-nine populations of the blind cavefish, *Astyanax mexicanus*, are known from different caves in North-Eastern Mexico. They evolved from eyed, surface-dwelling forms which only reached the area in the mid-Pleistocene. Quantitative genetic analyses have shown that the evolutionary impairment of eye development—as well as the loss of pigmentation and other cave-related changes—results from mutations at multiple gene sites ("eye loci"). Eye loss has evolved independently at least three times, and at least some of the eye loci involved differ between the different cave populations. Hybrids between blind cavefish from different caves have larger and better developed eye rudiments than their parents, reflecting these independent origins and complementation. Given the large number of mutations at different loci that have accumulated in these populations, we reasoned that hybridization among independently evolved populations might restore visual function. Here we demonstrate restoration of vision in cavefish whose immediate ancestors were blind and whose separate lineages may not have been exposed to light for the last one million years.

Source: *Current Biology*, vol. 18, R23-R24, 8 January 2008. Full paper accessible at http://www.cell.com/current-biology/fulltext/S0960-9822(07)02262-2.

Abstract: Evolution: Convergent Eye Losses in Fishy Circumstances. By Jeremy E. Niven.

Eye loss has occurred independently several times in Mexican cavefish. A new study shows that some aspects of vision can be restored by crossing cavefish from different populations, suggesting that changes at multiple loci contribute to eye loss.

Source: *Current Biology*, vol. 18, R27-R28, 08 January 2008. Full paper accessible at http://www.cell.com/current-biology/fulltext/S0960-9822(07)02247-6.

Abstract: Regressive Evolution in the Mexican Cave Tetra, *Astyanax mexicanus*. By Meredith Protas, Melissa Conrad, Joshua B. Gross, Clifford Tabin, and Richard Borowsky.

The evolutionary forces driving the reduction of eyes and pigmentation in cave-adapted animals are unknown; Darwin famously questioned the role of natural selection in eye loss in cave fishes: "As it is difficult to imagine that eyes, although useless, could be in any way injurious to animals living in darkness, I attribute their loss wholly to disuse." We studied the genetics of eye and pigmentation regression in the Mexican cave tetra, *Astyanax mexicanus*, by mapping and quantitative trait loci (QTL) analysis. We also mapped QTL for the putatively constructive traits of jaw size, tooth number, and numbers of taste buds. The data suggest that eyes and pigmentation regressed through different mechanisms. Cave alleles at every eye or lens QTL we detected caused size reductions, consistent with evolution by natural selection but not with drift. QTL polarities for melanophore number were mixed, however, consistent with genetic drift. Arguments against a role for selection in the regression of cavefish eyes cited the insignificant cost of their development, but we argue that the energetic cost of their maintenance is sufficiently high for eyes to be detrimental in the cave environment. Regression can be caused either by selection or drift.

Source: *Current Biology*, vol. 7, R52-R54, 6 March 2007. Full paper accessible at http://www.cell.com/current-biology/fulltext/S0960-9822(07)00890-1.

VERACRUZ

In the summer of 2008, three members of the club Espeleo CEMAC Veracruz were attacked by Africanized bees during a trip to a small cave in northern Mpo. Cuitláhuac. Each

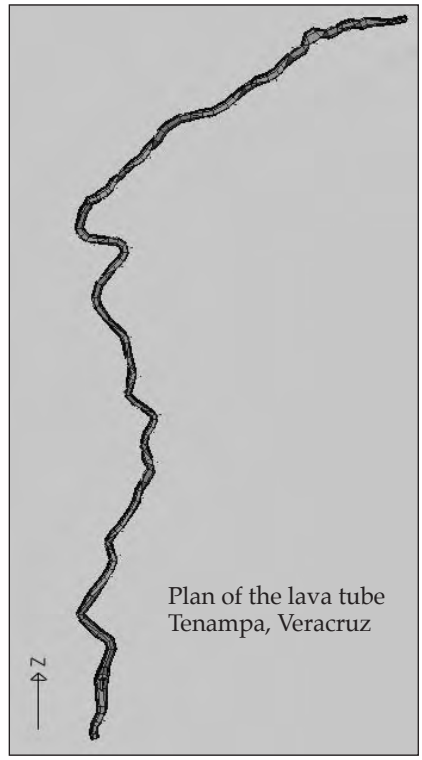
received more than two hundred stings, resulting in exhaustion, vomiting, and diarrhea. One managed to return to the nearest town for first aid in a rural clinic. The other two were ill in the cave, from which they were able to emerge after dark. All are alive and well and still caving in Veracruz. *Source*: January 10, 2009, post to Iztaxochitla e-mail list by Guillermo "Memo" Gassós.

In early January 2009, farmer Pablo Lara López, 70, was killed by an attack by bees while serving as a guide to **Cueva Pintada**, near Paso Panal, Mpo. Paso de Ovejas. *Source*: http://www.notiver.com.mx/index.php?news=13946. (It might be a good idea to review the advice about bees in the miscellaneous section of "Mexico News" in *AMCS Activities Newsletter* 31.)

Mexican cavers have explored **El Boquerón del Río Jamapa** (also known as **El Boquerón de La Palma**), Veracruz. This very wet cave swallows the Río Jamapa, which originates from the glacier on the northern flank of Orizaba and ultimately flows into the gulf at the city of Veracruz. The unenterable resurgence is 20 kilometers away and 400 meters lower, but the insurgence cave sumped after 230 meters of passage, all of which had to be rigged with ropes because of the swift and deep water. *Source*: article by Chris Lloyd in Canadian Caver 70, pages 16–23, spring 2009.

Members of the club CEMAC Veracruz have explored the lava cave **Tenampa**, formed in the Naolinco lava field. The length of the cave is 1153 meters and the depth is 69 meters. A notable feature in the cave is a lava stalagmite they named Los Hermanos that is almost 5 meters tall. *Source*: e-mail from Guillermo Gassós, translated by Laura Rosales. There is a slide show on the cave at http://www.espeleoveracruzano.com/album/displayimage.php?album=74&pid=501&slideshow=5000, and further information on the group's Jilotepec project can be found at http://www.oztotl.com/ps/reports/Jilotepec.pdf or http://espeleojarocho.blogspot.com/2007/07/proyecto-vulcano-espeleolgico-jilotepec.html.

Cueva de la Orquídea (Orchid), Xalapa, was developed briefly for tourists in 1996, but the organization involved no longer exists. The cave is a lava tube developed in a 30,000-year-old flow from Cerro Macuiltépetl. Trustees of the Parque Ecológico Macuiltépetl (http://macuiltepec.org) hope to restore and reopen the cave, and they have been encouraged by the response of the state governor and the *alcalde* of Xalapa. Help and advice from cavers is requested by those preparing the proposal. *Source*: Sergio Humberto Águilar Rodríquez (aguilar.sergio@gmail.com).



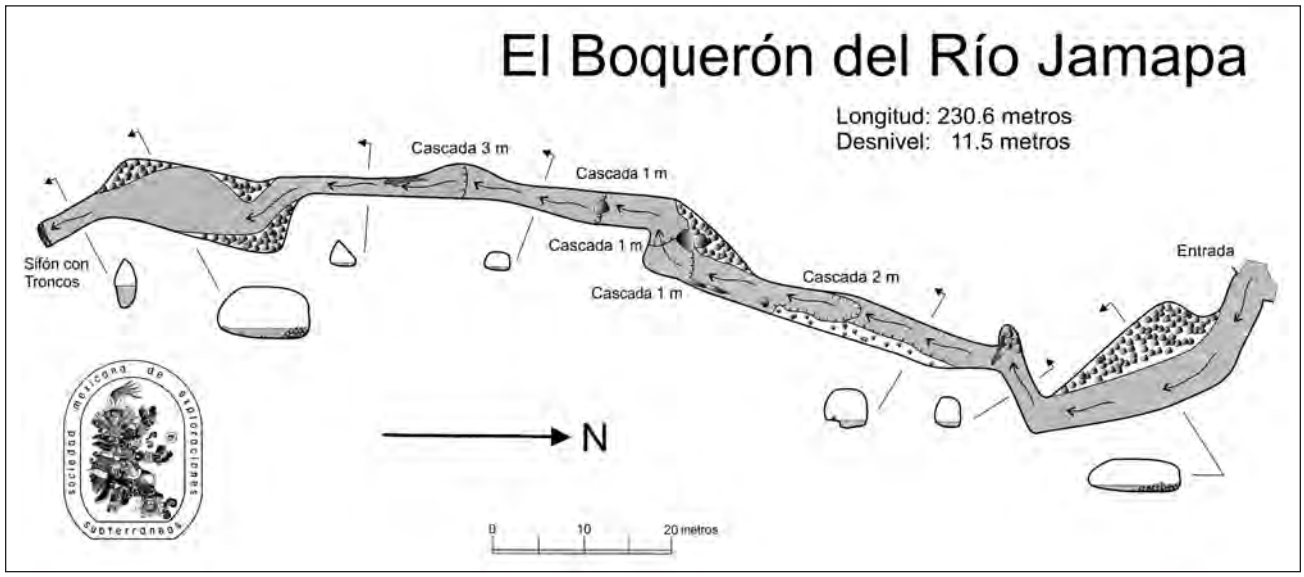
Plan of the lava tube Tenampa, Veracruz

YUCATÁN

Portal to mythical Maya underworld found in Mexico, by Miguel Angel Gutierrez, August 14, 2008—

Mexican archeologists have discovered a maze of stone temples in underground caves, some submerged in water and containing human bones, that ancient Maya believed was a portal where dead souls entered the underworld.

Clad in scuba gear and edging



Lava stalagmite in Tenampa, Veracruz.

through narrow tunnels, researchers discovered the stone ruins of eleven sacred temples and what could be the remains of human sacrifices at the site in the Yucatan Peninsula.

Archeologists say the Maya believed the underground complex of water-filled caves leading into dry chambers—including an underground road stretching some 100 meters—was the path to a mythical underworld, known as Xibalba.

According to an ancient Maya scripture, the *Popol Vuh*, the route was filled with obstacles, including rivers filled with scorpions, blood, and pus and houses shrouded in darkness or swarming with shrieking bats, Guillermo de Anda, one of the lead investigators at the site, said on Thursday.

The souls of the dead followed a mythical dog who could see at night, de Anda said.

Excavations over the past five months in the Yucatan caves revealed stone carvings and pottery left for the dead.

"They believed that this place was the entrance to Xibalba. That is why we have found the offerings there," de Anda said.

The Maya built soaring pyramids and elaborate palaces in Central America and southern Mexico before mysteriously abandoning their cities around 900 A.D.

They described the torturous journey to Xibalba in the *Popol Vuh* sacred text, originally written in hieroglyphic script on long scrolls and later transcribed by Spanish conquerors.

"It is very likely this area was protected as a sacred depository for the dead or for the passage of their souls," said de Anda, whose team has found ceramic offerings along with bones in some temples.

Different Maya groups who inhabited southern Mexico and northern Guatemala and Belize had their own entrances to the underworld that archeologists have discovered at other sites, almost always in cave systems buried deep in the jungle.

In the Yucatan site they have found one 1,900-year-old ceramic vase, but most of the artifacts date back to between 700 and 850 A.D.

"These sacred tunnels and caves were natural temples and annexes to temples on the surface," said de Anda.

Source: http://www.oztotl.com/maya/xibalba/. A Reuters version of the same article is at http://www.msnbc.msn.com/id/26208873. A different article about the same thing was put out by the AP at the same time; Google "highway through hell" to find one of the numerous places it has been posted.

One of the caves on the "path to Xibalba," Yucatán. *Tammara Thomsen*.

Abstract: Speleothem Paleoclimatology of the Last Deglaciation from Two Caves in Yucatan, Mexico. By Cara L. Gentry, et al.

Speleothems were sampled from **Cueva Columnas** and **Cueva Oxpehol** in Yucatan, Mexico. Samples from Columnas and Oxpehol have basal ages placing the initial grown of the stalagmites in the last glacial period (U/Th basal ages range from 21,089 to 30,816 years). Oxygen and carbon isotopes were measured on calcite samples drilled every 0.5 mm along the growth axis of these speleothems. Oxygen and carbon isotope values from stalagmites decrease along the speleothem growth axis. These results are consistent with recent findings in sediment cores from Lake Peten Itza in Guatemala and expected changes in oxygen and carbon isotope values across the Pleistocene/Holocene (P/H) boundary. Previous pollen studies on lake cores indicated a cooling of 6 to 8°C during the Pleistocene in the Maya lowlands, which would have increased the $\delta^{18}O$ of speleothem calcite. Furthermore, the

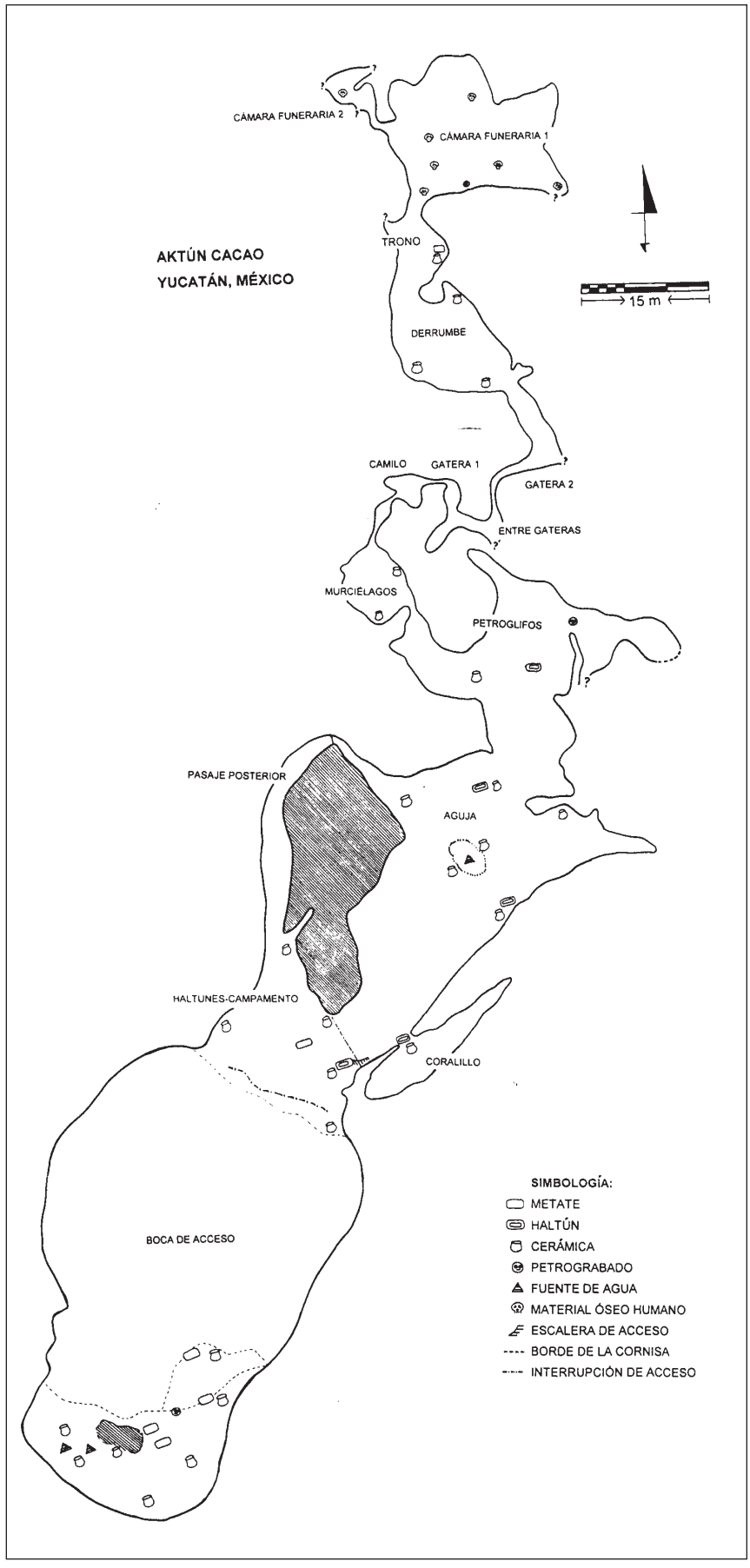
Maya lowlands were drier during the Pleistocene, which should also have been expressed by an increase in the $\delta^{18}O$ of speleothem calcite owing to an increase in the $\delta^{18}O$ of rainfall (i.e., the amount effect). During the glacial period, the abundance of dry-adapted C_4 vegetation was greater than today and transitioned to an increased abundance of C_3 vegetation at the start of the moister Holocene. The decrease in the carbon isotopic values across the P/H boundary is consistent with such a vegetation shift above the caves. Other current work includes a detailed investigation correlating rainwater and cave drip water $\delta^{18}O$ ratios to precipitation amount in the Yucatan Peninsula.

Source: Abstracts for the geology and geography session at the 2008 NSS Convention.

Now I live in **Yokdzonot**. Yokdzonot's ecotourism committee has a big cenote, or water-filled sinkhole, with a nice restaurant beside it, and wants more visitors. Like Sabacché, the folks are Maya and speak Mayan in their homes, but the educational level and standard of living in Yokdzonot are much more developed than in Sabacché, and the community has a completely different feeling. For one thing, being farther east, the climate is rainier here, so consequently the forest stands nearly as tall as a typical woods in the eastern US. Tree branches bear many more epiphytes, particularly bromeliads, than trees in arid Sabacché.

Yokdzonot, the word, means *above the cenote*. You can see the *cenote* in *dzonot* in *Yokdzonot*, so you can figure out that in Mayan *yok* means *above*. The town is located on the old highway between Mérida and Cancún. A four-lane toll road now connects the towns, but much traffic continues on the old road, because in Mexico toll roads are much more expensive than up north, even when they're potholed. My first guess at the town's population was about 50, but, knowing how lots of people pack themselves into Mexican households, I decided it would be around 300. When I asked, it turned out to be ±850.

Early Wednesday morning, when I first approached Yokdzonot's main



cenote, I thought I heard a lot of trickling water, but it turned out to be the soft chattering of hundreds of cave swallows, *Hirundo fulva*. Clinging to the cenote's rock walls, individual birds would launch into the air independently and join other birds already circling counterclockwise inside the cenote. As more and more birds joined, the circling flock rose higher inside the cenote, then finally they'd all escape from the pit, flying right at treetop level. Meanwhile, another circling flock would be forming below. In short, the birds exited in puffs of maybe fifty to one hundred birds, not in one massive emergence. A wild guess is that about a thousand birds live there.

I entered the cenote via a steep wooden staircase, the air becoming ever more humid. A feeling for the pit is provided by a picture of the opposite wall at http://www.backyardnature.net/n/08/081013yk.jpg. The dangling items are the rootlike stems, or stemlike roots, of strangler fig trees growing at the rim.

Source: Jim Conrad's Naturalist Newsletter for October 13, 2008, archived at http://backyardnature.net/n/08/081013.htm. The e-mail newsletter, sent about weekly, can be subscribed at http://backyardnature.net/news/natnat.php. Material in it about caves is rare, and Conrad is currently back in the U.S. after an extended period in Mexico, but I nevertheless recommend it for those interested in flora and fauna.

PlongeeSout'Mag, a free international cave diving magazine that can be downloaded from www.plongeesout.com, contains an article on a Yucatan 2008 expedition led by Curt Bowen for cave diving in cenotes in Yucatán. The article, on pages 8–15 of issue number 7, for December 2008–May 2009, is heavily illustrated in color and has the full text in both French and English. (This magazine is recommended to anyone interested in cave diving. The PDF files are very difficult to print, however.) The article describes a dive in **Cenote Karril**. This might be the same as Cenote Carril, 20°30.990 89°01.540, in the list of Yucatán cenotes located by Bowen's *Advanced Diver Magazine* trips. See "Mexico News" in *AMCS Activities Newsletter* 31.

The magazine *Unicornio de Por Esto!* (probably a Sunday newspaper supplement) contained an article "Aktun Cacao, un Tesoro Subterráneo del Sur" by Carlos Agusto Evia Cervantes on pages 7 and 8 of the 29 March 2009 issue. The article describes a trip to **Aktun Cacao**, about 8 kilometers northwest of Akil, in 1990. The cave is rich in archaeological material, and was the subject of a 1996 thesis by Oana Del Castillo at the Universidad Autónoma de Yucatán, from which the map accompanying the article (and reprinted here) was taken. *Source*: 31 March 2009 posting on Iztaxochitla e-mail list, brought to our attention by Jerry Atkinson.

An article "Un palacio de cristal únicas en el estado gruta **Zastun Tunich** or chocantes" can be found at the web site of Yucatán a la Mano, http://yucatanalamano.com/noticia/un-palacio-de-cristal-nicas-en-el-estado-gruta-zastun-tunich-o-chocantes or at http://www.oztotl.com/ps/reports/Zastun_Tunich.pdf. *Source*: Peter Sprouse.

MISCELLANEOUS

The IX Congreso Nacional Mexicano de Espeleología was held from 30 January to 2 February 2009 in Villahermosa, Tabasco. It was organized by the Unión Mexicana de Asociaciones Espeleológicas (UMAE) and the Sociedad Espeleológica de Tabasco. The program of papers at the congress follows:

Viernes 30 de enero

18:30–19:10 Conferencia magistral "Experiencias de un explorador inglées en México," a cargo de Peter Lord Attewell. [See article in this issue.]

19:10–19:40 Presentación del libro "Privilegios de la Luz, Maravillas Subterráneas de México." Presenta: Carlos Lazcano Sahagún.

Sábado 31 de enero

09:00–09:30 Conferencia magistral "**Cueva del Chorro Grande**, Chiapas, México." Presenta: Eric David, Stéphane Kleinman, Oscar Carbrera, y Jorge Antonio Paz Tenorio. Exploration Karstiques Sud-Américaines y Grupo Espeleológico Vaxakmen, A.C.

09:30–09:50 "Estudio de los niveles geomorfológicos de la gran **Paleocaverna de Bellamar**." Presenta: Humberto Hernández Ramos, Esteban Grau González-Quevedo, y Lourdes Cabello Batista. Grupo Félix Rodríguez de La Fuente, Sociedad Espeleológica de Cuba.

09:50–10:10 "Cenotes y cuevas, una propuesta de desarrollo sustentable de los recursos naturales de la Península de Yucatán." Presenta: Arq. Sergio Grosjean Abimerhi, Dr. Jorge Victoria Ojeda, y Antropólogo José Ruiz Silva. Fundación Convento Sisal, Valladolid, Yucatán; Instituto de Cultura de Yucatán; y Secretaría de Desarrollo Urbana Urbano y Medio Ambiente del Estado de Yucatán.

10:10–10:30 "Intervención de cuevas para uso de espacio público. Ecoturismo vs. Protección de áreas naturales." Presenta: Enrique Antonio Embriz Sánchez y Jesús Bravo Rodríguez. Grupo IE Palax Ha.

10:30–11:00 "Clasificación del agua de manantiales y su relación con la formación de cavernas en la región de la Sierra de Tabasco, Norte de Chiapas, México." Presenta: Laura Rosales Lagarde, Penelope Boston, Mike Pullin, Andrew Campbell, y Kevin W. Stafford. Earth and Environmental Science Department, New Mexico Institute of Mining and Technology; National Cave and Karst Research Institute; Chemistry Department, New Mexico Institute of Mining and Technology.

Salón 1

11:20–11:50 "Rabia transmitida por murciélagos." Presenta: Diódoro Batalla Campero y Juan Antonio Montaño Hirose. Centro Nacional de Servicios de Diagnóstico en Salud Animal y Grupo Xhasmagu.

11:50–12:10 "Proyecto **Akemabis** 2008." Presenta: Franco Attolini Smithers. Sociedad Mexicana de Exploraciones Subterráneas.

12:10–12:30 "Proyecto de Geo-

referenciación de cuevas en México con presencia de murciélago hematófago." Presenta: Baltazar Cortes García. Departamento de Rabia Paralítica Bovina y Garrapata, Dirección de Campañas Zoosanitarias, Dirección General de Salud Animal.

12:30–12:50 "Presencia de variantes rabia V3 (*Desmodus rotundus*) y V4 (*Tadarida brasiliensis*) en murciélagos que habitan en cuaevas y casas en el Departamento del Valle de Cauca–Colombia." Presenta: Bióloga Constanza L. Núñez Mejía. Grupo VIREM, Universidad de Valle, Cali, Colombia.

12:50–13:10 "Uso de los Sistemas de Información Geográfica en la prevención y vigilancia de la rabia transmitida por vampiros." Presenta: Alejandro Jiménez Ramírez. Tuxtla Gutiérrez, Chiapas.

Salón 2

11:20–11:50 "Colémbolos cavernícolas y de otros ambientes subterráneos de Quintana Roo, México." Presenta: Leopoldo Q. Cutz Pool, Arturo García-Gómez, y José G. Palacios Vargas. Laboratorio de Ecología y Sistemática de Microartrópodos, Departamento de Ecología y Recursos Naturales, Facultad de Ciencias, UNAM.

11:50–12:10 "Diversidad genética de *Histoplasma capsulatum* asociada a murciélagos cavernícolas." Presenta: Maria Lucia Taylor, Daniel A. Estrada-Bárcenas, y Lorena Hernández García. Laboratorio de Imnmunología de Hongos, Departamento de Microbiología y Parasitología, Facultad de Medicina, UNAM.

12:10–12:30 "Amblipíigidos cavernícolas de Chiapas, México." Presenta: Kaleb Zárate-Gálvez. Grupo Espeleológico Jaguar A.C., Chiapas, México.

12:30–12:50 "Relicto de selva alta perennifolia y su regeneración en el Parque Estatal de **Agua Blanca**." Presenta: M. en C. Ofelia Castillo Acosta, Dr. Juan Ignacio Valdez Hernández, Dr. Joel Zavala Cruz, M. en C. Víctor Zarco, Estudiante de Ecología, Blanca Pérez, y Dra. Luisa Cámara Cabrales. División Académica de Ciencias Biológicas, UJAT y Colegio de Postgraduados, Campus Tabasco.

12:50–13:10 "Divulgación de la espeleología en Chiapas, México." Presenta: Jorge Antonio Paz Tenorio y Oscar Cabrera. Grupo Espeleológico Vaxakmen A.C.

16:00–16:40 Conferencia Magistral "La gran caverna de **Santo Tomas**, Viñales, Pinar del Río, Cuba," a cargo de Ángel Graña González, Presidente de la FEALC y Sociedad Espeleológica de Cuba.

16:40–17:00 "Cueva de hielo **Gheratul de la Scarisoara** (montañas Apuseni, Rumania): un estudio de caso sobre su acondicionamiento y turisomo sostenible." Presenta: Marcel Ciobanu y Maili Alicia González Machorro. Institute of Biological Research, Department of Taxonomy and Ecology, 48 Republicii Str., RO-400015 Cluj-Napoca, Romania; Universidad de Jaén, Jaén, España.

17:00–17:20 "Contribución al estudio de las pictografías de las **Cuevas de Diego**, Catalina de Guines." Presenta: Reinaldo Guerrero Guerrero y Georgina Mantilla Perera. Grupo Alejandría SEC de Cuba.

17:20–17:40 "**Sistema Pool Tunich**, la cueva seca más larga de Quintana Roo." Presenta: Gustavo Vela Turcott y Otto Von Bertrab. Grupo Alltournative; Sociedad Mexicana de Exploraciones Subterráneas.

18:00–18:20 "Pasado, Presente y Futuro de la Espeleología en México: Estrategias deportivas para el buen futuro del karst mexicano." Presenta: Saúl Aguilar Morales y Ada Alicia Ruiz Castillo, con la colaboración del Dr. Jun Morales Malcara. Laboratorio de Acarología y Laboratorio de Microartrópodos, UNAM.

18:20–19:00 Conferencia magistral "Avances en el registro y la ubicación de vestigios arquelológicos en **Aktun Hom**, cueva localizada en la región de Tekax, Yucatán," a carga de Susana Echeverría Castillo y Mario Novelo Dorantes. Grupo Ajau; Grupo URIÓN.

Domingo 1 de febrero

09:00–09:30 Conferencia magistral "Proyecto Sierra Gorda de Querétaro," a cargao de Argelia Tiburcio Sánchez, Alejandro Villagrán Hernández, Israel Huerta Ibarra, Tlatoani de Jesús Reyes Bermejo, y Edgar Francisco Mendoza Gualito. Asociación de Excursionismo y Montañismo del Instituto Politécnico Nacional.

09:30–09:50 "Proyecto de exploración geográfica y espeleológica San Fernando, Chiapas, México. Presenta: Mauricio Náfate López. Grupo Espeleológico Jaguar A.C.

09:50–10:10 "Desde 2 niños atrapados en Yoshib al Salto Base de Adam Gibson." Presenta: Salvador Rodríguez Pola y Manuel de Jesús Napabe López. Área de Espeleosocorro de Cruz Roja Mexicana, Delegación Tuxla Gutiérrez.

10:10–10:30 "Entidades de la República Mexicana que han tenido algún registro de accidentes en el ámbito subterráneo." Presenta: Mario Gómez Ramírez. Universidad Veracruzana.

10:30–11:00 Conferencia magistral "Exploración espeleoarqueológica en la **Gruta de San Fielipe**, Tacotalpa, Tabasco," a cargo de Luis Alberto Martos López y Roberto Porter Núñez. Instituto Nacional de Antrhopología e Historia y Sociedad Espeleológica de Tabasco.

11:20–11:50 "Petrología y química de las perlas de caverna de la **Gruta de las Canicas**, Tabasco, México." Presenta: S. Houston, P. S. Mozley, A. Campbell, and P. Boston.

11:50–12:10 "Rituales en las cuevas de Yucatán." Presenta: Carlos Augusto Evia Cervantes. Grupe Espeleológico Ajau, Mérida, Yucátan.

12:10–12:30 "Aprovechamiento de las cuevas del municipio de Opichen, Yucatán." Presenta: Raúl Ernesto Manzanilla Haas. Grupeo Espeleológico Ajau, Mérida, Yucátan.

12:30–13:00 Conferencia magistral "Turismo Sustentable en Áreas naturales Protegidas y Educación Popular ambiental en cuevas de San Juan Tlacotenco, Tepoztlán, Morelos," a carga de Karla Quintana Pearce, Eduardo Granados García y Gerardo Obispo Morgado. Sociedad Bioespeleológica Moreleanse A.C.

13:00–13:20 "Proyecto Quebradas de Durango, Casas en cuevas." Presenta: José Javier Vargas Guerrero, Walter Bishop Velarde, y Carlos

Lazcano Sahagún. Asociación de Montañismo de la UNAM; Fundación Vida para el Bosque A.C.; y Aventuras Pantera.

13:20–13:40 "Exploración en la cueva de la **Gota de Agua** en Zongolica, Veracruz." Presenta: Jesús Donmínguez Navarro, Reyes Orozco Villa, Claudio Cruz García, y Manuel Fuentes Ayohua. Grupo Zongolica; Grupo URIÓN.

13:40–14:00 "Inventario de Cuevas en México, como Iniciativa de Conservación." Presenta: Ada Alicia Ruiz Castillo y Saúl Aguilar Morales. Laboratorio de Microartrópodos y Laboratorio de Acarología, UNAM.

16:00–16:40 Conferencia magistral "Los estudios bioespeleológicos de la **cueva de las Sardinas** y sus perspectivas," a cargo de José Palacios Vargas. Laboratorio de Ecología y Sistemática de Microartrópodos, Departamento de Ecología y Recursos Naturales, Facultad de Ciencias, UNAM.

16:40–17:00 "Gestión y conservación de las naturaleza en el municipio de Atoyac en Veracruz, México, en las perspectiva de Desarrollo sostenible." Presenta: F. Pimentel Ugarte y J. Peña Montenegro. H. Ayuntamiento de Atoyac, Atoyac, México; Fundación Latinoamericana de Apoyo a la Economía y Saber Popular, México; Universidad de Jaén, Jaén, España.

17:00–17:20 "Proyecto Espeleológico de Villa de las Rosas, Chiapas." Presenta: Gabriel Merino Andrade y Camilo Thompson Poo. Grupo Espeleológico Jaguar A.C., Chiapas.

17:20–17:40 "Determinación de la capacidad de carga turística del Parque Estatal de Agua Blancoa." Presenta: M.A. Carlina Zerqueira Larios. División de Ciencias Biológicas de la Universidad Juárez Autónoma de Tabasco.

18:00–18:20 "Relevancia de las Inverstigaciones Arquelógicas en las cuevas de Tabasco." Presenta: Enrique Méndez Torres y America Amalbran Oporto. FFyL, IIA, EM-UNAM.

18:20–19:00 Conferencia magistral "¿Que es la FEALC?" a carga del Dr. Ángel Graña González, Presidente de la Federación Espeleológica de Améerica Latina y del Caribe.

The American Geophysical Union's 2007 Joint Assembly was held in Acapulco, Mexico, May 22–25. The following cave- or karst-related papers were presented. To see a full list of authors and their affiliations and the abstract for a paper, go to http://www.agu.org/meetings/ja07/waissm07.html. Select the section named after the title below, enter a word or two from the title or author list in the keyword box, and click "submit." *Source*: Patricia Beddows.

Y. Cruz de la Garza and E. Escobar Briones. "Relevance of the Halocline in the Diet of the Troglobitic Shrimp *T. Mitchelli* in the Yucatan Peninsula." (Hydrology [H])

O. Torres Telamante and E. Excobar Briones. "Hydrobiogeochemical Description of Remipede Habitat in a Coastal Karst Cave." (Hydrology[H])

B. R. Neuman, et al. "A Regional-Scale Groundwater Model Supporting Management of the Sian Ka'an Biosphere Reserve and its Catchment, Quintana Roo." (Hydrology [H])

J. E. Cole, et al. "Holocene Hydroclimate of the Sonoran Desert: Results from Cave of the Bells, Arizona." (Union [U])

J. Sánchez-Sesma. "Paleo-Hurricanes in the North Eastern Pacific: A Proposal for the Reconstruction and Analysis Based on Proxy Record Covering the Last Millennium." (Paleoceanography and Paleoclimatology [PP])

H. Ernesto, et al. "Comparison of New Geochemical Proxies in a Stalagmite from Sub-Tropical Mexico." (Paleoceanography and Paleoclimatology [PP])

H. B. Ramirez, et al. "Band-counting and Grey Tone Spectral Analysis in Banded Stalagmites, a New Proxy for Paleoclimate Reconstruction?" (Paleoceanography and Paleoclimatology [PP])

J. Bernal, et al. The 8.2 ka Event in Southwestern Mexico, What Did Really Happen?" (Paleoceanography and Paleoclimatology [PP])

E. A. Endsley, et al. "Late Holocene Droughts Recorded in Speleothems from the Maya Lowland of the Yucatan Peninsula, Mexico." (Paleoceanography and Paleoclimatology [PP])

V. Velasco Hererra, et al. "Mayan Historical Drought Trends." (Hydrology [H])

I. Marino-Tapia, et al. "Fine-Resolution Thermohaline Structure of the Yucatan Coastal Sea." [Ocean Sciences [OS])

An article in Spanish, "La Aventura de la Espeleología" by Ruth Diamant of Mexico City, can be found at http://www.angelfire.com/ms2/luegexpedition2000/documents/artruthdiamant.html. Sections of the article are subtitled "¿Qué es la espeleología?," "¿Y qué son las cuevas?", and "La espeleología en nuestro país."

The Texas Memorial Museum and the Texas Natural Science Center have published *Studies on the Cave and Endogean Fauna of North America, Part V*, as their Speleological Monograph 7, 2009. The volume or the individual papers in it are available for free download at http://www.nsrl.ttu.edu/personnel/cokendolpher/speleobooks/Monograph7(5)2009.pdf. Bound paper copies of this volume and the preceding numbers of the title series are available from the AMCS (amcs-pubs.org). The papers in the new volume about Mexican cave biology are:

"Description of a New Species of Troglophile *Pseudouroctonus* (Scorpiones: Vaejovidae) from Coahuila, Mexico," by Oscar F. Franke. Abstract: *Pseudouroctonus savvasi*, n.sp., is described from specimens collected in two separate caves in the state of Coahuila, México, though it does not exhibit any marked troglomorphies. It is most closely related to *Pseudouroctonus apacheanus* (Gertsch and Soleglad), from which it is clearly differentiated by size, the number of teeth on the movable finger of the chelicerae, hemispermatophore morphology and pedipalp chela morphometrics.

"Cave Scorpions of Mexico and the United States," by W. David Sissom and James R. Reddell. Abstract: Scorpions reported from caves in

Mexico and the United States are reviewed. New records are included for: *Centruroides gracilis, C. vittatus, Troglocormus willis, Alacran tartarus, Pseudouroctonus apacheanus, P. reddelli, Uroctonites sequoia, Serradigitus gertschi striatus, S. wupatkiensis, Vaejovis carolinianus, V. chisos, V. intermedius, V. nigrescens,* and *V. rossmani.*

"A New Species of *Agastoschizomus* (Schizomida: Protoschizomidae) from Guerrero, Mexico," by Héctor Montaño Moreno and Oscar F. Francke. Abstract: *Agastoschizomus juxtlahuacensis* is described from **Grutas de Juxtlahuaca**, Guerrero. It is a troglobite, as are the other four known species in the genus. This is the first species in this genus reported from the Sierra Madre Occidental.

"A New Species of *Modisimus* (Araneae: Pholcidae) from Chiapas, Mexico," by Alejandro Valdez-Mondragón and Oscar F. Francke. Abstract: *Modisimus deltoroi,* new species is described from males and females collected in two separate caves in the Chan-Kin Ecological Reserve in the Lacandona rainforest, Municipio de Ocosingo, Chiapas, in southeastern Mexico. It appears to be related to *Modisimus ixobel* Huber, 1998 from Guatemala and *Modisimus propinquus* O. P.-Cambridge, 1896 from Mexico, from which it differs primarily in the setation of the chelicera, palps of males, and epigynum of the female.

"Description of the Male of Genus *Typhloroncus* Muchmore, 1979 (Pseudoscorpiones: Ideoroncidae)," by Gabriel A. Villegas-Guzmán and Oscar F. Francke. Abstract: We describe the males of *Typhloroncus attenuatus*, Muchmore, 1982, which were collected in the **Purificación Cave System**, Tamaulipas, Mexico. Five species of the genus *Typhloroncus* are known, and all the descriptions are based on females; this is the first description of adult males for the genus. Males lack eyes, the pedipalps are extremely elongated, and the body is pale yellow-brown, as in the female. Males present some differences from the female: the number of contiguous marginal teeth on the fixed and movable fingers of the pedipalps is lower in males; males are slightly smaller than females and have the modified, longitudinally striate setae on tarsus IV diagnostic for the species.

"A New Troglobitic Species of *Anelpistina* (Hexapoda: Zygentoma: Nicoletiidae) from Northern Mexico," by Luis Espinasa and Yevgeniya Boyko. Abstract: We describe a new species of cave adapted *Anelpistina* from **Pozo Cokendolpher** cave, Coahuila, México. Its affinities within the genus were assessed using its 16S rRNA sequence.

"Living in the Dark—Species Delimitation Based on Combined Molecular and Morphological Evidence in the Nicoletiid Genus *Texoreddellia* Wygodzinsky, 1973 (Hexapoda: Zygentoma: Nicoletiidae) in Texas and Mexico," by Luis Espinasa and Gonzalo Giribet. Abstract: The troglobitic insect genus *Texoreddellia* constitutes an important component of the cave-adapted fauna of the Southern U.S.A. and Northern Mexico. Here we study the representatives of *Texoreddellia* from multiple cave systems across its range using morphological and mitochondrial gene sequence data to unravel the presence of at least six species in a complex. The type species of the genus is re-described and five new species are erected for groups of individuals with unique combinations of appendage and ovipositor characteristics, as corroborated by the molecular data. The evolutionary origin of the group may be somewhere near the border of Texas and Mexico, although more data are needed. From this central origin various lineages dispersed and diverged morphologically. Furthermore, different species of *Texoreddellia* can also inhabit the same cave.

Mark Minton
May 2009
Depth in meters

DEEP PITS OF MEXICO

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

DEEP CAVES OF MEXICO

Mark Minton
May 2009
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 Nogochl (Akemabis - El Santito)	Puebla	1182
8	Sistema Ocotempa	Puebla	1070
9	Soncongá	Oaxaca	1014
10	Sistema Purificación	Tamaulipas	957
11	Guixani N'dia Kijao	Oaxaca	955
12	Sistema Perrito (Nia Quien Nita + Nia Nga'co Nita)	Oaxaca	906
13	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli)	Puebla	899
14	Nita Chó	Oaxaca	894
15	Sótano de Agua de Carrizo	Oaxaca	843
16	Sótano de El Berro	Veracruz	838
17	Sótano de Trinidad	San Luis Potosí	834
18	Hard Rock Cave	Oaxaca	830
19	Resumidero El Borbollón	San Luis Potosí	821
20	Las Tres Quimeras	Puebla	815
21	X'oy Tixa Nita	Oaxaca	813
22	Nita Ka	Oaxaca	760
23	Sistema H31-H32-H35	Puebla	753
24	Sonyance	Oaxaca	740
25	Nita Xongá	Oaxaca	739
26	Yuá Nita	Oaxaca	705
27	Aztotempa	Puebla	700
28	Sótano de los Planos	Puebla	694
29	Sótano de Alfredo	Querétaro	673
30	El Santo Cavernario+Tototzil Chichiltic	Puebla	667
31	Sistema de los Tres Amigos	Oaxaca	659
32	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	658
33	Sótano de Tilaco	Querétaro	649
34	Nita Nashi	Oaxaca	641
35	Cuaubtempa Superior	Puebla	640
36	Sistema Soconusco - Aire Fresco	Chiapas	633
37	Sistema Atlalaquía	Veracruz	623
38	Cueva de Diamante	Tamaulipas	621
39	Sistema Coyolatl	Puebla	620
40	R'ja Man Kijao (Nita)	Oaxaca	611
41	Nita He	Oaxaca	594
42	Meandro Que Cruce (H54)	Puebla	588
43	Yometa	Puebla	582
44	Sótano de las Coyotas	Guanajuato	581
45	Arriba Suyo Sótano	San Luis Potosí	563
46	Sistema Tepetlaxtli	Puebla	535
47	Sótano de Nogal	Querétaro	529
48	Resumidero de Piedra Agujerada	San Luis Potosí	526
49	Grutas de Rancho Nuevo	Chiapas	520
50	Sistema Los Toros	Nuevo León	517

Updates and corrections:

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Mark Minton
May 2009
Length in meters

LONG CAVES OF MEXICO

1	Sistema Ox Bel Há	Quintana Roo	179978
2	Sistema Sac Actun	Quintana Roo	170998
3	Sistema Purificación	Tamaulipas	95766
4	Sistema Dos Ojos (Sistema Jacinto Pat)	Quintana Roo	62252
5	Sistema Huautla	Oaxaca	62099
6	Cueva del Tecolote	Tamaulipas	40475
7	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	37676
8	Kijahe Xontjoa	Oaxaca	31373
9	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli)	Puebla	28564
10	Sistema Soconusco - Aire Fresco	Chiapas	27793
11	Sistema Toh Há	Quintana Roo	27629
12	Sistema Cheve	Oaxaca	26194
13	Sistema Actun Hu	Quintana Roo	24913
14	Sistema Naranjal (Najarón-Maya Blue)	Quintana Roo	24324
15	Sistema Coyolatl	Puebla	23000
16	Sistema K'oox Baal	Quintana Roo	20087
17	Sistema Aerolito	Quintana Roo	18000
18	Sistema Tux Kupaxa	Quintana Roo	15917
19	Cueva de Alpazat	Puebla	15200
20	Sistema PonDeRosa (Pondazul, Eden)	Quintana Roo	15019
21	Atlixicaya	Puebla	13000
21	Sistema Río La Venta	Chiapas	13000
23	Chjine Xjo	Oaxaca	12400
24	Pool Tunich	Quintana Roo	12038
25	Cueva Pitch	Quintana Roo	12000
26	Sistema San Andrés	Puebla	10988
27	Cueva de la Mano	Oaxaca	10841
28	Sistema Camilo	Quintana Roo	10752
29	Sistema Taj Mahal - Minotauro	Quintana Roo	10600
30	J2 (Ozto Faustino, Ozto Barbie)	Oaxaca	10366
31	Actun Káua	Yucatán	10360
32	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
33	Cueva del Arroyo Grande	Chiapas	10207
34	El Chorro Grande	Chiapas	9650
35	Sistema Muul Three	Quintana Roo	9630
36	Sistema Tepetlaxtli	Puebla	9600
37	Sistema Chac Mol - Mojarra	Quintana Roo	9193
38	Cueva Quebrada	Quintana Roo	8921
39	Sistema Brumas Selváticas	Puebla	8870
40	Sótano de Las Calenturas	Tamaulipas	8308
41	Nohoch Aktun	Quintana Roo	8200
41	Gruta del Tigre	Quintana Roo	8200
43	Sistema Dos Pisos (Ka'p'el Nah)	Quintana Roo	8128
44	Sistema de Tepepan Zaragoza (TZ48-TZ62 (Promesa))	Puebla	8000
45	Sumidero Santa Elena	Puebla	7884
46	Sistema La Ciudad	Puebla	7828
47	Cueva Yohualapa	Puebla	7820
48	Cueva de la Peña Colorada	Oaxaca	7793
49	Cueva de Comalapa	Veracruz	7750
50	Sistema Zapote (Toucha-Há - Vaca Há)	Quintana Roo	7697

ARTICLES

Franco Attolini rappelling into one of the entrances to Tres Quimeras, Puebla. *Gustavo Vela.*

PROYECTO AKEMABIS 2008

Gustavo Vela Turcott

Olga, Franco, and Pablo finally got back to the surface after spending three days underground at the bottom of Akemabis—a thousand meters down in the cave that we had tried to explore the year before, but for various reasons were not able to. Those of us in base camp were happy to see them, worn out, but happy, as they brought the very latest news from the bottom of the cave. "What happened?" "Does it continue?" "Did you find anything interesting?" "Does it go, or does it end?" We didn't give them a moment to eat or drink, but just continued to bombard them for news from their "voyage of discovery."

For all of April 2008, fifteen of the eighteen cavers who had been involved in our project were back in the Sierra Negra, Puebla, in the center of Mexico. Under the leadership of Franco Attolini, Al Warild, and Gustavo Vela, we would be continuing with the objectives left from the year before, like having a good time and bottoming Akemabis. This time we'd arrived with more people, better equipment, and more determination. The others on the expedition, including some new people, were Kasia Biernacka, Alfonso (Fonso) Calvo, Marta Candel, Luis (Wicho) Díaz, Mike (Papa Mike) Frazier, Olga García, Marc Kotte, Roberto (Legas) Legaspi, Pablo Martínez, Enrique (Zape) Ogando, Guillaume Pelletier, Vladimir (Vladimitzin) Ramírez, Homero Resendiz, David Tirado, and Bev (Beverlitzin) Shade.

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Translated from Spanish by Al Warild.

And so it began, at the end of March, when some stayed behind in the nearest city, Tehuacán, to buy the food, while others went on ahead to arrange the permissions, rent burros, and begin to set up base camp in front of don Doreteo's house on the ridge at 1850 meters elevation.

The history of Olbastl Akemabis began in 1990, when a group of cavers from the Groupe Spéléo Alpin Belge found and explored the cave to a reported 1015 meters deep. In time, their explorations led them to other parts of the sierra, and the end of Akemabis was left unfinished. The cave's name comes from *olbastl*, *pit* in the local dialect of Nahuatl, and the GSAB cavers asking the name of a cave nearby. They were told *akemati* (I don't know), which gave Akemati its name. Their new cave was so close to Akemati that it had to connect, so they added *bis* and called it Akemabis. It never did connect.

The GSAB cavers were happy for us to take a look and see how Akemabis ended, so in 2007 we went to see what we could find. After twenty years (that's before GPS), the correct cave was hard to find, but we did manage to find a new cave, El Santo Cavernario. We did locate Akemabis at the end of that trip, so at least this year we knew exactly where Akemabis was and what the first part was like. [The 2007 expedition is reported in *AMCS Activities Newsletter* 31, pages 27–36.]

One of the great things about expedition caving is that it is a mix of teamwork and individual effort. While one team is resting in base camp, another is rigging in the cave and another is prospecting the hills for more caves to explore. But it doesn't stop there. Every member of the team needs to be physically and mentally prepared to contribute

Franco Attolini and Al Warild in one of the entrances to Akemabis. *Gustavo Vela.*

to the team effort. We tended to rig in teams of two, and in five days we were at –910 meters. In those same five days we ran a survey down to –875 meters, to the same survey point where the GSAB team had ended their survey in 1990. The point was obvious: a few spare spits, a scrap of blue rope, and a "pepperami" wrapper, empty. A little way below we hit the last point that we believe the GSAB group reached. Below this 28-meter pitch, at –949 meters, there were no footprints or marks of any kind.

Rigging and mapping were taking longer and longer. It was on one of these trips that Al, David, and Vladimir passed the last known point, and after an 8-meter drop entered a much larger gallery that ran north-south. They ran from one end to the other, always expecting to find another pitch, but only encountered three domes and a small continuation. Having already been in the cave for quite some time, they had to leave their exploration and start the long climb out. Vladimir said that he was so tired that he didn't know what hurt more, his entire body or the prospect of having to climb one thousand meters of rope.

This collector, up to 10 by 20 meters and 400 meters long, we called Calle Sierra Negra (Sierra Negra Street) due to its unusually large dimensions in this otherwise narrow cave.

At the same time as Akemabis was being explored, teams were prospecting higher areas above base camp on the slopes of Tzontzecuiculi. They found only a few small caves that went nowhere. Others began exploration of a new cave only 38 meters from Santo Cavernario, our unexpected new 593-meter-deep cave of the year before. At first we were so convinced that this new cave was little more than another entrance to Santo Cavernario that we called it El Santito. The more rope we took in, the farther Santito diverged from Santo. With no more time then, we stopped at the top

Photos by Gustavo Vela. At bottom, Roberto Legaspi is at the entrance to an unnamed cave near basecamp.

Olbastl Akemabis

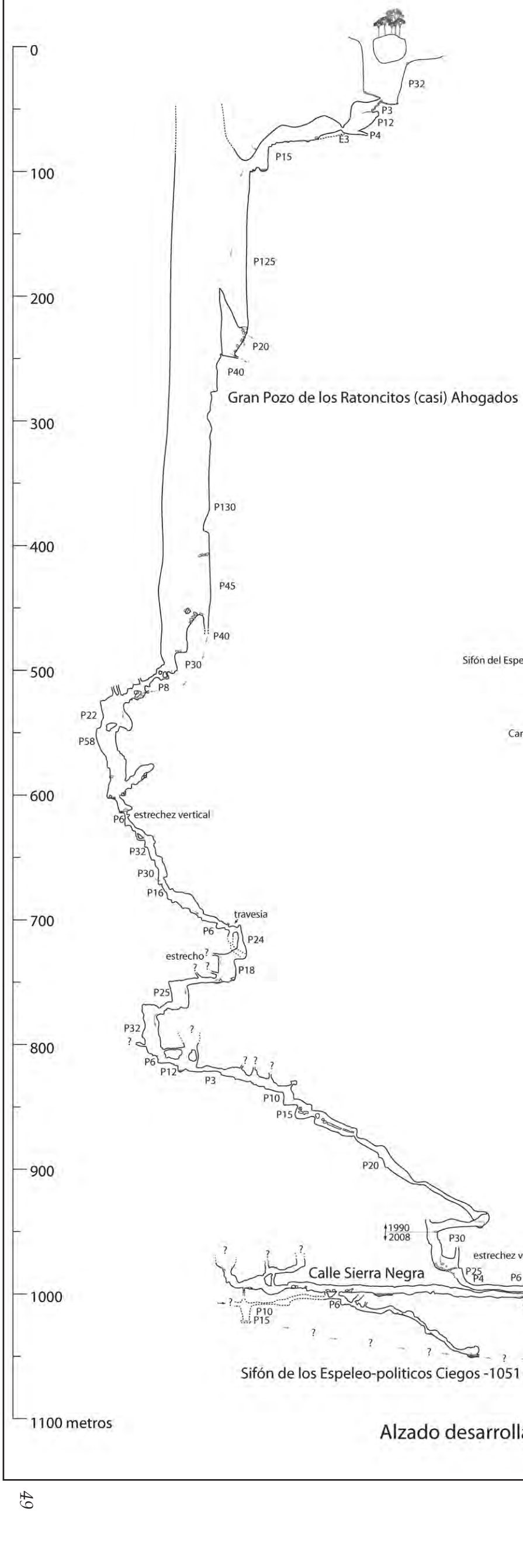
Huizmaloc-Ocotempa
Puebla, México

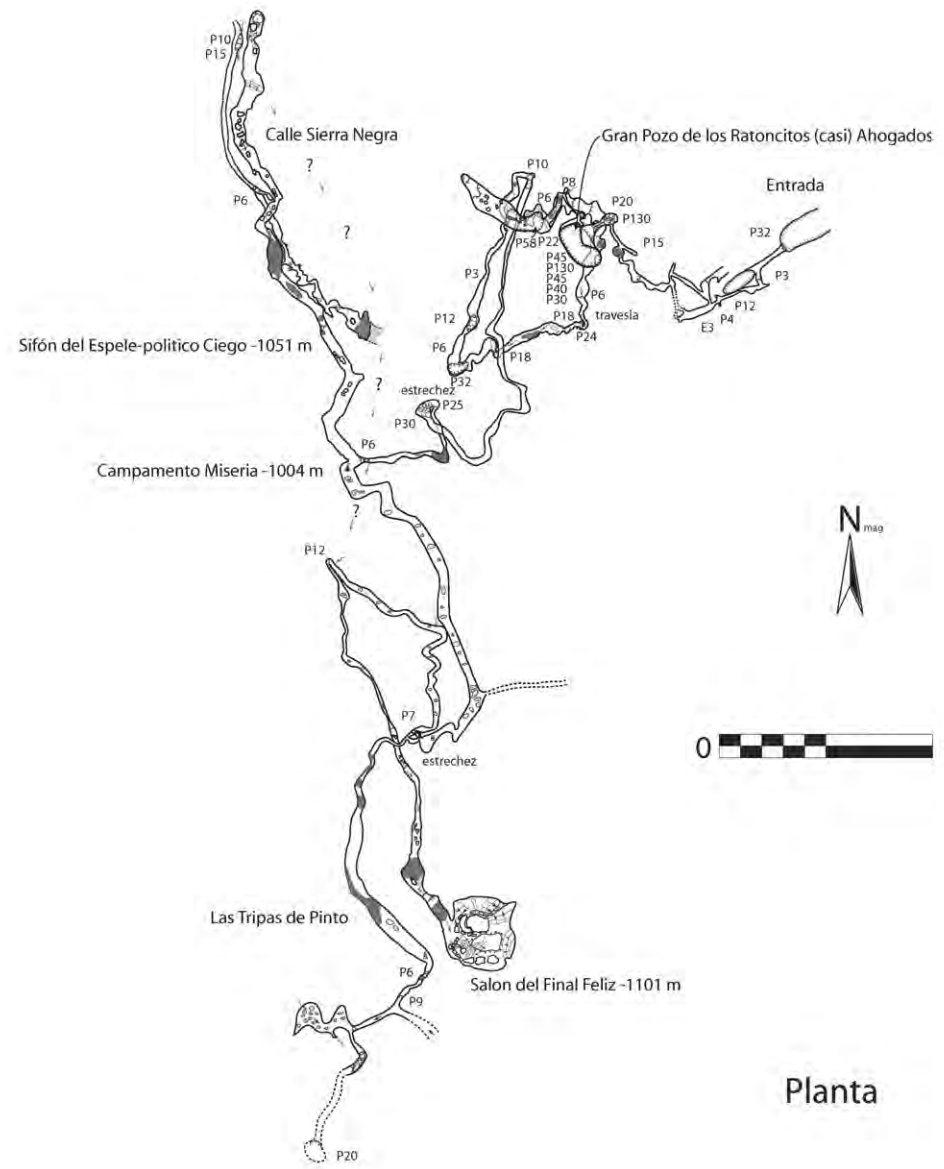
X: 716392, Y: 2040452, Z: 1762

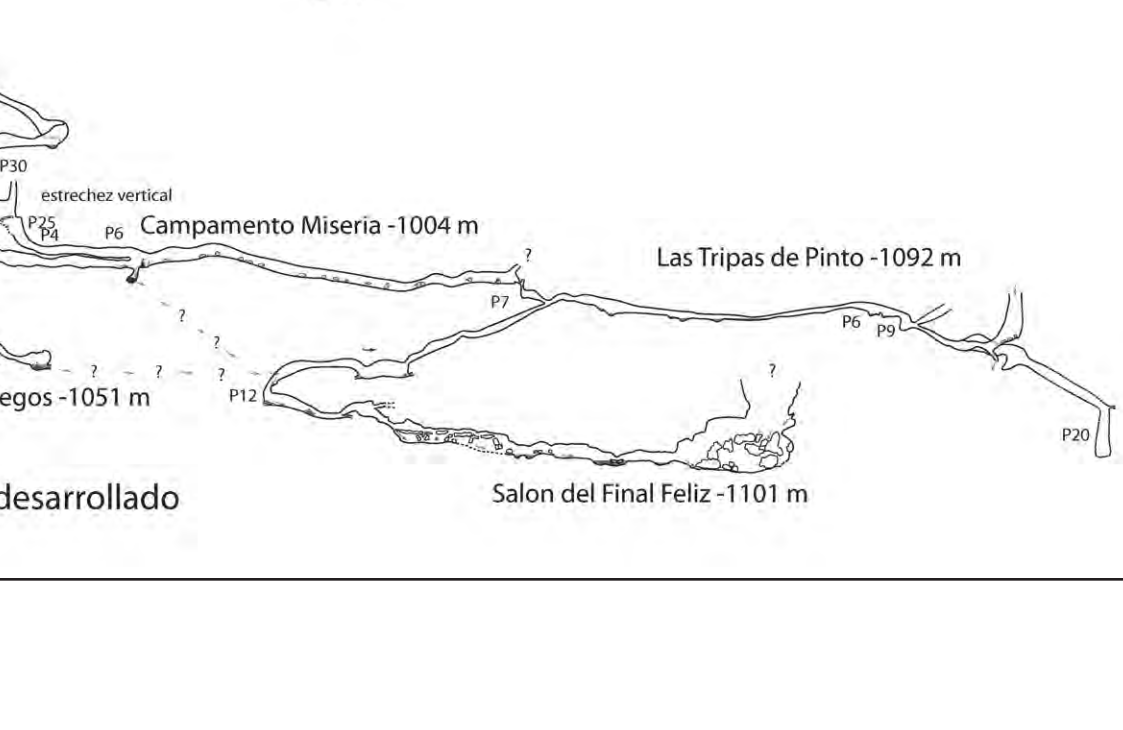
Profundidad: 1101 metros Longitud: 3219 metros

Explorado por GSAB en 1990.
Topografiado con topofil, Suuntos y cinta
en abril 2008 por los integantes de "Ocotempa 2008":

Franco Attolini, Kasia Biernacka, Alfonso Calvo, Marta Candel, Luis Díaz, Mike Frazier, Olga García, Roberto Legaspir Pablo Martínez, Enrique Ogando, Guillaume Pelletier, Vladimir Ramírez, Homero Resendiz, David Tirado, Bev Shade, Gustavo Vela, Al Warild.







Nacho de Rafael descending one of the pitches in Akemabis in 2007. *Gustavo Vela*.

of a 50-meter pitch with no Santo Cavernario in sight.

As the previous group down Akemabis hadn't had time to explore all the leads in Calle Sierra Negra, Al and Gustavo went to take a look at the northern part. They dropped a short pitch to a muddy, narrow area with the sound of water rumbling in the distance. Another uncomfortable drop led to a narrow slot with white water gushing in, but no space for humans. The other way, back under a perched lake, was even more mud-coated. Slithering on down, they reached the shore of a lake that had dozens of white, presumably blind isopods swimming in it. They too took a swim, but found nothing, and in honor of the isopods called it El Sifón de los Espeleo-políticos Ciegos, Blind Speleo-politician Sump. They had been down there for hours, and they had no bivvie gear. It was time to start climbing.

Trips to the bottom were taking too long and too much energy for the amount of exploration that was getting done. Trouble was, we hadn't come prepared to establish a bivouac, so we scrounged around base camp, a spare sleeping bag here, an old foam mat there. Three days later Pablo, Olga, and Franco set up Campamento Miseria right at the Calle Sierra Negra T-junction at –1004 meters. They then set to work pushing the south end of the *calle*, and after a lot of effort, Olga got past a tight spot to more pitches and another gallery. Either following the re-found water or passing over blocks high above led to the foot of a dome where the water disappeared between the rocks in the Salón del Final Feliz, the Happy Ending Room.

But there were still passages to map and leads to push, so Fonso, Gustavo, and Guillaume tried their luck, but found no way on. They pulled the gear back to the last lead and started on out. On the way up, they thought it was a little wetter than they remembered. A bit concerned about being hit by rocks moved down the cave by the higher water, they continued on up. Near the top of the 310-meter pitch the flush came, giving a name for the pitch, El Gran Pozo de los Ratoncitos (Casi) Ahogados, Big Pitch of the (Almost) Drowned Little Mice. For a few anxious hours we waited for Fonso to arrive without a snorkel, but he was just taking his time.

A few days to let the water levels drop and we'd have a last push. Marta, Kasia, Zape, and Al moved on down to look at that last lead. It was tight, it was dirty, it was wet—Las Tripas de Pinto, Pinto's Guts. (Pinto was our host Doreteo's dog. He'd visit our camp each night, stealing food and spreading rubbish everywhere. Thanks only to his owner's influence, he's still free and wagging his tail.) Las Tripas de Pinto ended in a dome only a fraction shallower than the previous deep point. The team also got the cave derigged to –800 meters. It took another couple of hard trips to get all the gear out of Akemabis.

During the last week of the expedition the slopes of Tzontzecuiculi began to bear fruit. A small walk-in entrance at 2400 meters led to a pitch, then another with airflow. Pablo, Olga, and Fonso took another long walk to give it a try, but ran out of rope, still unable to see the bottom. In another direction, trips down Santito got the survey to –527 meters and exploration to –580 meters. [For an update on El Santito, see "Mexico News in this issue.]

Thanks to Auriga software, our

Nacho de Rafael in Akemabis in 2007. *Gustavo Vela*.

light-weight trip could get the numbers before we went home: Sifón de los Espeleo-políticos Ciegos –1051 meters, Las Tripas de Pinto –1092, and Salón del Final Feliz –1101. Akemabis is 3219 meters long.

And so, eighteen years after it was first explored, a conclusion to Akemabis has finally been reached. The most probable resurgence is Coyolatl, some 5 kilometers away to the east. All the other new caves we've found lie between these two points, so we'll keep exploring these unknowns. This expedition will also go into the books as the first –1000-meter exploration done by a mainly Mexican team.

Guillaume Pelletier and Alfonso Calvo in Campamento Miseria at –1004 meters in Akemabis. *Gustavo Vela.*

Guillaume Pelletier working on the map of Santito in base camp, using Auriga software for a Palm Pilot. *Gustavo Vela.*

Proyecto Akemabis 2008

Olbastl Akemabis había sido explorada por espeleólogos belgas en 1990 a una profundidad de más de 900 metros, pero se había dejado incompleta. Esta expedición encontró pasaje horizontal que llevó a tres puntos más profundos, el de mayor profundidad a –1101 metros. El fondo de Akemabis es la primera cueva de más de 1000 metros de profundidad explorada por un grupo con una mayoría de espeleólogos mexicanos. La expedición también encontró una cueva cercana, El Santito, que se topografió a –527 metros y exploró a –580 metros.

THE ISTHMUS OF TEHUANTEPEC AND VALLE NACIONAL

Peter Sprouse

In 2008 our Austin-based crew of usual suspects headed a bit farther south than normal to check out some promising karst in the San Miguel Chimalapa area in southeastern Oaxaca, on the Isthmus of Tehuantepec. We pulled out of town on 14 April in our two seasoned Toyota 4Runners, with Joe Datri, Tone Garot, Geoff Hoese, Paul Bryant, and me on board. Our first night was spent in Cd. Mante, Tamaulipas, where we presented donated vertical gear to the fire-department rescue squad. After traveling down the lovely Emerald Coast of Veracruz, we arrived in Acatlán, Oaxaca, for a botanical stop. Geoff is a cycad researcher, and while searching for caves on a previous trip I had noticed unusually tall cycads. My local friends knew right where to take us to see the best specimens, which exceeded Geoff's expectations. The cycads were enormous, as big as palm trees, hundreds of years old but threatened by wildfires escaping from nearby sugar-cane burns. One of our guides, local environmental expert Claudia Rosiles, decided to join us for the trip to the isthmus. The following day we reached the southern part of the isthmus and split up on separate missions.

Claudia, Tone, and I began what turned out to be a protracted and ultimately fruitless effort to obtain permission to explore in the San Antonio area of the *municipio* of San Miguel Chimalapa. Geoff, Paul, and Joe set off to check several Google Earth and topo-map leads I'd identified around La Ventosa. The Ojo de Agua de Nizanda, north of La Ventosa, turned out to be a nice spring in a canyon, with a short cave associated with it. Pictographs and bats were seen there. Another site, to the east, also called Ojo de Agua, also had a spring and small cave. We joined up again in Zanatepec, where we had plans to meet up with more cavers from the U.S. Soon our crew was complete, with the arrival of Jason Ballensky, Aimee Beveridge, Bev Shade, and Vickie Siegel. As we were still hoping for permission at San Antonio, we bided our time checking local leads around Zanatepec. The heat was oppressive, and numerous small wildfires could be seen in the hills.

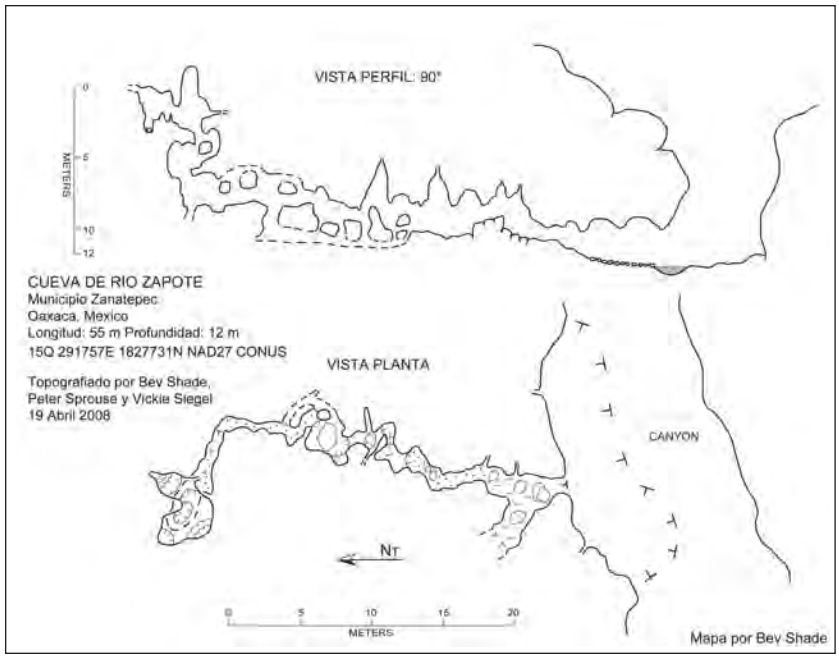
We could see from the topo map that the nearby Río Zapote cut a canyon through a limestone massif, so we drove up to check it out. The Río Zapote was a nice flowing jungle stream, and we split into two groups to hike up each side of the river. The crew on the right-hand (east) side soon found a cave entrance, but it was gated. It had a water pipe coming from it and a stern warning sign about protecting the water supply. Farther ahead we got to the source of the river's flow, a deep pool between high canyon walls. Though we gave the pool a good swim, there was no obvious entrance there. But a close inspection of the canyon wall revealed a small blowing hole that we were able to squeeze into. Cueva del Río Zapote is a series of squeezes and walking passages characterized by large root mats. At the back, it climbs up to a high, dry level; length was 55 meters, depth 12 meters.

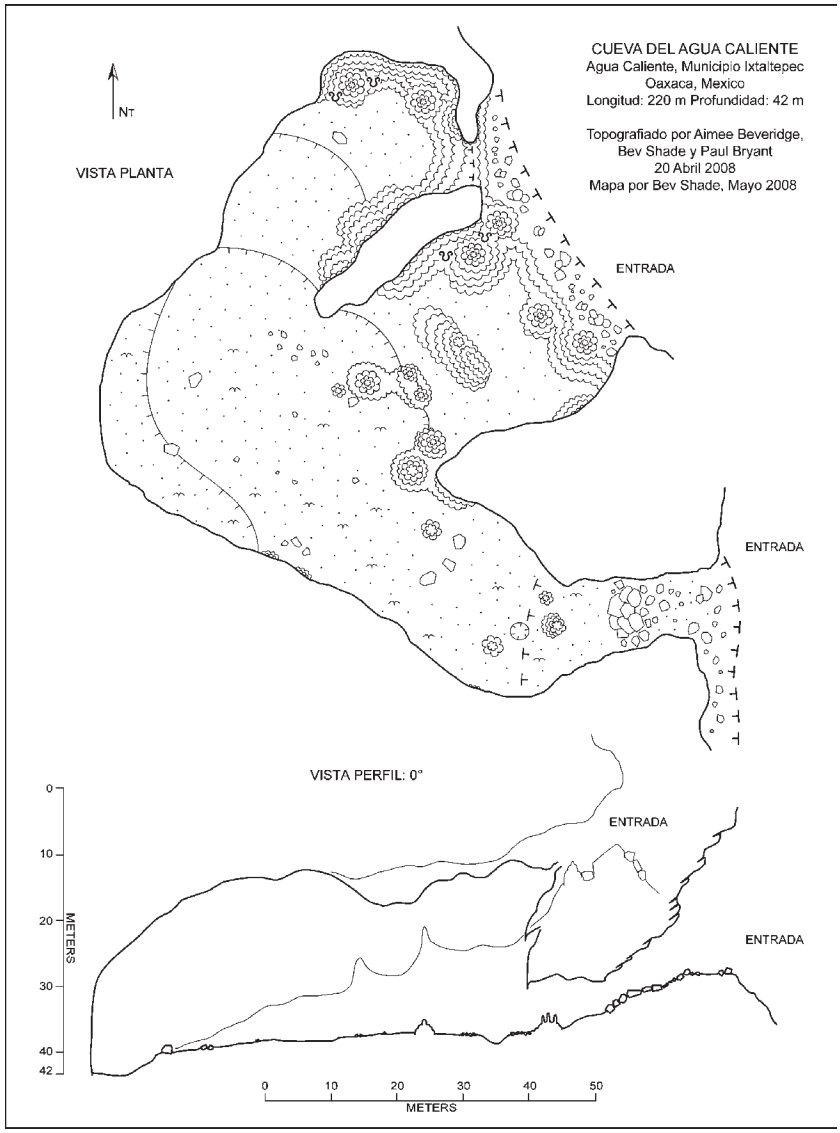
Finally it was time to switch to Plan B and head back to northern Oaxaca, but before leaving the isthmus we checked out a lead a Zanatepec restaurateur had given us, at Agua Caliente, just north of La Ventosa. We pulled off the highway at a ruined spa situated on a large travertine deposit and hiked up a canyon through xeric vegetation. At length, we located the cave entrance, high on the north slope.

Cueva de Agua Caliente has two entrances at the base of a cliff that open into large passage. Headlamps were hardly needed, as it is mostly naturally lit. Soon we came to realize that this cave is an important archeological site. There were numerous petroglyphs depicting human and monkey figures, and pictographs, perhaps not quite as old, that showed warriors in ceremonial dress. Other pictographs consisted of glyphic

Pictograph in Cueva de Agua Caliente. *Peter Sprouse.*

petersprouse@yahoo.com



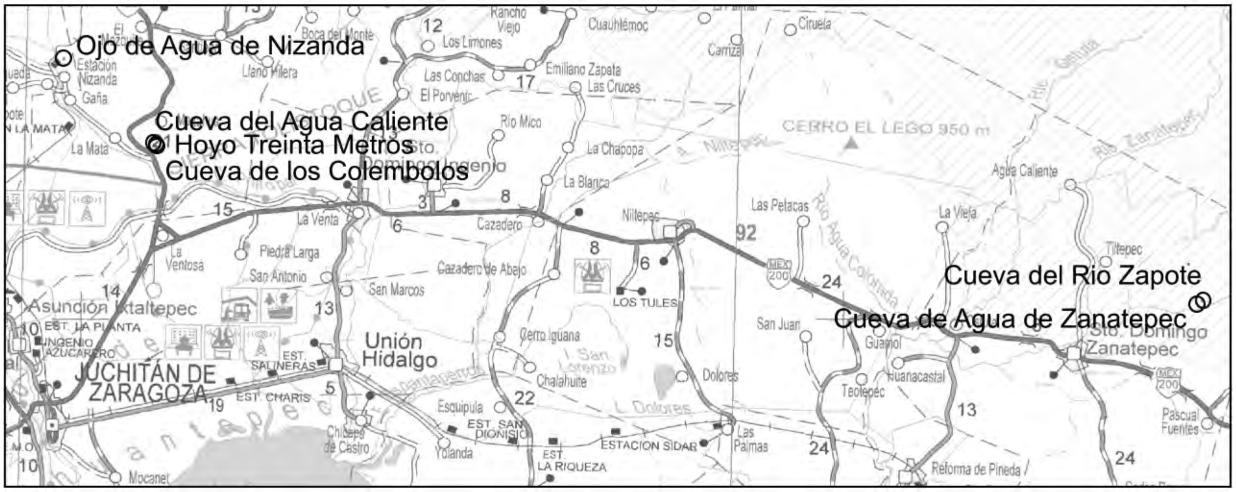


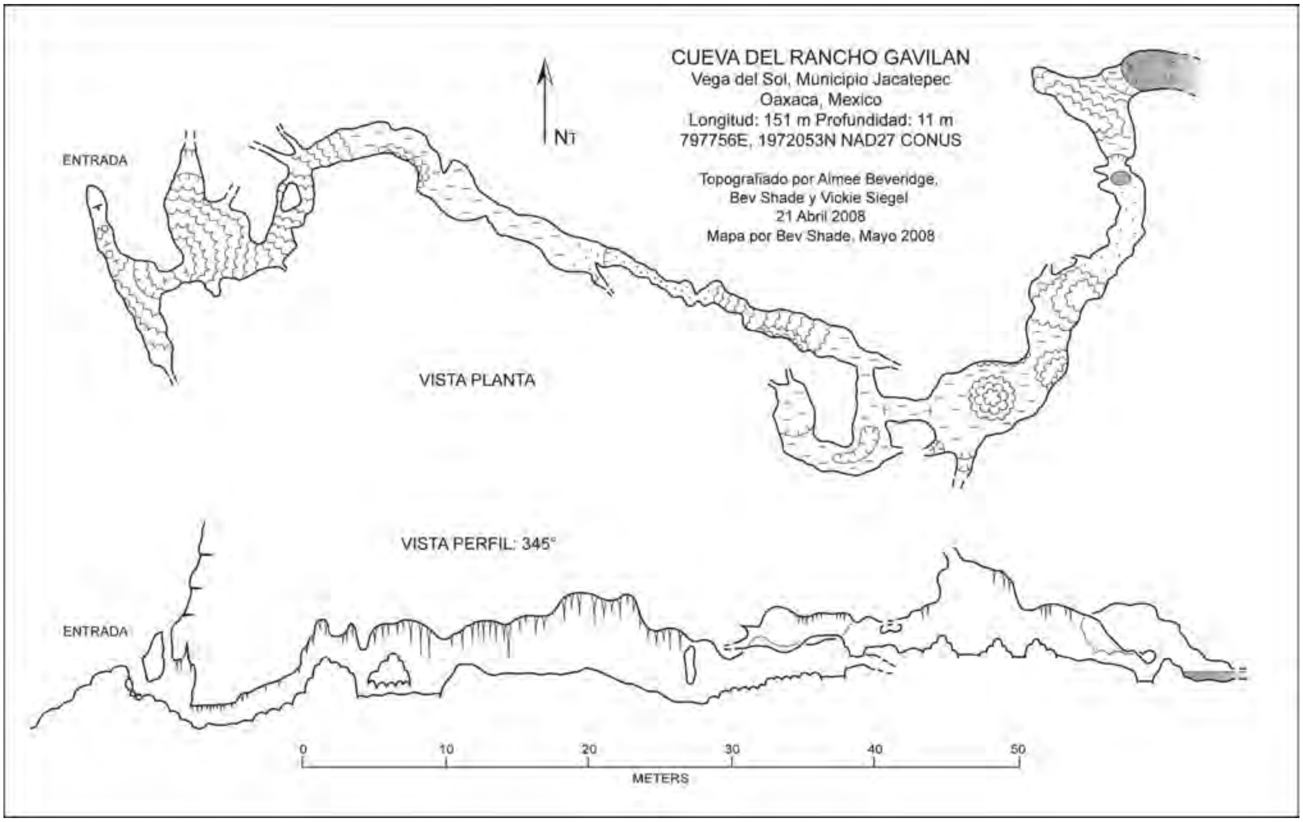
writing panels and the ever-popular hand outlines. We mapped the cave, which was 220 meters long, and photographed the rock art before trekking back north to our next destination, San Juan Baustista Valle Nacional.

Valle Nacional sits at the southern end of Mexico's premier karst, the Zongolica-Huautla belt. It is an area of moderately high mountains along the highway that crosses over the divide to Oaxaca city. The evening of our arrival, we went to the village of Vega del Sol, where we camped in a park by the Nacimiento Zuzul, a large karst spring. The next day, while Claudia and I worked to arrange permission and guides, the rest of the crew hiked up to a local cave called Cueva del Rancho Gavilán. This is a well-decorated cave 151 meters long to a sump. Geoff probed the sump, but couldn't find a way on. A lot of fauna were seen, including crabs, crayfish, spiders, amblypigids, bats, and tree frogs. That evening we relocated our base to the Nacimiento Monte Flor at the town of Cerro Marín, were we rented a cabaña. Some of us spent the next day following some guides around to minor holes in the ground, running away from angry bees, and looking at a puny pyramid in the jungle. Bev, Paul, and Vickie fared better while checking a cave across the highway from our cabaña, Gruta de Cerro Marín. The local museum curator was their guide, up until the first squeeze anyway. Several more squeezes were passed, but it was not virgin; ancient peoples had used the cave for burials. They mapped 193 meters in this cave.

Claudia unfortunately had to leave the expedition due to fires threatening her conservation areas at Acatlán. After a few days at Monte Flor, we decided to relocate our base camp to another cabaña, at Yetla, where there was less foot traffic through our space, and a good restaurant as well. Things were peaceful there, except for early one morning (unbeknownst to us some patron saint's day), when all of the locals jubilantly arrived at the riverside at 5 a.m. to slaughter a cow by our tents.

We wanted to venture higher into the mountains to look for caves, so


Ojo de Agua de Nizanda
Cueva del Agua Caliente
Hoyo Treinta Metros
Cueva de los Colembolos
Cueva del Rio Zapote
Cueva de Agua de Zanatepec
CERRO EL LEGO 950 m
Asunción Ixtaltepec
JUCHITÁN DE ZARAGOZA
Unión Hidalgo
Zanatepec
La Venta
Cazadero
Niltepec
LOS TULES
Chicapa de Castro
ESTACION SIDAR
Reforma de Pineda


CUEVA DEL RANCHO GAVILAN
Vega del Sol, Municipio Jacatepec
Oaxaca, Mexico
Longitud: 151 m Profundidad: 11 m
797756E, 1972053N NAD27 CONUS
Topografiado por Aimee Beveridge,
Bev Shade y Vickie Siegel
21 Abril 2008
Mapa por Bev Shade, Mayo 2008
NT
ENTRADA
VISTA PLANTA
VISTA PERFIL: 345°
ENTRADA
0
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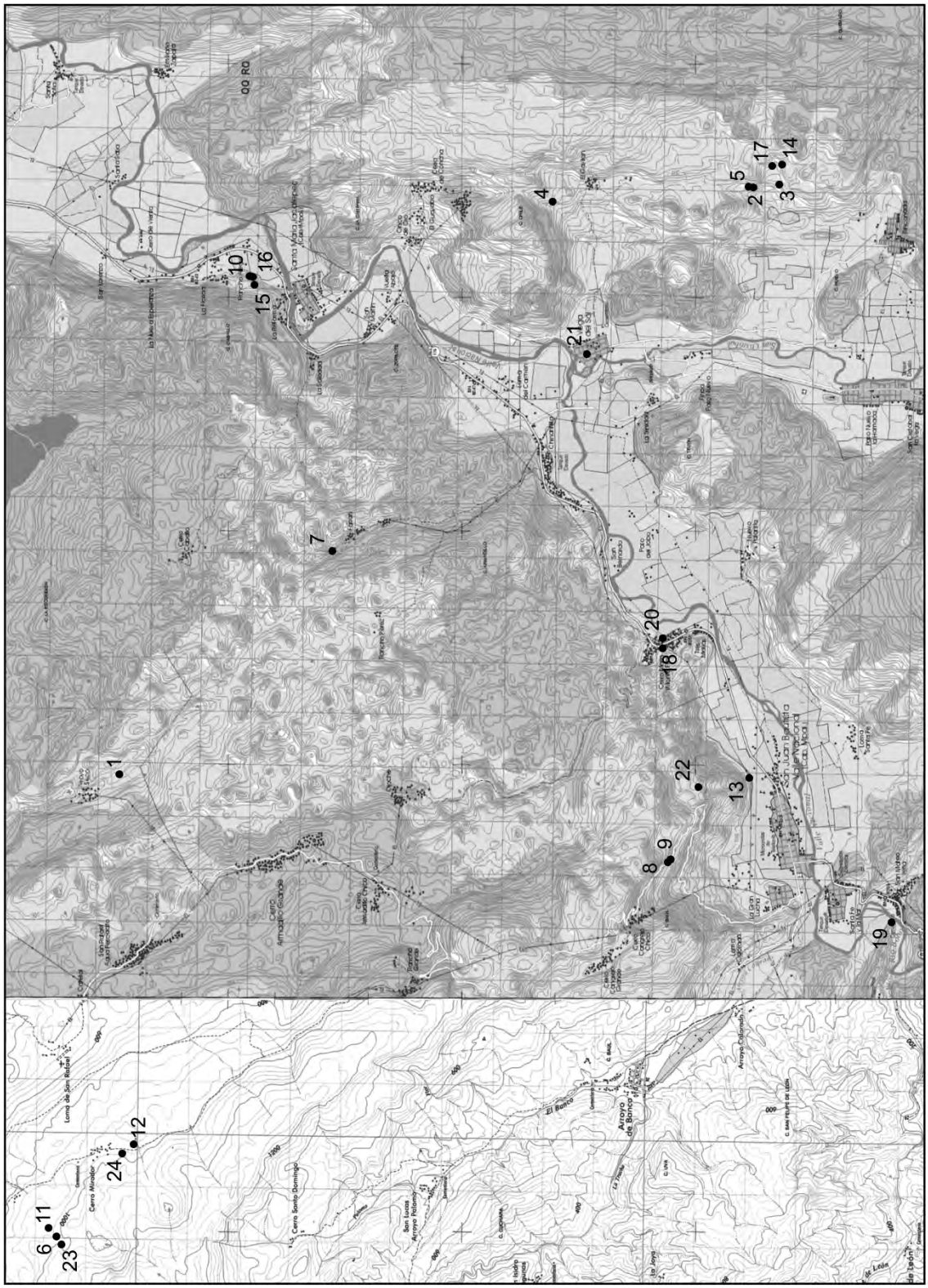
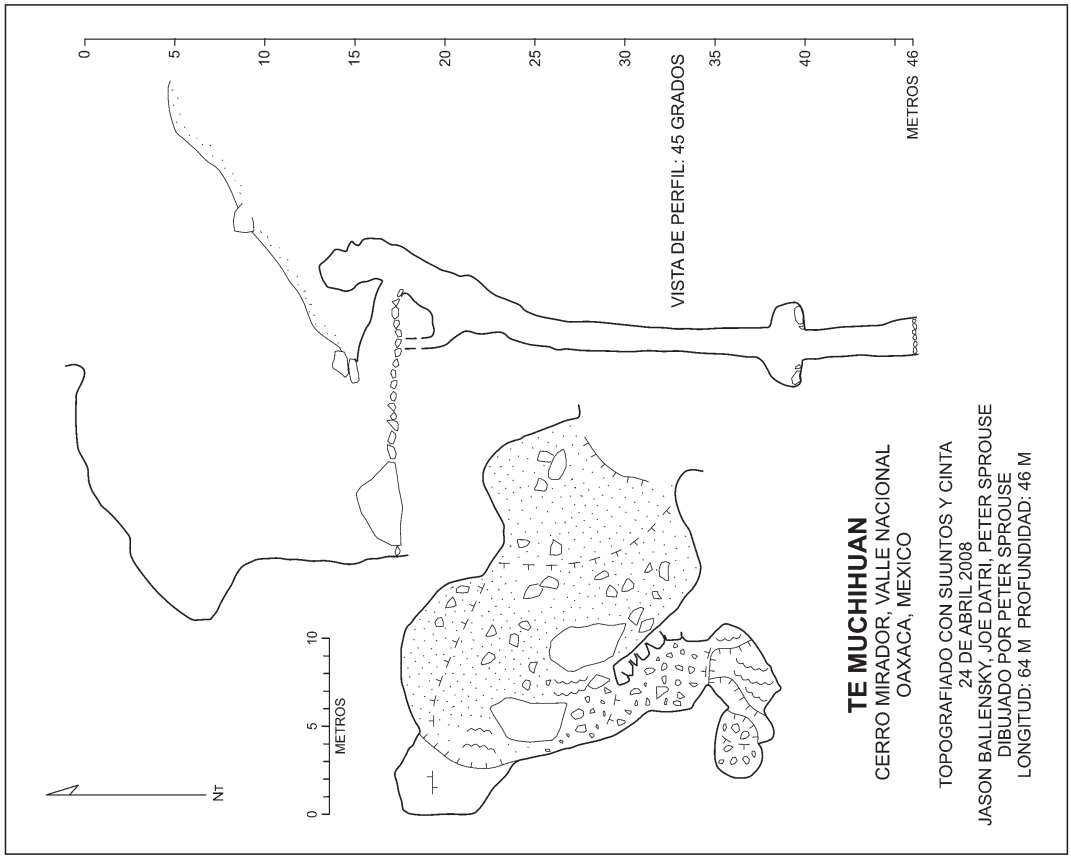
20
30
40
50
METERS



1. Cueva Arroyo Seco
2. Cueva Manantial
3. Cueva Quirino
4. Cueva Rancho Gavilán
5. Cueva Refugio
6. Cueva Roso
7. Cueva de El Faisán
8. Cueva de la Capilla no. 1
9. Cueva de la Capilla no. 2
10. Cueva de la Florida
11. Cueva de la Montaña
12. Cueva de la Parcela
13. Cueva de los Murcielagos
14. Cueva del Agua
15. Cueva del Bote Alegre
16. Cueva del Gran Trabajo
17. Cuevita de Agua
18. Gruta de Cerro Marín
19. Manantial Don Alfonso
20. Nacimiento Monte Flor
21. Nacimiento Zuzul
22. Pozo Cerro Pato
23. Te Cimutaa
24. Te Muchihuan

VALLE NACIONAL 2008
not shown:
Caverna Rinconada no. 1
Nacimiento Rinconada


NT
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METROS
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25
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35
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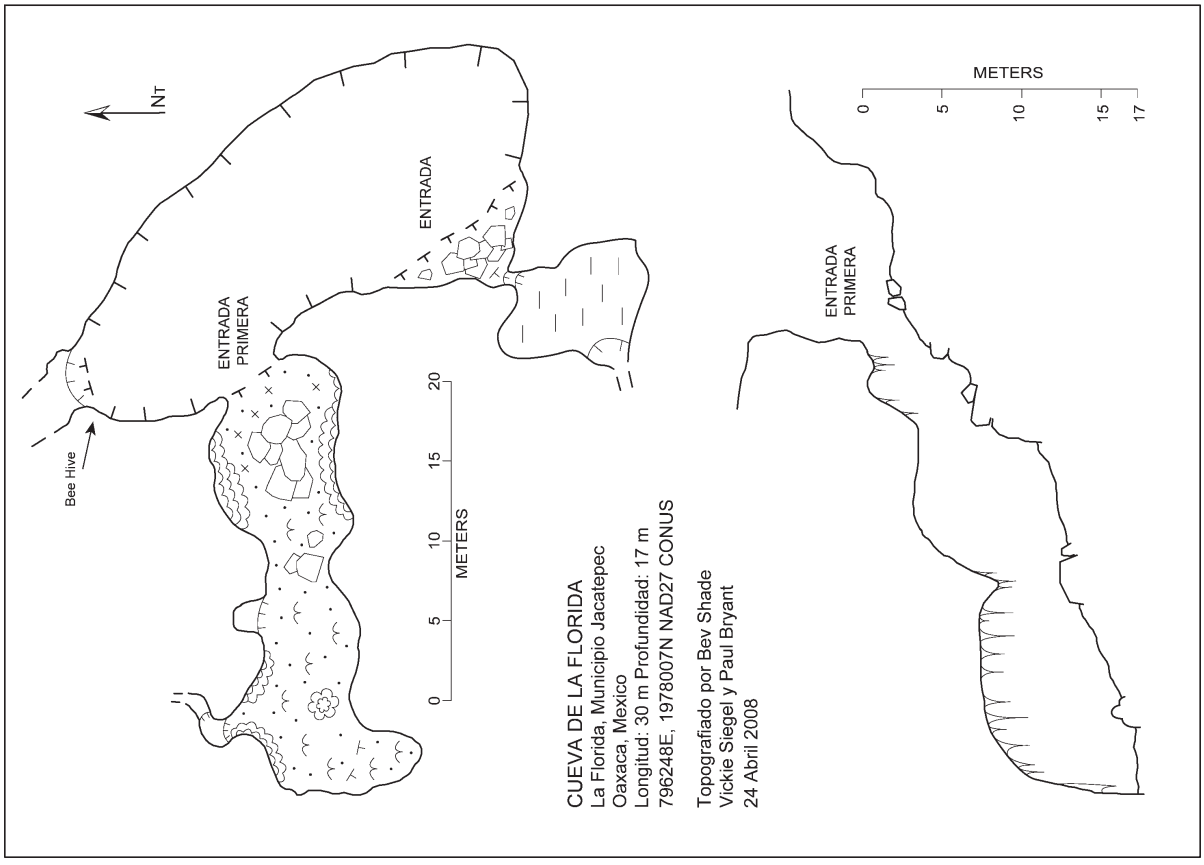
METROS 46
VISTA DE PERFIL: 45 GRADOS
TE MUCHIHUAN
CERRO MIRADOR, VALLE NACIONAL
OAXACA, MEXICO
TOPOGRAFIADO CON SUUNTOS Y CINTA
24 DE ABRIL 2008
JASON BALLENSKY, JOE DATRI, PETER SPROUSE
DIBUJADO POR PETER SPROUSE
LONGITUD: 64 M PROFUNDIDAD: 46 M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Bee Hive
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PRIMERA
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METERS
CUEVA DE LA FLORIDA
La Florida, Municipio Jacatepec
Oaxaca, Mexico
Longitud: 30 m Profundidad: 17 m
796248E, 1978007N NAD27 CONUS
Topografiado por Bev Shade
Vickie Siegel y Paul Bryant
24 Abril 2008
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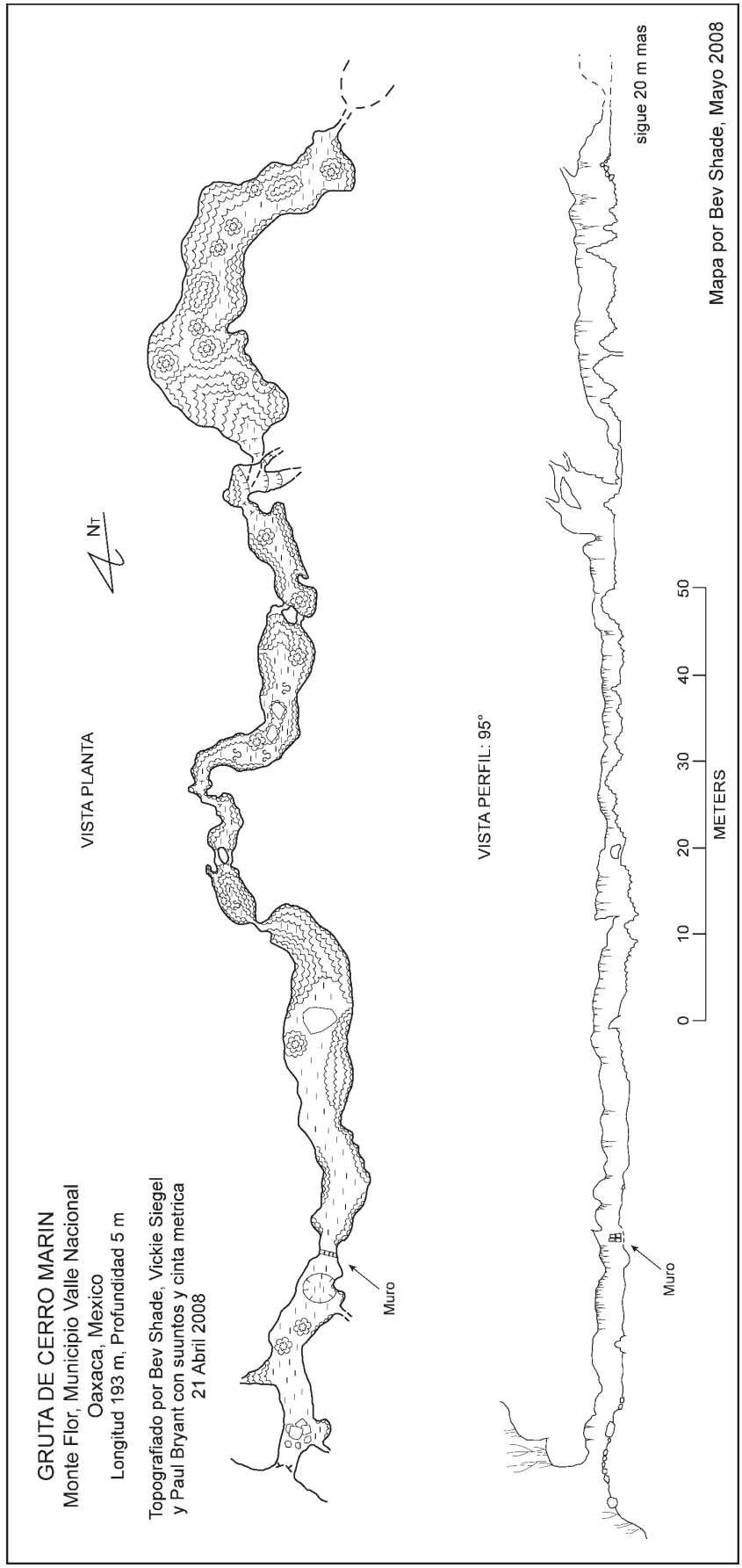
GRUTA DE CERRO MARIN
Monte Flor, Municipio Valle Nacional
Oaxaca, Mexico
Longitud 193 m, Profundidad 5 m
Topografiado por Bev Shade, Vickie Siegel
y Paul Bryant con suuntos y cinta metrica
21 Abril 2008
VISTA PLANTA
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VISTA PERFIL: 95°
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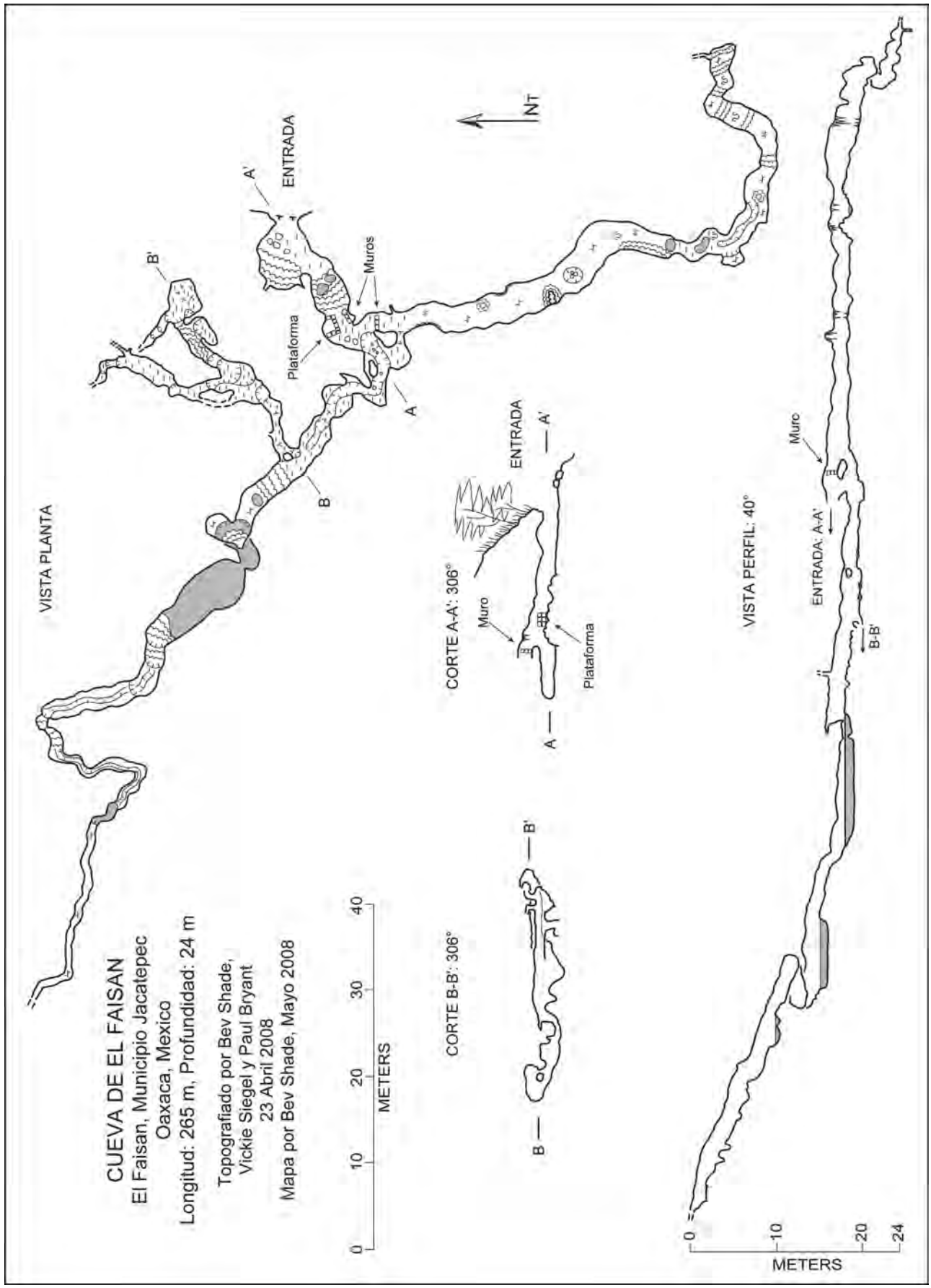
METERS
Mapa por Bev Shade, Mayo 2008


CUEVA DE EL FAISAN
El Faisan, Municipio Jacatepec
Oaxaca, Mexico
Longitud: 265 m, Profundidad: 24 m
Topografiado por Bev Shade,
Vickie Siegel y Paul Bryant
23 Abril 2008
Mapa por Bev Shade, Mayo 2008
VISTA PLANTA
ENTRADA
Muros
Plataforma
A
A'
B
B'
NT
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METERS
CORTE A-A': 306°
ENTRADA
Muro
Plataforma
CORTE B-B': 306°
VISTA PERFIL: 40°
ENTRADA: A-A'
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B-B'
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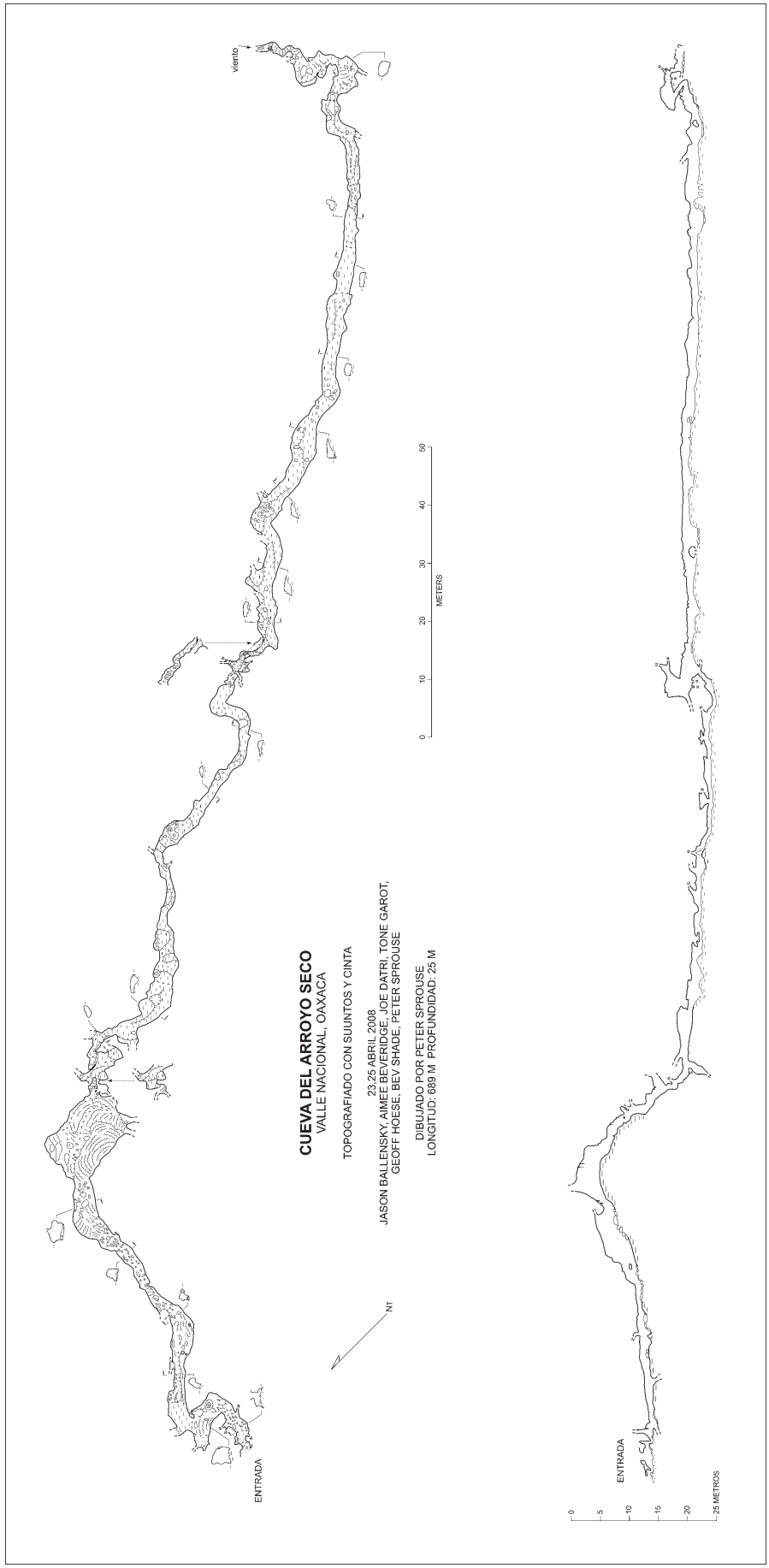
METERS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ENTRADA
CUEVA DEL ARROYO SECO
VALLE NACIONAL, OAXACA
TOPOGRAFIADO CON SUUNTOS Y CINTA
23,25 ABRIL 2008
JASON BALLENSKY, AIMEE BEVERIDGE, JOE DATRI, TONE GAROT,
GEOFF HOESE, BEV SHADE, PETER SPROUSE
DIBUJADO POR PETER SPROUSE
LONGITUD: 689 M PROFUNDIDAD: 25 M
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METERS
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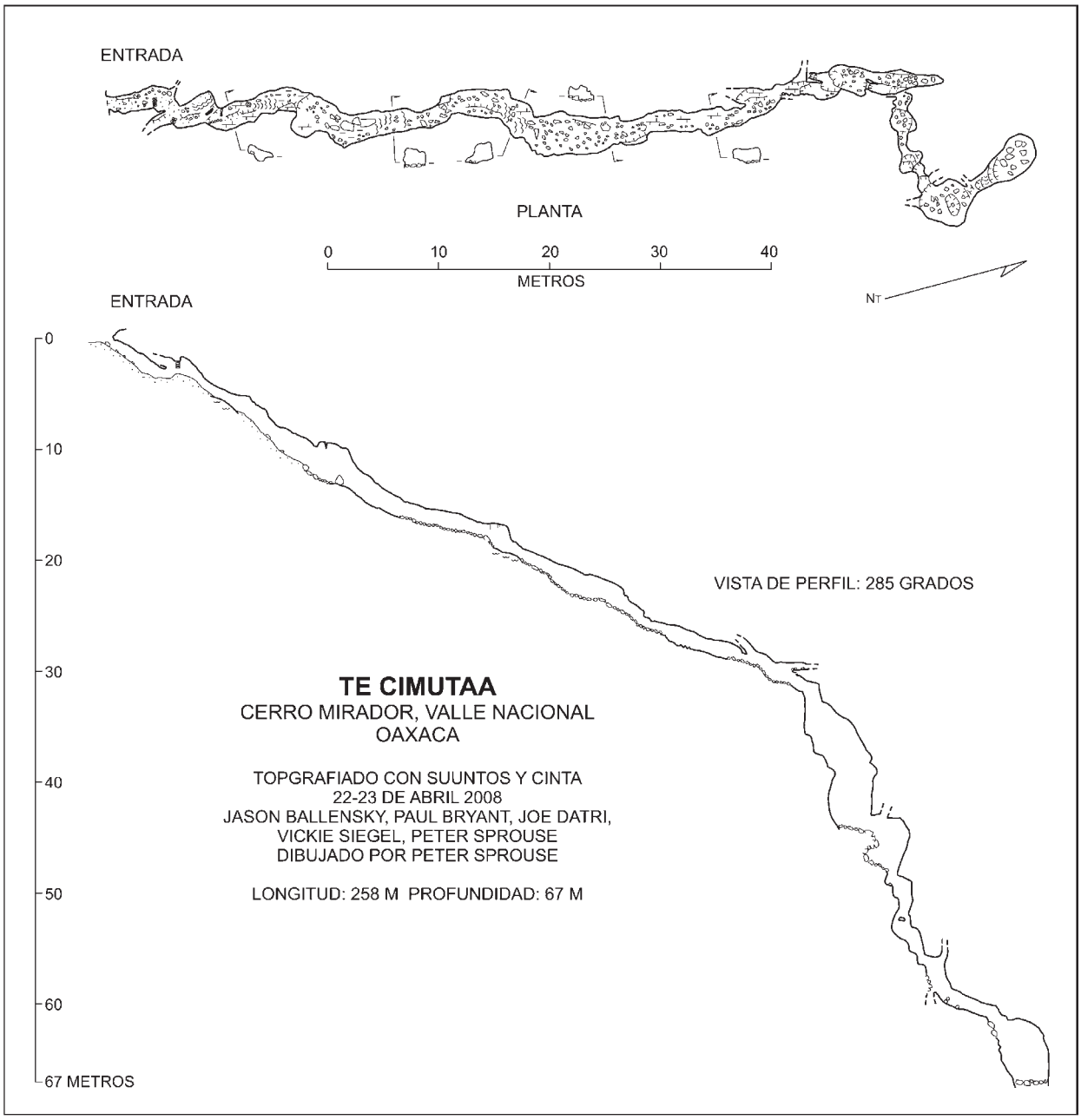
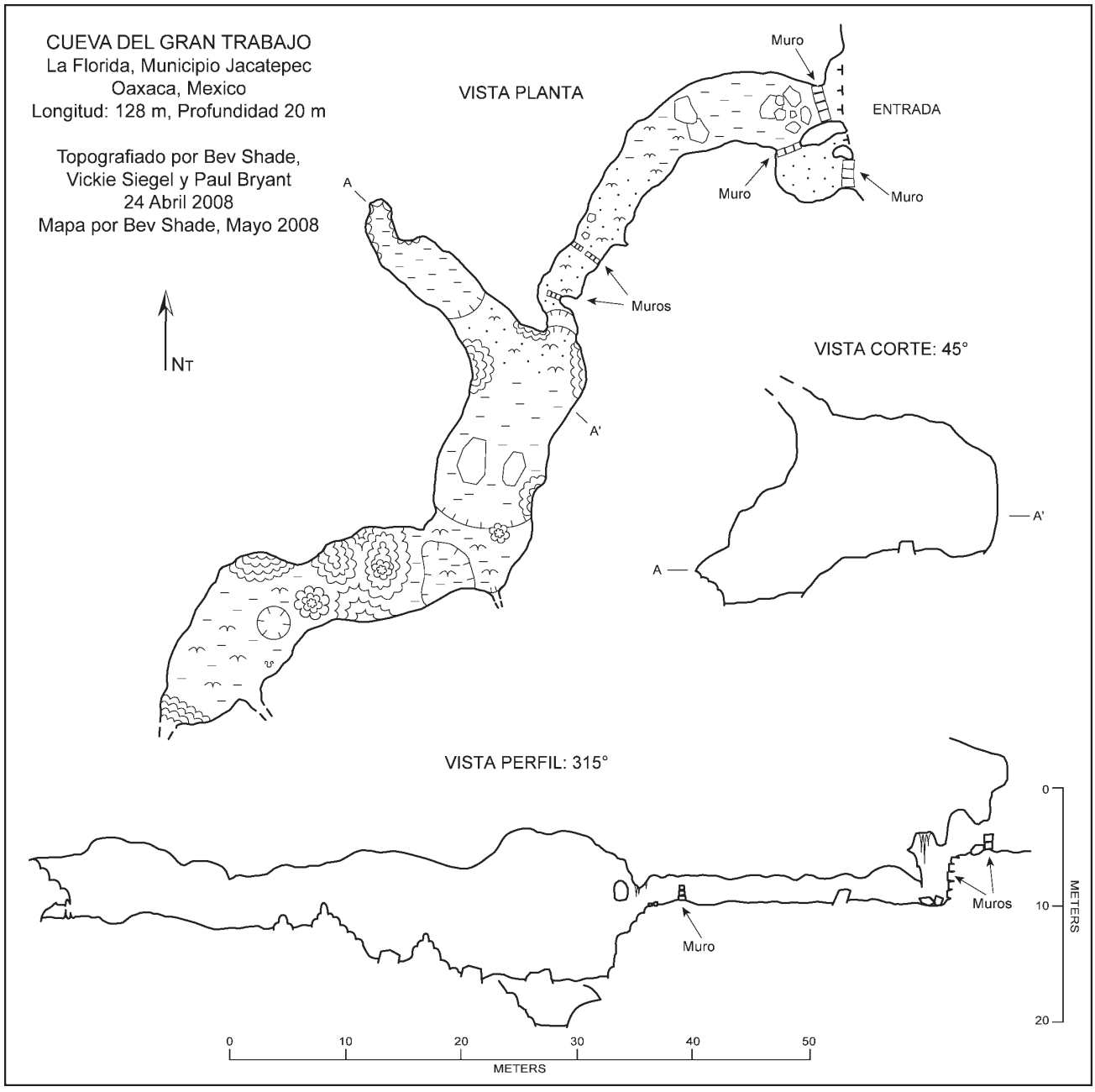
25 METROS

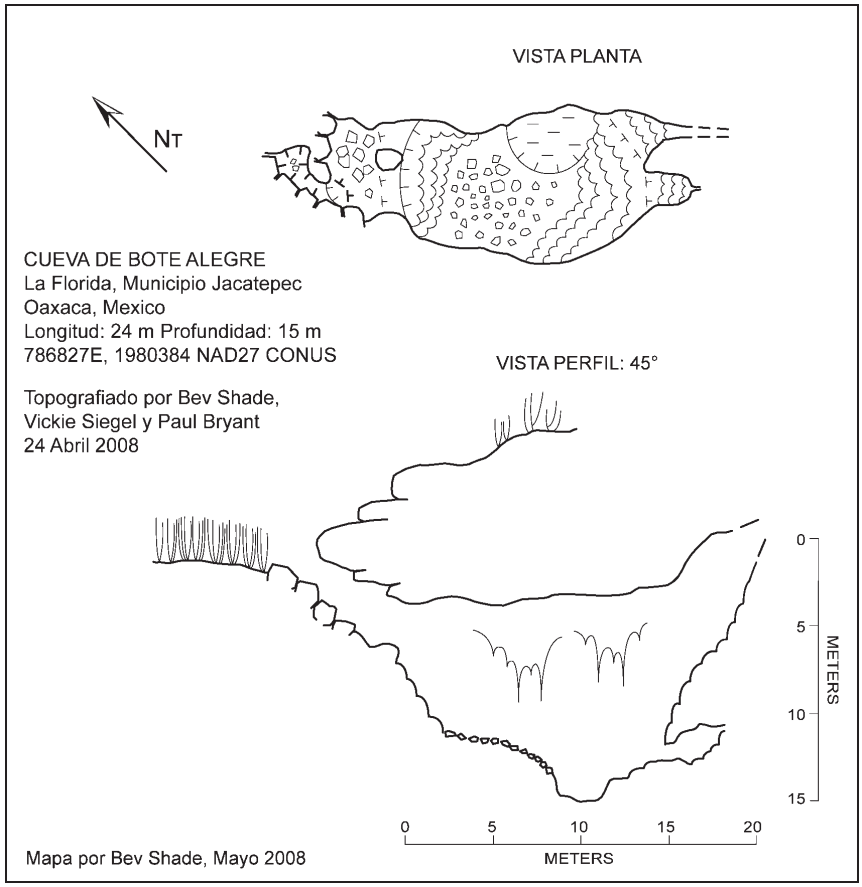
Scorpion from Te Cimutaa. *Peter Sprouse*.

Joe Datri at a wall in the passage in Te Cimutaa. *Peter Sprouse*.



we headed north of Valle Nacional to the village of Cerro Mirador, where we explained our mission in front of a town meeting. Over the next several days we were shown five caves in this area, at up to 1000 meters elevation. Two of them, Te Muchihuan and Cueva de la Parcelawere, were close to the village, while the other three were several kilometers away. Our guides led Jason, Joe, and me through coffee plantations, which gradually gave way to undisturbed forest, where tree ferns put up fiddleheads the size of your fist. The first cave we were shown was Cueva de la Montaña, consisting of a slope down into a single room. The second was a small hole in a vegetable plot in a clear-cut in the forest, but we did not enter this one. The third was the largest; we named it Te Cimutaa (Millipede Cave in the Chinanteco language). It has a small entrance that opens into a sloping passage. We passed through three stone barriers left by ancient peoples, long since breached. These are impressive constructions, with large lintel stones placed over the doorways. Beyond, the passage enlarged to walking size, still sloping steeply down. A few human bones were scattered about, likely burials related to the walling off of the cave. After about 100 meters, we were stopped by a drop for which we had no gear. Some days later Vickie, Paul, and Jason returned to push this, finding the skeleton of a child and other remains below. Paul also found a cave-adapted scorpion swimming in water. This is being described in Oscar Francke's lab at UNAM as the second member of the genus *Alacran*, co-gener to the amphibious scorpion found in the caves of Huautla. The depth of Te





Cimutaa is 67 meters.

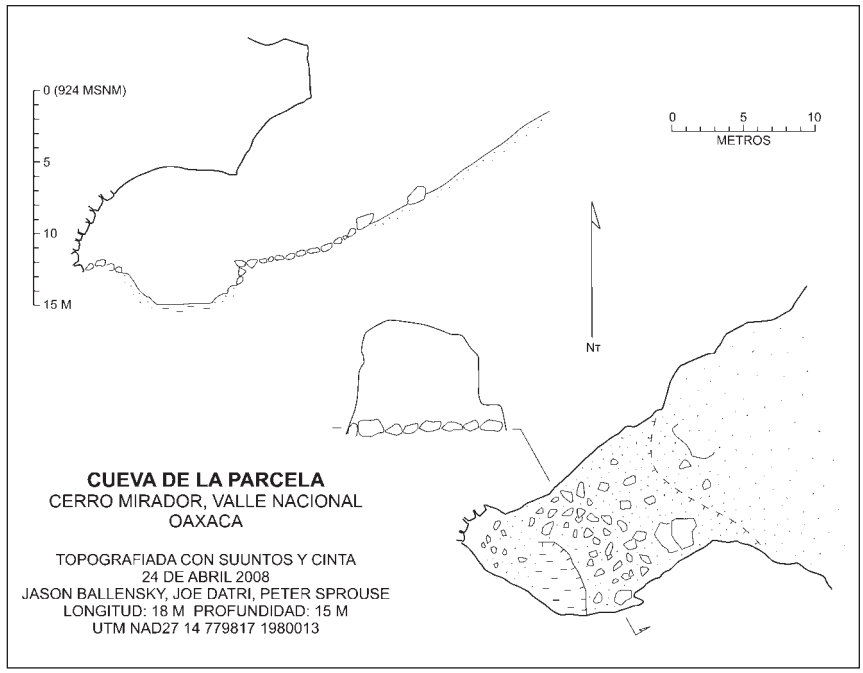
Meanwhile, Bev led a crew to investigate the area around El Faisán and quickly rounded up a guide to a local cave. Cueva de El Faisán turned out to be an overflow-resurgence cave 265 meters long. As at Te Cimutaa, there were old walls that had once blocked passageways, and there was a platform as well. The cave is complex, with the entrance passage teeing into a main route route extending SE-NW. Fossil drain passages are fed by more recent vadose infeeders. There are permanent pools and aquatic and terrestrial fauna.

Bev, Paul, and Vickie were shown four caves at La Florida, just north along the highway from Jacatepec. The first one was Cueva de La Florida, which has a smaller cave adjacent to it. Cueva de La Florida has about 20 meters of fossil passage, with bats and deep guano deposits. Plans to survey these two caves were thwarted by a large beehive, but the next cave was ample compensation. Cueva de Gran Trabajo has three massive, ancient walls constructed at the entrance, followed by smooth-floored horizontal passage with further wall constructions. A short climb down over slimy vampire guano tees into 70 meters of nice borehole, after which the cave is choked by sediment and flowstone at either end. This cave is a significant archeological site. The last cave they did in that area, Cueva del Bote Alegre, is a single, well-decorated fossil chamber, located along the edge of a sizable *dolina*. The cave is about 12 meters deep, and the room is about 20 meters long by 7 meters wide. There is a drain in the floor, but it is plugged with rocks and dirt.

Aimee and Geoff spearheaded explorations around Rinconada, 10 kilometers east of Valle Nacional, locating six caves and a spring. Caverna Rinconada No. 1, located 1500 meters southwest of Rinconada, is a large cave with bats, including vampires. It experiences a lot of visitors. The entrance is on a hillside above a spring and opens into a single large room. A talus slope leads down to a dirt floor. A small stream passage leads through several pools to a deep sump, which likely resurges

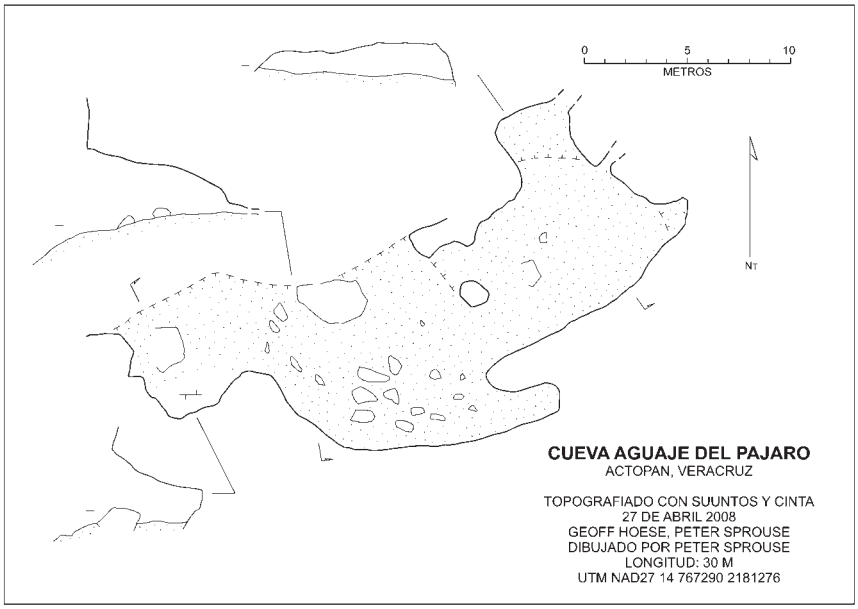
at the Nacimiento Rinconada just below. Three kilometers north-northeast of Rinconada is a cluster of five caves, the largest of which is Cueva Quirino, a large entrance on a hillside. It has a flat bedding-plane ceiling and a talus slope leading down to dirt floor. The back wall is covered with formations.

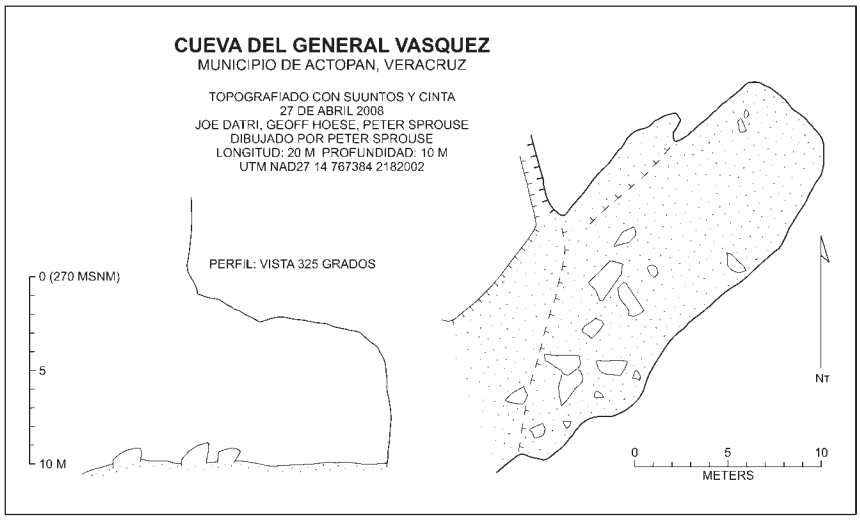
The largest cave we found in the area was located 10 kilometers north of Valle Nacional at Arroyo Seco. Jason, Tone, and I were led through forest and pasture to a non-descript entrance that immediately opened into walking passage with occasional, scattered human bones, culminating in a large burial chamber 200 meters in. Here numerous skulls and bones are strewn about. As Tone and I wrapped up the survey and shot photos, Jason poked into some breakdown and found an extension dropping into a lower level. Returning on our last day in the area, we put two teams into this lead. Bev, Geoff, Joe, Aimee, Tone and I leapfrog-surveyed until we ran out of time 689 meters in. Below the breakdown, we could see that we were the first ones in this passage for a millennium or so. Intact, undisturbed burials are tucked into alcoves on each side of the passage, each with its own "killed" *olla*. Soon we had surveyed past these features, perhaps into virgin passage. It is generally horizontal and muddy, with occasional pools hosting blind shrimp and crayfish. We stopped where the cave ramps up a bit in a flowstone area, still continuing with airflow, because it was time for us to leave Oaxaca.



The next day we broke camp at Yetla, having washed off the Arroyo Seco mud from our gear. Bev loaded up Aimee, Jason, and Vickie to carry them to the Oaxaca City airport, while Geoff, Tone, Joe, Paul, and I began the drive back up the Gulf coast. We stopped in Tierra Blanca, Veracruz, for lunch with my friends Vicky and Karla, who would return to Claudia gear she had left with us. At the port of Veracruz we made the obligatory ice-cream stop by the historic square and tried to meet up with local caver Memo Gassós, but a parade prevented him from reaching our location. We spent the night farther up the coast in a beach cabaña near the Quiahuitzlán archeological site. In the morning I quizzed a local harmonica player about caves, and we were soon off inland in search of them. A few more inquiries, and we found a milking

Cueva del Arroyo Seco. *Peter Sprouse*.





farmhand who knew about two caves in the volcanic hills he could take us to. As we hiked up the hill, we could look down upon Laguna Verde, Mexico's only nuclear power plant. Both of the caves were basically shelters. The first one, Cueva Aguaje del Pájaro, had some interesting fauna, including a lizard, a tarantula, and vampire bats. Hiking farther up the hill through lush vegetation, we reached Cueva de General Vásquez, a high-ceilinged shelter with a few potsherds. As we hiked back down on a road, we caught a ride in a gold miner's pickup truck. An American geologist was among the group, and we commented to him how nice it must be to be able to work in such a beautiful area, but he'd been there six months and was ready to go home.

We got lunch a little farther up the coast, at Boca de Andrea, where volcanic rocks meet the sea. A conversation with the waitress led us down to some sea caves that we were unable to enter due to high surf. Kayaks, PFDs, and helmets would be advisable here.

The last cave of the trip was one I'd been to before, along the coast in northern Veracruz. Cueva de Tampico Alto is in a highway road cut in an isolated area of limestone just south of Tampico. Back in 2001 I'd been stopped at the entrance crawl by numerous vampire bats, so this time we would enter it at night. Paul got one body-length into the crawl before the ammonia was overpowering, and the vampires were still numerous.

El Istmo de Tehuantepec y Valle Nacional

En abril de 2008 se exploraron y topografiaron varias cuevas en Oaxaca, primero en el sureste, alrededor de Zanatepec e Ixtepec, y después en el norte, alrededor de San Juan Bautista Valle Nacional. La mayor cueva encontrada fue la Cueva del Arroyo Seco, con 689 metros de longitud.

GRUTAS DE BUSTAMANTE OPENING CEREMONY

Orion Knox

On April 15, 2009, the governor of the State of Nuevo León, tourism officials from Mexico City and Monterrey, and dignitaries from Bustamante and surrounding towns gathered at the Grutas de Bustamante for the official dedication of the newly developed and reopened cavern, previously known to cavers as Gruta del Palmito. Several hundred people attended the event, which featured bands, clowns, mimes, refreshments, entertainment for the youngsters, souvenir stands, and the official dedication ceremonies. It was a very festive event, enjoyed by all. After the dedication, dignitaries, the press, and invited guests were given a tour of the cave, followed by a luncheon in town.

The cave, which had been closed for the past several years during development, is now under the jurisdiction of the Tourist Development Corporation of Nuevo León and is in effect a state park. Others include Grutas de García and Cola de Caballo.

Research and planning for the development was an international effort involving experts from Mexico, Italy, and the United States. One of the goals in the plan was to make the tour handicapped-accessible. To accomplish this, a tunnel was bored directly into the first room at floor level, and the trail structure within the room is at a gentle grade, making it wheelchair friendly. This is the only developed cave in Mexico with such access.

A second objective was to install the trail structure in such a way that it could be removed in the future with minimum impact on the cave. This was accomplished by the use of fiberglass structural members and decking, with only the column bases in contact with the cave floor. The artful lighting enhances the natural colors in the cave, with no use of colored lights.

Because of the drastic humidity difference between the outdoors and the cave environment, there are three sets of doors between the outside and the cave.

The tour circles the large entrance room and is relatively short compared to others, but that is more than made up for by the size of the room and the huge, spectacular formations. Hopefully in the future consideration will be given to opening the big room that lies beyond. That room is currently ranked as the seventeenth-largest known cavern chamber in the world.

In addition to work in the cave, other development included widening and paving the road from "El Cono" at the base of the mountain to the cave entrance, constructing an enclosed waiting area at the tunnel entrance where interpretive information will later be added, building a picnic area at El Cono, and completing a restaurant in the building that has been at El Cono for many years. The expenditure for the project was between six and seven million U.S. dollars.

As with many caves that undergo development, indications are that sport caving will no longer be permitted.

Ceremonia de Inauguración de las Grutas de Bustamante

La cueva turística en el pueblo de Bustamante, Nuevo León, fue oficialmente inaugurada el 14 de abril de 2009. La visita guiada es accesible para personas discapacitadas e incluye únicamente la primer bóveda de la cueva, conocida anteriormente como la Gruta del Palmito. Probablemente bajo la nueva administración no se permitirá el acceso a las zonas más profundas de la cueva.

The restaurant at "El Cono," with the road up to the cave winding up the mountain in the background. The structure on the mountainside is a platform outside the entrance. *Orion Knox*.

orion_knox@alumni.utexas.net

Temporary structure erected for the opening ceremony.

The new entrance tunnel.

Photos by Orion Knox

Seated, left to right: Homero Rico Garza, Director, Operadora de Servicios Turísticos de Nuevo León; ?; Carlos Maldonado Quiroga, President of the Tourist Development Corporation of Nuevo León; Rodolfo Elizondo Torres, Secretary of Tourism of Mexico; Jose Natividad Gonzalez Paras, Governor of the state of Nuevo León; Jorge Santos Gutierrez, Mayor of Bustamante; Lic. Luis Trevino Chapa, Director General of the Tourist Development Corporation of Nuevo León.

The van used to transport visitors up the mountain to the cave, with the start of the newly widened and paved road.

Photos by
Orion Knox

TABASCO 2009

Vickie Siegel

The sky was a cold, pale blue, and the water pooled in the deck chairs was now ice. The one frozen morning in Austin this winter just happened to be the same morning we had agreed to meet up at dawn, pack the truck, and head down for some caving in Tabasco. Mike Pugliese, also of Austin, and ex-Austin-now-Tuscon resident Tone Garot met me at the Stone Ranch a little way out of town. Our frozen breath billowing around us, we groggily agreed that it was time to head for warmer climes, and we made quick work of loading all of our gear into my little Toyota, Sparky. A last-minute stop at the hardware store for some hammer-drill bits and a file to sharpen the machetes, and we were on our way to the tropics.

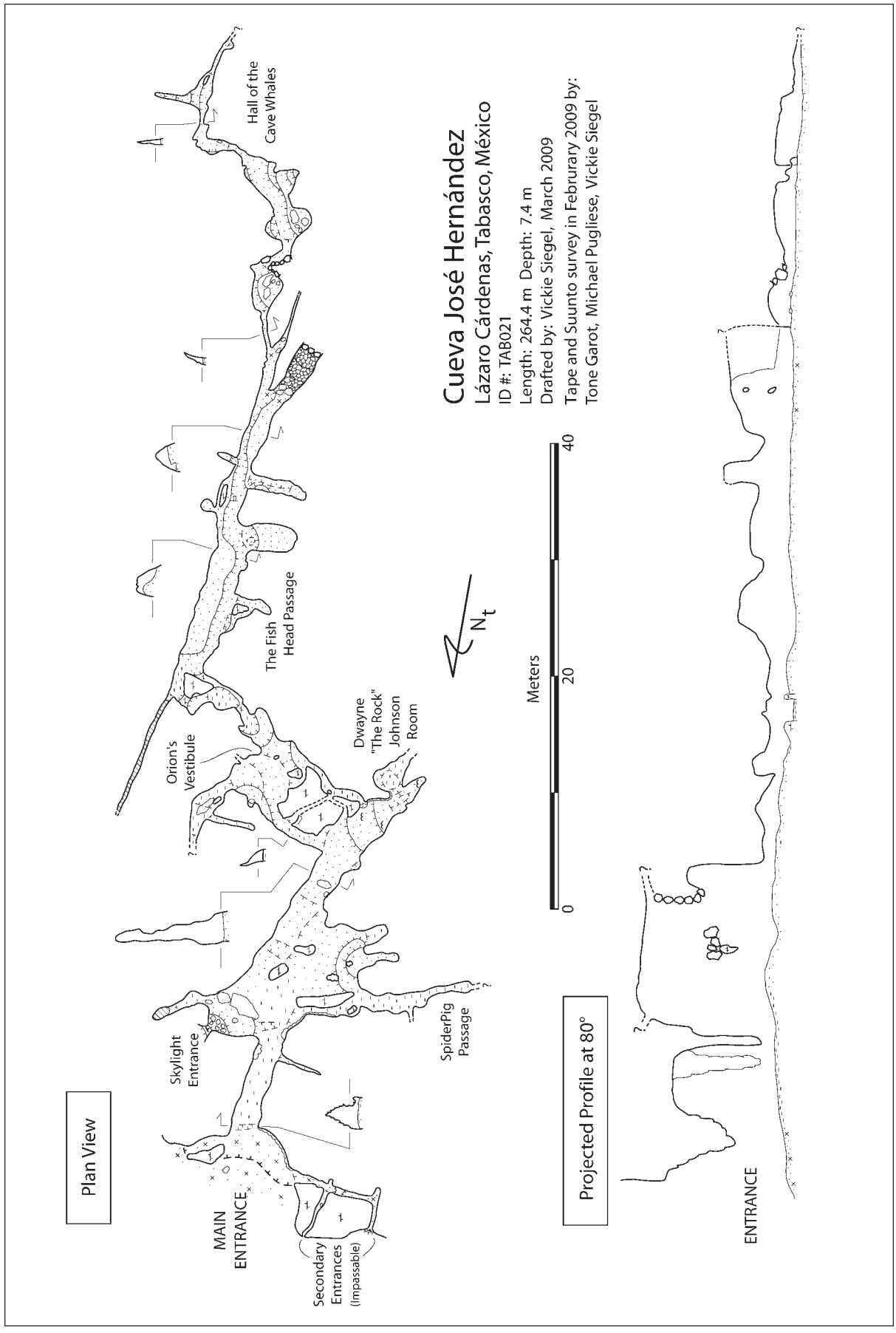
On the afternoon of our third day of leisurely driving, we arrived in downtown Villahermosa, Tabasco's capital. Laura Rosales Lagarde, a regular participant in Caves of Tabasco trips and PhD student at New Mexico Tech, was in town to present some of her research at the IX Congreso Nacional Mexicano de Espeleología. After making Laura promise to join us later for some caving, we left the marshlands of Villahermosa and made our way up into the karsty hills that lie at Tabasco's southern border. As we have commonly done in years past, we decided to use the pleasant, though increasingly touristy, town of Tapijulapa as our home base for this trip. Lured by the reliable hot showers and rooftop patio view, we opted for the town's nicer hotel. Now it was time to get to work.

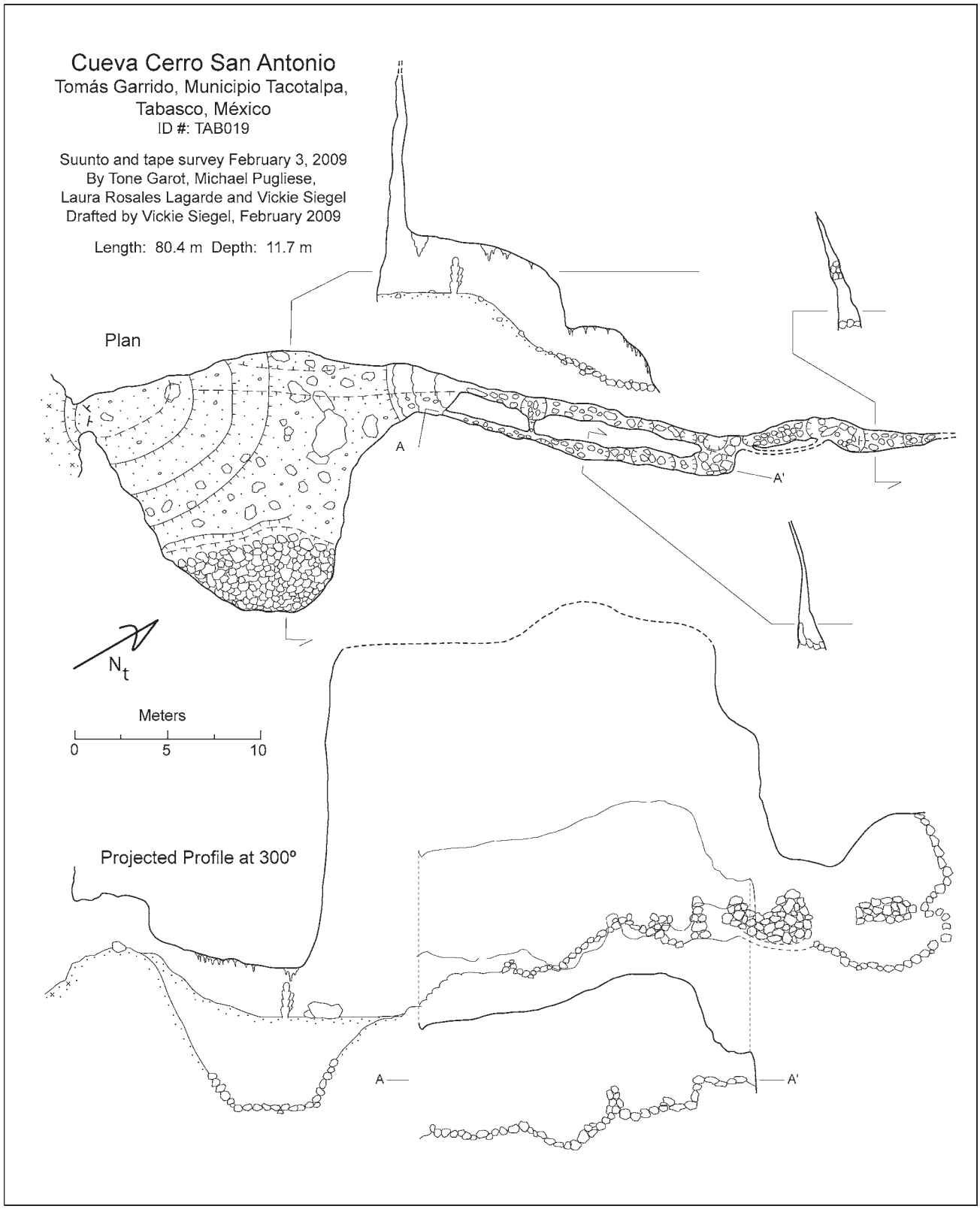
vickie_siegel@yahoo.com

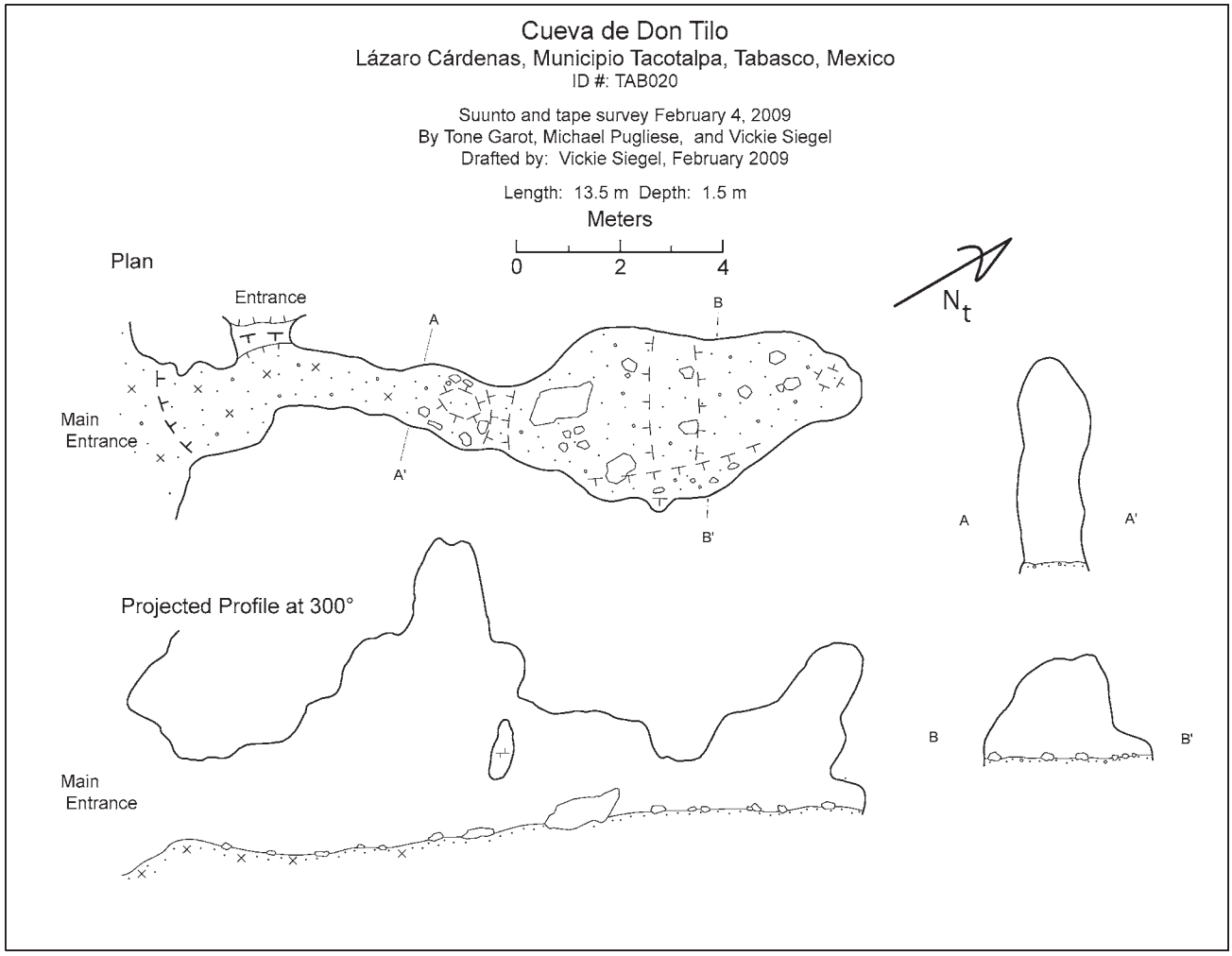
Eladio Terreros Espinosa, an archaeologist studying the ancient Zoque people's use of caves in our field area, worked with Caves of Tabasco in 2007. Both groups found that collaboration useful, so Eladio and his new assistant, Joel Jiménez Pérez, decided to join us for some caving this year as well. They had some leads outside the town of Cuitlahuac and a guide lined up for our first day of caving. Thus it was that we found ourselves, for a few hot, sunny hours that morning, sitting in the street in Cuitlahuac waiting for a rather tardy guide. We sat there and explained to Joel what cavers are and what we do. I used the time to swap out the distributor cap, the rotor, and the spark-plug wires on Sparky. Mike took photos of town. Tone scared little children. I told Joel my life story, and right about then Eladio returned with our guide.

From town we walked several kilometers along the west wall of a valley looking down on the Río Almandro. After eventually confessing that he didn't really know where he was taking us, our guide agreed to take us to see some caves he actually was familiar with, instead of whatever it was we were originally trying to reach. He led us on a small, steep track that branched off from the road we had been following, and soon we were down at the river's edge. In the massive cliff on the opposite bank we could see three things of possible interest. Two of these were shadowy holes in the cliff face, just on the shore. From our vantage point these looked like shelter caves, but we couldn't say for certain. The third was a sizable waterfall feeding the river from some height above, its top obscured by vegetation. Our guide knew nothing of the waterfall, but it matched a description of a cave lead Jim Pisarowicz had given me several years ago. However, as it had been raining the past few days, the river level was up and the water was too fast to make for an easy crossing, so we couldn't investigate further. Thus the only time we spent underground that day was walking through approximately 100 meters of abandoned road tunnel during the course of our hike. At least we got to break out our headlamps.

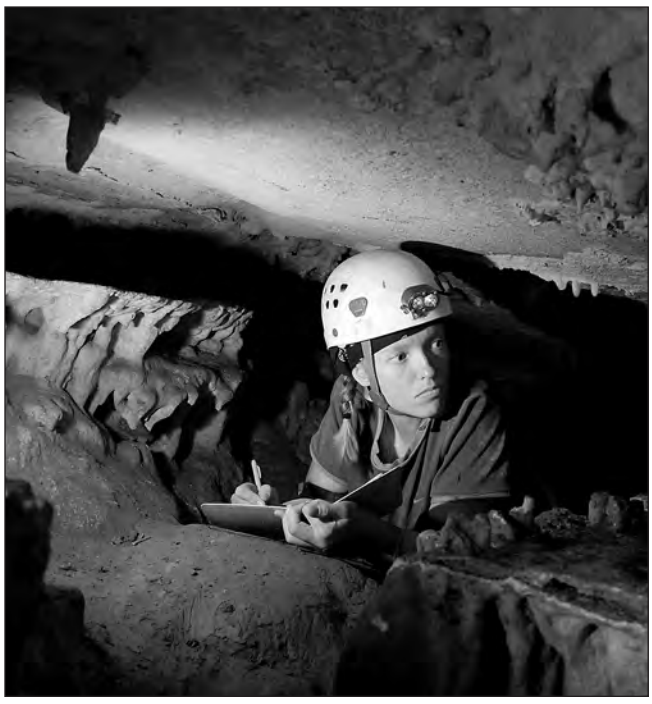
The following day we set out on foot from Tapijulapa for Parque Villa Luz. Peter Lord and Laura were leading a group from the caving congress into the notorious sulfur-reeking, snottite-dripping Cueva de Villa Luz, also known as Cueva de las Sardinas. While the group toured the cave, Tone, Mike and I went with Peter to investigate some possible entrances uphill of the main Villa Luz entrance. In 2004, led by Jim Pisarowicz, we had surveyed some pit entrances that lead into the cave (see *AMCS Activities Newsletter* 28), but Peter suspected that more pits existed and could possibly lead into virgin areas in the Villa Luz system. The neighboring farmer had cleared more of the forest around the cave since either Peter or I had been there, and as a result we quickly spotted several tight entrances exuding a sulfurous smell. On the surface it seemed that these entrances might lie outside of the known passage in Villa Luz. Mike, the team's designated "small passage guy," squeezed into these and reported first that there were biting ants and then later that


Plan View
Cueva José Hernández
Lázaro Cárdenas, Tabasco, México
ID #: TAB021
Length: 264.4 m Depth: 7.4 m
Drafted by: Vickie Siegel, March 2009
Tape and Suunto survey in Februrary 2009 by:
Tone Garot, Michael Pugliese, Vickie Siegel
Hall of the Cave Whales
The Fish Head Passage
Orion's Vestibule
Dwayne "The Rock" Johnson Room
Skylight Entrance
SpiderPig Passage
MAIN ENTRANCE
Secondary Entrances (Impassable)
Meters
0
20
40
Projected Profile at 80°
ENTRANCE


Cueva Cerro San Antonio
Tomás Garrido, Municipio Tacotalpa,
Tabasco, México
ID #: TAB019
Suunto and tape survey February 3, 2009
By Tone Garot, Michael Pugliese,
Laura Rosales Lagarde and Vickie Siegel
Drafted by Vickie Siegel, February 2009
Length: 80.4 m Depth: 11.7 m
Plan
A
A'
Nt
Meters
0
5
10
Projected Profile at 300º
A
A'



Vickie Siegel and Tone Garot surveying in Cueva Don Cosme. *Mike Pugliese*.



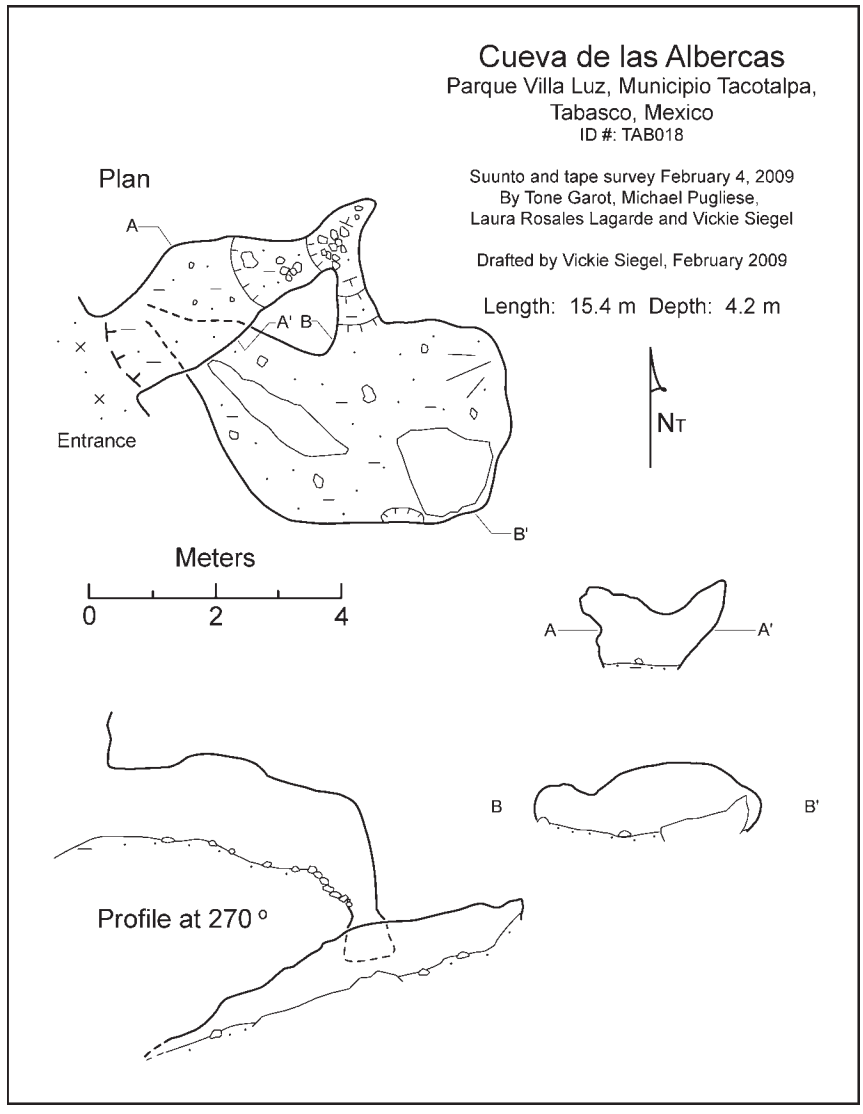
the passages opened up and went. Given the time constraints we had that day and the fact that we didn't have any respirators for surveying safely in Villa Luz conditions, we only noted the locations, and the leads remain to be explored and tied into the Villa Luz survey if possible.

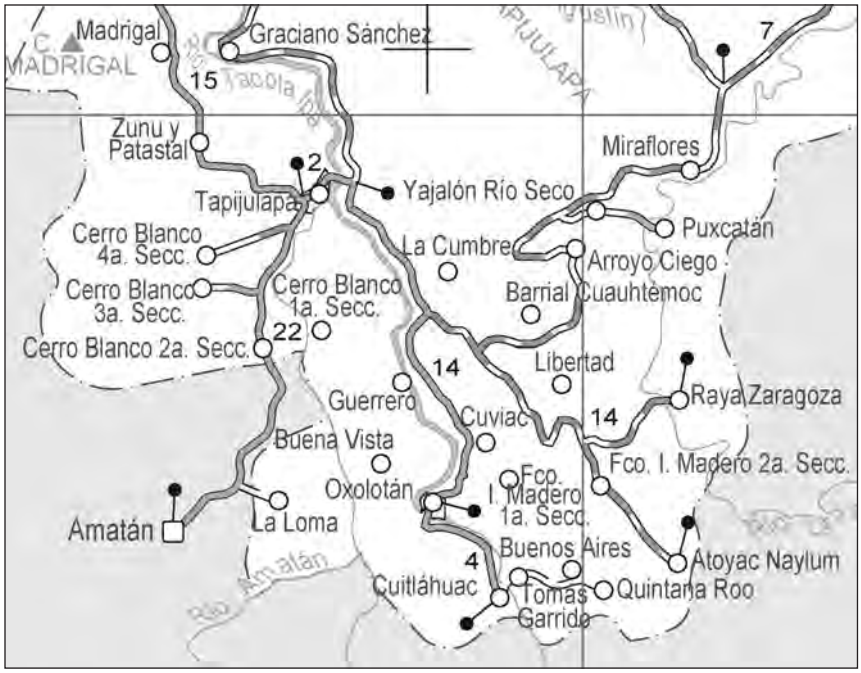
We went back to the Villa Luz entrance, and Tone and Mike did a quick tour of the cave, an activity that is something of a requirement for cavers visiting Tabasco for the first time. Having been there, smelled that, I dozed in the sunshine instead. When they emerged with Laura, the four of us went to the *albercas* area of the Parque Villa Luz. The *albercas* are pools where tourists go to enjoy any perceived benefits of soaking in the stinky, milky-white water coming from the cave. A coconut's throw from the *albercas* is the entrance to aptly named Cueva de Las Albercas. This small cave is relevant to Laura's research regarding the sulfur springs in the area. She told us that, though it is quite close to Cueva de Villa Luz, Cueva de las Albercas shows no signs of sulfur-influenced speleogenesis. For this reason she wanted our help surveying the cave, and we were happy to oblige.

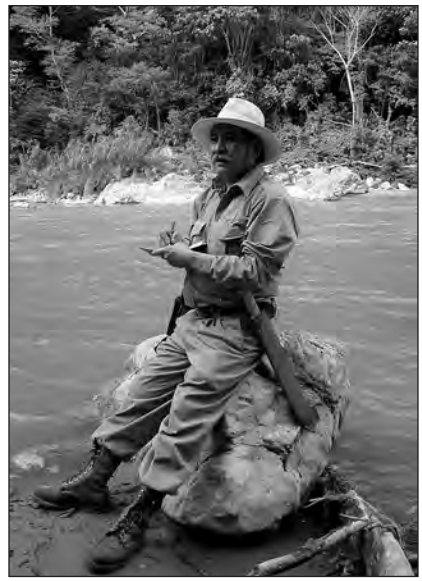
The stream flowing from Cueva de Villa Luz is white with suspended sulfur. *Mike Pugliese*.

One of the two swinging bridges into the Villa Luz park. This one replaces one that collapsed and killed nine people on Easter 2005. *Mike Pugliese*.

Wanting to move away from the much-searched Villa Luz area, we agreed to take on another of Eladio's leads. Though not able to join us that day, Eladio had arranged a guide to take us to another rumored lead, this time outside of the town of Tomás Garrido. According to my apparently outdated topographic map of this area in Tabasco, there is no road to Tomás Garrido and we had never heard of any cave leads around the place, so as we headed out of Oxolotán towards this new-to-us town, Laura and I, riding in the cab, were delighted to see more and more of the beautiful Tabascan karst roll out before us. Just from the road we spotted several possible







Eladio Terreros Espinosa noting possible cave entrances on the east side of the Río Almando. *Tone Garot.*

cave entrances in the white cliffs we passed. This, it appeared, would be a whole new area for us to work.

Upon arriving in town, we had that all too rare experience in Mexican caving (or any caving): our guide led us easily and directly to a cave. The cave was known as Cueva Cerro San Antonio, and Tone, Mike, and I promptly started the survey, while Joel and Laura searched the cave for any items of archaeological or geological interest. While there was nothing present to contribute to Eladio and Joel's research, the cave is something of a geologic curiosity. The relatively wide entrance room quickly narrowed down to two linear, parallel passages. Essentially the cave is a vertical fissure in the bedrock where a large slab has broken off of one wall and divided the single fissure into two parallel passages. What at first appeared to be breakdown lining the walls, we soon realized, is actually a conglomerate bedrock with large (about 30 centimeters), poorly-sorted limestone clasts.

Happy to have another cave survey in the bag, we headed back to Tapijulapa, marveling again at the landscape surrounding Tomás Garrido. It is an area worth more investigation on future trips.

Feeling the call of her dissertation, Laura headed back to New Mexico, leaving us to carry on. Our next stop, Cerro La Iglesia, is named for the crumbling remnants of a centuries-old Spanish mission (*iglesia*) that lies between the hill and the Río Tacotalpa. Until this year, the hill was just one of the countless monkey-covered, white-walled *cerros* that we drove past on our way to other places. This year we found and mapped two caves there.

The first cave, Cueva Don Tilo, is a two-survey-shot wonder. It is a total of 12 meters long and was named after the land owner. Near this cave, in addition to a plethora of edible plants, our guide showed us a spring entrance that, during the rainy season, reportedly spews both water and large fish.

The second cave is on the opposite side of the hill. Cueva Jose

Tapijulapa. *Mike Pugliese.*

Hernández is considerably longer, 264 meters, and took us a few days to survey. The wide, tall entrance gives way to smaller passage that shows evidence of large volumes of water moving through during the rainy season. These effects were most notable in the area we dubbed the Fish Head Passage. Not only was this section littered with several 8-centimeter-long fish skulls and various other fish bones, it is also half-filled with sand that has been piled up to one side of the passage and then the other, forming a steep bank for the meandering stream that must run through the tunnel during the rainy season. We noticed organic flood debris stuck to the walls on a line near the ceiling in this section. We don't know how much of this to attribute to Tabasco's disastrous flood in 2007 and how much of it is just normal for the cave. We finished our survey at a low sand dig, one of a few leads we noted in the cave. Not feeling any airflow, we ended the survey there.

We took some time out in between our survey days at Cueva Jose Hernández to spend another day caving with Peter Lord. He took us to Cueva Don Cosme, a cave he, Roberto Porter, and other Mexican cavers had visited before, but had never surveyed. This cave is in the Sierra Poana, a few kilometers east of Rancho Arroyo Azul, where we had surveyed the gorgeous white, scallop-walled walking passages of Cueva Safari and its sister caves in 2006 and 2007.

From the entrance room, Don Cosme branches in three directions. At the far left is a stoop/crawl to a climb that benefited greatly from a handline. To the far right was a virgin crawlway that led to a second entrance. In the center lies the main trunk of the cave. At Peter's request we surveyed the left-most route first, to document the vampire bats living there and investigate the top of the climb, which we believe was also virgin. When we reached the top of this vampire-guano-slimed climb, we named the area Nosferatu's Attic for the bats, though we later found that most of the vampires seem to live in a different part of the cave. The passage beyond Nosferatu's is small, dreadful, and full of sticky mud. We were not sad when it ended.

The second area we tackled with our survey was the Shindig Passage, the crawl to the right from the entrance. Mike and then Tone and then Peter spent some time on some short sand-and-mud digs to push this virgin branch to a second entrance. We surveyed here diligently until, due to the effects of some sort of disagreeable meal (the *molé*? the *pozol*?) the day before, it turned out that belly-crawling through a cave was neither very enjoyable nor prudent just then, so we stopped surveying a little short of emerging from the second entrance. Packing up for the day, Mike and I decided to take a quick look down the main trunk passage to see how much cave remained to be surveyed the next day, which was to be the final day of our trip. To our surprise, it turned out to be not such a quick look—the cave kept going and going walking size, first through a forest of flowstone columns, with a larger vampire population that Nosferatu's, and then into wider, less mazy passage. We turned around before we reached the end and then took a wrong turn into even more passage on the way back. With mixed feelings, we agreed that there was too much to finish in the one day we had remaining and that it would be best to leave the entire branch to survey on our next trip down. It would be more enticing, we thought, to return to survey hundreds of meters of walking passage than to return to mop up the last nooks and crannies, so we left it at that and look forward to finishing next time. Cueva Don Cosme currently has 160 meters of surveyed length. In the end we decided to start back towards Texas a day early to catch some classic Mexico tourist stops on the way north.

The entrance to Cueva Don Cosmo. *Mike Pugliese.*

Thanks to the help of our friends and collaborators, Peter, Laura, and Eladio, our short trip to Tabasco was packed with nice caves, good survey, and good times. We got a happy dose of all that makes Tabasco distinct—run-ins with howler monkeys and *tayras*, in-your-face flora, fruits with tongue-twister names, and dramatic karst framing it all, always waiting to reveal a cave or two.

Tabasco 2009

Durante y después del IX Congreso Mexicano de Espelología se exploraron y topografiaron algunas pequeñas cuevas en los alrededores de Tapijulapa, Tabasco. También se buscaron posibles manantiales sulfurosos en adición a los de la Cueva de Villa Luz.

SISTEMA LOS TOROS DEEPEST CAVE IN NUEVO LEÓN

Mark Minton

The Christmas holidays of 2008 marked our fourth trip to the caves near the village of Los Toros in the central Purificación karst (see *AMCS Activities Newsletter* 31, pages 64–70). Ten people from across the U. S. gathered in Zaragoza, Nuevo León, on December 21: Aaron Moses, Yvonne Droms and Mark Minton from Virginia, Paul Heinerth from Florida, James Hunter from New Mexico, Heather Levy from Maryland, Tanja Pietraß from New Mexico and the District of Columbia, and Bill Steele, Ellie Thoene, and Diana Tomchick from Texas. We all arrived within a couple of hours of one another, which was amazing considering our varied origins and the trials and tribulations of getting there.

For some of us the trip got off to an incredibly slow start. Diana's truck crossed the Solidarity Bridge at Colombia around 8:30 p.m. on Saturday to find a parking lot of vehicles, a sea of people, and a heavy army and police presence. Lines snaked out of the *aduana* in three directions, and no one we asked seemed to know where we should start the process. We finally got into the proper line and got tourist visas in under an hour. The car permit, however, required most of the night. We took turns standing (and sitting in lawn chairs) in line and sleeping, and finally got our papers at 6 a.m., after 9.5 hours, my worst crossing time ever in forty years of Mexican caving. We talked to people who said they had been in line for 12 hours, and heard that in Laredo people were waiting 24 hours or more. The secret of Colombia seems to be out, and it is no longer a quiet, quick place to cross. Heather's group fared better, needing only tourist cards, but that alone took 4 hours in Laredo. They had by far the longest drive, about 48 hours total for Heather. Two more of our group, Charles Fromen of Texas and Mexico and Emily Zuber of Washington, unfortunately never made it at all due to car trouble.

We spent the night in Zaragoza at our usual spot, the Hotel Reyna, before driving up the mountain the next day. The road was in considerably worse shape than it had been the year before, but was still readily passable. It was a beautiful sight when we punched through the clouds of the valley and arrived near El Viejo under a beautiful blue sky. We made rapid progress until Diana's camper shell opened near Márgaras and several items fell out onto a steep stretch of road over a distance of about one kilometer before we noticed. Fortunately everything was recovered, including most of the broken eggs. We noticed that some new roads had been cut in the area, but we did not have time to check them. At the apparently abandoned San Fernando mine near Peñuelas we took a small detour to explore. Heather even drove her truck to the end of the main tunnel. There were a few pockets of natural cave exposed in the diggings, so a more thorough investigation is in order.

After six hours of four-wheel driving we arrived in Los Toros, where we were warmly welcomed by our many local friends. The weather had been cold and unusually dry. The main spring where we get drinking water was even lower than the year before, but fortunately there was still plenty, and the locals were happy to share. The smaller spring near our camp, which we use for washing, had essentially stopped flowing.

On our first full day in camp we

Heather's truck approaching the San Fernando mine. *Paul Heinerth.*

mminton@illinoisalumni.org

Bill Steele admires giant agaves. *Yvonne Droms*.

set up a rebelay course in a tree so that people could tune their vertical rigs and practice maneuvers some were unfamiliar with. Then teams went into both Soplo de Los Toros and Poza Zorillo, the two major caves in the area, to rerig the entrances and stage rope for the first pushes. Only Yvonne had ever been past the Octopus Drop in Zorillo, and the others on that first trip were impressed by the nice passage and beautiful formations Zorillo had to offer. An occasional and unusual feature on the passage walls beyond the Octopus Drop is mud nests that look like small pottery urns. Some had one neck while others had several. I suspect that these are millipede nests, but that has not been confirmed.

The first push trips took place the following day, December 24. Aaron, Heather, and James went to the bottom of Soplo at –459 meters. The passage became too narrow at floor level, but by climbing to higher levels and hammering open squeezes they were able to get through and eventually go back down again. At the end of their trip, however, they had still not gotten as deep as the previous end. They emerged after 22 hours with a going pit lead with air flow. Bill, Ellie, Mark, and Yvonne went to Zorillo and surveyed the passage beyond the Octopus Drop that Yvonne had explored solo the previous year. Beyond the end of the known cave, the passage opened up to very nice dimensions with beautiful formations. At the bottom of the Pearl Drop we found a single perfectly formed cave pearl 2.5 centimeters in diameter. Just beyond, Bill exclaimed that he was in passage 3 meters wide and 15 meters tall, so we named it Pure Booty. We hoped that Zorillo would continue on its own, but alas, at the next pit Yvonne spied a rope hanging in the distance. It took a while to recognize the spot, but we had connected part way down the 50-meter Soplo Shaft, the deepest drop in Soplo. We got down to a ledge, but unfortunately we did not have enough rope on that trip to get to the bottom of the pit and connect the surveys.

The connection of Zorillo with Soplo was our Christmas present. Even though we were sad to see such wonderful passage come to an end, everyone agreed that Zorillo was a better way in than the Soplo entrance. It avoided most of the mud, as well as Zuber's Bathtub, where we had a rope traverse and squeeze over a deep pool. We had Christmas presents for the locals as well. We had made color prints of several photographs of members of the two main families and their housing compounds and framed some of them. We delivered these and in return were given homemade blue-corn tortillas and pastries called *buñuelos*. We also bought some of their embroidery and arranged for pack animals. Back at camp we consumed various libations, including Ellie's excellent *mojitos*, while sitting

Christmas skull. *Tanja Pietraß*.

Heather and Mark surveying at the top of the Soplo Shaft connection. *Yvonne Droms*.

Mules and Paul return from the dive at the *nacimiento*. *James Hunter (left) and Yvonne Droms*.

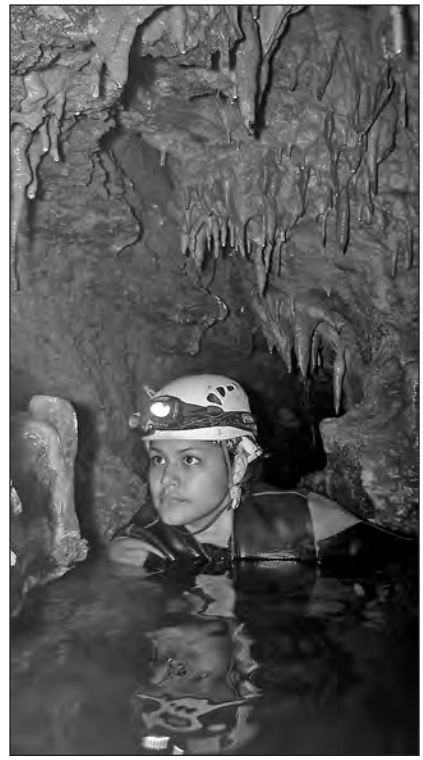
around a campfire and a cow skull sporting Christmas lights. A huge feast followed, with ham, sweet potatoes, mashed potatoes, stuffing, baked beans, cornbread, and many desserts, including cherry cobbler. Our two Dutch ovens got a good workout.

The next day, December 26, the team split into two groups. Bill, Diana, Ellie, Paul, and two local guides with mules packed down to the resurgence, Nacimiento de Los Toros, in the Arroyo Luna canyon. Their three-day plan was to do a proper survey of the cave and dive the sump. They were successful in both, with 200 meters of "dry" cave surveyed and 70 meters of underwater passage mapped. Paul, the diver, came up into air-filled passage going two ways, one with a small waterfall. This bodes well for the lower parts of the system not being inundated. There were several large cave-adapted isopods in the sump. Paul noted that this dive was one of the most remote he had ever done, at least with respect to the amount of gear hauling required. It's a killer all-day hike.

Meanwhile teams were working in Zorillo and Soplo. On December 26, Aaron, James, and Tanja went on a photo trip in Zorillo, which is more highly decorated than Soplo. It features everything from sparkling flowstone falls to delicate, translucent helictites. Deeper down, the Zorillo-Soplo connection was physically made, and the surveys were tied together by Heather, Mark, and Yvonne, giving birth to Sistema Los Toros. Not far past the connection, we bashed open a narrow pit in the SAM Passage and Heather descended, but it didn't go. On the way out, Heather swung into a large lead part way up the Octopus Drop, and I followed, but it soon ended in a massive flowstone choke.

Using the Zorillo entrance, Aaron, Heather, James, and Tanja made another 22-hour trip to the bottom of the cave on December 27. They continued to push the tight canyon there, going up and down and back

Diana and Paul hauling tanks in the Nacimiento de Los Toros. *Ellie Thoene*.



Elllie in the resurgence. *Paul Heinerth.*

Cave pearl at Pearl Drop. *James Hunter.*

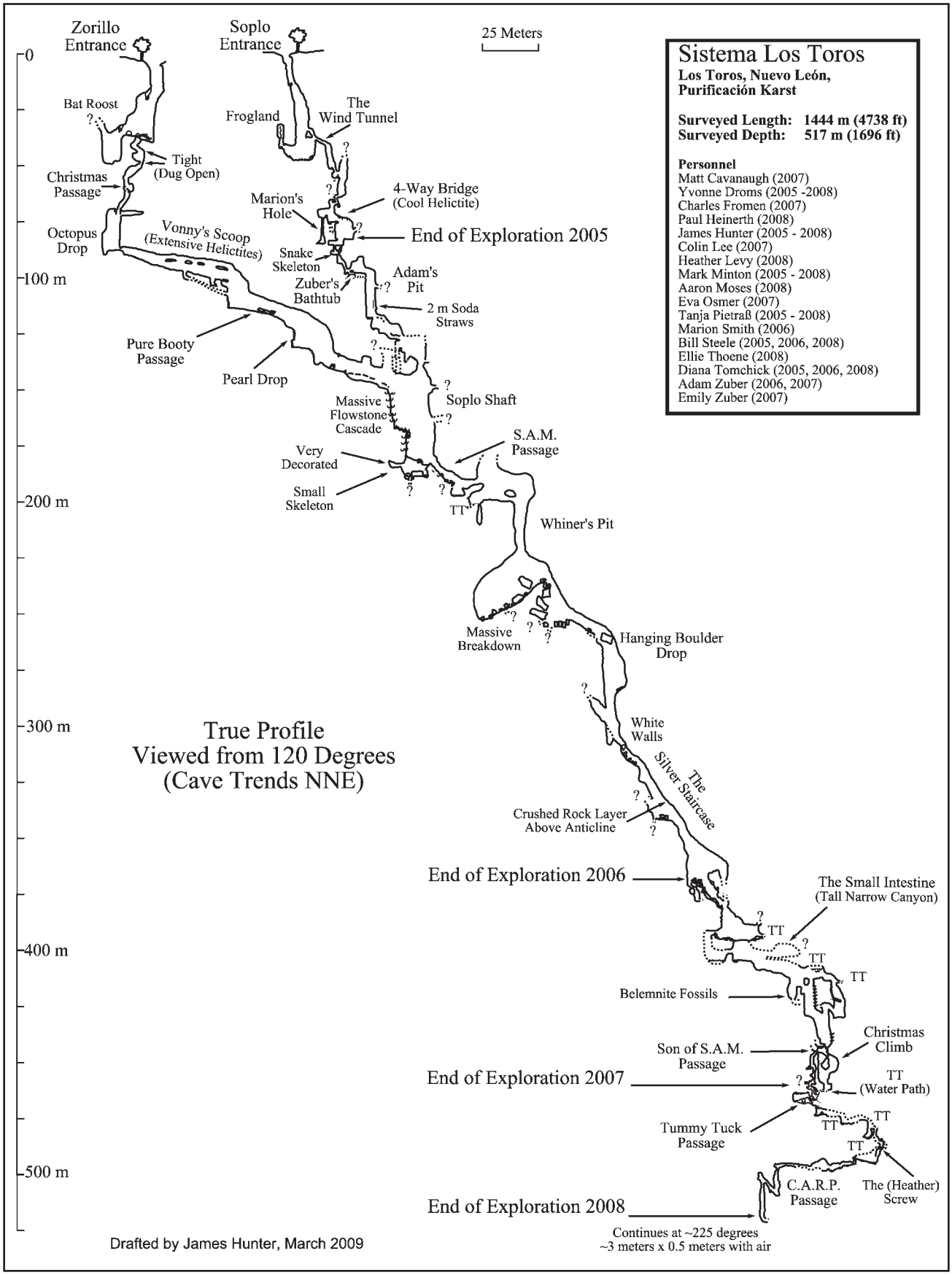
and forth but gaining only a little new depth. A hammer was often necessary to open tight squeezes. At the same time Yvonne and I did a bolt traverse to a passage on the far side of a pit at –410 meters. This was just beyond the Belemnite Drop, where some long, pencil-like fossils had erroneously been called sea-urchin spines last year. It turns out they are more likely belemnites, from an extinct squid-like animal. The passage is briefly larger there, and we hoped to bypass the narrow canyons deeper on the main route. We got into well-decorated passage and descended a pit with unusual chocolate- and butterscotch-colored flowstone and good air flow, running out of rope at another drop.

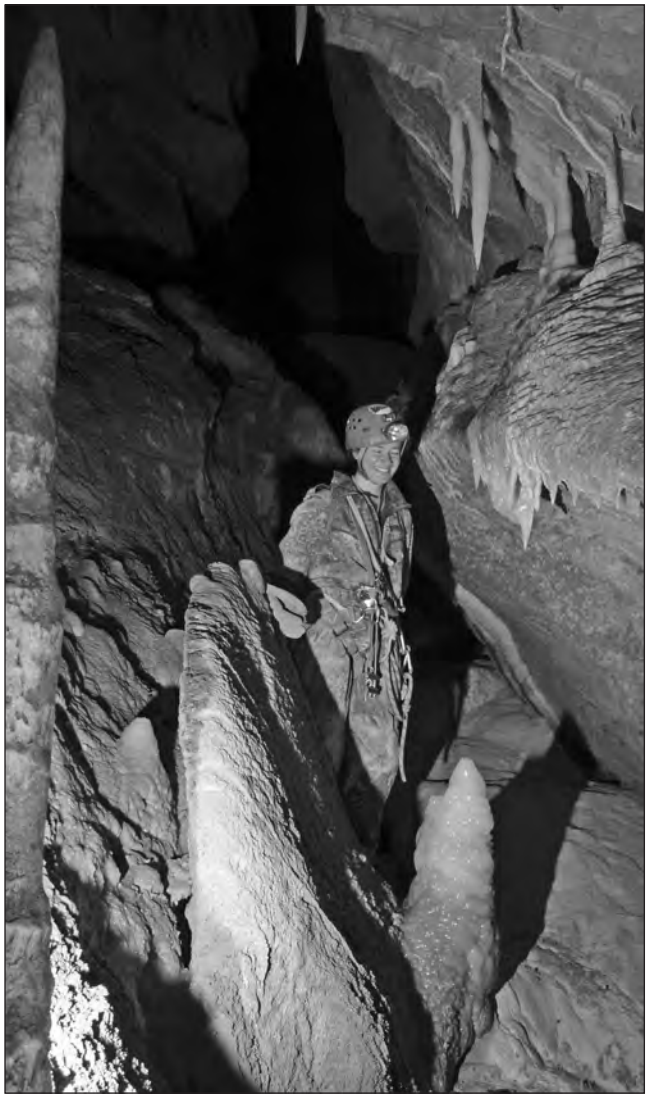
The final push came on December 31. Yvonne and I returned to our bolt-traverse lead, but unfortunately the next pit connected back into known cave, dashing our hopes for a new deep route. The usual team of Aaron, Heather, and James headed to the bottom with a goal of breaking 500 meters depth. Since Aaron and Heather were leaving the next day, they hoped for a shorter trip than their previous two. After bashing through more tight, gnarly passage, they finally broke out at a 17-meter drop. The passage at its bottom seemed to be getting larger, and had the air—a great lead for next year. They made it out after sixteen hours, and a tally of their survey data put the depth at 517 meters. Success!

Aaron, Heather, and Paul left the next morning, January 1, 2009, and took the road east, completing another west-to-east crossing of the sierra. Our last day at camp was mainly spent derigging the upper parts of the caves and cleaning and packing gear. A couple of local guys came by and told us of a deep pit thirty minutes' walk from camp. Ellie and I decided to check it out. When they saw that we were only taking 30 meters of rope, they said we would need much more, but we said we just wanted to have a quick look and would go back next year if it was not enough. The pit, Pozo Destilero, turned out to be only 15 or 20 meters deep and didn't go. It

Yvonne Droms ready to descend second part of Soplo Shaft. *Mark Minton*.

Mark Minton sketching at the connection between Zorillo and Soplo Shaft in Los Toros. *Yvonne Droms*.


Sistema Los Toros
Los Toros, Nuevo León,
Purificación Karst
Surveyed Length: 1444 m (4738 ft)
Surveyed Depth: 517 m (1696 ft)
Personnel
Matt Cavanaugh (2007)
Yvonne Droms (2005 -2008)
Charles Fromen (2007)
Paul Heinerth (2008)
James Hunter (2005 - 2008)
Colin Lee (2007)
Heather Levy (2008)
Mark Minton (2005 - 2008)
Aaron Moses (2008)
Eva Osmer (2007)
Tanja Pietraß (2005 - 2008)
Marion Smith (2006)
Bill Steele (2005, 2006, 2008)
Ellie Thoene (2008)
Diana Tomchick (2005, 2006, 2008)
Adam Zuber (2006, 2007)
Emily Zuber (2007)
25 Meters
Zorillo Entrance
Soplo Entrance
0
100 m
200 m
300 m
400 m
500 m
Bat Roost
Frogland
The Wind Tunnel
Tight (Dug Open)
Christmas Passage
Marion's Hole
4-Way Bridge (Cool Helictite)
Octopus Drop
Vonny's Scoop (Extensive Helictites)
End of Exploration 2005
Snake Skeleton
Zuber's Bathtub
Adam's Pit
2 m Soda Straws
Pure Booty Passage
Pearl Drop
Soplo Shaft
Massive Flowstone Cascade
Very Decorated
Small Skeleton
S.A.M. Passage
TT
Whiner's Pit
Massive Breakdown
Hanging Boulder Drop
White Walls
The Silver Staircase
Crushed Rock Layer Above Anticline
End of Exploration 2006
The Small Intestine (Tall Narrow Canyon)
Belemnite Fossils
Christmas Climb
Son of S.A.M. Passage
End of Exploration 2007
TT (Water Path)
Tummy Tuck Passage
C.A.R.P. Passage
The (Heather) Screw
End of Exploration 2008
Continues at ~225 degrees
~3 meters x 0.5 meters with air
True Profile
Viewed from 120 Degrees
(Cave Trends NNE)
Drafted by James Hunter, March 2009



Left: Tanja in Pure Booty passage. Above: Translucent formations in Pure Booty. *James Hunter.*

did have two owls in it that came out as Ellie was descending, giving her quite a start. There were also large black bats and unusual big black ants with yellow abdomens. That was the last cave of the trip.

We packed up and drove back out to Zaragoza on January 2, a slow 30-mile journey. On our way through Los Toros we said our goodbyes and gave away old ropes and water jugs. Diana's group (Bill, Diana, Ellie, Yvonne, and I) spent the night at the Hotel Ancira in Bustamante. In the morning we met Mexican caver Nico Escamilla for breakfast, and then drove out into Bustamante Canyon to look up the cliffs at Precipicio. Later, on our way north, we stopped at a bizarre shrine to Santa Muerte, complete with various Grim-Reaper images. At the Colombia border crossing we were confronted by an even larger traffic jam than on the way down. Cars were backed up all the way out onto the main highway, a distance of over a mile from the bridge. Since they didn't seem to be moving, we got out of line while we still could and headed west to Piedras Negras, where we crossed in only an hour and a half. That will likely become our preferred crossing point in the future.

We had ambitious plans for the year and succeeded in all of them. Sistema Los Toros is currently 1444 meters long and 517 meters deep. It surpassed Sistema Cretácico to become the second-deepest cave in the Purificación area and also surpassed Pozo de Montemayor to become the deepest cave in the state of Nuevo León. Although downward progress was painfully slow again this year, netting only 58 meters of new depth, we hope that we are finally past the tight sections. Cave camping will almost certainly be required in order to continue. We look forward to returning in 2009 and pushing on toward the resurgence.

Sistema Los Toros, La Cueva Más Profunda de Nuevo León

Durante la cuarta visita al poblado de Los Toros en la zona cárstica de Purificación, espeleólogos conectaron Soplo de Los Toros y Poza Zorrillo, y exploraron al fondo del sistema, que cuenta ahora con 517 metros de profundidad y una extensión de 1444 metros. El Nacimiento de Los Toros, en las profundidades del Arroyo Luna y alcanzado después de una larga caminata de un día completo, fue topografiado, y el sifón de 70 metros fue buceado. El buzo reportó pasaje no inundado después del sifón, partiendo en dos direcciones, una de ellas con una cascada.

WHEN THE SURVEY IS NOT ENOUGH: TEMPERATURE, SALINITY, AND DYE TRACING REVEAL FLOW PATHS

Patricia A. Beddows[1] and Melissa R. Hendrickson[2]

Sistema Aktun Ha is a water-filled complex of two caves located about 8.6 kilometers inland from the Caribbean coast on the Tulum-Coba highway (Figure 1a). The system comprises a "spring" side explored to a length of 1467 meters and extending northwest from the central entrance sinkhole, called Cenote Car Wash, and, on the coastward "siphon" side, 1342 meters of explored water-filled cave (Figure 1b). Cenote Car Wash is an open basin of water, while the other two cenotes are small and sediment-choked. All three of them are post-genetic, offset collapses, such that the actual point of entry into the water is offset from

Figure 1a. Location of Cenote Car Wash within the Sistema Aktun Ha at 8.6 km straight line distance inland from the Caribbean Sea on the Tulum-Coba highway. The location of the individual wells of the Tulum municipal well field, as well as the Tulum garbage dump are indicated.

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[2] Department of Geography, University of Western Ontario, London, Ontario, Canada.

Slightly revised from an article in *Proceedings of the 18th National Cave and Karst Management Symposium, October 8–12, 2007, St. Louis, Missouri*, pages 198–203.

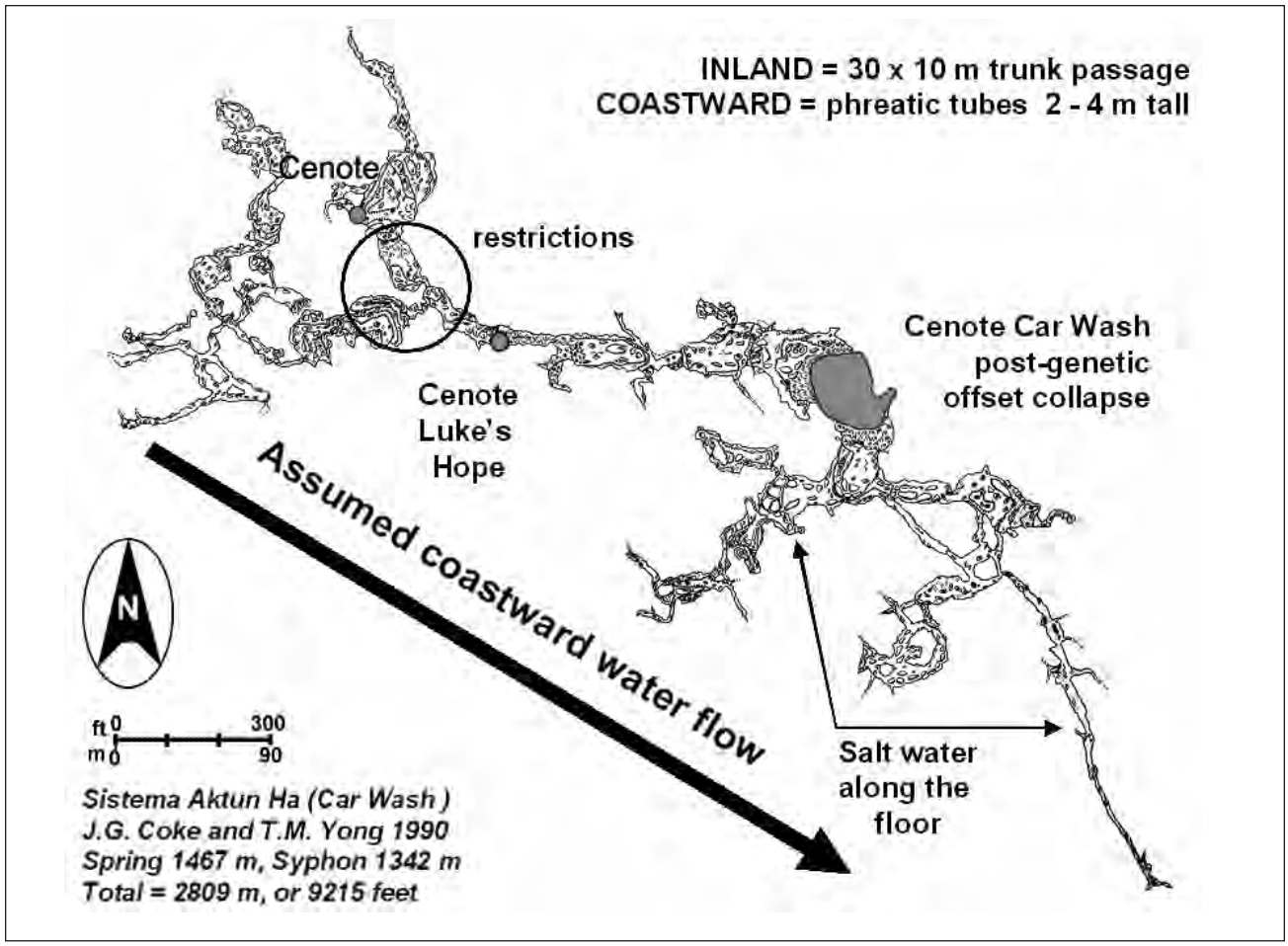

Figure 1b. Survey of Sistema Aktun Ha with annotations (Coke & Yonge, 1990).

the apparently principal flow path. This cave system was one of the first explored and mapped in detail in the region, with a published survey in 1990 by J. G. Coke and T. M. Yong (1990). No additional exploration or survey data has been compiled for this cave since 1999, despite this likely being one of the most often dove cave systems of the whole region.

The cave system is flanked within 2 kilometers by the Tulum municipal well field and, inland, the unregulated municipal garbage dump. (However, it is reported by word of mouth that the dump has been closed in the last two years.) The dominant orientation of the cave complex is northwest-southeast, consistent with the dominant direction of most cave development in the region (Smart et al., 2006) and suggesting that the cave acts as a conduit of groundwater from the area of the dump coastward to the well field. This is further supported by the orientation along the hydraulic gradient of the region, although this is exceptionally low, at 10^{-5} (Beddows, 2004).

Beginning in 2000 and continuing to 2007, a number of vertical physico-chemical profiles have been obtained in most areas of the cave using multi-parameter probes

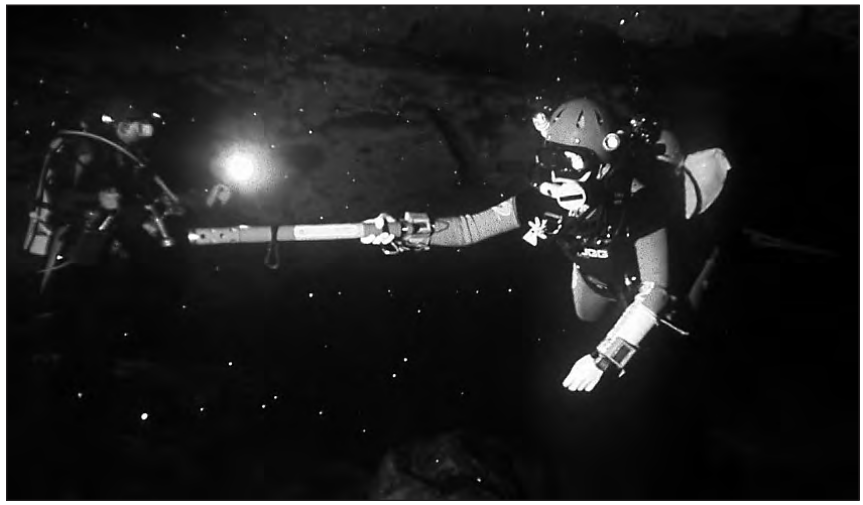

Figure 2a. Collection of multi-parameter profile data by Samantha Smith (foreground) and Stefan Doerr. *A. Kuecha.*

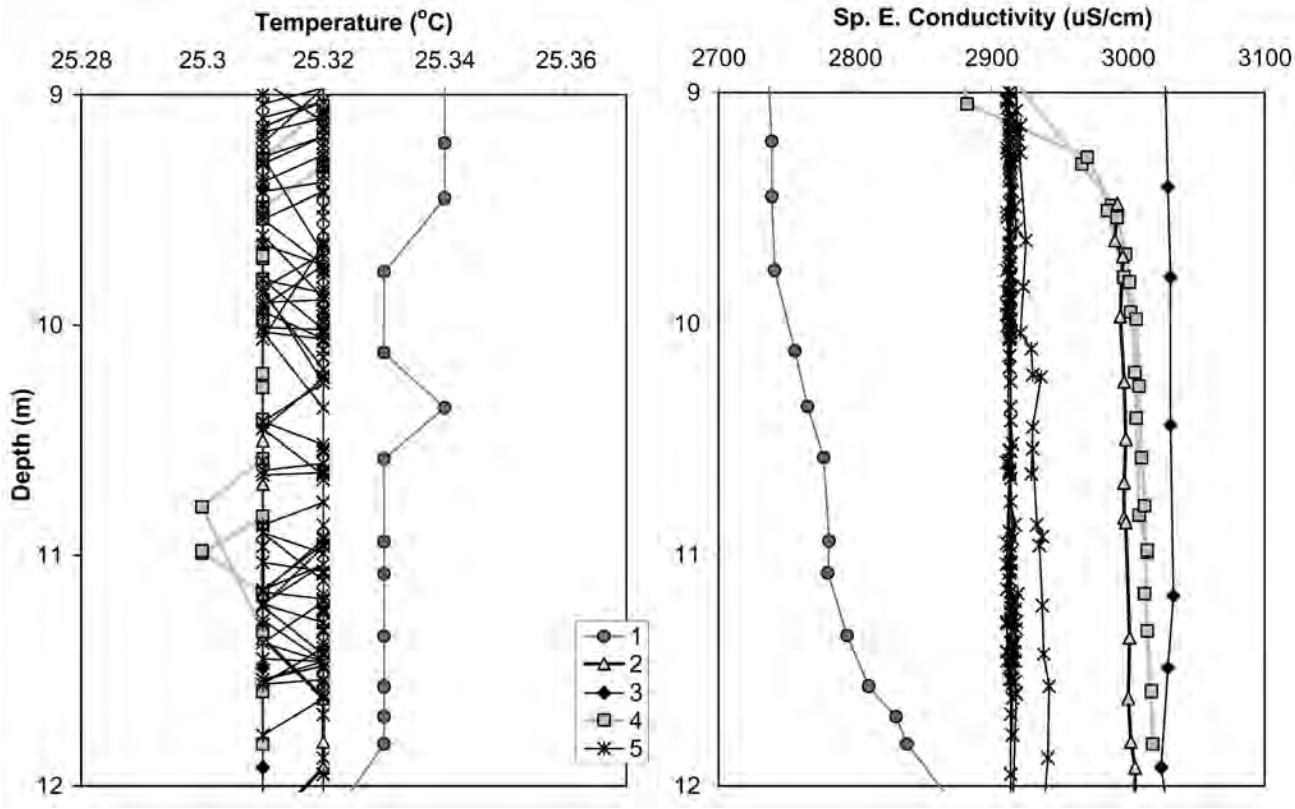

Figure 2b. Temperature and specific electrical conductance (SpC) between 9 and 12 m depth below the water table from 5 locations in Sistema Aktun Ha as identified in Figure 2c.

(Hydrolab M5, or YSI600XLM). These profiles are collected at discrete locations by a cave diver extending the probe out horizontally and descending slowly and smoothly from the ceiling to the floor, all the while moving slowly forward into undisturbed water (Figure 2a). The data pertaining to the profile are extracted from the data taken for the whole dive and then plotted in relation to depth. At shallow depths, less than 7 meters, in Sistema Aktun Ha, as in other cave systems of the region, isolated pockets of water are often encountered within the cenotes, with distinct temperatures due to rapid recharge of storm water or direct insolation and distinct coloration due to algal blooms or organic acids (tannins). These surface waters are affected by top-down processes and are not part of the active circulation of groundwater through the cave. The mixing zone between the fresh and saline water in this density-stratified aquifer is encountered at approximately 20 meters in Sistema Aktun Ha, and below that is saline water, which can

Figure 2c. Water sample locations in the cave.

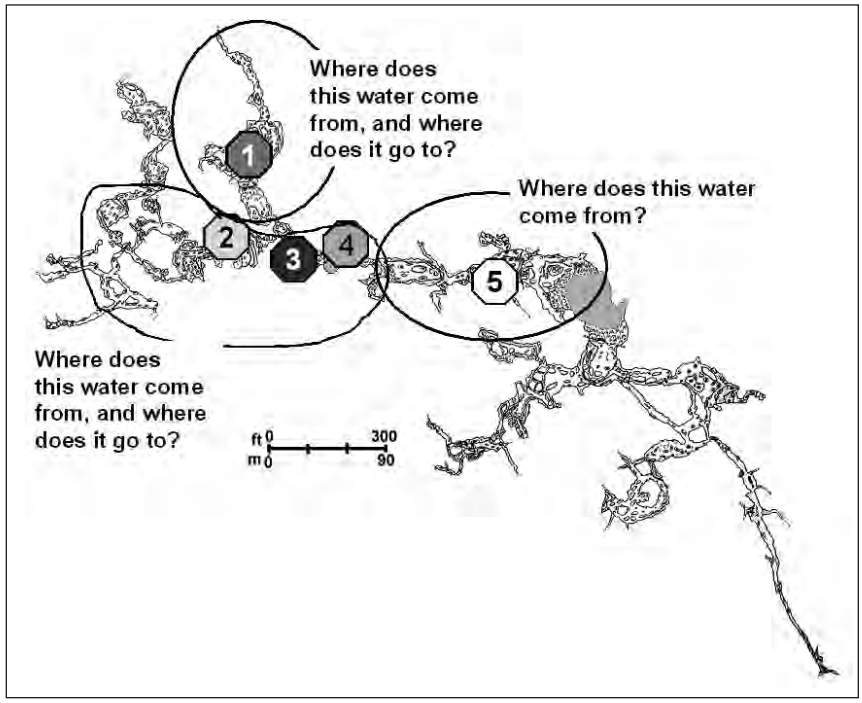

Figure 3a. Cave divers Patricia Beddows and Simon Richards (right) handling two lengths of the sample tubing at the cenote surface. *Melissa Hendrickson.*

Figure 3b. Pre-dive briefing on the dye release protocol showing the two heat sealed non-permeable cloth pouches containing masses of dye. These are cut open with utility shears underwater. Patricia Beddows (left) and Simon Richards. *Edward Mallon.*

only be accessed in the coastward sections of this cave.

The temperature and specific electrical conductivity profile data from 2007 at depths of 9 to 12 meters below the water table (Figure 2b) from five locations on the inland side of Cenote Car Wash (as indicated in Figure 2c) show distinct water masses. This depth increment is selected here because it is within the principal depth of conduit development in this cave system, along which the fresh water obviously may flow. Almost all of the water throughout the cave is at the same temperature (25.31 to 25.32°C) except for Profile 1, from the northeastern, inland section of the cave, called Adriana's Room, where the temperature is very slightly cooler, but the distinctiveness of this water is clearly seen by looking at the specific conductivity, which is significantly lower than elsewhere in the cave, with a value of about 2750 microSiemens per centimeter, versus a minimum of 2900 μS/cm elsewhere. Looking at Profiles 2, 3, and 4, from the northwestern inland and central portions of the cave around Cenote Luke's Hope, a second type of water is discriminated. Here the waters are all 25.31 to 25.32°C, but with a generally higher specific conductivity of about 3000 μS/cm. Profile 5 data are a compilation from along the whole of the passage inland from Cenote Car Wash and approaching, but not reaching, Cenote Luke's Hope, and here the water is of intermediate SpC, with values of 2900 μS/cm.

In the inland section of this cave system, the common idea among cave divers is that the water simply flows from the northwest and northeast segments, along the very large trunk passage, measuring 30 by 10 meters, around and through Cenote Car Wash, and then into the coastward sections of the cave. The physico-chemical data from temperature and SpC, however, clearly show three distinct water masses, and these cannot be easily explained by the hypothesized hydrology. While mixing of the northeast and northwest water at the confluence of the cave passages would result in a water of temperature and SpC similar to that observed near Cenote Car Wash at Profile 5, it remains to be understood why the water at Profiles 3 and 4 would then still be distinct. Without such mixing at the confluence, there is, equally, no likely process for reducing solutes and salts in the water observed in the northwest segment and near Luke's Hope (Profiles 3 and 4), so that it arrives more dilute to flow coastward directly through Cenote Car Wash.

Fluorescent dye tracing was used to test the hydrological connectivity between the different zones of the cave shown to have different water chemistry by the physico-chemical profiles. A single sampling location in Cenote Car Wash was used, with water samples pumped manually from about 11 meters water depth through a tube anchored in the middle of the northwest, inland side of the debris collapse pile within Cenote Car Wash (Figure 3a, 3b). On April 19, 2007, water-soluble, food/domestic-product-grade dyes were released within the flooded cave by cave divers, with rhodamine WT released in the northeast inland segment (RhWT on Figure 4b) and uranine (sodium fluorescein; Fl on Figure 4b) released immediately downstream of Cenote Luke's Hope. Background water samples were collected pre–dye release, and then samples were collected at intervals of one-tenth the time elapsed since the first dye

Figure 3c. Manual pumping of water samples from a fixed point in the water filled cave. The internal volume of the tubing is voided into the bucket before each sample. Patricia Beddows (left) and Melissa Henrickson. *Edward Mallon.*

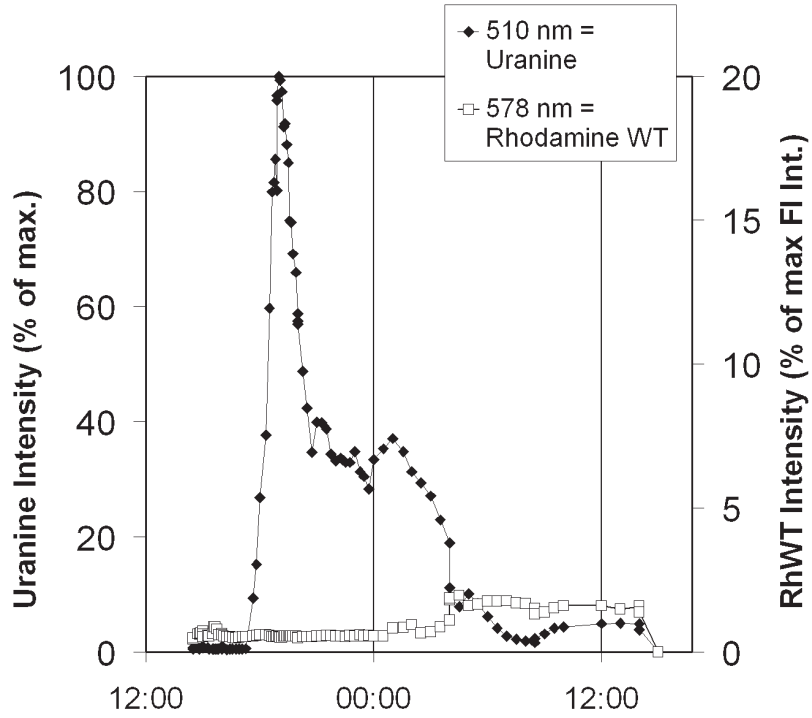

Figure 4a. Relative intensity (three-point moving average) of fluorescence at 510 nm for uranine (sodium fluorescein) and at 578 nm for rhodamine WT in water samples pumped from ~11 m water depth on the inland northwestern side of Cenote Car Wash, Sistema Aktun Ha.

release, rounded to the closest 10 minutes. The internal volume of the sample tubing was calculated, and this amount was voided into a bucket before each new sample was collected. No adjustments to the time series have been made to account for the two to five minutes spent voiding the tube volume. Water samples were analyzed for relative fluorescent intensity at the University of Western Ontario using a PTI QM-1 spectrofluorometer with a xenon-arc source. Both emission and excitation variations were accounted for with real-time corrections. Synchronous scan spectra were produced at delta lambda = 20 from excitation range 250 to 600 nanometers and emission 270 to 600 nm.

The breakthrough of uranine dye was rapid in the water samples from Cenote Car Wash, with a recession curve spanning 13 hours and a return to near-background levels afterwards, although a possible secondary pulse is evident through to the last sample taken 21.5 hours after initial appearance (Figure 4). In contrast, the fluorescent intensity at 578 nm, for rhodamine WT, showed only a little variation over the course of sampling. It may be, most simply, due to natural variations in the background fluorescence such as from organic acids, or it may indicate some minor dye leakage beginning at 1:00 a.m. on April 20.

Cave divers have provided additional visual observations of the dye distribution in the system. A "vivid green algae color" along the ceiling in the northwest section was observed three months post-injection (E. Reinhardt, pers. com.). Previous experience of the principal author in that section of the cave suggests that this likely was dye, as water discoloration has never been previously observed there. Furthermore, the only locations regionally with vivid green coloration are those with open water pools experiencing algal blooms, and there are no exposed water surfaces in that section of the cave. In the northeast section, visual observation by the primary author the day after the dye release indicated a significant red color consistent with the RhWT dye that had been released there, with no obvious movement of the water. A further, unsolicited report arrived three weeks later, reporting red coloration remained in the northeast (B. Phillips, pers. com.).

Physico-chemical profiles of temperature and specific electrical conductivity have effectively identified three distinct water masses in the inland portion of Sistema Aktun Ha. A dual dye release indicated that water in the inland northeast section of the cave (Adriana's Room) is nearly stagnant over weeks and months, with little if any water flowing coastward via the large-diameter flooded cave towards Cenote Car Wash. The water within this large

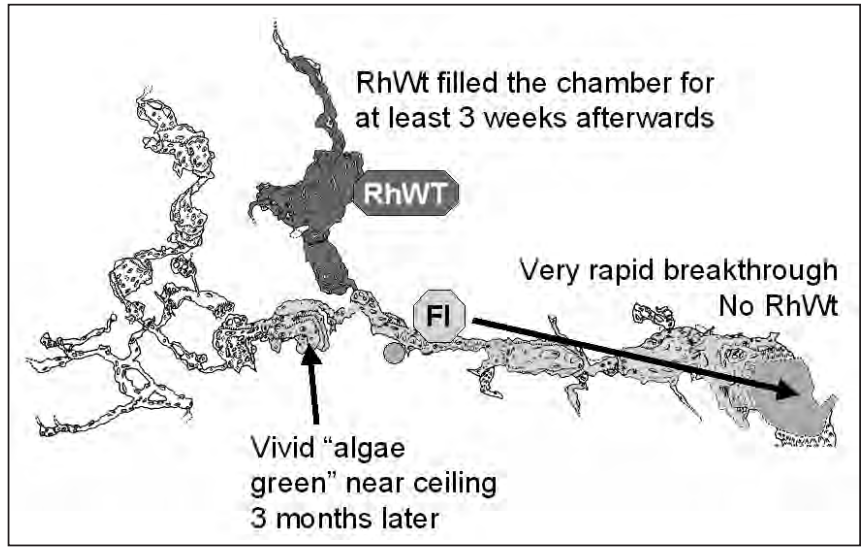

Figure 4b. Schematic showing the regions of the inland cave affected by the two dyes released based on dye tracing and diver observations.

passage inland of Cenote Car Wash has a rapid flow coastward, but with a relatively extended flushing time spanning more than 12 hours over this relatively short distance of approximately 220 meters. Furthermore, some *inland* flow of water from this principal trunk passage into the northwest section of the cave is indicated by diver observations of water discoloration three months post–dye release.

The source of the water flowing through the principal trunk passage immediately inland of Cenote Car Wash cannot be either the northeast or northwest sections of the cave, posing the challenge of locating the source of the large volume of water that flows through Cenote Car Wash. Close examination of the northeastern wall at and just coastward of Cenote Luke's Hope is warranted.

The non-obvious flow paths of water through Sistema Aktun Ha demonstrated here suggest that contaminants from the municipal garbage dump may follow equally complex flow paths through the aquifer, and therefore may not traverse this particular cave, even though the cave is located near and coastward of the site. Complex flow paths on the coastward side of the explored cave may further mediate the direct arrival of contaminants from the dump at the municipal water supply wells. Other point and diffuse sources of contamination in the broader area may instead pose a more direct threat to the municipal well field of Tulum or the cave system, but it would be very difficult to locate such sources, since they are not necessarily located along obvious inland-coastward lines.

It is suggested that physical and chemical characterization of water throughout the underwater caves of the Yucatan Peninsula using multiparameter probes while cave diving may be a very effective and cost efficient means of identifying distinct water masses, therefore elucidating where complex or obscure flow paths occur. Where the observed physicochemical properties of the water throughout the cave are inconsistent with the simplest hypothesized flow path, the actual hydrology through the cave system may be revealed using well constrained (one day, less than 500 meters) dye traces.

We would like to thank the Quintana Roo Speleological Society for a grant in support of basic field expenses, the Centro Ecológico Akumal for acting as a safe home base within their cost-sharing research scheme, Simon Richards and Cave Exploration for the use of cave-diving and field-safety equipment, and Kevin Casey, Bibi Neuman, and Peter Bauer for their contributions to the overnight manual pumping.

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Cuando la topografía no es suficiente:
Uso de la temperatura, salinidad y trazo de corrientes mediante pigmentos para revelar las trayectorias activas de flujos

El desarrollo debido al turismo en la costa caribeña de la península de Yucatán está originando un corredor urbano casi continuo de 200 kilómetros desde Cancún al sur de Tulum. Hay una urgente demanda de conocimiento hidrogeológico en esta zona, donde el buceo de cuevas está revelando una densa red de más de 700 kilómetros de pasajes inundados de cuevas. Los extensos depósitos de espeleotemas debajo del nivel actual de agua indican que las cuevas son poligenéticas, y han sido drenadas y reinundadas. Las profundidades distintas de pasajes están ligadas a la espeleogénesis en niveles del mar pasados y distintas condiciones climáticas. Las secciones más antiguas de cuevas que han sido reinundadas muchas veces muestras varios niveles de desequilibrio hidrodinámico con respecto a las condiciones de frontera actuales. Como consecuencia de esto, no todas las cuevas exploradas son necesariamente hidrológicamente activas. Los perfiles de temperatura y salinidad a lo largo de un pasaje principal en el Sistema Aktun Ha, río arriba del Cenote Autolavado, han ayudado a la cartografía de masas de agua distintas. La liberación de pigmento en dos sitios ha confirmado dos regímenes hidrológicos distintos y que el agua no fluye a lo largo de lo que parecería ser el mayor conducto. Estos resultados muestran la importancia de la cartografía fisico-química de masas de agua mediante métodos de costo adecuado y con técnicas modificadas de uso de pigmentos trazadores que transforman la exploración y topografía de una cueva en conocimiento hidrológico de gran valor.

PALOS MARÍAS PROJECT MARCH 2008

Peter Ruplinger

This was my fifth trip to the Michoacán and Colima area. This time I was with Emery George, Josh Kaggie, and Michael Beard. Each trip has been a rewarding experience that has enabled us to map several virgin caves. [See *AMCS Activities Newsletter* 28, pages 177–180.]

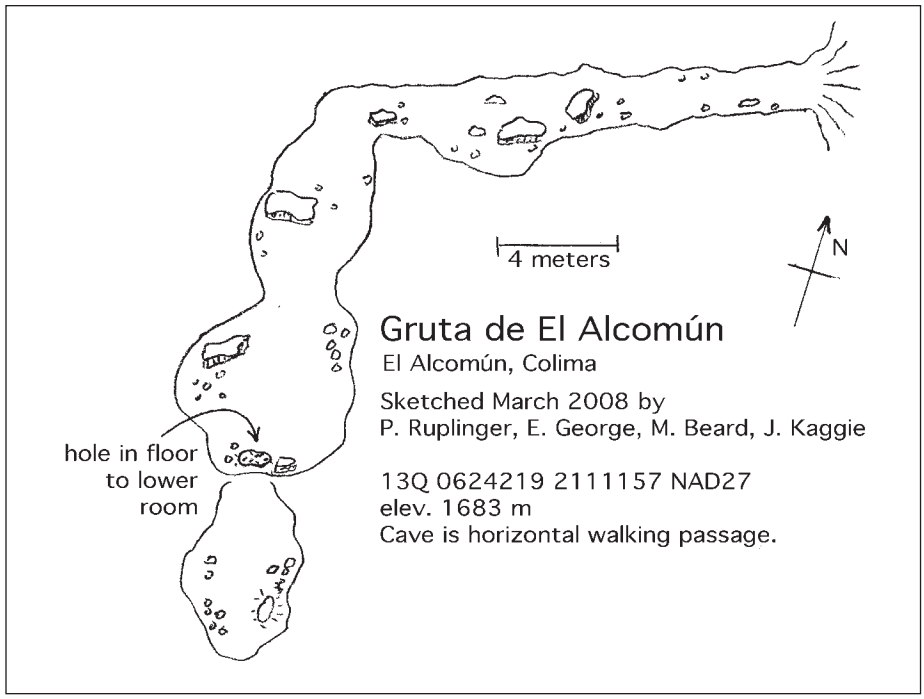
Cueva de las Canoas is a river cave on the outskirts of Palos Marías, Michoacán. This is my third visit to survey the cave. It's a chore. Much of the cave is less than 1.5 meters high. It is a relief to find a place to stand up. There are a few formations, including a large heart-shaped stalactite much like the famous Heart of Timpanogos in Utah's national-monument cave of the same name. We surveyed 92 meters on this trip, bringing the mapped total to 293 meters. The cave continues, with little change in size. We hope to find the end during our next visit. [A partial map of this cave appears in the article in number 28. Unfortunately, the survey during the 2008 trip is not connected to the older survey, so a map cannot yet be assembled.]

Twelve kilometers down the canyon, high on a hill is Cueva Tragaluz. We had heard about it on our last trip, but didn't have time to map it. It turned out to be a real gem. The main passage is 125 meters long. The big room has a ceiling 21.5 meters high, with a large opening. (*Tragaluz* is Spanish for skylight.) Locals told me that when the cave was first entered, there were stone boxes, much like auto-battery boxes, on the floor, and that they contained *monos*, figurines. We found no sign of stone boxes, sherds, or other indications that anyone had been there, not even any graffiti or litter. There is one area in the cave that we dared not explore. A chimney leads up to a domepit. We suspect it is a hydrothermal dome. The top was swarming with bats. The passage continues below, but it is covered with black, gooey guano several centimeters deep. The smell of ammonia was almost overpowering. Anyone rappelling into it would become covered head to foot with the slimy mess. I'm not that gutsy.

peter@ruplinger.org

El Alcomún. *Peter Ruplinger*.

The Heart of Palos Marías. *Max Cook*.

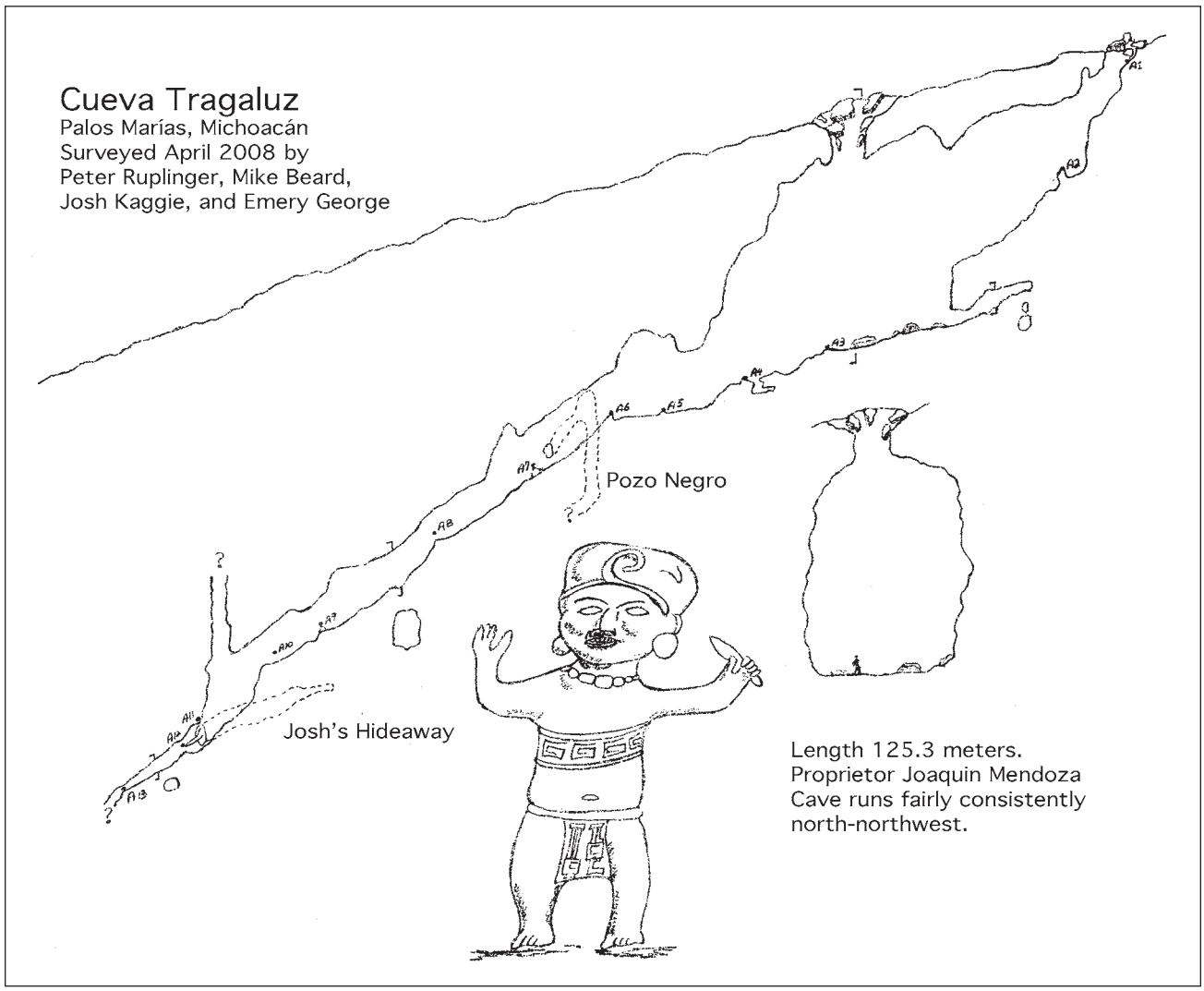


Gruta de El Alcomún

El Alcomún, Colima

Sketched March 2008 by
P. Ruplinger, E. George, M. Beard, J. Kaggie

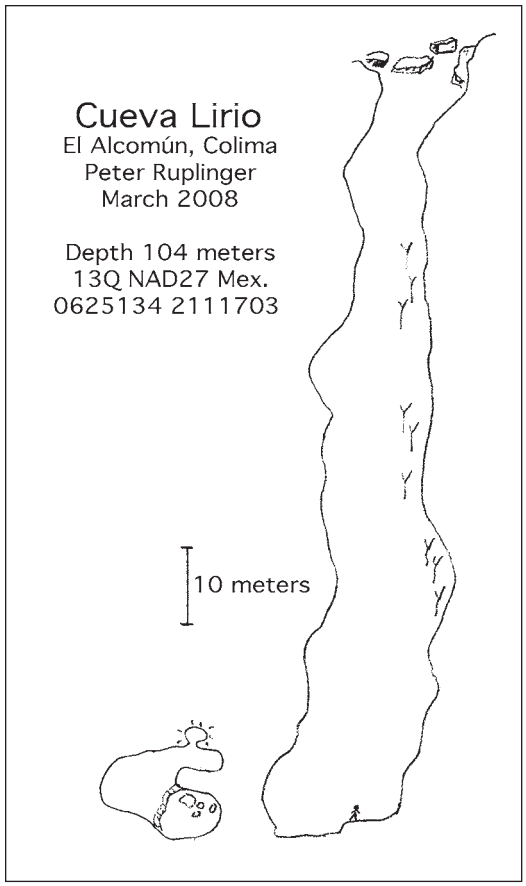
13Q 0624219 2111157 NAD27
elev. 1683 m
Cave is horizontal walking passage.



Cueva Tragaluz

Palos Marías, Michoacán
Surveyed April 2008 by
Peter Ruplinger, Mike Beard,
Josh Kaggie, and Emery George

Length 125.3 meters.
Proprietor Joaquin Mendoza
Cave runs fairly consistently
north-northwest.



A hundred kilometers north of Palos Marías is the small town of El Alcomún, Colima. It's an incredibly beautiful area, and the people are equally delightful. They speak their own dialect, and most are related. The town is too small to have a mayor. The *comisario* welcomed me. He said we should consider ourselves guests of the community and that we were free to explore any neighboring caves. He added, "In Alcomún we are all one big family. There is no crime here."

The first cave we visited is Gruta de El Alcomún. It is all walking passage and is popular with adventurous teenagers. I had heard about it years ago. It was said to have hieroglyphic writing on the walls. Indeed that are what appear to be cryptic symbols on the walls, but on closer examination they appear to be simply effects of erosion. There were lots of bats, which frequently flew into our faces. Considering how well known the cave is, we were pleased to observe no graffiti or litter.

Our last cave was a 104-meter put on the plateau east of El Alcomún. It is a straight drop, with no sign of side passages. The young man who took us there said it had no name, so with his consent I named it Lirio, which is what the locals call the orchids that grow near its entrance.

Proyecto Palos Marías, Marzo 2008

Se exploraron y topografiaron cuevas pequeñas cerca de Palos Marías, Michoacán, y El Alcomún, Colima.

NEW PUBLICATIONS FROM THE AMCS

Exploring Highland Maya Ritual Cave Use: Archaeology & Ethnography in Huehuetenango, Guatemala, Edited by James E. Brady. AMCS Bulletin 20, 2009. 97 pages, softbound. $8.

The Cenotes of Yucatan. A. S. Pearse, et al. AMCS Reprint 8, 2008. Facsimile reprint of Carnegie Institution of Washington publication 457, 1936. 304 pages plus 19 photo plates, softbound. $20.

Fauna of the Caves of Yucatan. Edited by A. S. Pearse. AMCS Reprint 9, 2008. Facsimile reprint of Carnegie Institution of Washington publication 491, 1938. 304 pages plus 8 photo plates, softbound. $20.

Cave Papers of Federico Bonet. AMCS Reprint 10, 2009. Facsimile reprint of *Cuevas de la Sierra Mardre Oriental en la Región de Xilitla* (1953), "Datos Sobre las Cavernas y Otros Fenómenos Erósivos de las Calizas de la Sierra de El Abra" (1953), and *Espeleología de la Región de Cacahuamilpa, Gro.* (1971). Total 318 pages, softbound. $12.

Further information, such as tables of contents and ordering information, including postage charges, can be found at amcs-pubs.org.

HISTORICAL REPRINT

ARCHAEOLOGICAL REMAINS IN THE MAZATEC COUNTRY

Louis N. Forsyth

Reprinted from pages 328–334 of Records of the Past, *volume IX, 1910, published by the Records of the Past Exploration Society of Washington, D.C. The large cave near San Antonio is probably Grutas de San Antonio, near San Antonio Eloxochitlán northeast of Huautla. A map of that cave appears in* The Canadian Caver *number 4, 1971.*

The Huautla road follows the Teotitlan river, crosses a number of dry water courses or barancas, continues on a nearly level stretch for some distance, then zigzags up the San Bernardino Sierra, 2,000 ft. above sea level. Mesquite trees, some small shrubs, and different varieties of cacti are plentiful; the lighter varieties of the henequen or smaller ixtle are scattered here and there. Large patches of the hillside are stained, and there are other good mineral indications; some profitable mines may yet be found, though at present the spasmodic efforts at mining have not been successful in this vicinity. The vegetation increases as one ascends the Cumbre, becoming a forest of scrub oaks, some tall pines occurring in the more sheltered places, with the wind-swept exposed parts of the mountain bare. Nine thousand feet above sea level, near the summit, which is known from the supposed imprint of a large human foot in a volcanic slab, as La Cumbre dc los Frailes, "The Summit of the Friars," are the first artificial works, consisting of some shallow ditches running in a straight line with the earth thrown on one side, giving the appearance of trenches, which they probably are, as some fighting occurred on this road.

On the San Bernardino slope the ground is loose, of a clayey nature but well mixed with small stones and rock dust. From San Bernardino to the Cumbre the soil is darker, though the subsoil must be clay as is evident from the several deep cuts that have been dug to make the road. On the summit of the Cumbre the road bank on the left shows the different layers of soil; under the first, which is leaf mold and volcanic loam, may be seen a thin stratum of ash probably of the same date as the volcanic ash in the Petlanco basin, plainly seen near the blow holes of the Hot Springs. After passing the Cumbre the road rapidly descends with much the same vegetation prevailing for some distance until the clearings occur. Not far from the spring, on the comparatively level stretches there are what appear to be small artificial mounds. Like the small cairns and crosses that are occasionally found on this road as well as on others throughout the Republic, they are probably graves made in late years.

The first interesting archaeological object is a large slab of rock evidently quarried at a considerable distance. It is well hewn and of about the same dimensions as the stone slabs found near Teotitlan and in the mounds on the banks of the Rio Salado near Tecomavaca. On the side of the road is a hole disclosing a larger opening that has been partly filled since it was uncovered. Plainly visible are the ends and sides of other slabs showing that the mound is probably the same size and of the same construction as those referred to, but part of the road running over the top has reduced its height. The excavation is recent. There is another similar mound also excavated before the descent of the Espinazo del Diablo begins.

An important mound is located on the Carlota Plantation. It is not large, having a circumference of about 40 ft. Successive cleanings and the different excavations have reduced its height. When first uncovered the rooms must have been below the surface; the slabs of stone used in its construction are much smaller than the Teotitecan blocks. Nearly 20 years ago, when it was first opened, it must have proven a rich find, for, according to the reports, there were many metal figures. Don Antonio Martinez, chief engineer of the Carlota Plantation, told me that the small silver animals were of fine workmanship. There were also other figures, and plates of slate with hieroglyphs, and a flat stone weighing about ¼ pound which was said to have been used as an ironing iron. Subsequent excavations have brought to light other objects of inferior value. The fact that the valley is good agricultural land and comparatively free from rocks in this locality may have led to its having been selected as a place for settlement, and the burial of a Cacique. An unusually large building site occurs in the vicinity and other smaller stone floors are to be found in several places.

The Mazatec country is a limestone region, especially Tenango, Chilchotla, Ayautla, part of San Juan Coatsospaum (which latter pueblo is Mixtec) and other localities. The earth mounds are nearly all covered

with grass, and are isolated. The rainfall here is about 50 times greater than that of the Teotitlan valley and sandstorms are unknown, so that the deductions made from the Teotitecan mounds are not applicable here.

Situated in those sections, the last to feel foreign influence; the stone squares or walls are distinctly dissimilar to any ruins of the surrounding tribes and characteristically Mazatec archaeological remains.

The stone square (or altar, which it may have been) situated at the lower end of Netzalmalcoyott is very similar to the one shown in the accompanying illustration [not reproducible from the copy available], and represents the usual type. What their age is, it is impossible to say, but there are indisputable evidences of great antiquity.

The stone square is about 5 ft. long, 4½ ft. high, 4 ft. wide. The limestone used in its construction consists of pieces broken from large stones and natural slabs. Although few of the blocks are square, nearly all show the work of the stone cutter. Cement is absent, but the larger interstices are filled in with chips of the same stone. The first indication of its age is a large tree growing on the top; the second, the leaf mold at the base. But the strongest proof of great age is that newly broken limestone has a very white and glassy surface which retains its brightness for years though exposed to the weather; and the 4 sides of this block have lost not only their brightness, but their whiteness, and the rock has disintegrated to such an extent that fine dust may be scraped from the exposed sides of the stones with the finger nail. Although it is not a hard stone and the disintegration is not as great as on the top of some natural stones in the vicinity where the powder is very thick, it must have taken centuries to bring about these conditions, especially in view of the fact that while the rainfall is very heavy it is almost all perpendicular owing to the thick forest and underbrush; little rain patters on the sides of the square block, most of it sinking through the cracks at the top.

There is another square located near the former, somewhat larger and with a decayed tree trunk on the top.

A trip was made to the hot lands following a trail where one of the guides lost his life by stepping on a loose slab of limestone rock which dislodged a larger boulder that crushed him. Near the Narangal there are some indications of former habitation. In a clearing in the vicinity of Avendano's ranch is located the largest stone wall seen. The measurements are: 5 ft. high; 75 ft. long; 4 ft. wide. These figures are not exact. The wall is not straight but forms a slight angle at about its center. Another wall of similar dimensions lies close to the former.

Natural caves are to be found in many parts; the largest near the (Mazatec) pueblo of San Antonio extends over a mile underground. This cave was explored for some distance with the aid of ladders and ropes. Stalactites are suspended from the roof and stalagmites rise from the floor. A small stream fed by percolations from the roof runs through the cave. Close examination of the place where the water enters revealed a small dam, made of stones plastered with clay, which formed a little pool. Small pieces of charcoal were picked up on the flat surface of large boulders. Some of the large rocks were covered with black patches showing the location of former fires. A figure found here is 1¾ in. high, ¾ in. wide, and resembles a large thimble, being hollow and the sides shaved off by a sharp celt after it had been made and partly dried. The cuts are clean. A rude face and long hair is scratched on the top. This figure is probably an idol and is a rare relic. A small celt with its sides chipped off was picked up in a hole in a rock with some natural pebbles. The dripping of water from the roof of the cave had caused the stones to work over one another and thus acquire a natural polish, yet several large flakes had been knocked off the implement, which was probably an unfinished celt of the smaller type. This was the only chipped stone picked up. On some rocks we noticed the well defined imprint of some animal such as a monkey—another rock had as many as 4 or 5 larger foot marks.

Another cave was visited twice; on the first trip it was entered by the light of large pine torches. Some cairns were uncovered, disclosing large skeletons lying at full length. Beside them a number of beads were picked up, and a large vessel of thick black pottery in the shape of a headless duck, its mouth being the neck. This jar had a coating of white cement, as did the amphoræ-shaped earthen vessels of Teotitlan. Another grave produced a plate 14 in. in circumference of the most primitive make, showing the imprint of fingers and signs that it had been used over a fire. A few of the bones were petrified and loose ashes were mixed with the grave earth which was 4 in. deep.

On the second trip to this cave, I was accompanied by my friend Georg Von Rettegg. As the cave roof had fallen in giving the appearance of a hole, the descent was easy, but it was dark enough to compel us to use lights. My companion remarked that the atmosphere was heavy, and so it was, but being anxious to unearth some relics we continued digging. While in a stooping position the gas that filled the place overcame me; however, I revived and for once was discourteous enough to precede my friend, who tottered at my heels, gasping for air and very pale. Although this trip was not very productive we secured a shin bone and confirmed the reputation of the place as a haunted hole.

Such experiences occurred to several exploring parties in this region and in other parts of the state and should be a warning to others.

Mr. Edio McCue, former Manager of the Carlota Plantation, told me that he visited some of the caves in the vicinity that were full of human bones and a few relics such as beads, etc. The skulls in these cliff caves are separated from the larger bones, and collections of bones thus separated were found in several of the caves. I examined a number of beads from this cave and found them to be about the size of those from other parts of the state. An idol similar to those of Teotitlan and the Mixteca had the legs drawn up in the usual sitting position. It was made

of conglomerate which showed disintegration so that its original high polish could be seen only in specks. A large broken shin bone from the same source had a most perfectly executed design, the cuts were not deep but clean. Each design was about ¾ in. square interlocked in a string about 3 in. long. Near the same source came a small clay cup. It had been placed in the cleft of a limestone rock, and, as Mr. McCue says, the rock had grown partly over it thus causing the partial closing of the cleft. The cup was thus locked up by the action of water over the cleft. If it is contemporaneous with the grave relics some idea can be had of their great age. Although not common, I have seen a petrified human bone thus imprisoned by the growing of the rock. This gentleman also spoke of numerous mounds to be found on the top of the cliff that overlooks Carlota. As the area is of the same extent and the situation impregnable—the location would seem ideal for such a people.

A custom among these people which still survives is the mixing of ground green tobacco with lime and placing it in the mouth to prevent snake bites and to ward off other possible harm. Large boulders by the wayside have artificial hollows on their even surfaces made by these medicine makers, the rubber used is a limestone, preferably an ordinary river pebble that is immediately discarded. Sunken places occur on flat rocks in the heart of the forest which may indicate that this was a very ancient custom.

Near the house foundations a number of what may have been metlapilles or rubbers with slightly tapering ends were picked up. The stone used was from foreign parts. Since the length was 9 in. and the ends were also highly polished by wear, it seems that their use was varied either as a pestle, or rubber, like a rolling pin, that crushes but does not roll, as necessity demands. Much larger stones of a spheroidal shape had two sides perceptibly worn; they were of granite and different kinds of close grained rock with a high polish. Their weight was about 10 pounds. Other stones of not so perfect a shape or polish were evidently used to deal blows with as well as to knead. Flat, irregular and in one case almost triangular stones averaging 2½ in. in thickness, sometimes with only one side flat and varying in length and breadth from 8 in. to a foot, were lying uncovered on the house sites. The well worn and in one case slightly depressed center of these slabs is evidence that their use would correspond to that of the modern metate. A modern pestle for mashing peppers was picked up in the field where it must have been dropped by some passing native, likewise a number of broken bowls that cannot be associated with the ruins. Arrow points are scarce, only one broken head being found in the Tenango Section. The Indians claim that their former weapons were slings. We discovered numerous small round river pebbles, not of this locality, which could not be classed as anything but sling stones. These weapons still survive though they are rarely seen.

A single sea shell was found without any artificial marks; its presence with dishes, pestles, and celts in a large house site would seem to indicate that it was of value, especially in view of the fact that it must have been brought a great distance, the nearest place at which it could have been secured being many miles away near the sea coast. Besides the graves in the caves mentioned, several bodies were placed in small clefts of the rocks, and under over-hanging rocks that could not have admitted the body entire. In these places the bones were all scattered over a small area, whether because of re-interment or separation of the different portions of the body as reported by Mr. McCue in the caves above Carlota, it is impossible to determine as no folklore refers to it. Some few beads were mixed with the dirt, but it is evident that the graves were unimportant; however, it may be interesting to note that small pieces of limestone (there is a singular absence of small loose limestones scattered here) with angles indicating that they must have been broken, showed unmistakable signs of disintegration, and this, with but slight if in some cases any exposure to the air.

An expedition made to the Agua Que Suena region was undertaken. The mountains separating Tenango from Chilchotla were crossed; the river was passed with but little of interest being encountered. The Chilchotla ruins were evidently nearer the plantations which we could barely see in the distance.

A peculiar spindle, the only one of its kind, was found. In general form and details it is lighter and more elaborate than the common spindle in use at the present time. Red clay was used in manufacturing; all red pottery is rare in Tenango.

To the hurried traveler it may seem that the Mazatecs bind their heads as Professor Star states in his ethnography of these people; this, however, is not the case. The occiput is certainly not deformed by artificial means as the Professor seems to think, nor does head binding seem to have been an ancient custom of these people. The skulls examined from the Ayautla caves and Tenango showed no such indications but were well formed and natural in shape.

Ayautla at the present day is a small village built at the foot of Cerro Rabon. In the material used and the type of the dwellings it differs slightly from the other Mazatec pueblos. Numerous limestone walls are to be seen running in and around the village. These walls have probably been there since the place was first settled, but the only object that could have caused their building seems to be the clearing of the streets of limestone rocks which are very plentiful. As already said, the ancient site of the town is further North, the foundations of the houses are numerous, and the exposed limestones are blackened with age. Being viewed from the road, it is impossible to say much about them; though doubtless they have been built at different times.

Several parts of the Mazatec country show, if not the actual occupation, at least the influence of the Zapotec and Aztec peoples. The rocky region of Tenango is perhaps the least affected by these higher civilizations, and in reaching this conclusion I take as a clue the character of the country.

Restos Arqueológicos en la Región Mazateca

Este artículo de 1910 describe una visita a la zona de Huautla, Oaxaca, incluyendo los poblados de La Carlota y Ayautla. Se visitaron dos cuevas, una de ellas es probablemente Grutas de San Antonio.

Once upon a time, and a long ago time it was, I took a wonderful trip to the Grutas de Juxtlahuaca in Guerrero, Mexico. It was in celebration of the successful completion of my first big commercial waterfall project in 1981 that I invited my Mom to accompany me on a trip to Acapulco. The peso had been devaluated a few days before, so everything was virtually free. We stayed in a luxury hotel for three bucks a night and lived exclusively on artichokes.

That was all well and good, but a bit boring, so after some days on the beach I rented a VW and headed inland. Somewhere around Chilpancingo I somehow learned of the existence of the Grutas de Juxtlahuaca and headed there on a scenic but horribly bumpy cobblestone road. The ride alone utterly destroyed my poor mother, so when we got to the quaint village, with it's plaza full of palm trees and playing children, she announced that she would be happy to sit there as long as necessary drinking beer in the square while I explored the cave.

The friendly owner of the cave made the necessary arrangements for a guide and Coleman lanterns for me and a nice Mexican family that also wanted a tour. The only problem was that I insisted on using my carbide lamp, which they considered to be an untrustworthy newfangled invention. The middle class Mexican family consisted of Dad, a big rancher with a sombrero and cowboy boots, his wife, and their absolutely stunning daughter, a tall, thin girl, pale of skin, with luminous dark eyes and long black hair. We were instructed to wear swimming suits, but only the lovely daughter had one, a very skimpy bikini that served her well. With them was her twenty-something fiancé, a completely unworthy little wimp. We all piled into the rancher's 4x4, and off we went.

The cave gate alone was worth the price of admission. It was apparently designed by Picasso during his psychedelic period and made of auto parts and grillwork ripped off from Gaudi's Sagrada Familia cathedral, all welded together. Inside there were wonders to behold, such as an image of Quetzalcoatl himself, a large painting of a sacred jaguar, and a crystal-covered human skull laying in a pool of cave pearls. The beautiful, nearly naked girl was fearless and led the way despite the protestations of our guide, a young man almost as wimpy as the fiancé, who was whimpering and trailing behind the elderly *señora*.

After about an hour in the cave, we arrived at a pool of water blocking the passage. The guide explained that beyond there lay a chamber filled with snowy anthodites, but that it was impossible to get there without swimming. Mom and Dad were growing very tired and the fiancé could only gurgle, so they and the guide stayed behind while the beautiful girl and I forged ahead into the water. The chamber of anthodites was truly a magical place. The needle-fine crystals completely covered the walls, but would melt with even the touch of a breath. I cannot imagine that they still exist today.

The panicked guide swam in to tell us that the parents were in bad shape and the fiancé had begun to cry, so we made our way out. It was grim. Mom could barely walk, so Dad had to help her, but he was having heart palpitations and stumbling badly in his soggy cowboy boots. The wretched fiancé had become an object of complete scorn, especially by Dad, who made it very clear that under no circumstances would such a wimp ever marry his beautiful daughter. That crushed him even further, so the guide had to help him out. That left me to help the pretty girl, who became extremely flirtatious, pretending to need help when she didn't need any help whatsoever. "Jew brave Jankee please to help push my bottom while I climb, por favor." I loved it!

There was a final treat as we left the cave: a fine big lyre snake was twined through the gate snagging bats as they flew into the darkening sky.

Dad was just about done, so on the ride back he lost control of his truck as we crossed a small bridge. Luckily for us a crowd of cowboys saw the accident. One look at the *senorita* was all it took, and they rushed to our aid. They hitched the truck to their horses, and soon we were back on the bridge.

Back in town I looked for my mom, but she was nowhere to be found. We had been gone for hours, and I was alarmed. She spoke no Spanish and had never been out of the country in her life. Not to worry, the friendly family that owned the cave had adopted her. She sat in their beautiful private garden, hung with acalypha blossoms, sipping tequila while being attended like a queen as children played at her feet. She announced in a tipsy voice that she would never leave. My mother was happier than she had ever been in her entire life, and it makes my heart glad to remember it. Still, I cannot help but wonder whatever became of that brave-hearted, raven-haired beauty.—Bruce "Sleazel" Morgan

MAPPING FLOODED CAVES FROM ABOVE: SURFACE KARST INVENTORY OF THE YUCATAN PENINSULA

Patricia A. Beddows[1], Melissa R. Hendrickson[2], Kirstin H. Webster[3], and Simon M. Kras[4]

The Yucatan Peninsula is the approximately 150,000-square-kilometer emergent portion of the Yucatan Platform, which divides the Gulf of Mexico from the Caribbean Sea. Its aquifer is density stratified, with a lens of fresh water overlying naturally intruding saline water. The aquifer system remains the only natural source of potable water for the whole peninsula, while it is also widely used under government directives as a sink for treated and untreated effluent. Mexican government plans include the establishment of several new urban centers, each with a target population of two hundred thousand, along the Caribbean coast, which will result in a nearly continuous urban strip from some 50 kilometers south of Cancún to the northern border of the Sian Ka'an Biosphere Reserve. These development plans aim to increase the local population forty-fold in the coming twenty years.

The whole peninsula is highly karstified. However, there is a notable concentration of more than 700 kilometers of explored caves along the 200-kilometer north-central portion of the Caribbean coast, and cave density reaches more than 4 kilometers of passage per square kilometer in well-explored areas (Beddows, 2004). Collapse sinkholes, locally called cenotes, are abundant throughout the region, and these provide access to the underlying cave networks. Most of these caves explored so far are water-filled, and exploration is therefore by cave diving. The morphology of the flooded caves shows that speleogenesis is principally related to sea level and the depth of the fresh-saline mixing zone, where the phenomenon of mixing corrosion generates waters undersaturated with respect to calcium carbonate in situ (Smart et al., 2006).

The cenotes overlie the phreatic cave networks, and they form principally by mechanical collapse of the cave roofs during low sea levels, when buoyant support is lost. The vast majority of cenotes along the Caribbean coast do not have exposed water pools and are invisible from the air under the closed forest canopy. Mapping their distribution is a serious challenge. Nonetheless, the cenotes remain excellent surface proxies for the underlying caves that function as the river networks throughout this large region. Mapping of cenotes will not only expedite direct exploration of the subterranean rivers, but may also provide the basis for defining an ecological signature based on the distinct vegetation often growing in the cenotes. Equally importantly, mapping will contribute to water and waste management by testing concepts of structural and geological controls on regional-scale speleogenesis. Using data generated by a wide range of stakeholders, this project aims to establish a georeferenced surface-karst inventory of features situated principally within the proposed urban footprints.

In 2006, efforts were begun to establish a standardized cenote data-collection methodology, covering geological, biological, archeological, and land-use aspects, for use by local people, explorers, and interested visiting people. The methods need to be usable by people with no specific background in karst or the local area. The Surface Karst Inventory package

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presently consists of:

- An instruction booklet of about ten pages, with a brief introduction to karst in the local context, definitions of scientific terms needed for collecting data, instructions on how to collect correct GPS points, and exercises to build field-sketching and mapping skills.
- Picture guide of features of interest.
- Data-collection sheets, presently three pages and mostly tick-box driven to facilitate easy and rapid data entry.
- Grid paper for sketching the site to scale.
- Data inventory sheets to track the sites visited and the photographs taken.

It is a common temptation to document sites using only digital photographs. However, the information on location, scale, and orientation of the field of view are rarely adequately documented, and therefore these photos fail to show the site dimensions, orientation of features within the image, depth profiles, and so on. Most often, quickly taken digital images only show the undergrowth vegetation. This project requires, at a minimum, low-resolution quantitative information on the long and short dimensions in both plan and cross-section in order to address questions of fracture and structural controls on cenote-collapse formation and how these factors may relate on a larger scale to regional speleogenesis. We assume a low level of prior knowledge in the target workers, and therefore a significant challenge so far has been providing instructions on how to draw simple but adequate plan and cross-section field sketches that provide key measurements. We believe that providing limited written instructions, but with numerous examples of good field sketches, followed by exercises on estimating distances will result in adequate site sketches. Distance-estimation exercises and methods include calibration of paces, training on visual estimates outdoors (e.g., distance between trees) and inside a room analogous to inside a cave, and use of a knotted string for horizontal measurements combined with a plumb weight for vertical measurements at actual sites. While we are not trying to enforce standardized and codified symbology for the maps, the foundations of good field sketches are required, including a listing of symbols and shading marks used, drawing to scale (one square on the grid paper equals a stated measure such as 1 meter), north arrow, and metadata including site name and date. We think that new data collectors with no prior experience may be trained in less than a day. Parts *a* and *b* of Figure 1 provide examples of sketches generated shortly after their involvement in the project began by volunteers with no prior experience in karst. While the more accurate and computer-enhanced surveys generated by experienced cave-mapping volunteers, as in part *c* of Figure 1, provide some advantages, in all cases the simpler sketches to scale serve equally well the purpose of documenting the fundamental aspects of the feature, which may be of particular value when significant cenote modification subsequently occurs (Figure 2).

This effort aims to ultimately include the participation of local landowners, staff members of non-governmental organizations and municipal-government agencies,

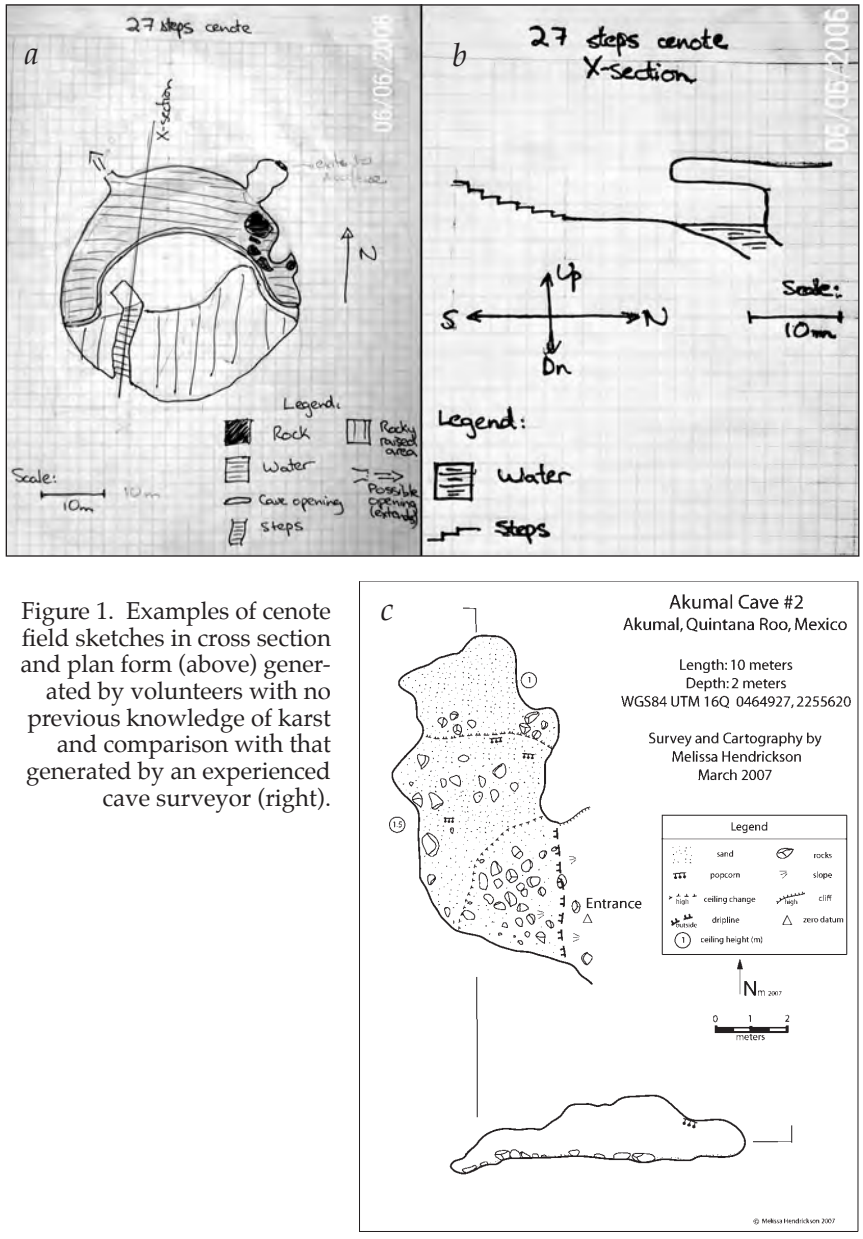


Figure 1. Examples of cenote field sketches in cross section and plan form (above) generated by volunteers with no previous knowledge of karst and comparison with that generated by an experienced cave surveyor (right).

KARST INVENTORY DATA SHEET
CENOTES & ROCK SHELTERS

*Names of Persons	*Date of site visit *Date form filled out
*Position (volunteer, resident, tourist):	
*GENERAL LOCATION (nearest settlement)	*Common name of site (if exists)
*GPS COORDINATES	*GPS MAKE, MODEL, PROJECTION
*LANDOWNER + CONTACT INFORMATION	
*WHO SHOWED YOU OR TOLD YOU ABOUT THE SITE?	
*DIRECTIONS TO SITE (sketch):	

SITE FAMILIARITY

How familiar are you with this site?

- ☐ VERY FAMILIAR - EXPLORED VERY WELL AND KNOWN OVER A LONG TIME
- ☐ SOMEWHAT FAMILIAR - FIRST TIME VISITING BUT EXPLORED WELL
- ☐ NOT VERY FAMILIAR - VISITED ONCE BUT OBSERVATIONS INCOMPLETE
- ☐ VISITED LONG TIME AGO - FACTS BASED ON MEMORY
- ☐ _____

SITE TYPE

- ☐ ROCK SHELTER → Cave present, no water.
- ☐ CAVE CENOTE → Water within cave (not readily visible from above, outside cave), eg. Dos Ojos.
- ☐ WATER HOLE CENOTE → Water hole fully open to daylight, eg. Cristal cenote.
- ☐ UNKNOWN. DESCRIBE: _____

SITE USAGE

WHAT IS THE PRESENT USE OF THE SITE, AND LAND WITHIN VIEW?

- ☐ ACTIVE GROWING OF CROPS
- ☐ GRAZING CATTLE
- ☐ YOUNG TREES GROWING BACK ON FARM/RANCHLAND
- ☐ WATER EXTRACTION WITH PUMP
- ☐ WATER EXTRACTION WITHOUT PUMP
- ☐ FENCED SITE
- ☐ FORESTRY
- ☐ APICULTURE (BEES)
- ☐ TOURIST SWIMMING/SNORKELING
- ☐ NATURE TRAILS / BIKE TRAILS / ETC
- ☐ LITTER / GARBAGE / REFUSE
- ☐ USED TOILET PAPER
- ☐ CONSTRUCTION SITE (HOTEL, ETC)
- ☐ HOMESTEAD / RANCH
- ☐ NO CURRENT KNOWN USE
- ☐ OTHER. DESCRIBE: _____

KARST INVENTORY DATA SHEET
CENOTES & ROCK SHELTERS

FLOOR COVERING

- ☐ DIRT
- ☐ MUD
- ☐ LOOSE SAND
- ☐ CALCITE RAFT (Look closely!)
- ☐ ROCK - FLAT
- ☐ ORGANIC LITTER
- ☐ BOULDERS
- ☐ BAT GUANO
- ☐ OTHER, DESCRIBE: _____

VEGETATION

- ☐ TREES INTO CENOTE: _____
- ☐ ROOTS VISIBLE IN CAVE:
- ☐ AREA WITHIN CENOTE CLEARED: _____
- ☐ AREA SURROUNDING CENOTE CLEARED:
- ☐ OTHER, DESCRIBE: _____

FORMATIONS

- ☐ STALACTITES (FROM CEILING)
- ☐ STALAGMITES (FROM FLOOR)
- ☐ SODA STRAWS
- ☐ CURTAINS
- ☐ COLUMNS: JOINED STALAGTITES/MITES
- ☐ CALCITE RAFTS ON WATER SURFACE
- ☐ FLOWSTONE ON WALLS AND FLOOR
- ☐ RIMSTONE DAMS
- ☐ NO FORMATIONS DETECTED
- ☐ OTHER, DESCRIBE: _____

GEOLOGY

- ☐ FOSSIL CORALS IN THE WALLS
- ☐ FOSSIL SEA URCHINS
- ☐ FAULTING
- ☐ MASSIVE (HARD) ROCK
- ☐ FRIABLE (CRUMBLY) ROCK
- ☐ CHEESY LIMESTONE BEDS
- ☐ VISIBLE LIMESTONE LAYERS BEDDED HORIZONTALLY, THICKNESS OF BEDS:

COLOR OF VISIBLE LIMESTONE: _____

ARCHEOLOGY

- ☐ CARVINGS IN THE WALLS
- ☐ GRIND STONES
- ☐ POSSIBLE ANCIENT RITUAL STRUCTURES
- ☐ DRY STONE WALLS
- ☐ BROKEN ARTEFACTS
- ☐ POT SHARDS
- ☐ STAIRS
- ☐ OTHER. DESCRIBE: _____

WATER

COLOUR

- ☐ CLEAR / TRANSPARENT
- ☐ BLUE
- ☐ GREEN
- ☐ BROWN
- ☐ TOO DARK TO TELL
- ☐ OTHER, DESCRIBE: _____

TEMPERATURE

- ☐ COLD TO TOUCH
- ☐ WARM TO TOUCH

MOVEMENT

- ☐ STAGNANT (swampy)
- ☐ OBVIOUS FLOW

AQUATIC VEGETATION

- ☐ ALGAL BLOOM
- ☐ ALGAL MATS
- ☐ OTHER, DESCRIBE: _____

KARST INVENTORY DATA SHEET
CENOTES & ROCK SHELTERS

WATER

DISTRIBUTION OF CAVE ABOVE/BELOW WATER:
- ☐ MOST OF THE VISIBLE CAVE IS SUBMERGED
- ☐ ABOUT HALF OF THE VISIBLE CAVE IS SUBMERGED
- ☐ MOST OF THE VISIBLE CAVE IS ABOVE WATER

SIZE AND LOCATION OF WATER POOL
- ☐ OPEN WATER POOL IN FULL SUN
- ☐ PARTIALLY SHADED
- ☐ UNDERGROUND, BUT IN THE LIGHT ZONE
- ☐ COMPLETELY IN THE DARK (DO NOT ENTER)

_____ VISIBLE SURFACE AREA OF THE WATER

_____ MAX WATER DEPTH: ☐ ESTIMATED OR, ☐ WHILE SWIMMING

DIVER LINE

☐ CAVE DIVER LINE VISIBLE, COLOUR OF THE LINE (WHITE, YELLOW, ETC):_____
- ☐ ARROW ON LINE, COLOUR OF ARROW: _____
- ☐ ROUND DISK ON LINE, COLOUR OF DISK: _____

WHAT MARKINGS ARE ON THE ARROW / DISK? _____

_____

CRITTERS

Please indicate TYPE, DISTRIBUTION, NUMBER/DENSITY, if critters are visible.

ON LAND	IN WATER
☐ SNAKES: _____	☐ SWIMMING "INSECTS" – COLOURED: _____
☐ SPIDERS (general): _____	☐ SWIMMING "INSECTS" – WHITE: _____
☐ TARANTULAS: _____	☐ FISH – BLACK CATFISH: _____
☐ SCORPIONS: _____	☐ FISH – COLOURED: _____
☐ IGUANAS:	☐ FISH – WHITE/COLOURLESS:
☐ SMALLER LIZARDS:	☐ TURTLES:
☐ BIRDS – MOT MOTS:	☐ FROGS:
☐ BIRDS – OTHER: _____	☐ CROCODILES: _____
☐ FOOT PRINTS OF LARGER ANIMAL (SKETCH): _____	☐ OTHER. DESCRIBE:_____
☐ BATS: _____	
☐ HERONS: _____	
☐ OTHER. DESCRIBE:_____	

DIMENSION (aerial perspective)

LONGEST AXIS (m or ft within cave or water hole cenote, using compass AZM)

SHORT AXIS (m or ft within cave or water hole cenote, using compass AZM)

DIMENSION VERTICAL DEVELOPMENT

If cave system, state maximum clearance between ground and ceiling:

Distance between ground level (use a point outside the cenote's depression area) and water level:

ENTRANCE DETAILS

Dogs, Entrance fees, owner rules or requirements etc.

LAND OWNERS

What does the landowner say about the site?

KARST INVENTORY DATA SHEET
CENOTES & ROCK SHELTERS

Figure 2. Recent example of cenote enlargement using heavy machinery. In this case, the goal of the landowner was to create an open-water pool to attract paying snorkeling tourists. *Robbie Schmittner*.

scientifically knowledgeable volunteers recruited for the project, cave explorers and cave divers visiting and living in the area, and university and high-school groups on field trips. For the five volunteers who have so far employed the existing methods, ability to speak Spanish and explain the goals of the work to the local people and landowners have proven most valuable in generating leads and gaining access to new and previously unidentified cenotes. There remain a large number of known and publicly accessible sites that have never been documented and that would keep a willing volunteer occupied, even without the ability to speak Spanish. With the number of cenotes being modified, it is becoming increasingly obvious that return visits, perhaps every two years, will prove valuable in documenting changes to the surface karst features, notably in relation to tourism and waste-disposal activities.

In 2006–2007, three volunteers spent a total of four months dedicated to collecting data on eighty sites, with a smaller number of contributions coming from two local cave divers. For 2008, goals include:

- Upgrading the data-collection sheets based on input from the dedicated volunteers of this project.
- Additional data collection by more volunteers.
- Entry of all data into a GIS framework that includes the significant geopolitical features of coastline and proposed urban footprints.
- Initial attempts at comparisons of cenote geospatial data with structural and topographic features in this subtle, low-relief karst platform.

Effort so far has been concentrated in the area of the village of Akumal, located 105 kilometers south of Cancún and slated to be the city of Akumal with a population of 200,000 by 2036. Akumal and the neighboring village of Puerto Aventuras, also slated to become urbanized, are likely to remain the focal points of efforts in 2008 in part due to the local support available through the Centro Ecológico Akumal (www.ceakumal.org). Other significant collaborations include financial support from the Quintana Roo Speleological Society and data sharing with Amigos de Sian Ka'an. Most recently, the GIS aspects are beginning through coordination with Aaron Addison of Washington University in St. Louis. The greatest long-term challenge in this effort remains legal issues surrounding information management and ultimately transfer to government decision-makers, and these will remain to be addressed beyond 2008.

We would like to thank the people who have supported this project so far, and in particular the landowners who have been kind enough to grant access to their properties. We thank the Centro Ecológico Akumal for acting as a safe home-base for volunteers within their cost-sharing research scheme; Cave Exploration for the use of field-safety equipment, on site orientation of volunteers, and GPS equipment; and the Quintana Roo Speleological Survey for a grant to support basic field expenses.

Beddows, P. A. 2004. *Groundwater hydrology of a coastal conduit carbonate aquifer: Caribbean coast of the Yucatán Peninsula, México*. PhD thesis. University of Bristol, UK. xix+303 pp.

Smart, P. L., P. A. Beddows, S. Doerr, S. L. Smith, and F. F. Whitaker. 2006. Cave development on the Caribbean coast of the Yucatan Peninsula, Quintana Roo, Mexico. Geological Society of America Special Paper 404: *Perspectives on Karst Geomorphology, Hydrology, & Geochemistry*, pp. 105-128.

Topografía de Cuevas Sumergidas desde la Superficie:
Inventario del Carst Superficial de la Península de Yucatán

A lo largo de 200 kilómetros de costa al sur de Cancún, en la península de Yucatán, México, han sido documentados más de 700 kilómetros de cuevas sumergidas. Las proyecciones de crecimiento poblacional estiman un incremento de cuarenta veces en el número de personas viviendo en la zona en los próximos veinte años. El acceso a las cuevas es a través de dolinas de hundimiento llamadas cenotes, que pueden ser vistos como marcadores superficiales de los sistemas cavernarios subyacentes. El levantamiento topográfico de los cenotes podría facilitar la exploración y finalmente contribuir al proceso de administración y manejo del agua y desechos. Sin embargo, la información sobre los cenotes sigue siendo limitada. En 2006 se iniciaron unos pequeños esfuerzos para establecer un sistema estandarizado de colección de datos sobre cenotes, cubriendo aspectos geológicos, biológicos, arqueológicos y de uso de suelo, para ser usados por habitantes locales, exploradores y visitantes. Los métodos necesariamente tienen que ser utilizables por gente sin antecedentes específicos en carst no en la zona local. Un formato de tres páginas para recolección de datos está apoyado por una guía de campo con fotografías y una guía de orientación de 10 páginas que incluye instrucciones para realizar diagramas en el campo. En 2006-2007 voluntarios pasaron un total de cuatro meses recolectando datos en ochenta sitios. En 2008 el proyecto incluirá más voluntarios, la integración de los datos en un sistema de información geográfica y comparaciones iniciales de la información geoespacial de los cenotes con características topográficas y estructurales en esta plataforma cárstica de relieve limitado. El mayor reto a largo plazo son los asuntos legales que rodean al manejo de la información y finalmente su transferencia a las agencias gubernamentales con poder de decisión.

HISTORY

DIVING BENEATH THE MAYA CITY OF XCARET

Sheck Exley

"You gotta see it to believe it!" Ned insisted. "The cave is huge and the water is as clear as air." Amid Ned's ravings, I squinted at badly underexposed slides of the entrance. It was obvious that if I was going to see it, I was going to have to go there. However, I had heard enthusiastic babbling about "bottomless holes" and "endless tunnels" in Florida all too often not to be skeptical of his claims. Nine times out of ten the reputed underwater answer to Mammoth Cave turned out to be nothing more than a tight mud hole less than 30 meters in length.

But this time it promised to be different. For one thing, Ned DeLoach was a far cry from the hoary winos and redneck fishermen who so frequently lead us astray in Florida. Quite possibly the best underwater cave photographer and film-maker in the world, he had just finished a trip to the Yucatan Peninsula to scout out the diving possibilities for *Sport Diver* magazine. It was ironic that the only roll of film not to come out among the many he shot on the trip was the one of the gaping cave entrances he had found at the ruined Maya city of Xcaret. Sure, we had heard of diving expeditions to the large sacrificial cenotes (sinks) at Chichén Itzá and Dzibilchaltún farther inland. However, until Ned returned with his tales of huge springs discharging crystal-clear water through swift-flowing *caletas* (short rivers) to the Caribbean, we had no idea what happened to the vast amounts of rainfall entering the ground through the hundreds of cenotes pockmarking the peninsula.

The thought of diving in virgin conduits amid jungle-shrouded Maya ruins was irresistible, so in August 1979 three members of the Cave Diving Section of the National Speleological Society, Ned, Karan Exley, and I, mounted a nine-day expedition to the area. After a couple of days of wandering around the popular diving resorts on the island of Cozumel, we finally hooked up with Pedro Delgadillo, who introduced us to Ken Young, owner of a dive shop in Houston. Ken had been the subject of an article in *Mariah* about the 130-meter-deep Great Blue Hole of Honduras, and he kindly offered to sail us across the straits to the mainland.

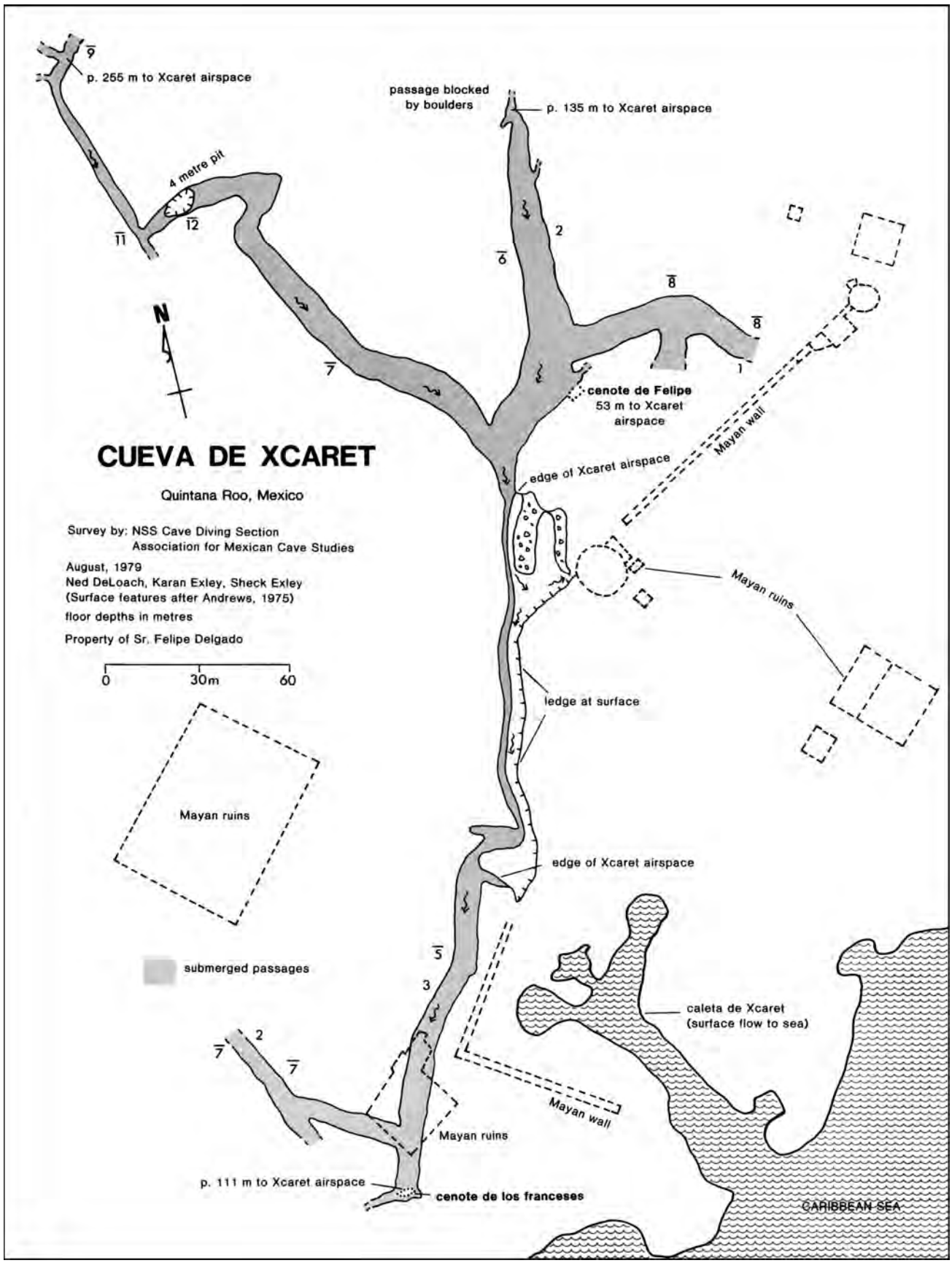
After a particularly rough crossing during which I renewed my famous acquaintance with *mal de mer* (it's a standing joke in Florida that the mere smell of salt water is enough to make Exley seasick), we anchored in the Xcaret *caleta* and climbed up a low hill to the main entrance to the cave. From conversations with Pedro over fine Mexican *cerveza*, we had learned of a previous French diving expedition during which a "300-meter" underwater traverse had been made to a nearby cenote. Sure enough, after submerging in the limpid pool just inside the entrance, we quickly found the end of a length of yellow surveyor's tape that the French team had used as a guideline. The tape did not seem strong enough to be used as a guideline, so we proceeded to lay our own line, knotted at 3-meter intervals to assist in surveying.

The floor of the pool quickly plunged downward to a water depth of 6 meters and a 3-meter-diameter trunk passage of purest white limestone. The differential solution of the walls was much more complex than we commonly see in Florida, and the undulating walls frequently gave the impression of flowstone draperies and stalactites, though we were unable to verify the presence of any dripstone formations underwater. After only 80 meters of slowly winding passage, Ned abruptly flashed me down with his light and pointed toward the dim, azure glow of the cenote a scant 16 meters farther on. Obviously, someone got 300 meters confused with 300 feet when describing the traverse.

Exuberantly surfacing in the cenote, we checked our air and briefly searched for a way on. Unfortunately, the vegetation-covered collapse appeared to have blocked farther egress, so we proceeded back toward the main entrance to look for side passages. I soon spotted a low, silty one on the left, so we swung into it to investigate, laying a branch line separated from our main line between the entrances by a gap of 2 to 3 meters.

Meanwhile, Ken's group of five divers had also entered the water and traversed to the cenote. Unfortunately, several of them, unaware of the hazardous silting conditions in the side passage, now proceeded to swim in behind us and totally blitz the visibility, their careless fin strokes stirring up dense clouds of sediment behind them. However,

Reprinted from *Caving International Magazine* 8, July 1980.


CUEVA DE XCARET
Quintana Roo, Mexico
Survey by: NSS Cave Diving Section
Association for Mexican Cave Studies
August, 1979
Ned DeLoach, Karan Exley, Sheck Exley
(Surface features after Andrews, 1975)
floor depths in metres
Property of Sr. Felipe Delgado
0
30m
60
N
p. 255 m to Xcaret airspace
4 metre pit
passage blocked by boulders
p. 135 m to Xcaret airspace
cenote de Felipe
53 m to Xcaret airspace
edge of Xcaret airspace
Mayan wall
Mayan ruins
ledge at surface
Mayan ruins
edge of Xcaret airspace
submerged passages
caleta de Xcaret
(surface flow to sea)
Mayan wall
Mayan ruins
p. 111 m to Xcaret airspace
cenote de los franceses
CARIBBEAN SEA

Tlaloc was with us, and Ken, Ned, and I managed to get everyone onto the line and back to the main entrance without mishap.

While Ken led the others on a snorkel trip to the *caleta*, Ned and I snorkeled about 100 meters along the stream passage connecting the pool we had just dived with the upstream continuation of the spring. One interesting aspect of this partially-exposed tunnel is that it composed the central portion of a defensive wall the ancient inhabitants of Xcaret built around the city (see map). Andrews (1975) has described these ruins and their archaeological significance in detail. Apparently the *caleta* of Xcaret provided about the only protected access to the rugged coast, so it was used as a point of departure for Maya pilgrimages to the sacred island of Cozumel as well as a port for coastal shipping. Thus far it is not known whether the cave beneath the city had any religious or recreational significance, but it is hard for the few of us who have dived there to imagine the Maya ignoring anything as unique as this wildly beautiful grotto.

The upstream continuation proved to be much like the first area we explored, and this time the lack of the telltale yellow tape proclaimed the virginity of the 3-meter-high by 6-meter-wide passage. We quickly laid 94 meters of line before diminishing air forced a reluctant turnaround, and surveyed out. On the way we discovered another entrance, Cenote de Felipe, and two possible side leads. Just as in other areas of the cave, we found the water to be in two distinct layers, each with visibility in excess of 30 meters—a flowing brackish layer extending to a water depth of 3 meters, with placid salt water below. Oddly, the top layer was noticeably cooler (approximately 23°C), suggesting that it had been underground much longer and that the 27°C salt water was merely local back-flooding from the sea. A subsequent dive in a side passage three days later, on which we penetrated 255 meters underwater to a depth of 11 meters, revealed that the interface between the layers gradually descended to a depth of eight meters, a lens effect typical of the shallow fresh-water aquifers of the Bahamas.

One disturbing aspect of this interface is that the mixing caused by our movements and exhaust bubbles blurred the visibility and made photography very difficult. Also, silt loosened from the ceiling by our exhaust bubbles would pile up on top of the denser sea water, creating a flat false ceiling. The settling of the silt to the floor was delayed considerably.

My weak stomach made weathering the trip to and from Cozumel only slightly more desirable than drowning, so it was with considerable relief that we finally met Felipe Delgado, owner of Xcaret as well as the finest restaurant in the area. The three of us got a room at a *posada* in nearby Playa del Carmen, and from then on Felipe treated us like visiting royalty, driving us around in his truck and furnishing us with tanks and weight belts. But Felipe's finest contribution to our expedition was ferrying us and our gear down the coast to an unexplored cenote at the southern perimeter of the Xcaret area. In response to our questions about the name of the place, Felipe answered in his excellent English, "We call it Nonec," then added with a grin, "but the people I have shown it to call it Paradiso."

And paradise it was. It is hard for me to imagine a more striking surface setting than Nonec, with its deep-flowing aquamarine pools within walled cenotes surrounded with profuse flowering plants. I doubt if even the majestic cliffs of Río Choy, the magnificent desert oasis of Media Luna, or the gaping crater of Wakulla in Florida can compare to its scenic beauty. Quickly plunging into the largest cenote, Ned and I had a thrill that I will never forget: water so clear that the entrance to the next cenote upstream, 116 meters away, was plainly visible.

Our rapidly diminishing supply of line tempted us to swim the distance without a line, but we wisely refrained from doing so, having by now become accustomed to the unstable-ceiling silting conditions characteristic of the area's underwater caves. Surfacing at the next cenote, we skirted about 30 meters along the edge of the collapse to continue a farther 294 meters, still at a depth of 6 meters. With vague thoughts of exceeding the similarly shallow 2640-meter penetration at Australia's Cocklebiddy Cave in the back of my mind, I cursed my lack of my normal 300-cubic-foot twin-tank rig, as once again the small supply of the single 72-cubic-foot tank forced us to turn away from the beckoning 2-meter-high by 8-meter-wide conduit. On the way out we were surprised to see two troglobitic isopods, each 2 centimeters long, in the lower layer, the first time I have ever seen such animals in salt water.

At this point I doubt if it will surprise many readers to report that Ned and I are planning a return expedition for network television. Hopefully we will be able to share the unforgettable experience of Xcaret with many others.

Andrews IV, E. Wyllys, and A. P. Andrews, 1975. *A Preliminary Study of the ruins of Xcaret, Quintana Roo, Mexico, with Notes on Other Archaeological Remains on the Central East Coast of the Yucatan Peninsula*, Publication 40, Middle America Research Institute, Tulane University, New Orleans.

Buceando Debajo de la Ciudad Maya de Xcaret

En esta reimpresión histórica, Sheck Exley reporta su buceo de la cueva subacuática debajo de las ruinas mayas en Xcaret, en la costa caribeña de Quintana Roo.

WAITING FOR TRES AMIGOS

Donna "MudDonna" Renee

It's mid-March and I'm only just feeling fully acclimated to civilian life after five weeks caving in Mexico after Christmas. Having only recently been informed that I am to write an expedition article, I've dug out my musty journal. The pages are warped and stuck together from weeks of humidity and rain. I look over the names of towns, mileages, who paid for what in dollars and pesos, trying to refresh my memory—

December 26, 2007. On this crisp Colorado morning, Mike Frazier, Patricia Malone, Ryan Gosciejew, and I pile the last of the gear into Mike's 1978 Chinook camper and slowly back out of the driveway. Katie B., another Southern Colorado Mountain Grotto member, waves and smiles at us. "I miss Katie," says Ryan, a tear rolling down his cheek. "Ryan, she's right there, you can still see her." Ryan doesn't comment and disguises his quivering lip by eating Christmas cookies Katie has baked for him.

Mike makes his way to I-25 and heads south. There will be no stopping except for fuel. We live off whatever snacks we can grab at the convenience store counter while the tank is being topped off. Extra potty breaks have to be begged and bribed for. Frazier is on a mission. Twenty hours later, we reach the border of Mexico around midnight.

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Revised from the author's blog at http://muddonna.blogspot.com/2008/06/waiting-for-tres-amigos.html. The photographs are from /2008/03/mexico-2008.html.

Mike, Ryan, and I squeeze onto the tiny mattress ("sleeps six," oh, sure) Long, tall Patricia gets the narrow aisle on the floor, with her legs under the bed.

December 27. Border crossing. Endless tolls on the nice paved highway, but it is much faster than the side roads, with their speed bumps and slowing for stray dogs and nursing pigs.

December 28. We arrive in Huautla, Oaxaca, and enjoy a hot dinner and a hotel with a shower and get used to talking in Spanish again. I just can't make them understand their own darned language.

December 29 and 30. Patricia and I remain in town. Mike and Ryan go on to Ayautla. We check out the markets and eat fresh avocados, fruit, and fantastic breads in front of the church in the square. A small brass band plays while a wedding party walks out from under the arched doors, followed by the smiling bride and groom. Later we go hiking through the town's hills and discover an old and fascinating cemetery to explore.

December 31. We take a taxi and meet the others at the home of our hosts in Ayautla, Severo and Virginia, really wonderful, helpful people with great kids, too.

January 1, 2008. Mike drives us to just outside of town to the Río Uluapan, a popular river with numerous swimming holes. We hike a pleasant trail thirty to forty-five minutes upstream to its source, a beautiful waterfall flowing out of a large cave entrance and down over stair-step ledges to a pool below. The resurgence is located about 40 meters above us, but we carefully negotiate the moss-covered rocks and flowing water easily enough. Once at the top, we walk inside to an underground lake. I sink into the chilly water to cool off and paddle around a bit. Patricia gets in too, and with a few strong strokes she is headed for the center of the dark water. Mike, Ryan, and I watch Patricia's headlamp grow smaller and smaller as she swims to the opposite wall of the cave, exploring its edges perhaps 50 meters away. We lose sight of her light, and when she stops answering our calls, we wait a little nervously. About ten minutes later she reappears, still swimming calmly. Back on land she reports her findings to us. We're all impressed with her solo trip. [See map of Nacimiento del Río Uluapan, there called Uruapan, in *AMCS Activities Newsletter* 26, page 80.]

We pick our way back down the falls in full view of at least twenty locals who have followed us up. Except for the part where I slip and fall a meter onto my back into a pool of water in front of the audience below, I am a picture of grace and American rock-climbing perfection.

We meet more U.S. cavers: Ernie Garza, Jonathan Dible, and Tony, Marion, and little Simon Akers. They offer us a place to camp at their place up the road any time we need it. Randy Macan arrives separately by taxi just in time to observe Mike giving vertical training among banana trees to a crowd of local boys.

We camp back down at the river. Patricia, Randy, and Ryan are in the mood to celebrate the New Year. Mike is in the mood to get some rest.

A white-nosed coati, family pet.

He first tries to leave the Chinook and sleep on the ground outside. The merrymakers follow and continue their laughing and singing. Mike's growing annoyance only encourages them more. The last we see of him is his angry silhouette dragging his large orange sleeping bag, outlined by the oncoming headlights of passing trucks. It's a miracle he wasn't run over in the median while he slept.

January 2. Mike and other expedition members, along with Severo and Virginia, round up the local children and pass out boxes and boxes of donated notebooks, crayons, pencils, and more. We have to keep careful watch, because they like to sneak back through the line for extra.

That night we take Tony and friends up on their invitation and pay them a visit. It was a real pleasure getting to know each one of them. They've had the good fortune to rent a building on a coffee plantation. Their tents, bags, kitchen, and gear are set up in a long, spacious cement building out of the weather. This is especially important tonight, because rain starts and comes down heavily until early next morning. We can hear the wind and the constant drops on the roof, but we are warm and dry inside.

January 3. We head back to Uluapan to see how the additional water affected it. It is roaring. We jump out of the camper and begin filming and photographing the foaming whitewater. Mike convinces a nearby landowner to take us up to the cave on a safer back trail. We can hardly believe the change when we see it. The easy climb up the falls two days earlier is now buried under several feet of fast-flowing water gushing from the cave entrance. We have to shout to each other to be heard.

Safely back inside the camper, we quickly dry off our camera equipment. Ryan becomes increasingly agitated when he can't bring up photos from the memory. I remembered the great pictures he had taken during the past few days, and I too hoped he'd salvage them. After much toying with the settings, Ryan sank into his seat. The pictures were gone. Ryan is an excellent photographer, and I was disappointed at the loss. I tried to reassure him by stating there would be plenty more opportunities for photographing caves on this trip. "I don't care about any of those. I lost all of my pictures of Katie." He turned and looked out the window; the water streaming down the glass reflecting the crying in his heart.

January 4. Incoming Poles! Kasia #3 Kędraka and Kasia #4 Barcz arrive during the wee hours of the morning by taxi and sleep late. Marchin and Kasia #1 Gala and their baby Zusia arrive by taxi. (Kasia #2 Biernacka didn't make this trip.) Mike brings them up to date on his progress so far getting permission with the local officials. They go with him to the town hall. Surely having the lovely smiling child will soften the hearts of even the strictest bureaucrat. It doesn't hurt that Kasia #1 and Marchin are fluent in Spanish. A couple of hours later we see them walking back down the hill toward the house, smiling. We are hopeful for good news at last.

Paul Mozel and Jeff Dieterle roll into town on their heavily loaded motorcycles just as we are finding out we've gotten permission to head up to the cave.

We have our packs ready in no time. Randy Macan, one of the original discoverers of Tres Amigos, and Patricia Mallone, who has been on three previous expeditions, discuss with Mike the best route to the cave. Kasia #3, who was present on the 2006 expedition into the Papa Loco borehole, and Kasia #4 also join us. We start up the hill from the town with every confidence we would be camping at Tres Amigos that night. Randy and Ryan are in the lead. The terrain is mainly pasture, and gradually grew steeper, rockier, and more heavily treed. My pack is the lightest, about 20 pounds. Mike has very considerately kept in mind that I have never hiked far carrying a pack with more than what I needed for caving. Group toilet paper and a sleeping bag are my primary load. Because of this, I am able to keep up with Ryan, his MP3 player going strong, for a good part of the hike, although I will regret this hasty pace the following day. Randy stays up front too, but the much heavier weight of his pack forces him to stop from time to time. Patricia, K3, and K4 stay together at a slightly slower, methodical pace that served them well. A couple of hours into the trek, we come to a fork. Randy and Patricia discuss options and decide the upper fork is the correct direction. This trail is quite narrow, with low branches and vines catching our packs. We follow this fork for about an hour until we reach a coffee field where the trail seems to end. Randy and Pat don't think this looks familiar at all. After some discussion, we decide to head back down and try the lower fork. We retrace our steps to the fork in the path. Daylight is going to be a problem soon, and we walk up the more overgrown path, hopeful that we are at last going in the right direction. When the trail tapers off and ends in a banana field, we have to stop. Only a few shreds of daylight remain, and this area was about as flat as we've seen all day. It makes sense to set up camp and try again in the morning. K3 and K4 offer me a spot in their tent that I gratefully accept. Poor Patricia, I think. She ends up in the tent with the noisy boys. When I finally hit the sack, I squeeze into the tent next to the sleeping Kasias, trying not to wake them. To my horror, I realize I am on a small hill. Worse than that, it forces my body perfectly into a crevice between a large rock and a banana-tree root. No matter how I turn or angle myself, gravity forces me into a miserable ball in the corner

of the tent, like the last drips of ice cream attempting to escape from the point of a sugar cone. I sit up most the night listening to jungle sounds and the soft contented snoring of Patricia and the boys.

January 5. We get an early start and head back uphill to find out where we went wrong. At the fork, Kasha #3, Kasha #4, Ryan, and I drop our packs and wait. Randy and Patricia take the trail back toward town in hopes of discovering a path they recognized. The Polish girls kill some time photographing themselves peeking out from behind four-foot leaves. Very cute. Randy and Patricia come back without any good news. The rest of us return to the coffee field and split in different directions, looking for any lead. It feels good to be free of the packs. I head up to a shadowy area in the trees that I hope opens onto some kind of path. It really doesn't amount to much, but the karst is great, so who cares. There is no way in hell I am going to find the way to Tres Amigos in the middle of a jungle, in a foreign country with only level-101 map and orienteering skills, so I poke my nose into every crack and crevice looking for my own damned cave. I even muse about what to call it: Mucha Hambre, Friggin' Caliente, No Mas Agua, Donde Esta Yo, Perdido en México, and so on. I make note of anything remotely edible-looking and nibble on raw coffee beans. Some of the trees have hard, avocado-looking fruits, and I have my eyes on them as well. Who knows, I might have to bust them open with a stone and scoop out the pulp in order to survive—it was a little past lunchtime. I can't hear or see anyone else in the group, and I sit on a rock, staring and wondering who, years from now, will be the first to discover my body. Maybe no one will find me at all. Only my tattered and faded Patagonia label and half a Clif bar wrapper peeking out from under the layers of rotting vegetable matter will hint I've been on this planet at all.

But a number of calls and whistles reach me from down below, and I run to join the rest of the group, who are going back to Patricia and Randy's location. We have no idea where we are. Temporarily defeated, we start back to town, hoping to run into other expedition members heading up. About a half-hour down, we run into the guides, who are returning from taking the rest of the group up to Tres Amigos. We try to learn the correct path to the cave, but none of us is fluent enough in Spanish to be absolutely sure we have the right directions. We are on our twelfth hour on this ill-fated hike. Randy speaks fluent pesos and pulls out a large stack of them for the guides to see. He tells them they can have the cash if they lead us to the cave themselves. Jasper, the leader and a long-time friend to early expedition members, is more than happy to do this. He will get the same amount of money for walking half the distance, and he won't have to carry a load this time. It is a good day for Jasper.

Mike Frazier hands out donated school supplies to the children. *Ryan Gosciejew.*

He takes us straight back to the coffee field where the trail ended, making it our third visit here. Instead of heading uphill, he disappears into the jungle below, along a hidden trail hugging a cliff face and taking us through the most difficult part of the hike so far. We are feeling the burn, but it is great to know we are going to be at Tres Amigos today if we just keep putting one foot in front of the other. Patricia takes a bad fall when a low branch catches her pack and throws her off balance. Before she can recover, she is flipped around by the weight of her pack and sent rolling downhill. Had this happened at any point along the cliff, she could have fallen to her death. Fortunately, she isn't badly hurt, and she gets back on her feet and continues on.

Another guide, Phillippe, walks behind me and occasionally offers a hand. At one point he cuts a walking stick and gives it to me. I smile and try hard to use it, but it is more awkward than it is worth, and I prefer to have both hands free. I thank him and apologize before setting it aside. We reach a large tree lying across the path, and it is crawling with ants. I pass my pack ahead like the others and run up the trail as fast as I can, but it isn't fast enough. I can feel dozens of biting ants moving up my pants, gnawing at my flesh as they go. Not giving a hoot who is watching, I whip down my pants and start slapping at the little horrors. Phillippe is doubtless still retelling the tale of the crazy *gringa*, clad only in panties, hiking boots, and ants, screaming, hopping and cursing up the trail to Tres Amigos.

Upward, upward, upward, we continue to climb as we hear Mike's sweet shouts high up above us in base camp. The entire trip for them had taken only four hours. Ours was fourteen. We were the first to leave and the last to arrive. Some days go that way.

After some time to decompress, we join in setting up camp. Patricia is quickly and expertly setting up her tent in her favorite spot. Kasias #3 and #4 do the same. The ground

needs leveling in places, and the kitchen needs to be unpacked and organized. Mike has already set up the latrine, complete with flag—up for *occupied*, down for *available*. We hear Paul and Jeff yelling down at us from some remote location above. Their guide has ditched them part way up the trail, and they were struggling to get into camp. Although they can hear and see us, finding an actual trail is another matter entirely. It will be another hour before we see them.

Dinner tonight will likely be a concoction of any of the following ingredients: pasta, tomato sauce, tuna, twenty-two pounds of dehydrated vegetables, rice, and cheese when we were lucky. On the breakfast side of things: oatmeal, raisins, pancakes, peanut butter, and dried milk.

January 6. Daniel Laos arrives early in the morning with guides carrying more equipment for the cave. Mike, Marchin, and Kasia #3 head into Tres Amigos in order to set up the underground camp. A few of us are a bit out of practice and want to brush up on our vertical skills on the first three drops in Tres Amigos. The entrance is massive, and it is hard not to be distracted by its size and depth while picking my way down the muddy slope to clip in. I feel better when I hear the reassuring click of my biner and I start to load my rack. Paul, Randy, Daniel, and Ryan are ahead of me. I watch and learn from their maneuvers. Patricia follows behind, giving helpful instructions from her previous trips here.

It's about 6 meters to the first rebelay. Short cowstail into the hanger, long cowstail into the loop, then unload, reload the rack. Unclip from the hanger, test the rack, unclip from the loop, then down the second pitch to a fairly flat room, with plenty of natural light still shining down from above. Streams of water trickle down in a corner, and I unclip and follow the others down a rocky hill where the pulverized bones of an unfortunate deer-like animal lie. I lean my head back and stare upward 30 meters, imagining the terrifying fall of this poor creature and making a mental note to watch my step when I get back to base camp. We flick our headlamps on and half walk, half crawl through a narrow passage. A hanger is attached above to a rock extending a meter over a 15 or 20 meter drop , with a redirect a short distance below. Paul boldly hops onto the ledge and plants his feet on each side of the passage, reaching up to clip in. He might as well be performing the same action standing on a curb with a six-inch fall, such is his confidence. Ryan is next, and he carefully examines the ropes, the rigging, and the quality of the hardware before deciding he is willing to test them with his life. While he descends, I stare at the hanger only a few feet away. Leaning over the precipice to clip in is mildly intimidating, and I am annoyed at the butterflies in my stomach. I lean out over empty space and grab at the rope. Where Paul has stood with his cocky couldn't-care-less attitude, I half crouch, pulling the rope as close to me as I can wrestle it, while loading my rack. Leaning back, testing, I tie off my rack and then reach out and unclip from the hanger. Now I only need to worry about the swing factor as I make my way to the edge and allow my weight, the rope, and gravity to pull me out into space. A bump or two later and some unnecessary rotations, and I am back on track, moving past the redirect and enjoying a pleasant descent down to join the others waiting in the chamber below. The next drop is longer, but the rebelay isn't as tricky. A pool 20 meters below can be avoided by pushing off the walls and letting out rope at just the right moment in order to land on drier ground. We all meet at the bottom of the third drop. Patricia, Randy, Paul and Daniel discuss what we've done so far and tell us what can be expected ahead.

Everything goes smoothly enough, and we head back to camp for a hot spaghetti dinner and a look at the maps of the rest of the cave in anticipation of our trip. Patricia and I practice some Polish with Kasia #4, and she works on her English. Poles learn British English, and Americans are difficult for them to understand, but we manage to get our points across.

Jeff Dieterle works faithfully through the night in order to establish a fire. Finding wood dry enough to burn out here in the moist jungle is difficult, and his patience amazes me. Several times tiny little flames begin to show, but quickly go out again. Just watching the process is frustrating, but his efforts pay off and we have an excellent fire for the evening. Furniture is required, so there is much rolling about and uprooting of comfortable rocks to sit on. Ryan, always prepared with the latest gadgets and camping gear available, has his MP3 player turned up for our enjoyment, with thousands of

Ready to hit the trail. From left, Donna Renee, Patricia Malone, Kasia Barcz, Ryan Gosciejew, Kasia Kędraka, Randy Macon. *Mike Frazier.*

Donna Renee.

songs to choose from.

Paul and Jeff decide to return to town, and we all give them pesos and supply lists. Randy, Patricia, and Kasia #4 prepare for their turn into Tres Amigos and then they disappear into the abyss. It's really quiet with only Daniel, Ryan, and me this morning. I go on a quest for some sunlight and spend a few hours winding through endless green stuff trying to find a warm, dry spot to sit. I return to camp, and only then does Daniel warns me that *mala mujer*, a painfully poisonous plant in this area, also likes sunlight. Within forty feet of camp, he locates a perfect specimen, uproots it with his machete, and brings it to me. Aside from the fine red hairs growing along the stalk and underside of the leaves, it looks like every other danged plant growing above, below, and around us in this jungle.

Late in the afternoon, Daniel gathers firewood. Ryan drums on various handmade jungle instruments. Daniel stops his work and participates by blowing a few notes on an empty mescal bottle.

After dark Paul and Jeff return with supplies and there is much rejoicing. They tell us of their taco-fest in the village, a welcome treat until they made the mistake of asking what kind of meat they were eating. When the elderly cook continued to point at her head and smile, they realized they'd been chewing hungrily on brains. The guys continue to exchange stories around the fire, and I feel a creature scurry across my wrist and stop on my index finger. By the size, weight, feel, and strong grip of its crunchy little legs, I know I am dealing with a scorpion. Screaming, I fling it straight toward the fire. Within seconds we all have our head lamps snapped back on and are checking our clothes, boots, and seating arrangements for any more of the little buggers. On that note, I retire to my tent for the night, leaving the guys a little less secure around the fire.

January 8. Slow Day. Wash and rinse my shoulder-length hair in less than a half gallon of water and use the rinse water to shave my legs, a feat I am a bit proud of. Jeff and I head back to the pit to fill the water containers. He free climbs it easily, and I don't mind staying up top at all.

Making friends with the water hole: Whenever I am tempted now to complain about doing dishes in the sink at home, I remind myself of the twice-daily regimen of fetching water from the pit about 150 feet uphill from camp. Some can free climb down, but due to a sharp undercut at the top and the wet conditions, a handline is in place that I happily make use of. After one carefully negotiates all the foot- and handholds to reach the bottom, a second person will lower empty water containers from above. On the opposite side of the pit, a collection system has been set up under a trickle of water. By standing on tiptoe on a narrow ledge and leaning through an opening in the rocks, it is possible to immerse the bottles one by one into a tub and collect enough water for everyone for a half day if it is carefully rationed.

Later, while gathering wood on the hill near our tents, Daniel shouts down to me that there is a pit 5 meters behind me. I take a closer look and toss down a chunk of wood. Daniel estimates it is at least 6 meters deep. A bit later I find a decent rock to toss in, and we hear it roll a good deal farther. He wants to check it out. Daniel is the perfect size and tenacity, combined with acrobatic strength and agility, for checking out the tight leads. The cave continues on for 15 meters to another drop. He and Paul bring rope and vertical gear up the hill rig from the entrance, and cover 40 to 60 meters without reaching bottom. Further exploration will have to wait until more rope is available. That nice little passage is in what looked like a rat hole within sight of the camp. It's simultaneously exciting and frustrating contemplating all the leads that are hiding all around us. Which ones tie into Tres Amigos directly below?

January 9. A big snorting creature outside my tent wakes me up today. If not for the fact that I can hear a significant amount of brush, branches, and rocks being displaced under its weight, I would have assumed it was one of the guys snoring. My first thought is, what can I use for protection if it charges, tusks glinting. My second thought is, if I can find a rock big enough, maybe I can make bacon for breakfast this morning. I hide under the blankets until the snorting animal heads downhill. I make rice with raisins for everyone. It isn't as popular as the bacon would have been, and I kick myself for my lack of courage and hunting/gathering skills.

The fog is rolling in again. Instead of sitting around, I head off in search of caves, armed with coffee cup and headlamp.

An hour later I am still in the shade under the thick jungle canopy. By the bright green glow coming through the leaves, I know the sun still exists, but not down here, not today. I keep climbing. The karst is incredible, and I scramble from rock to rock looking for that next lead. Once in awhile I call out, waiting for an answer from camp, but eventually the return calls stop. After another hour of heading straight uphill under and over rotting trees, heavy vines, and dense foliage, I see a deep shadow. Just one more trick on my

Mike and MudDonna. *Ryan Gosciejew.*

eyes? No! It's a pit! The opening is about 12 by 6 meters, with a small drop of about 4 meters to the first ledge. Off to the side is a fissure that drops about 12 meters. It looks very doable as a free climb. Beyond the reach of my headlamp it curves away, promising even more passage. I holler as loud as I can, hoping to get a response from camp, but no one calls back. Lying on my stomach in the dirt, I drop one rock after another, straining to hear how far it rolls. The hole is calling me, inviting me to chimney down that first passage and see what lays beyond. No one knows where I am. If something goes wrong, the likelihood of being found is close to zero. I head back to camp, disappointed, but memorize every rock, plant and tree that will help me locate the pit again. (And I do. As it turns out, my wee little cave is not earth-shaking news to the other expedition members, who have been in the depths of Tres Amigos. Pits are everywhere around here. I find three more during later solo explorations. Still, I take dozens of mostly unnecessary photos of it from every possible angle. I named it Brontosaurus Pit, because of the long, curving, neck-like shape of a tree which grows right over it.)

Mike and Kasia #3 return, smiling, but exhausted from the trek out of the cave. I offer to haul his gear bag up the slope, but can barely lift it off the ground. How on earth did he manage to wrestle so much weight through the cave? I drag it back up to camp. Everyone helps where they can with their vertical gear, hanging up wet clothes, and getting them comfortable in anticipation of hearing news from the cave. They have a hot supper of spaghetti and dehydrated vegetables.

Regarding the veggies: Not being a huge meat eater, I special-ordered them with the intention of packaging many individual meals in Ziplocs for myself in camp and cave. Mike was so impressed with the quality of the food and the durable, light-weight, and reusable containers that he insisted we use it for group food. This would have been a stellar idea had the other expedition members been vegetarians. Instead, after a relentless diet of dried carrots, green beans, spinach, and peas, I am quite sure I hear numerous grumblings and whisperings of lynching the cook.

We're waiting for Randy, Patricia, and K4 to come out. They arrive at night, also tired, but with many stories of great caving below.

January 10. Another hike looking for pits.

Due to drier than normal conditions, our water hole is not producing much. Patricia and I pull the tubs and tarps out of the small cave. I get on vertical gear, make the first drop into Tres Amigos, and set up a new collection point under small but more reliable streams of water. From above, Patricia helps haul out the extremely heavy water barrel.

Ryan, Daniel, Paul, and Jeff started into Tres Amigos this morning, or possibly last night. It's a blur.

January 11. Rice and raisin cereal, coffee. Randy takes off alone toward town after breakfast; he has a bus and a plane to catch. Mike isn't feeling well, hasn't been terribly energetic since coming out of the cave. He sleeps a lot. I'm looking at nearly another week before my turn into Tres Amigos, so I might as well be comfortable out here in the jungle. The vertical gear goes on. Gathering up all of Mike's muddy gear, our laundry, and empty water containers, I rappel down to the new water hole. I spend the next three hours under a small icy waterfall simultaneously showering and washing and rinsing laundry. Imagine trying to clean your muddiest gear under a flow not much stronger than a standard home shower and you'll understand. A single angry bat makes his displeasure at my presence known by flapping about the cave from time to time.

A hot meal of spaghetti and dehydrated spinach with powdered cheese waits for me when I get back, compliments of Kasia #4. It is one of my favorite meals during our stay. Both the Kasias break out a package of Polish jam-filled cookies and pass them around with tea. It's so good I am unable to speak from shock and gratitude.

Kasia #3, Kasia #4, and I take turns at trying to keep a fire going. The conditions have been wetter, and it's not easy, but eventually we succeed. We have a lot of trash to burn and bury. We make double use of the fire by stringing a clothesline over it and hanging out wet gear.

Mike tries his hand at dinner with four females in camp. He is set on making tuna casserole. He reasons, "We have some leftover mayonnaise. Mayonnaise is white. Cream sauce is white. Perhaps if I add hot water to mayonnaise, I can have a nice cream sauce for the noodles and tuna. A little lime, milk, and jalapenos thrown in will add some zest." When Mike is finished with his masterpiece, he beams proudly like a little boy finishing his first family dinner in home-economics class. Although I have made a pact with myself to eat everything available like a trooper, for the first time I hesitate. Deep in the pot of mayonnaise soup, lifeless noodles and fish cling to the sides as though trying to escape their watery condiment hell. I turn away from Mike's smiling face, toward the jungle, and wrestled with my inner demons. "Does loyalty have to be willing to face death? Should one be truthful if it causes a loved one pain? Just where *is* the fine line between love for others and love for self?" Patricia and the Kasias (with caution) sample the concoction. One, two, three hours pass and they are still walking and talking with no apparent reactions. I try it. I live to tell the tale.

January 12. The fog is rolling in

fast and thick. We have pancakes. Patricia, Kasia #3, and Kasia #4 pack gear and get ready to leave camp. They all find something for Mike, who is still sick. Tea, aspirins, painkillers, and flu medicine are given generously. We send a note with them to give to Kasia #1 down in town: please send a guide with supplies. I make another trip into the cave for water before they leave. It's awkward carrying a full keg of water back up the rope, and their help is welcome. Soon after pulling up the keg and pack of bottles, they head downhill with their own heavy loads. The fog is as bad as any day we've seen and it is after noon, so we worry about their losing the trail.

It's just Mike and me and the birds in camp now. We discover a pack of Polish cookies that the Kasias have left behind for us, and we are as thrilled as kids finding presents under a Christmas tree. We make hot tea, eat our dessert, play twenty-questions and a dot game for a few hours, then take a long nap.

January 13. A guide shows up early morning with his son, carrying supplies. We are still crashed in the tent. Mike jumps out in his sandals and underwear and digs in his wallet for the appropriate amount of pesos.

Ryan Gosciejew.

He carries on a happy conversation in his broken Spanish and convinces them to carry unneeded clothing and gear back into town for extra money, and they take off. Supplies! I jump out of the tent in my sandals. Strawberry Jam! Tortillas! Cheese, sugar, coffee, and more, so much more. We eat and smile, eat and smile . . . .

Marchin comes out of the cave an hour or two later to a pancake breakfast and all the lovely new snacks. He and Mike look over his notes, data, and photos that are accurate and spectacular. Marchin was in the cave for eleven days. He is methodical, highly competent, and professional at everything he does, from maintaining his equipment, to organizing data, to rigging the cave. He is the only one who looks like he could still run a marathon after climbing out of Tres Amigos.

Ryan and Daniel come out about four hours later. Pancakes all around.

Paul and Jeff arrive about two hours after them. Pancakes all around.

The rain that has so far been light, starts. It doesn't stop for the rest of the expedition. We spend the remainder of the night adjusting tarps, digging trenches, bailing water. With everybody left on the mountain back in camp, there is a shortage of tents. Marchin sleeps under tarps without complaint. I don't ever recall hearing any of the Poles murmur a complaint. Even after all of Marcin's caving gear was lost at the airport and he had to make do with borrowed and often inferior equipment, he carried on with the mission.

January 14. Rainwater coffee, rainwater pancakes, rainwater soup, rainwater water. Various campers take turns trying to dry out and light the stove.

Marchin and Daniel head back to town early. Ryan, Paul, and Jeff leave a few hours later with two hundred pesos and a small supply list. We'll wait now for Marcin's wife, Kasia #1, to come up, and she, Mike, and I will head into Tres Amigos for the final camp.

We spend all day in the tent listening to rain and playing the dot game. Suddenly there is a huge cracking sound on the hill above camp. It sounds like one of the massive trees above us, or perhaps a muddy cliff face, is tearing away from the surface and sliding down hill straight toward our tent. It is so loud and so close and so big it doesn't even make sense to get out of the tent. Mike and I just hold each other, bracing for what we are sure is going to be a mass of rock, trees, or both crushing us. After several terrifying moments, the noise stops and we both rush out of the tent. We look in every direction above us and see nothing unusual. We consider hiking uphill to investigate, but the likelihood of finding even a large object out of place is close to impossible in the mass of jungle surrounding us. We go back into the tent, out of the rain. Our racing heartbeats slowly return to normal.

More dot games. I pull out my notebook of Beatles tunes in Spanish, and we take turns singing the bad translations to each other. I wonder what I look like after being in the jungle with limited use of showers and Maybelline. To save weight, I didn't pack a mirror, so I take a picture of myself with the digital camera. I quickly erase it.

An annoying insect I have been slapping at for hours turns out to be a precious little frog, the tiniest frog I've ever seen, and believe you me, I've seen a few frogs in my time. Mike sets it free outside our tent.

Twenty-questions. Nap.

January 15. The rain lightens—for two hours. We briefly air out the sleeping bags on the lines and prop the tent off the ground to get a little circulation underneath it. I gather up brush wherever I can find it and lay it under the main tarp in front of the kitchen area, which is now a boot-sucking swamp. We take turns trying to fix a Thermarest sleeping pad with a patch kit and finally succeed. I make oatmeal, and we sit on rocks with our breakfast listening to flies and bees buzz through our wet, smelly camp.

Ryan Gosciejew.

Mike fixes his boot with a sewing awl.

Mike spends an hour fashioning numchucks out of bamboo-like reeds, then demonstrates his mastery of them. I film him.

I take more pictures of the fog.

Serious boredom sets in.

Where is everybody? They said they're coming back today—are they going to ditch us up here?

Mike works on his cave notes.

I make way too much tomato/rice/dehydrated-vegetable soup.

I sit in the tent and count my pesos and dollars and wonder if I'll have enough to make it home.

Spaghetti with tuna and real cheese for dinner.

Twenty-questions and the dot game.

I have a nightmare that a tree is about to fall on our tent. Mike tells me to shut up and go to sleep.

January 16. A bit of sun, yay! I retape my helmet in anticipation of an imminent departure for the cave, at last. Mike pounds on rocks with a hammer, trying to make them a little flatter and more comfortable to sit on. Will anyone come today? We listen to bees, flies, and birds and then more rain.

Ryan, Daniel, and Marchin return just before supper. Kasia #1 is unable to make the trip up because their little girl is ill, and she remains in the village. She was an important factor in gaining permission for us to enter the cave, so it is especially disappointing that she will not be able to go into Tres Amigos herself. They ask if I want to wait until tomorrow. "No, I've been waiting for this for nearly two weeks." Marchin heads in before us, and then Mike and I head into Tres Amigos at last. Our descent goes quickly and smoothly, but on the longer drops I remind myself that it will be a lot more work on the way up. Although the cave is much larger than any I've been in, I would still say it is user-friendly. The few tighter crawls are reminiscent of the "Crawlorado" caving I am used to. We make the trip to camp in five hours. The final passage before our destination is one of the more troublesome. It is a tight, muddy fissure that requires ascending gear that is difficult to use in these conditions. When I climb out of the hole around the corner from base camp, Marchin is waiting with dinner nearly ready. I look around and try to get my bearings: where am I going to change, sleep, etc. It feels good to peel off the wet clothes and get into the warm camp clothes that have been worn, in shifts, by various expedition members since day one. There is no rain, just sweet underground silence and peace. We have hot orange drink and ramen noodles with dehydrated vegetables, which are very welcome after the trip down. Randy has left a small string of battery-operated Christmas lights strung about camp, and I watched them blinking back and forth before falling into a comfortable sleep.

Marchin is up early and prepares tea and oatmeal for us. The wet clothes go back on, and then we set off to begin the C survey. Marchin and Mike know the cave intimately, and their combined caving experience adds up to being older than me, so you could say I have to hustle to keep up. The formations are amazing and everywhere. Soda straws 2.5 meters long, pearls, gypsum flowers bigger than my shoulder, huge columns, and more. Even the formations that have naturally fallen and are lying in piles everywhere are more spectacular than most I've seen.

We spend several hours surveying stations C-1 through C-34 in a passage that ended in a fork, each way to a window overlooking a massive abyss below. We are psyched! Tomorrow Mike and Marchin will bring rope and drop into the pit.

Back at cave camp we have a dinner of noodles, veggies, salmon, and real cheese. Marchin suggests we

Ryan Gosciejew.

Jeff Dieterle, Paul Mozel, Marcin Gala, and Daniel Laos in camp in Tres Amigos. Marcin was underground for eleven days. *Ryan Gosciejew.*

do some more surveying in another section of the cave, near Papa Loco's Borehole, and we agree it's still early enough to get some more work done. After another few hours of surveying, we decide to wrap things up. Mike asks me to check a tight lead just below our final survey station. It is a squeeze, and I take my helmet off and push it in front of me for much of it. Although it is tight, I can still see many potential passages, and I poke my head into all of them until I see a large room ahead. Virgin passage? I crawl hurriedly toward the opening and discover a multitude of footprints. Darn! Many others have looked at this tight hole from the other side. Oh well, at least we made a connection between the two chambers. After Mike, Marchin, and I survey this cramped passage, we head back for some hot tea and sleep.

January 18. Up for tea and breakfast and a two-hour hike back to the end of the C survey with the rope. Marchin sets to work setting bolts and dropping the pit. Mike and I turn off our headlamps, listening to the ringing of the rock hammer, and rest in the dark, waiting, excitedly, for good news from below. After some time we hear Marchin walking about and his loud laughter echoing around us. "We've been here. We already surveyed this." I rappel down and take a long look. It certainly looks familiar, this place less than half an hour from camp. How could this spot be the spectacular undiscovered abyss we had looked down on yesterday? It is disappointing, but at the same time it is useful information to help complete the map.

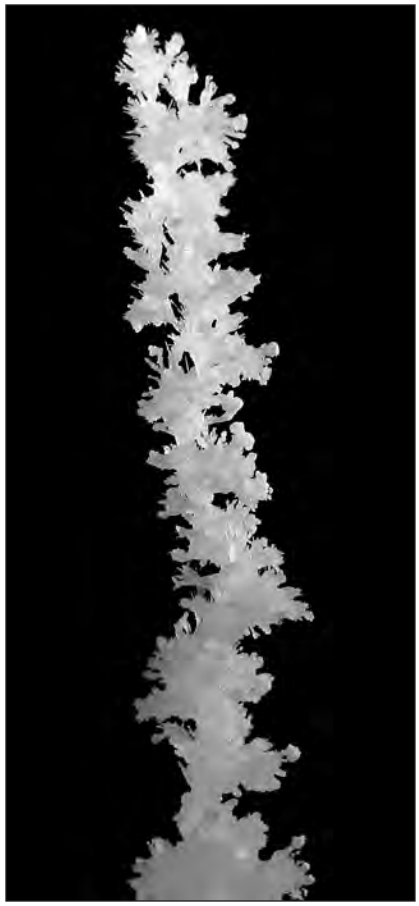
Marchin leads us to another pit that he also drops. It leads to a massive room, so large there is some debate on how to calculate its size. I spend a great deal of time scrambling over huge breakdown, setting survey points. It's a workout. Marchin inspects the room carefully, but does not find any additional passage leading out, despite the sound of water all around us.

We head back to camp. On the way, Mike and Marchin stop to pull up rope from the original drop. Mike suggests I get a head start and gives me instructions to stop at a point about 500 meters away if I am not sure about the directions. I reach the spot he designates and am absolutely, positively sure that I need to veer to the right. Everything about it is familiar; it should be, we surveyed that entire passage the day before. Mike says never to admit you're lost, so let's just say I was rechecking all the survey points from yesterday. Feeling just a little bit cocky at my quick progress toward camp, I speed up. Maybe I'll even surprise them by having dinner ready when they get there. After about forty-five minutes of hiking along, I run across a disturbing sign: a station on the D survey. I am nineteen survey stations in the wrong direction. Dang. A one-eighty and then retrace my steps just to get back to where Mike told me to wait at if I wasn't sure of my directions. Okay, let's be methodical about this. I arrive there and take a long look around. There is another passage leading out of this area, and I check that for about half an hour until I see another station not on the way. Wrong again. Back to square one. Start looking for the less obvious stuff. I finally see it. A dip, a shadow, that was the way back to camp. The survey points are making sense now, and I know I'm headed in the right direction. I won't be the first back to camp, and I sure as hell won't be making dinner. Maybe breakfast if I keep on track.

Walking alone down scores of meters of borehole passage is peaceful and pleasant. Without two macho cavers to keep up with, I can stop and carefully examine the delicate formations above, below, and all around me at my leisure. I pass CB, CA, C . . . . (We had accidentally duplicated the C survey numbers.) A couple of hours later, I see a point that I know had a rope on it for a short climb. Footprints planted on the wall are located farther up. Still, there's no rope. I am just starting to look around the area for a way to free-climb when Mike's familiar hoot reaches my ears. Marchin had pulled the rope up, thinking I was ahead of them. Mike tossed it down for me, and we finished the hike back to camp more or less together.

January 19. Mike is up at 5 a.m., packing up our cave camp. We put sleeping bags and pads into plastic bags, store the kitchen gear, and get our packs ready. Marchin leaves ahead of us, and we follow about half an hour behind. Mike sets a pace that will get us out in a reasonable time. The closer we get to the entrance, the more water we hear, and we suspect it has been raining heavily outside. The light trickles of water we descended through are now cold, steady streams pouring down on us from above, a treat while on rope. Although it makes the going more difficult, it is also an incentive to keep moving. We make it out in eight hours, but not before we stop and shower under a waterfall. With all this rain, there won't be a fire waiting for us, but at least we have clean gear.

We drag ourselves up the steep, twisting path to camp in the



Ryan Gosciejew.

downpour. Ryan and Daniel are waiting, shivering under the tarp. They hand us plates of hot spaghetti and give us a quick "welcome home." Then they run, slide, stumble, and struggle down the muddy jungle trail toward civilization, carrying their enormous packs, away from the miserable, soggy camp. If it weren't so wet, the two of them would leave clouds of dust in their wake.

Still hungry and a bit at a loss what to do with my time now that the expedition was nearly to a close, I make a dessert of rice and sugar from what supplies are left. Marchin digs trenches and bails water. Mike is in the tent, adding layers of packs, tarps, and anything else he can find to raise our sleeping bags farther off the ground. A small pond where a tent has formerly stood grows to within a few feet of our tent. I name it Lake Ryan in honor of its former occupant and set about to build a dam between it and us. I push up my soggy sleeves and begin prying up rocks, sticks, and vines from the mud, layering them in a low wall around our shelter, trying not to think about any snakes that might be hiding in the brush. Our efforts seem to work. The next morning only our feet and legs are wet, and we sleep fairly well, considering

January 20. The rain lets up, and we get up early to take advantage of it. We pack up camp. Ropes, tarps, sleeping bags, pads, kitchen, gear, and supplies must all be stored in safe containers in a cache or packed down the hill. Marchin had hoped to take some photographs inside Tres Amigos today, but the humidity has unfortunately affected his expensive camera equipment. He gathers his pack and heads toward town a few minutes ahead of us.

Our packs are ready now and very heavy and awkward. Every step down the slippery hillside must be negotiated carefully. Getting to the bottom of the hill through the mud, rocks, and vines is very difficult and dangerous, miserable and muddy. My favorite part is stumbling into a rotting banana tree and falling through it. That's right. My arms disappear into the disgusting pale brown-green mass of decaying vegetable matter and come out on the other side. Getting out of that gelatinous goo is no easy matter with a twenty-five pound pack on my back determined to push my whole body through. Imagine wrestling with a putrified head of celery the size of a maple tree and you'll have some idea of the ordeal. There's not enough rain now to wash the slime off, and the thin coat of stench dries on me quite nicely, adding to my vacation pleasure.

Up hill and down for hours. I can feel the straps of the pack scraping the skin off my shoulders, like I've seen on many of the other expedition members on this trip. Although stopping and resting sounds good, getting the gear off and on again is so time-consuming and awkward we keep going. Sometimes I bend over so the weight is positioned across my full back, which gives me a chance to get a decent breath and shift the pain to new and better locations momentarily.

Mike and I grimly endure the four-hour hike in silence, with only occasional grumbling. About a half hour outside of town, he suggests I stop at a well and clean up, because I look like hell. He missed my World Wide Wrestling match with Satan's Salad. Because he is the stronger, faster hiker, he also missed me, fifteen minutes behind him, face down in the dirt on repeated occasions, my hair being caught up, twisted, and dreadlocked by every branch I ducked under, frequent (and, I believe, intentional) strangulation attempts by conveniently placed vines, and my body and face in general being subjected to a hideous vortex of earth, water, wind, and fire ants. After washing my face and combing my hair, I ask him if he wants me to put on my pumps and a skirt as well. He wisely ignores my attempt at a scrap.

Daniel and Ryan greet us only a

Kasia Gala, Virginia, and Mike Frazier in Virginia's kitchen. *Marcin Gala.*

Cavers and hosts in Ayautla. Back row: Donna Renee, Jeff Dieterle, Mike Frazier, host family son, Marcin Gala, Paul Mozel. Front: Daniel Laos (kneeling), host Severo, Zusia Gala, hostess Virginia, Kasia Gala, family aunt, Ryan Gosciejew (kneeling).

few minutes later. They purchased cookies and sodas for us, but have consumed them out of boredom during their wait at the trailhead. They make up for it by carrying our packs the remainder of the distance into town and buying a round of *cervezas*, bless them both.

Back at Virginia's and Severo's home, Mike treats everyone to tacos for dinner. Ryan, Jeff, Paul, and Daniel party hard, like cavers will do at the end of a long trip. We all crash for the night.

The next morning I wash out my gear in the small cement-block shed next to the water barrels. I give 100 pesos to a local woman to clean the rest of our clothes. We learn there is some difficulty with local officials, and we hang around to see what the problem is. Apparently, a small number of officials are concerned we are looting the caves. We offer to let them inspect any and all of our packs, which they do. Mike and Kasia #1 do their best to cooperate with them and explain that we are only explorers and not interested in artifacts. As a whole, we are well received by the townspeople, but there is a small minority that is more suspicious with foreigners.

January 22. Mike volunteers to explore and map two small caves on local landowners' properties. It takes only a few hours, but they are interested and happy with the results of his efforts. We pack up to leave. There are many tearful goodbyes. A number of people wave and stop the easily-recognized Chinook on the way out of town. They say we are welcome in their homes any time. We look forward to returning.

Esperando en Tres Amigos

Proveniente del blog en Internet del autor, una descripción de la caminata y el campamento cerca del Sistema Tres Amigos, sobre San Bartolomé, Oaxaca. También acampó y topografió en la cueva. El artículo sobre la cueva está en el *AMCS Activities Newsletter 29*.

EXPERIENCES OF AN ENGLISH CAVE EXPLORER IN MEXICO

Peter Lord

In the summer of 1973 I arrived in Calgary, Alberta, Canada, to spend a couple of months exploring the caves of the Rockies, invited by Mike Boon, a Brit living in Canada. Imagine my surprise when I found myself in a hired car, along with Mike Boon, Joan Beckett, and John Donovan (another ex-Brit), en route to Sótano de la Joya de Salas in Tamaulipas, Mexico. We made a party stop in Austin, Texas, to add a couple of extra people, Blake Harrison and Peter Strickland, and to change the rental for Peter's Dodge Power Wagon, as in those days the route to the cave was very difficult, and even more so as we were the first visitors after the rainy season. However, while camping in the area we were hit by such a heavy storm that it appeared to be the beginning of a second Biblical flood. So much for the end of the rainy season.

We eventually arrived at the valley where the small population of Joya de Salas lives. Instead of finding an entrance close to the houses, we found a small lake and a large whirlpool. With his customary aplomb, Mike said. "Sleep tonight. Tomorrow there'll be no problem," and in the morning the area was bone-dry. That day we entered the cave, taking with us around 800 meters of rope. We reached the bottom of the Sima Terrible, where we camped.[1] I slept (?) with my vertical gear on, counting the falling drops of water, determined to be the first to climb the rope if the need arose.

The first day Mike, Peter, and Joan explored the Pasaje Inferior until its bitter end. Meanwhile, the rest of us explored the Pasaje Superior. We surveyed over 700 meters of new passage. I then continued, alone, for a further 300 meters without reaching an end. At the furthest point reached, the passage was 1.5 meters high with 1 meter of water, a very easy swim.

The second day, Blake and I went to investigate a passage below, but parallel to, the Angostura de Linda. After a drop of 15 meters, at a depth of around 300 meters, I came across a crawl, extremely low but wide. After a good while trying, I passed the short squeeze, and I found myself in a small room where I could just stand up. The passage continued as a very narrow vertical crack, but as luck would have it a boulder was jammed in the crack, dividing it in two. I struggled again for a good while, before I eventually got by. I shouted for Blake to follow, but he was unable to pass the first squeeze. We decided that I should carry on, to check if the passage continued. Almost immediately the passage became cylindrical, 0.75 meters in diameter, and this continued until a small step in the floor made the cylinder 1 meter in diameter, almost comfortable. Some 200 meters from Blake I came to a rimstone barrier that almost blocked the passage. With my helmet off I could just get my head through the gap, and to my surprise, with my light I could see . . . nothing. There was no floor, no roof, and no walls, just one big hole. I looked for a rock, there wasn't any, and so I filled my helmet with water and threw the water down the hole. I didn't hear a thing. That was the end; I had to leave it for someone else.

My carbide lamp fell into a pool and my spare electric decided not to work. I battled until I managed to ignite the acetylene. After a long odyssey, I managed to return to Blake. He, somewhat worried by my absence, had decided, while waiting, that the passage ended where he was, and that was how he reported it.[2]

The following day we left the cave with all the 800 meters of rope, most of it unused, and returned to Calgary, stopping in Austin only to leave Blake and Peter and to change vehicles. If anyone would like to continue the exploration of Sótano de la Joya de Salas, remember you need to be thin and agile. However, there is a lot of potential; you may need 800 meters of rope yet.

In December of the same year I found myself once more in Mexico. A group of people from the States was visiting Mexico to visit the "big pits," and I became a hanger-on. We went to Sótano de las Golondrinas and the Hoya de las Guaguas in San Luis Potosí, walking from Aquismón. This was the only time that I had

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Presented, in Spanish, as the After-Dinner Address at the opening of the IV Congreso Nacional Mexicano de Espeleología, held in Villahermosa from 30 January to 2 February 2009. Translated by the author. The photographs and some of the references have been added by the editor.

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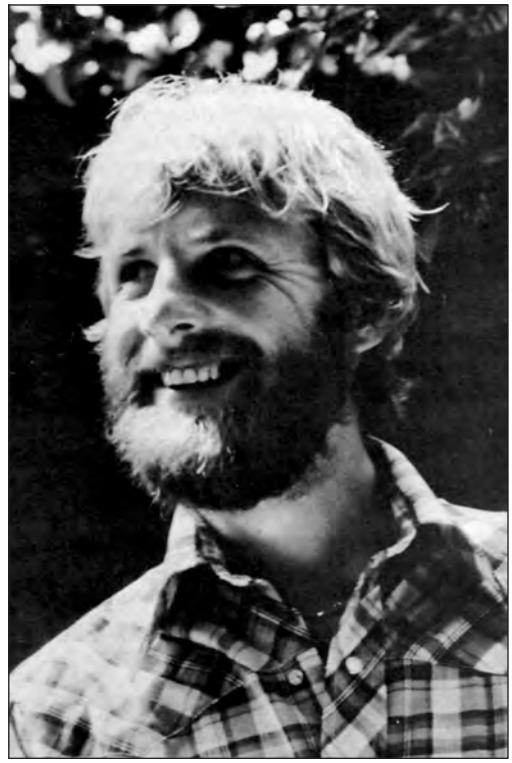
the opportunity to visit the deepest point of Golondrinas.

Afterwards, with another group, also from the States, I went to El Sótano del Barro, Querétaro. We walked from the road, like a snake, with the one piece of rope, 500 meters long, divide in coils among eight of us, taking two days. We used a new rigging point that gave a longer, 410-meter drop. The group was large, and to pass the time before my turn, I decided to walk to the other side of the pit to find a different point of view for my photos of the people rappelling and climbing the rope. Arriving at the other side, I found a narrow trail that dropped below the rim of the pit, following a ledge that brought me to a point directly in front of the rope and about 100 meters below the tie-off point, a great position for some different pictures. I was getting comfortable and set-up when I heard a noise from somewhere farther along the ledge. I was just looking in that direction when a *jabalí* came running at me, heading for out-of-here. Unfortunately I stood in the way. In an instant I luckily found a handhold, and I hung on and lifted my legs. The animal passed under me, rubbing my legs as it went. When my heart began to calm and I could breathe again, I knelt down to say a quick prayer of gratitude, and saw, way, way below, the floor. So ended my liking for photography.[3]

Meanwhile, Mike Boon had organized another of his explorations, and I found myself once again with Blake Harrison, in his VW bus, leaving Ciudad Valles on my way to San Cristóbal de las Casas, Chiapas. Arriving, we met with the rest of the crew: Mike, Joan Beckett, and Kitty Dunn from Calgary, Alberta; Sherry Dalby from Aspen, Colorado; and our young guide, Tony Mendes, a native of the town. From San Cristóbal we went to Tenejapa, finding ourselves in the middle of a war between taxi drivers and the local bus company. In Tenejapa we rented three burros to move all our equipment (a lot of rope) to a local marketplace called Yochib, below which is the entrance to the cave of the same name, a one-day walk from Tenejapa. (Now it only takes an hour by car, using the new asphalted road to Cancuc). We arrived the day of the market, and we found around three thousand people, some selling, some buying, but all drinking. When we entered the plaza we were surrounded by happily drunk men all chattering at us in some strange tongue. Tony found the *jefe*, Martin, of the local family, who rented us part of one of the four huts that were located in the plaza. (Now there are more than two hundred houses and shops, and very little plaza.)

The entrance to the cave is large and takes a river, the level of which can rise extremely quickly, as was found on this and later explorations.[4] The following day we entered the cave with the water level low, and in three hours we had surveyed more than 300 meters to reach a narrowing of the passage, where all the water of the river passed through a narrow canal and noisily fell into the depths. Blake rigged and went down the drop of almost 30 meters to find the Violent Lake. The noise and the movement of the water were overwhelming; Blake felt that there was no exit and that the lake was in fact a sump. A couple of days later, Mike, Joan, and Blake returned for another look at the sump. With a superhuman effort Mike swam the lake directly in front of the drop; he then pulled Joan over to join him in order to inspect the opposite wall. They found nothing and couldn't see anything to suggest any continuation. The end! That was it. Blake returned to Texas, Joan became very ill. and Mike, Sherry and Tony took her, and most of the gear, back to Tenejapa and a doctor.

Kitty and I had to go down the cave to de-rig the pit, so we decided to drop down to the lake in order to see and hear the "tornado" for ourselves. It was impressive, and we agreed with the others that we had arrived quickly at the end of Sumidero Yochib. Climbing the rope, some 5 meters above the floor I noticed a window in the wall. With the help of Kitty, I swung on the rope until I managed to get into the alcove. Kitty followed, and we continued for 30 meters to a small room with a trickle of water entering and draining into a pool by one wall. It had to have an exit, so I entered the pool feet first, searching under the wall until I found a place where it felt like my feet reached above water level. Turning around, I took a deep breath, dived, and came up almost immediately in a high passage heading in two directions. I went back for Kitty, and we both then followed the left-hand route until we reached the river, now amazingly quiet and calm. We followed the downstream passage, around 20 meters wide, for some 100 meters, passing from large rock to large rock, finally using a huge tree trunk that formed a solid bridge, wedged between the last two rocks, over the river, now once again noisy and turbulent. From this point we could see, but not safely follow, the river continuing its restless way down a passage more than 15 meters high. Now Violent Lake wasn't the end any longer. The following year,



The author in the late seventies.
From reference 6.

when a team returned to continue the exploration, the enormous tree bridge had disappeared during the seasonal floods.

At the end of 1975, I returned to Mexico for a job in Mexico City. Now it was necessary to find a project to occupy the weekends. In Texas, Peter Sprouse suggested I read one of the AMCS publications in which Nevin Davis wrote of two trips that he had made to the area around the town of Cuetzalan, Puebla, in 1972 and 1973.[5] His group had partially explored and surveyed various caves, showing an area with great potential. It was in 1976 that I arrived on one of the clearest days that I saw in all my visits to the Cuetzalan area. I saw the huge entrance to Coahuatichan, which really fired up my imagination—now I had found my project. That same weekend we walked with Don Rafael Arellano, who lived close to the entrance of Octimaxal, and in a route of some 7 kilometers he showed me twenty-five entrances, the exploration of which occupied our small group for more than two years.[6] The first entrance that we explored was that of Chichicazapan. The trip was tremendous, the small entrance crack gradually increasing in size until we arrived at a point where the stream disappeared into a large, dark hole. There was no floor, no roof, and no walls, just one big hole. (Where have I heard that before?) This time there were no access difficulties, as in Joya de Salas, only equipment requirements. We, now including Mike Boon, eventually managed to borrow a 200-meter rope, and we worried that it wasn't going to reach the bottom. False hopes—it was only 30 meters deep. The canyon below, however, was spectacular; we followed it downstream for about a kilometer and a half before the river entered an area of boulders, where we turned back. Surveying back, Mike called a rest where the river made an obvious turn and left the canyon. While the others rested, I decided to follow the line of the canyon. I climbed up over rocks and very dry sand, and after passing a constriction between the wall and a huge fallen rock, I entered a huge chamber, around 60 meters wide. I ran in one direction without reaching an end. I then ran in the opposite direction, again without reaching an end. I returned to the group, thinking that they would be concerned with my absence. Not so, they were sound asleep. I woke Mike and told him, "I've just found a huge new section of the cave," and I asked him if he wanted to have a look. He replied, "Maybe some other time." The following trip, without Mike, took us, among other things, to an area where the passage floor, some 30 meters wide, was covered with selenite needles, an extremely pretty place.

From the large chamber, another group found the Bochstiegel Connection that took them to a large unknown river. We thought that this had to be the river entering the Sumidero de Atepolehuit de San Miguel, explored by Nevin to a 15-centimeter-wide crack. Mike Boon, Jim Rodemaker, and I went to the limit of exploration in San Miguel and found a section of the crack that was 25 centimeters wide, and we got through. We continued down a number of small drops until we ran out of rope. The following day we were back, descending the small drop that had stopped us and continuing in a large passage for another kilometer and a half, for a total of 3.6 kilometers. We stopped for a rest in front of a huge boulder fall. Eventually I found a way through, and together we followed a section of cave that was large but unstable and dangerous, arriving eventually at the Mirador, where we could see the river way below us, at the bottom of a steep slope of very large loose boulders.

As the route was now long and tiring, we decided that the next trip should be a camping trip. I was to supply the equipment and Mike Boon the provisions. We reached the Mirador, and after some difficulty getting down the boulder slope Mike and I continued in a large passage until we reached a junction with another river, entering from the right. The water from both rivers disappeared down a 60-centimeter-wide crack. Putting on my wetsuit, I passed the crack to face, almost immediately, a narrow 5-meter drop, landing in a major whirlpool. That was the end for us. The smell of sewage from the river inlet led us to believe that the water came from Zoquiapan, and, due to the volume, that if must also include the water from Coahuatichan, Atichayan, and Chichicazapan. On our way back we camped, and Mike pulled out the provisions: *aguardiente*, chocolate, and sardines for dinner, *aguardiente*, chocolate, and sardines for breakfast, and you can imagine the menu for the snack on the way out. Even today I don't eat sardines!

Next Mike and I began the exploration of the Resistol entrance, named after the tree in the entrance, whose sap is used to make this well known Mexican glue. This entrance was the key, eventually connecting Atichayan Norte and Sur to Chichicazapan, the water from Coahuatichan (the river that Bochstiegel had found), and some years later Sumidero de Atepolehuit de San Miguel.[7]

I changed my job, and it sent me to Tabasco to work. I had no fellow cavers to explore with, but from the trips that I had to make through the sierra for my job, I could see the potential. In 1980, after a work accident, I was transferred to Edmonton, Alberta, too close to Mike Boon, who grabbed me for his local projects. While living in Canada with my wife Violeta (a tropical flower), we visited her family in Tabasco. During this visit, we escaped, and with Leonor and Rolando, friends of Violeta's, we visited the tourist area of Agua Blanca, Mpo. Macuspana. I had heard that there was a river emerging from a cave there, and I managed to persuade Rolando to accompany me if there was anything to explore. Arriving at the site, a local guided us to the two entrances, one with water and one without. Straight to the dry one! Rolando and I entered and found a large room with two pools at the end, the river on its way to the wet entrance. This was all that was known, according to the locals. Not satisfied, I investigated every nook and cranny on the way out. Soon, behind a rock, I found a crack some 2 meters off the ground. I climbed up and found a crawlway

leading on, which we followed for over 200 meters, and all the way poor Rolando, in his 'caving' clothes, complained and taught me new swear words in Spanish. After the crawl, the cave opened up, without signs of exploration, and obviously continued, but my group rebelled, and we turned back.

In 1986 Violeta and I came back to live in Tabasco. I took all the opportunities I could to explore, taking with me anybody who I could persuade. I lost a lot of possible friends that way. We found many entrances, and most showed sign of recent exploration, but by whom? At the invitation of my good friend Berta Ferrer, I gave a series of talks in the Museum Carlos Pellicer Cámara. At one of these I found the Scouts, among them Roberto and Ramiro Porter and Víctor Dorantes. They were the guilty ones. One of the first places we explored together was the main resurgence of the Agua Blanca river, where with their help and the help of a drought, we joined the two entrances together and entered a second level. At this time I heard about a group of *gringo* explorers, and eventually I ran into Jim Pisarowicz and his group, who were part of the Tabasco Project, under the auspices of the AMCS. With them we passed Rolando's Crawl in the Agua Blanca resurgence cave and explored up a large river passage to a large collapse entrance in the middle of the tropical forest. The cave continued beyond this entrance to a lake. Swimming across this lake, we reached a muddy crack that we followed up an equally muddy climb, to be immediately faced by a drop. We descended the drop, of 7 meters, to a low crawl, floored with river cobbles. This was followed until it became too tight. However, some 2 meters above the tie-off point for the drop, we could see a large passage, but to get into it we would have to cross the mouth of the drop. It didn't seem too difficult, but definitely required protection. When we returned via the new entrance with equipment, we could not reach the crack due to meter-high waves on the surface of the underground lake. Later we had a severe drought followed by state-wide forest fires, which unfortunately passed through the area and burnt all our route markers and, as this was prior to the famous GPS, we lost the entrance and the interest to continue. The lead is still there.[8]

In the area of Aqua Blanca we have explored, together with various groups, a number of other caves, but one that stands out is Benemérito, which I found with Pedro García Conde, a great Mexican explorer who now lives in Canada. This we explored during a drought, and it required over 2 kilometers of swimming. The big lead in this cave is a large, crystal-clear downstream sump, close to the entrance.

The really famous Tabascan cave at an international level is the Cueva de Villa Luz, Tapijulapa, Mpo. Tacotalpa. The exploration here was almost entirely carried out by the AMCS group led by Jim, mainly because of the special equipment and special care required to protect against the poisonous gases that abound in this cave. This site has still many secrets to give up, both cave-wise and scientifically, but everything associated with it requires special attention and great care.[9]

The most recent exploration in Tabasco of note has been that of the Cueva de San Felipe, Puxcatán, Mpo. Tacotalpa. The front section of this cave, well known in the region by the local Indians, has traditionally been used for their ceremonies to pray for rain. In the back section it was said that there were many skeletons of local people who had died during the Spanish Flu epidemic of 1918. We received an invitation to explore the cave, and a group from the Sociedad Espeleológica de Tabasco went to the cave. Yes, there were many skeletons, but to our surprise all the skulls were deformed, representing Maya skeletons, much older than was thought. Then, together with Pedro García Conde, I managed to pass a squeeze at the end of the known cave to discover a completely untouched funeral chamber. This site was reported to the Instituto Nacional de Arqueología y Historia (INAH) and has now been excavated by their experts. We are awaiting the results of their investigations.

Tabascan caves do not rank in the international or national lists of the longest or deepest, and never will. Tabasco does, however, have many unexplored caves, many with archaeological or other scientific interest. It also has other big advantages. In general the caves are relatively easy to reach, and they are usually technically easy to explore.

As it says in a famous local song, "Vamos a Tabasco, que Tabasco es un Eden." Let me show you; I'll still be here.

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[1] A map of the cave based on Canadian surveys before this trip appeared in *The Canadian Caver*, 4(1)5, 1972. This map is reproduced in Orion Knox's article in this issue.

[2] *Association for Mexican Cave Studies Newsletter*, 4(3)97–98, December 1973.

[3] A map of El Sótano del Barro appears in *AMCS Activities Newsletter* 9, following page 82. Trip reports on the discovery and first descent appear in *Association for Mexican Cave Studies Newsletter* 3(5)92–95 and 106–112, July 1972.

[4] *Yochib: The River Cave* by C. William Steele. Cave Books, St. Louis, 1985.

[5] *Association for Mexican Cave Studies Newsletter,* 4(5–6)153–184, April

The author during the 2009 Tabasco Project (see article in this issue). *Tone Garot.*

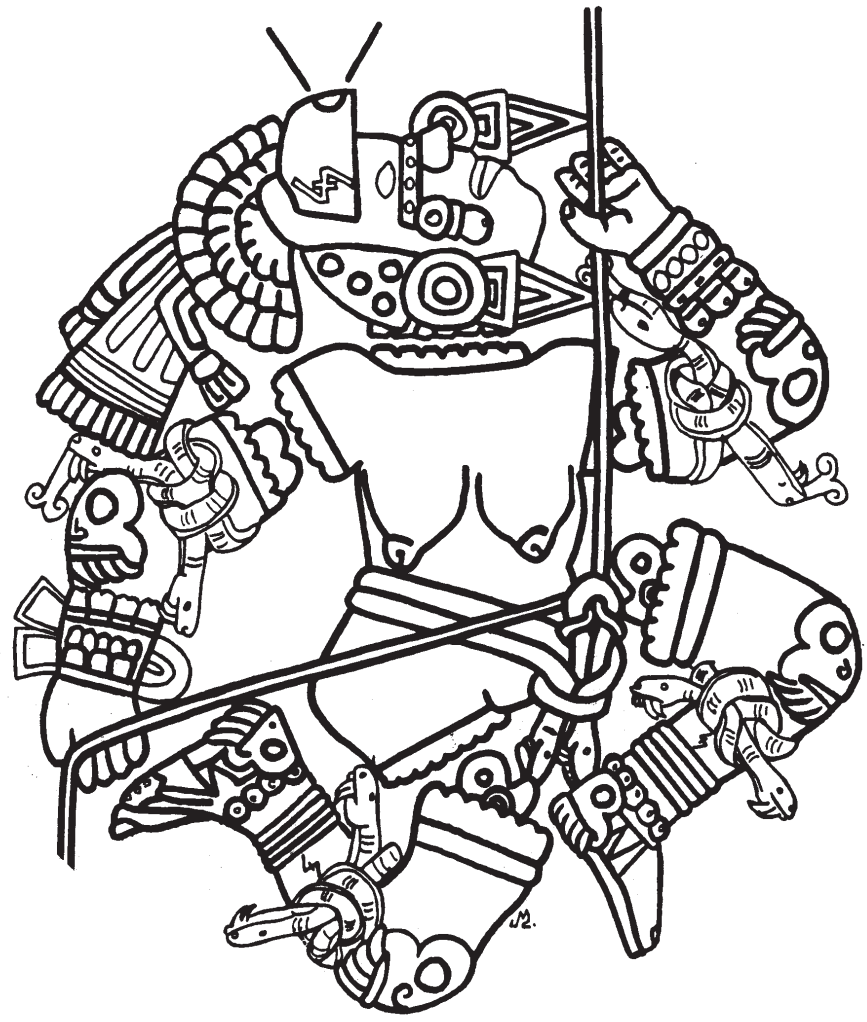
1974.
[6]*Caving International* 2, pages 13–20 and 25–26, January 1979.
[7]*International Caver* 12, pages 17–25, 1994.
[8]See *AMCS Activities Newsletter* 28, pages 27–29, 2005.
[9]See *AMCS Activities Newsletter* 24, pages 48–54, 2001.

Experiencias de un explorador ingles en México

Un espeleólogo, originario de Inglaterra, radicado en Villahermosa, Tabasco, describe sus más de treinta años de exploraciones en México. Su primer viaje fue al Sótano de la Joya de Salas, Tamaulipas, en 1973. Otras cuevas mencionadas incluyen El Sótano del Barro, Querétaro, Sumidero Yochib, Chiapas, y varias cuevas en la zona de Cuetzalan, Puebla, y Tabasco.

Las cuevas de Tabasco no figuran en las listas nacionales o internacionales entre las más largas o profundas, pues nunca lo serán. Como sea, Tabasco tiene muchas cuevas inexploradas y muchas otras de gran interés científico.

"Vamos a Tabasco, que Tabasco es un Edén." Deja que él te lo muestre; él continuará estando allí.



Drawing by José Montiel Castro, from front cover of *Base Draco* number 10, 1994.

THE DESERT CENOTE

Peter Sprouse

The Mexican state of Chihuahua is not known for its deep pits. So when Antonio Holguin, tourism director for the *municipio* of Jiménez, Chihuahua, posted in early 2008 on the Iztaxochitla cavers forum about a deep pit in his area, it caught my interest. El Hundido was said to be a "desert cenote" that dropped 185 meters to a large lake. I had been caving in Chihuahua, Mexico's largest state, a number of times over the years, and observed that its caves were always unusual in various ways. Caver Carlos Lazcano visited the site and was lowered in via a winch-and-bucket system contrived by the ranch owner, who had set up machinery to draw water from the pit. I made plans with Carlos to map the cave and search for aquatic fauna, though when the trip came Carlos could not make it.

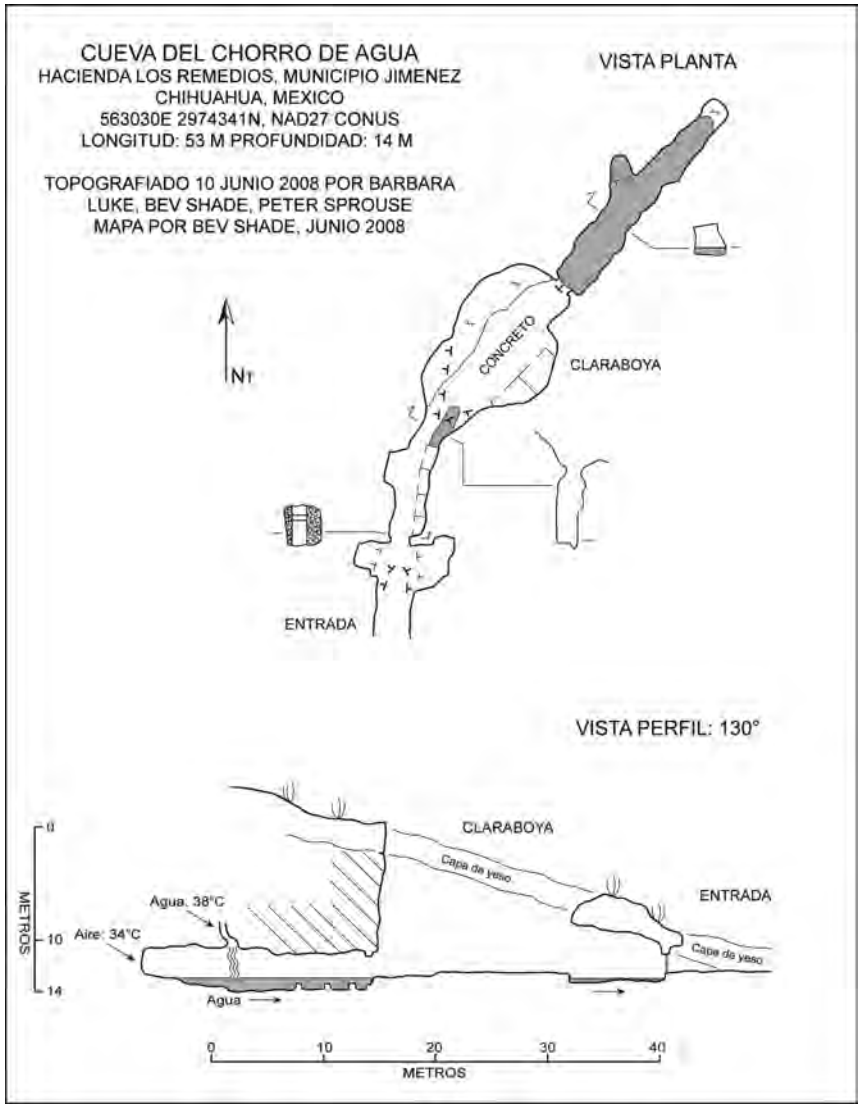
Eight of us departed Austin on 8 June 2008 in a pair of trusty 4Runners. Geoff Hoese was the other driver; our vehicles had already crisscrossed much of Mexico together this year. Bev Shade was along, continuing her months-long Mexican caving adventures of 2008. Barbara Luke joined us, as she has on a regular basis for many years. The brothers Paul and Stephen Bryant (young, capable cavers from San Antonio), John Middleton from Austin, and Alejandro Benavente, who had started caving in his native San Luis Potosí, rounded out our crew. Since there was no direct route to Chihuahua for us, we selected a southern route through Saltillo for the drive down. The next day, after passing Saltillo, we stopped at the spectacular petroglyph site of San Rafael, where a band of sandstone extending up each side of a gap in a ridge contained hundreds of glyphs. Crossing from Coahuila into Durango, we then visited Ojuela, a famous tourist site with a long, hanging footbridge leading into a silver mine. The tour of the mine features a mummified mule that had fallen down a shaft; mules had been used to haul ore. The mule's hoofs were long and curly, and we wondered if this happened before or after death.

We had arrangements to meet Antonio Holguin on 10 June, but a mix-up in communications meant we were to have some extra time in southeastern Chihuahua. We visited a quiet tourist site near Escalón, the Hacienda los Remedios, which has a hot-spring cave. Cueva del Chorro de Agua is a partially excavated cave with a shower-head spewing water at 38 degrees C. The inundated floor has been carved into pools for soaking, and at some time in the past the water had been channeled into further soaking booths outside of the cave, relics of the mineral-water craze a century before. There was not much to the cave, but we mapped it before hiking up the mountain above, where there is a pictograph cave. Cueva de Cerro de los Remedios had fine panels of Chihuahuan desert rock art, but a bee hive in the shelter prevented extensive examination. That afternoon we drove northwest to Salaices to visit Cueva del Diablo, an overused cave popular with spray-painting spelunkers. I knew that a partial map of the cave had been made by Bill Elliott in 1972, but I did not have a copy with me. As we drove the highway toward the cave, I made futile attempts to download the map via a poor Internet connection on my laptop. Since we had the afternoon to use up, we decided to start a new survey of the cave. We split up into three survey teams and began mapping. Considering the level of disturbance in the cave, it was not surprising that we saw none of Elliott's survey stations. Spray paint and trash were everywhere, and the smell of diesel from torches permeated the air. Still, the cave was large, and we left quite a bit of it unsurveyed.

The next day we met up with Antonio, who introduced us to the *presidente municipal* and the owner of Rancho el Hundido. The rancher joined us for the long drive out to his property. We left the paved road at Escalón and drove east toward Coahuila along a railroad track. The desert landscape was occasionally disrupted by melon farms. Off to the south we could see the legendary Zona del Silencio, popular with paranormalists. A U.S. Air Force missile launched in the western United States in 1973 had gone off course and crashed there, leading to stories about magnetic ore bodies and a "silent zone" where radios would not work. Add a dose of Carlos Castañeda and you have nice mix of myths that never end. Turning north from the railroad, we headed up a wide desert valley flanked on the left by the Sierra el Diablo. El

petersprouse@yahoo.com

Reprinted, with one additional map, from *NSS News*, November 2008.



Bev Shade on the surface at El Hundido. *Peter Sprouse*.

Hundido is situated on the foothills leading up to the mountain range. I had been caving in the northern deserts for decades, yet surprises like this can still crop up. Pick any remote limestone range on the map and head out there, and something is liable to be waiting for you. I set aside my musings as we entered the Rancho el Hundido. We drove through an abandoned field below a mesa that led up to the mountains looming to the west. Old furrows and lengths of irrigation pipe were what remained of attempts to eke produce out of the dusty desert. A short climb up onto the mesa led to the ranch house, which has an expansive view across the desert to the east, flat as the ancient Tethys Sea that once existed there. The famous desert springs of Cuatro Ciénegas lay 185 kilometers away, but what is in between is largely a mystery to me.

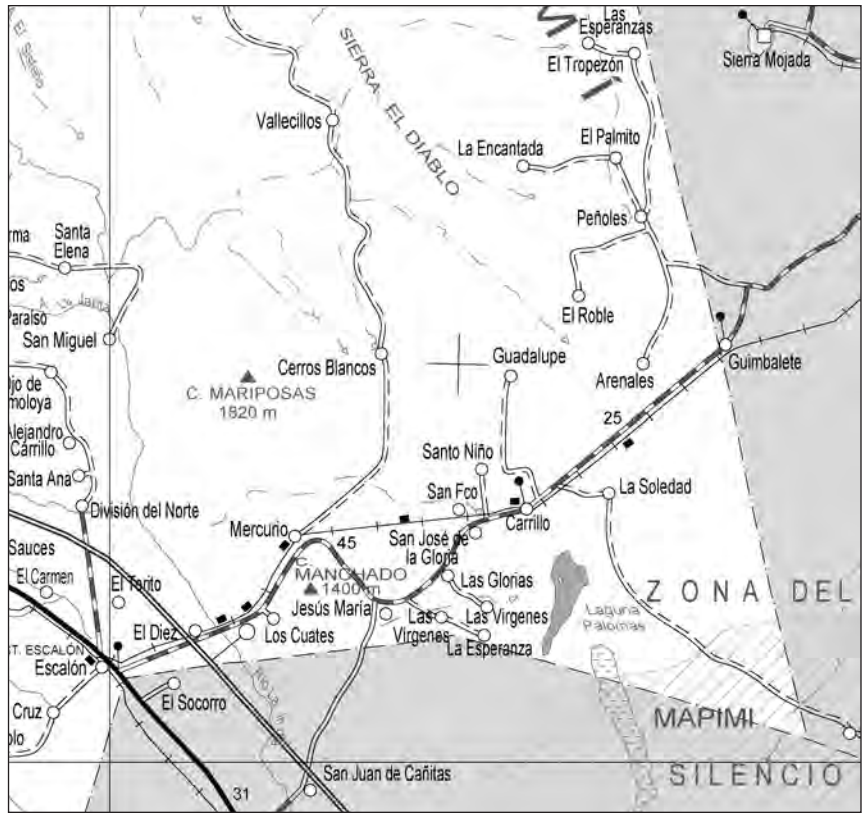
Nice as the view was, our interest was to the west, where we walked over to a windmill and the conglomeration of steel that had been erected over the pit. The entrance is situated on a flat-topped buttress that is bounded by shallow canyons coming down from the mountains. Bare limestone leads up to the edge of the pit's entrance, 20 by 25 meters across. On the north side there is a series of ledges as the pit drops through various flat beds of limestone, narrowing the pit toward the south wall, where it is a sheer drop to the bottom. The rancher had built a platform over the pit to create a free drop down which to hang well pipe. Sections of steel pipe, perhaps 40 centimeters in diameter, had been welded in the shape of a T. Where they intersect, there is a large diesel engine that operates a winch. Two pipes hang down from the platform all the way to the bottom of the pit. From the entrance, piping leads across the surface back down to the old farm fields we'd passed. Standing on the platform, we could look down the pit and see the sky reflected off the water far below. Next to us was the bucket, or *capsula* as they call it, which is used

Bev Shade and Peter Sprouse rigging on the Crescent Ledge, as Barbara Luke descends to it. *Geoff Hoese*.

to lower people to the bottom. It was an open oil drum, with a roof over it like a Vietnamese hat. This hangs from a pulley on a short boom, like a ship's lifeboat. Cavers from Saltillo, Coahuila, had rigged off of this a few months before to get a free drop all the way to the bottom.

Our methods would be different. We wanted to make a detailed map of the pit, which would not be possible hanging in the middle of it next to a steel pipe, so our survey team would make its way down the wall using rebelays. That first afternoon we mapped the entrance to the cave while a rigging team started in. Cave swallows constantly flew in and out. We disturbed an owl that silently glided from ledge to ledge as we worked. Fortunately we did not disturb the bees whose hive hung on the south wall of the pit. As evening came, bats started flying from the depths. We tried to catch one to identify it, but were unable to. The bats came in two distinct flights, which seemed to represent two species of different size. As it became dark, we set up our tents and broke out the cooking gear, enjoying the silence of the desert, unmarred by the sound of any aircraft. But far above we saw the twin spots of the space station and a shuttle, one chasing the other from west to east around the planet. Then it was off to bed, for the next day would be a long one.

We continued as before, a rigging team followed by the surveyors. As sketcher, I came last, which involved a fair amount of waiting on ledges. The sound of the hammer drill echoing up the pit indicated steady progress. The first short drop of about 15 meters lands on a broad ledge that forms a crescent around the north and west sides of the pit. By following this around to the west, we were able to get under the dripline to where the pit fell away, a good place for the next bolt. I stretched on this ledge, talking occasionally with my crew below or with those who remained on the surface, who had a good view of the proceedings. At length it was my turn to descend, past a rebelay and to the next ledge. Here the decision had been made to traverse the rest of the west wall to get to the south wall of the pit. The north wall was cutting way back below the *garganta* or pit's throat, and we would have soon lost any rebelay opportunities on that side. As I landed on the ledge I could see Geoff and Alex, who had mapped several stations along this traverse, which curved around to the left via two bolted traverse lines to the next pitch. Above the traverse was a broad guano slope up to an alcove that they'd covered with a spray shot. The arc of the traverse along the west side of the pit resembled a wagon wheel, with the hub represented by the pipe hanging free in space 7 meters in front of us. The traverse was problematic, as it was



hard to avoid dropping material on the riggers below, so we waited for the clear signal to proceed. The rappel down the south wall was broken by two more rebelays, landing us on a smaller ledge. Three of us could huddle in a small alcove, taking care that the steep guano slope didn't slide us over the edge of the next pitch. By this time we were nearly 70 meters down, with still enough surface light that we didn't need headlamps. We knew that soon the walls would leave us as they opened into the lake room, sucking away the light. Already we could not see all parts of the pit's wall, as some areas curved behind corners, leaving inevitable dashed lines on the plan.

When my turn came to descend, I dropped over the sloping guano ledge onto a sheer wall, passing two bolts to join Geoff at a rubble-floored ledge in the form of a slot that curves as a chute into the main pit. He had managed to get off rope here, precariously spanning the chute next to a hardhat fallen in from far above. He was resting, trying to let an upset stomach settle. I empathized, I wasn't feeling so great either, and waiting at rebelays and on narrow ledges all day takes its toll. But the last rebelay was just below us, and we were anxious to get to the bottom. When I reached this bolt, I could see the rope go free below me in a final pitch of 54 meters, with a knot to cross partway down. Almost everything was black around me, save the well pipe, and around the bottom of it I could see the caving team milling about on another metal structure.

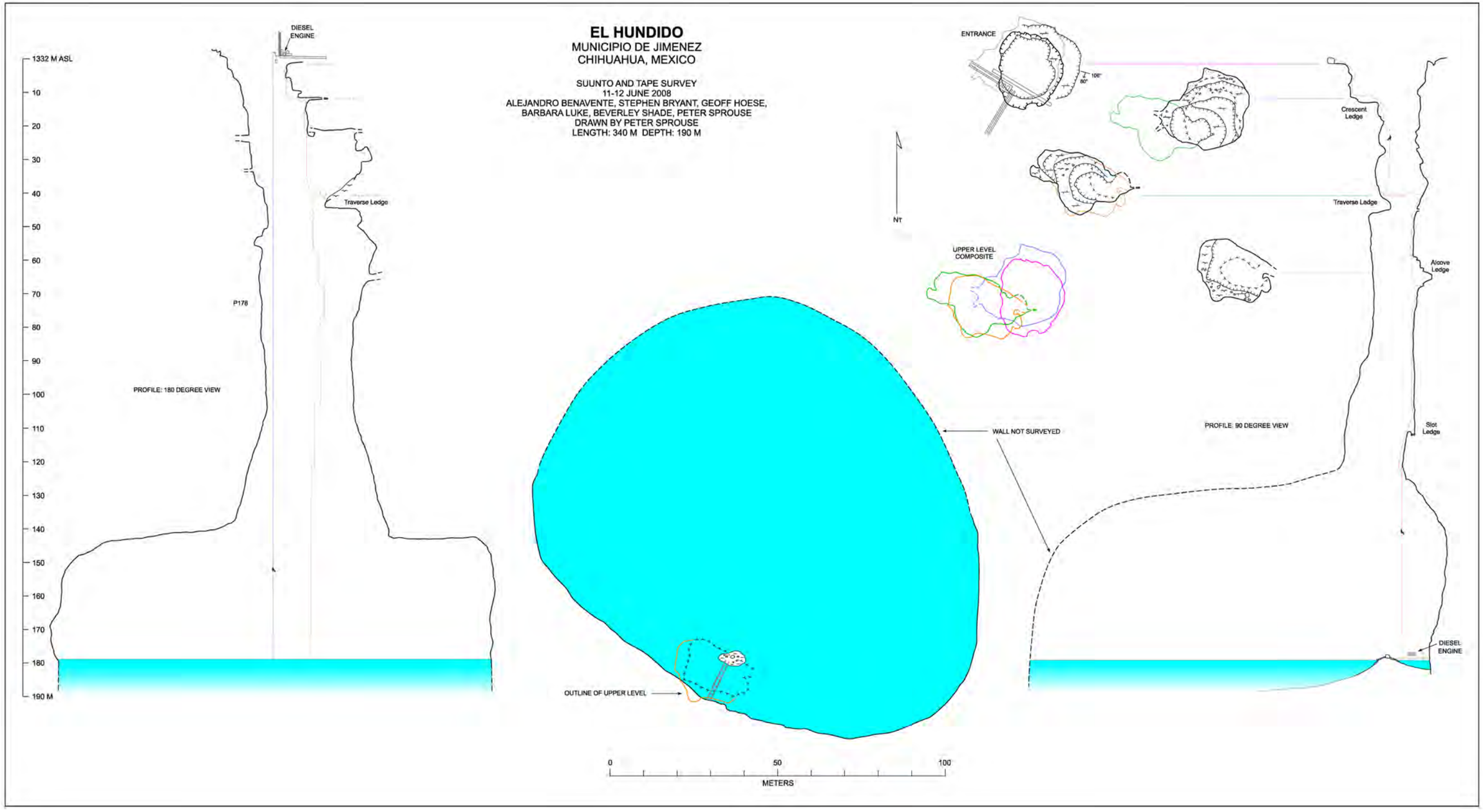
Alex Benavente surveying across the Traverse Ledge. *Geoff Hoese*.

The rope landed in the water a few meters from a metal-pipe bridge that connects a small island, surrounded by a vast lake, to the south wall of the pit. The rope had been tied off to the bridge for an easy pull-over that kept you dry. On the metal bridge was another large diesel engine, intended to pump water up out of the pit. A few steps balancing on the bridge gets you to the island, which is 10 meters across and chock full of junk: an oil drum, welding tanks, and lengths of pipe and structural steel. The Cummins turbo-diesel had proved to be the only shelter from the rains of small rocks that came down as we descended. Only the south wall is close to the island, and the walls recede into near darkness in both directions, with only a faint reflection back from distant walls at the other three compass points. Now that all were down, we could proceed with the survey of the cave. Paul and Stephen had been searching the bottom for cave fauna, but found only surface life.

View down the pit, with the *capsula* at the right and the reflection of the entrance in the lake at the bottom. *Alejandro Benavente.*

Nothing swam in the water but giant belostomatid water bugs, 7 centimeters long with jaws that inflict a painful bite. The water was milky with hydrogen sulfide clouds, and a rotting owl carcass added to the stench. Most everyone was equipped with wetsuits and flotation, but no one was enthused about entering that water. I handed the survey book to Bev and changed into my wetsuit. Geoff loaned me his air mattress, and we tied together two survey tapes to get an 80-meter length. We started doing spray shots; these got progressively longer as I did a counterclockwise rotation around the lake wall, starting to the southeast, to set stations, read the tape, and provide a target for the compass. The ceiling was about 30 meters over my head, vaguely discernible, as were the far walls. The lake was pure blackness as I looked across it, and milky blue as I looked down with an underwater hand lamp. About 20 centimeters below the surface was a white cloud of hydrogen sulfide or related bacteria, and shining my submerged light across it revealed elaborate curling shapes reminiscent of flying above clouds in an airplane. The water itself was not unpleasant after I'd left the area directly below the entrance, and I could not see any evidence of diesel fuel on the water surface. The water was cool, unlike the hot-spring cave we'd been in two days before. From time to time a giant water bug would paddle up through the cloud bank, looking for food. Besides me, the only thing I could see for them to feed on was a few floating bat carcasses. As I paddled around with my chest on the air mattress but the rest of my body in the water, I was very glad that I had a wetsuit on. Belostomatids inject digestive fluids into their prey, then suck out the liquefied flesh. A common name for them is toe-biters, according to Wikipedia.

Pulling the survey tape taut became more and more difficult, as there was nothing to stand on and only fingernail holds on the walls. As the length of tape grew longer, it


EL HUNDIDO
MUNICIPIO DE JIMENEZ
CHIHUAHUA, MEXICO
SUUNTO AND TAPE SURVEY
11-12 JUNE 2008
ALEJANDRO BENAVENTE, STEPHEN BRYANT, GEOFF HOESE,
BARBARA LUKE, BEVERLEY SHADE, PETER SPROUSE
DRAWN BY PETER SPROUSE
LENGTH: 340 M DEPTH: 190 M
1332 M ASL
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190 M
DIESEL ENGINE
Traverse Ledge
P178
PROFILE: 180 DEGREE VIEW
NT
ENTRANCE
108°
80°
Crescent Ledge
Traverse Ledge
Alcove Ledge
UPPER LEVEL COMPOSITE
WALL NOT SURVEYED
PROFILE: 90 DEGREE VIEW
Slot Ledge
DIESEL ENGINE
OUTLINE OF UPPER LEVEL
0
50
100
METERS

Paul Bryant starts over the edge of Alcove Ledge. *Stephen Bryant.*

took more pull to raise it out of the water, and I was constantly being pulled from my station. For awhile I would pull more tape to me, and with a carabiner weighting the end of the tape I would plumb the water depth, measuring 5, 8, and then running out of tape without touching bottom at 12 meters. When I reached to east side of the lake, I'd run out my 80 meter tape, and I could survey that way no more. I looked across the lake to the west wall, a vague glow in the distance; the north wall I would have to forego. I could see what looked like a rock jutting out from the west wall, so I pushed off toward it, hoping to set a station out of the water. Crossing the lake, I had to keep aiming to starboard, as the weight of the survey tape wanted to pull me back toward the island, where Stephen stood at a boulder in the middle, holding on tightly and shining his headlamp across the lake to me like a lighthouse. As I swam toward the boulder I realized that it was not on the far wall, but it was something floating in the water. It came into resolution and it was an oil drum, labeled "Mobil." I passed it on my starboard side, so it wouldn't tangle my tape, and continued on toward the far wall. There was nothing to orient me in the middle of the lake save the pinpoint of Stephen's light, and the dim glow of the wall ahead of me never seemed to get any closer. Having so little to use for points of reference is an unusual feeling, like scuba diving at night, or what it must be like on a space-walk gone bad. The size of the place hit me when I looked back and the oil drum was no longer visible. Finally I could start to see detail on the west wall, and looked to the north to try to assess what I'd missed. I could see the north wall the whole time I'd been swimming, but again it was a featureless glow. Using the vague impressions of perspective I'd gained during my paddle, I estimated that I hadn't come within 40 meters of the north wall. Much as I wanted to place to survey stations over there, it wasn't going to happen that day.

On the west wall I set another station at the limit of the 80 meter tape, and then we made progressively shorter shots as I neared the island. Another depth sounding showed the water to be 8.5 meters deep, though the rancher told us that the Saltillo cavers had measured a depth of 40 meters from a raft they had taken in. Perhaps some divers will explore this lake some day and see if there are any submerged passages continuing on. I beached on the island after an hour of swimming.

Most of the crew had already started up, and as I changed out of my wetsuit, Stephen swung away from the steel bridge to begin his climb. Bev and I huddled under the engine block while the occasional rock fell, though when it came time to climb all you could do was hope your on-rope profile was small. I took a last look around the island for any of our junk that might have been left among all the other junk, then swung out over the water. I climbed a few meters, then coiled up the 20 or so meters of rope that lay in the pool to preclude any snagging. It was past sunset as I climbed, with the well pipe 5 meters away my only companion. I passed the knot and the lowest bolt, and at the Slot Ledge I laboriously hauled up the wet coil, sweating out much of my body moisture in the process. I was glad I'd stashed a water bottle at the Traverse Ledge on the way down, and hoped the others had not drained it. At the ledge with the sloping alcove I caught up with Bev

Bellastomatids collected from the lake at the bottom of El Hundido. *Peter Sprouse.*

Stephen Bryant starts the long climb out. *Peter Sprouse.*

and Stephen for the final de-rig pass off, then they took off for the surface.

At the Traverse Ledge, I did the reverse of what the riggers must have done, except that I didn't have to carry the drill and bolt gear across it: de-rig from the bolt and tiptoe across the sloping guano ledge toward the next anchor, hoping you don't have to take a fall onto your ascender, which is something you never want to do. I reached my water bottle at the bottom of the next pitch and drank my fill. Bev was waiting for me at the Crescent Ledge just below the entrance. We left the entrance rope in place and supremely enjoyed cold Modelos under the stars. The next day we grabbed the entrance rope, loaded gear into the trucks, and headed north for a tour of the giant crystal cave in the Naica mines.

Our survey of El Hundido showed the depth of the cave to be at least 190 meters, with more depth likely if the bottom of the lake were to be mapped. The free-hang drop from the bucket boom we calculated to be 180 meters, but considering the height of this boom above the edge of the pit itself, the drop should be considered to be 178 meters to the water, which is about a meter deep at that point. This makes El Hundido the deepest pit in northern Mexico; you'd have to travel 500 kilometers southeast to reach deeper ones. It certainly contained the biggest lake I'd seen a cave, 140 meters across. There are longer swims one can take underground, such as in Honey Creek Cave, but those are in conduit-type passages. The lake may represent the local water table, and the presence of hydrogen sulfide in the water suggests a hypogenic rather than epigenic (surface water) origin for the cave. There are strange, anomalous things in the Chihuahuan desert, and truth can be stranger than fiction.

El Cenote del Desierto

El Hundido es un tiro profundo que cuenta con agua en el fondo en el Municipio de Jiménez, en el sureste de Chihuahua. Está equipado con maquinaria para extraer agua de él, y fue hasta 2008 que espeleólogos se enteraron de su existencia. La distancia al agua es de 178 metros, y el lago fue sondeado a 12 metros de profundidad durante la topografía de la cueva. Espeleólogos de Saltillo han mencionado que en otras zonas el agua alcanza profundidades de 40 metros. Es el tiro vertical abierto a la superficie más profundo en el norte de México.

MEXPÉ: TWENTY-TWO YEARS AND COUNTING

Chris Chénier

In December 1987 and January 1988, a group of Société québécoise de spéléologie (SQS) cavers set out to explore a previously unvisited karst area in the Mexican Sierra Negra. This mountain chain, composed mostly of limestone of Early Cretaceous origins, is part of the Sierra Madre del Sur and is located between the Sierra Zongolica and the Sierra Mazateca in the southeastern corner of Puebla, very close to the states of Veracruz and Oaxaca. This general area of Mexico was already well known for its cave potential, as it is located some 20 kilometers north of Sistema Huautla, then the deepest cave in Mexico, as well as several other deep cave systems. The exact location of the expedition was chosen because of a huge sinkhole some 1.5 kilometers long that jumped to the eye on topographic maps.

It turned out that this sinkhole was not even bottomed during the first month-long expedition, partly due to its remoteness, but also because countless smaller sinkholes and caves were discovered on the way, keeping everyone busy and satisfied. Not being able to fulfill all the objectives of an expedition because of other discoveries being made has been a recurring situation ever since.

The study area is situated between about 300 meters and 3200 meters in elevation, with the focus in the 1000-meter to 2200-meter range. Precipitation is over 2500 millimeters per year, and the mean temperatures are around 18 to 22°C. Most of the rain falls during the summer and fall rainy season. Vegetation varies greatly with elevation, from tropical jungle to pine forests. Agriculture is present at all elevations under about 2100 meters and on slopes up to about 45 degrees. Indeed, the rare flatter lands being reserved for grazing, the communities survive by growing corn for consumption and coffee for consumption and export wherever they can. This type of farming leads to excessive erosion and deforestation, an obviously unsustainable business model for the rapidly growing local population.

After that first expedition, several cavers where hooked, and nothing would have stopped them from returning year after year for more discoveries and adventures. Thus a series of expeditions known as Mexpé began.

Base camp for Mexpé I (1987–88) was right in the center of the village of La Cumbre, located three hours by mule path from the nearest road, which ended in Tlacotepec de Porfirio Díaz. Villagers were quick to show us their "sótano": a steep-sided sinkhole with an apparent cave at its bottom, just outside the village. The bottom of this sinkhole contains a 220-meter free drop that eventually leads to a sump after a series of other large free drops: 122 meters, 105 meters, and 70 meters. Within a few days, the –694-meter Sótano de Los Planos was bottomed. Not bad for a first cave in the sierra.

Next was a much smaller sinkhole near the trail to Los Planos. After a few small drops, there's a large one in which a rock was heard hitting bottom after some five seconds. The 95-meter rope that was on hand on that day was not enough, but the bottom could be seen, or so they thought. The next day a 160-meter of rope was brought in. The first person down made it to a ledge, after a small pendulum; he was out of rope. As he waited there for more, he decided to throw another rock—eight seconds! The remaining rope was rigged, but it wasn't enough. On the third day, the team finally made it to the bottom of this 329-meter pit. Sótano de Alhuastle contained the then tenth-deepest pit in the world, the deepest one that didn't open to the sky. That record was surpassed not long after, but that doesn't take anything away from these two incredible discoveries in so little time.

Unfortunately, interaction with the locals was difficult, most of them speaking only Mazateca. After some time, the word was that the gringos were stealing treasures from the caves, and we were asked to leave.

Luckily, exploration was taking place in parallel around the nearby village of Tepepa, where the villagers were most welcoming. The caves there descended less rapidly, but covered more distance. These were to become parts of what is now known as Sistema Tepepa.

It is to Tepepa that two dozen cavers returned a year later (1988–89) for Mexpé II, setting up camp just outside the village in a field that was soon called Plan de Canadá by the locals. Its location being ideal, it is there that camp was to be set up for many expeditions to come.

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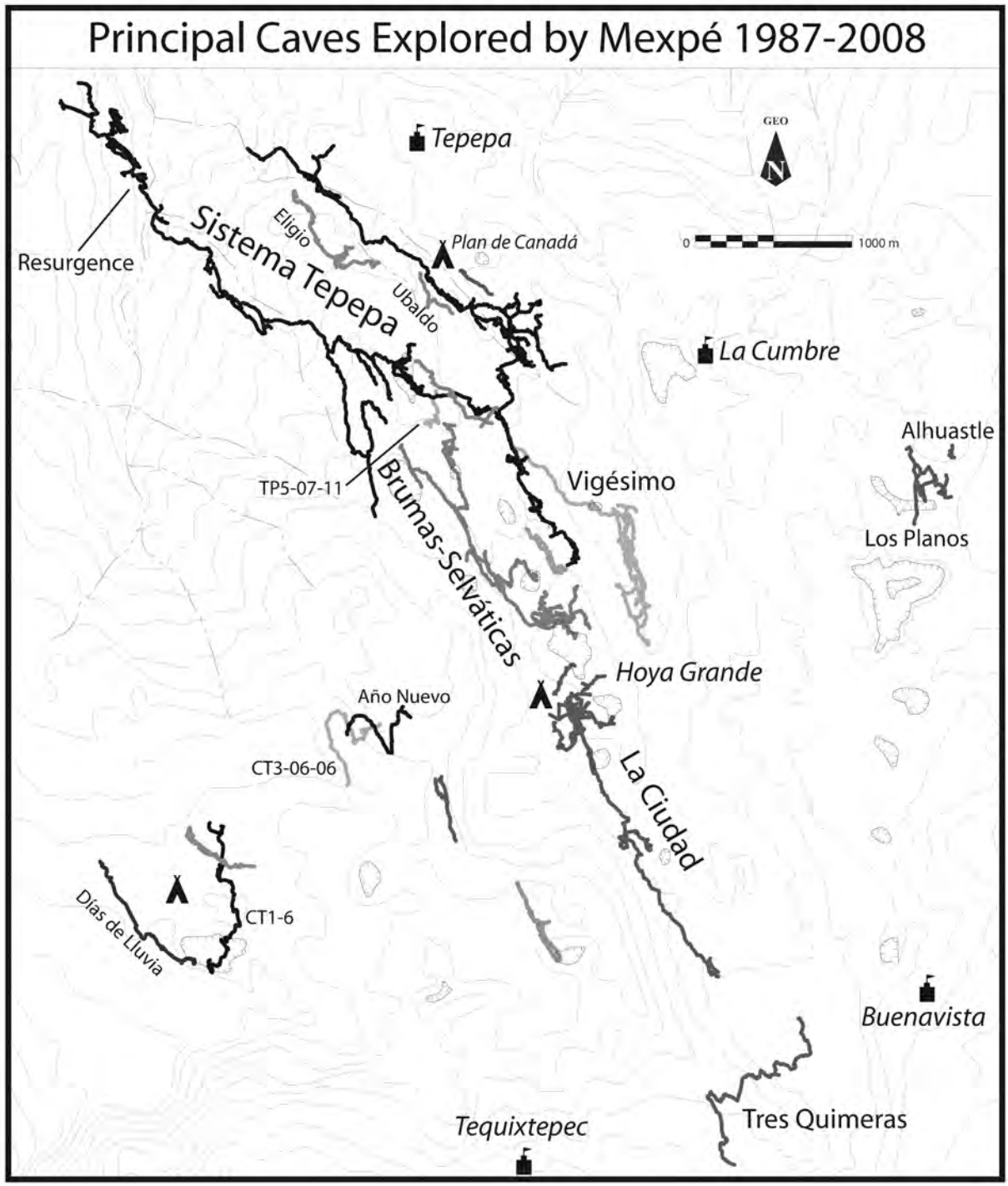
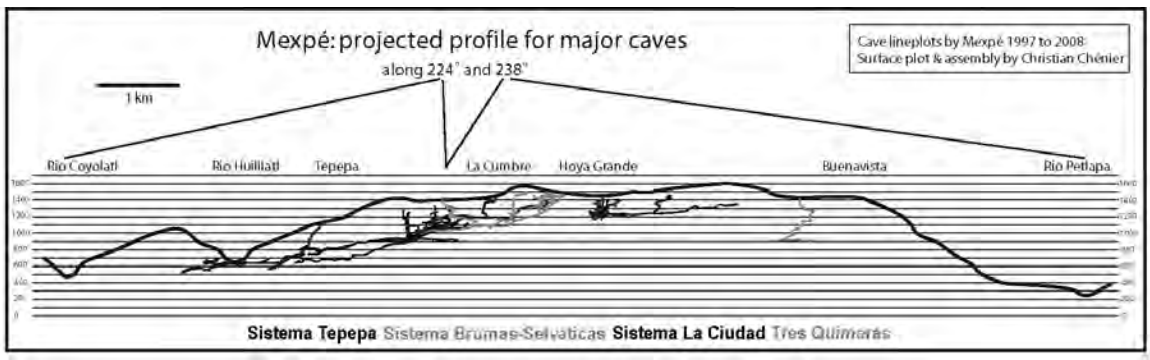

Principal Caves Explored by Mexpé 1987-2008
Tepepa
GEO
N
0
1000 m
Resurgence
Sistema Tepepa
Eligio
Plan de Canadá
Ubaldo
La Cumbre
Alhuastle
TP5-07-11
Brumas-Selváticas
Vigésimo
Los Planos
Hoya Grande
Año Nuevo
CT3-06-06
La Ciudad
Días de Lluvia
CT1-6
Buenavista
Tequixtepec
Tres Quimeras


Mexpé: projected profile for major caves
along 224° and 238°
Cave lineplots by Mexpé 1997 to 2008
Surface plot & assembly by Christian Chénier
1 km
Río Coyolatl
Río Huilliatl
Tepepa
La Cumbre
Hoya Grande
Buenavista
Río Petlapa
Sistema Tepepa
Sistema Brumas-Selváticas
Sistema La Ciudad
Tres Quimeras

Our relationship with the locals was good, and we made sure to help them with communal chores and participate in religious celebrations. We also took the bravest of them caving. Although located just 2 kilometers from La Cumbre, the locals in Tepepa are of Nahua descent. Indeed, our exploration sector is located right on the division between the Nahua and Mazateca cultures. Moreover, we're also located on the border between two *municipios*, Coyomeapan and Tlacotepec de Porfirio Díaz, making the speleo-politics all the more confusing.

Again that year, discoveries were significant, with Sistema de Angel reaching –533 meters and almost 5 kilometers long and Olfastle Niebla at –518 meters and over 3 kilometers long. Moreover, another area, to the south-west and higher in elevation, was investigated, with caves going to –400 meters. La Ciudad was discovered farther to the south, with its huge 100-by-200-meter room. Everywhere we went, there were caves—significant caves.

Exploration continued with expeditions in 1990 and 1990–91. Mexpé III (1990) was a very small expedition, during which Olfastle Niebla was extended by 2 kilometers and 200 meters more depth. Mexpé IV (1990–91) was split between the Tepepa valley, where most recent activity had taken place, and the plateau to the west. Calling that area a plateau is a misnomer, as elevation varies from 2000 meters to 2300 meters, but it is less steep than the surrounding landscape. Las Brumas was discovered (–388 meters, 3.5 kilometers), as well as an important resurgence to the northwest, Xalltegoxtli, which was in the right location for potentially being the resurgence of some of the caves around Tepepa, as its upstream waterfall, which stopped exploration after 1 kilometer, was just 200 meters away from and 100 meters lower than the farthest point reached in the Ehecatl section of Sistema de Angel. Olfastle Niebla was extended again, this time to 8 kilometers and –800 meters. This expedition also marked the beginning of collaboration with Mexican cavers, with three members of the Sociedad Mexicana de Exploraciones Subterráneas (SMES) participating.

Mexpe V (1991–92), another very small expedition, established a base camp on the plateau. Mexpe VI (1994) returned to the same location with a larger team, but later retreated to Plan de Canadá because of the weather, the same day-after-day wet weather other teams had encountered at that elevation. There, most caves sump around –300 meters. Another 2 kilometers was added to Olfastle Niebla, and several other significant but unconnected caves were surveyed.

In 1996–97, Mexpe VII added another 3 kilometers of various discoveries in the Tepepa area, but it is only after the expedition that it was realized that major connections could probably have been made. This set the stage for the next expedition.

After many years of finding long stretches of disconnected virgin eaves, the 1999–2000 expedition was all set to connect some of them. Unfortunately, in late December 1999, as Mexpé VIII had just begun, one member fell 8 meters at –400 meters. This turned the expedition into a rescue effort. Chaos followed as cavers, the army, and the Red Cross all tried to help. The injured caver was eventually taken out of the cave several days after the accident. Luckily, by that time he had started to recover and was able to help himself through tight meanders. It was not long after this accident that Espeleo Rescate México was put together. This organization has since grown into a well organized and efficient group.

Almost all expeditions up to this point had taken place in December and January, mostly to take advantage of the availability of cavers during the winter holidays. The weather at that time is sometimes good, sometimes awful, turning camp into ankle-deep mud baths. From this point forward, expeditions were systematically held in the early spring, with warmer weather and systematically drier climate.

Mexpé IX, a joint SMES-SQS expedition held in the spring of 2000, focused on the resurgence area first seen in 1990–91. After some effort and many climbs, a connection was made between the Xalltegoxtli resurgence and Ehecatl, a traverse of 756 meters depth and total surveyed length of over 13 kilometers. One peculiar feature of Xalltegoxtli is the fact that the resurgence is not the lowest point in the cave. Indeed, modern water escapes the main passage to connect to a surface valley that is clearly much younger that the main dry trunk passage, which keeps going slowly down, to the northwest.

Two more important connections were to come in 2002 (Mexpé X), when Sistema Tepepa was created at 26.5 meters long and 899 meters deep. Gimnastica Selvatica was also discovered close to a camp that had been, finally, established in the big sinkhole that drew the very first expedition to the area, called by some locals Hoya Grande. This camp has been reused for most expeditions since. It was also the year when the once remote village of Tepepa was first accessible by regular passenger cars and electricity reached the village. Raising the electrical posts was done by hand as communal chores in which we participated.

Mexpé XI (2003) brought new entrances to Gimnastica Selvatica and La Ciudad and more overall knowledge of Hoya Grande.

For a change, Mexpe XII in 2005 saw a small team opting to recce the nearby summit of Cerro Zizintepetl, culminating at 3250 meters in a rather harsh environment. The karst is so well developed there that any rain finds itself underground within centimeters of where it hit the ground. This is not good, as it doesn't

Caves of the Mexpé project over 1.5km long or 200m deep, sorted by length

	Length	Depth
Sistema Tepepa	28.564	899
Sistema Brumas-Selvaticas	8.870	473
Sistema La Ciudad	7.828	299
Cueva del Vigésimo	6.137	334
Las Tres Quimeras	2.306	513
Cueva de Eligio	2.229	237
CT1-6	2.026	244
Sótano de los Planos	1.526	694
Días de Lluvia	1.424	260
CT3-06-06	1.423	383
Sumidero del Año Nuevo	1.173	402
Cueva Ubaldo	828	227
TP5-07-11	703	228
Sótano de Alhuastle	596	410

provide enough water in one place to create large passages. Countless blind pits were descended, but a single significant cave was found. The karst being continuous for some 3000 meters down, this area will likely see more exploration in the future. A recon was also done to the villages of Buenavista and Tequixtepec to the south, where promising entrances were found. One of them with a 100-meter entrance pit was named Tres Quimeras.

The year 2006 saw a return to Hoya Grande, where yet more entrances to La Ciudad were discovered, one of which allowing us to extend the trunk passage over 1 kilometer to the south. Sistema Tepepa was also extended to the south, extending to Hoya Grande. Also, an epic connection was made between Gimnastica Selvatica and Las Brumas.

The twentieth anniversary of Mexpé in 2007 drew together a very motivated group for Mexpe XIV. One objective was to continue in the trunk passage of La Ciudad where exploration had ended the year before. Another kilometer of trunk passage was easily surveyed. There was also a return to Tres Quimeras, where exploration continued well past the entrance pit all the way to –513 meters. This cave shows no sign of ending and will be the main focus of the 2009 expedition. A major resurgence in a valley some 800 meters lower than the entrance might be where it will end. A major new discovery, Cueva del Vigesimo, which was getting close to Sistema Tepepa, gave us hope of a connection to yield the magical 1000 meters depth, but that was not to be.

Mexpé XV in 2008 doubled the length of Cueva del Vigesimo to over 6 kilometers, to –316 meters. Much time was spent trying to connect Sistema Brumas Selvatica to both Sistema Tepepa and to La Ciudad, but it did not happen. Perhaps another year?

Currently, close to 80 kilometers of caves have been surveyed, and there's no end in sight. Sistema Tepepa, at –899 meters and 28.5 kilometers, is a significant cave, especially when considering the 769-meter-deep traverse, one of the deepest in Mexico. But the fact that other significant caves lie nearby with real potential for connections and extensions makes it even more interesting.

No less important than the survey statistics are the friendships and collaboration that have developed over the years between some of the 110 participants from seven countries. For many of these participants, Mexpé was their first important expedition, thus serving as some sort of expedition school. Emerging Quebec cavers have greatly benefited from this access to world-class caving opportunity.

Witnessing the rapid changes in the sierra over the last twenty-two years has also been quite educational. From villages previously accessible only by hours of hiking on mule trails where people lived much like they did several hundred years ago, the towns have now been transformed by roads, electricity, telephone, TV, and even high-speed satellite Internet.

Mexpé has also been the test bed for high-tech survey gear and software such as Auriga. This has proven quite helpful in obtaining and managing survey data.

The caves are typically composed of multi-pit entrance sections followed by more horizontal base-level passages, often on multiple levels. Data obtained to date show that base-level water flow was, and still is in active sections, towards the north-northwest. There are of course a few exceptions, such as Tres Quimeras, which looks like it's going to go towards the south-southeast. This cave is most likely of more recent origin, as the water that currently flows through it was probably originally responsible for the creation of the upstream (southern) sections of La Ciudad.

The fact that most caves on the western plateau sump between 300 and 400 meters, coupled with the existence of an important regional fault between the two areas (running NNW-SSE) makes us think that the likelihood of connecting that area with caves of the Tepepa valley is quite slim. Moreover, the only surface water for kilometers around is found at various places, for short stretches, along that fault, likely due to an impermeable layer somewhere between the limestone beds that dip steeply to the east-southeast. If water can't make it through, it is doubtful that cavers will.

While most large sinkholes in the center of the study area have been at least partly visited, there surely remain countless cave entrances waiting to be discovered, as every year we find more where we thought we were done. There are promising leads in several places, but the largest potential now lies on the periphery: the plateau to the west and the flanks of Cerro Zizintepetl, the Tres Quimeras and Tequixtepec areas to the south, La Cumbre to the east, an the resurgences area to the northwest.

An expedition is planned for the spring of 2009 [see Mexico News in this issue]; it will be a record fifth year in a row that a Mexpé is held. The main focus this time will be the southern sections, especially the continuation of Tres Quimeras. Motivation to continue the exploration is a high as the potential for new discoveries.

Mexpé expeditions have been reported in *The Canadian Caver* 20(2), 22(2), 24(2), 30(2), 60, and 66.

Articles or notes, mostly in French, appear in the SQS's magazine *Sous Terre* 5(3), 8(2), 8(3), 8(4), 9(3), 9(4), 15(1), 16(2), 19(1), 20(2), 21(1), and other issues not in AMCS library.

Past articles or notes in the *AMCS Activities Newsletter* are in numbers 17, 18*, 19*, 20*, 21, 22*, 24, 25*, 27*, 29*, 30*, and 31 (* = Mexico News).

Mexpé: Veintidos Años y Contando

Espeleólogos canadienses de la Société Québécoise de Spéléologie han estado explorando cuevas en los alrededores de Tepepa, Puebla, desde 1987. Hasta ahora han topografiado casi 80 kilómetros de cuevas ahí.

HISTORY

JOYA DE SALAS

Orion Knox

This is a transcription of the author's log books written during the first trips by cavers to Sótano de La Joya de Salas, Tamaulipas. An article on the January trip by David McKenzie appeared in the *Association for Mexican Cave Studies Newsletter*, volume 1, number 3, pages 23–28, 1965. An article on the May trip by John Fish appeared in number 6, pages 54–58. The foldout map was made during a later survey by Canadian cavers.—Editor.

January 18. Met John Porter at James's. Bud Frank is going with us.

Tuesday, January 19. Got up 4:00 a.m. and fixed a flat. Went to David's and fixed breakfast. Got away at 6:45 a.m. and picked up Bud. David [McKenzie] and I rode in the back of the pickup most of the way. Snacked along the way. 2:40: Reached Renosa and got across border. Now getting papers and inspection. 3:35: Got on way, but are now lost in Reynosa.

Got out of Reynosa and made pretty good time for the next 200 kilometers. At 5:30 we stopped for gas near San Fernando. Muffler fell off for the thirtieth time, and we left it off. 8:30: Arrived at Victoria and spent next hour looking for Highway 70 to Jaumave. Finally found it and started out. It is in real bad shape, only gravel. Stopped in foothills to spend the night.

Wednesday, January 20. Got up and fixed some breakfast. Pretty cool. Beautiful weather. After beautiful, hairy ride over Sierra de Guatemala, we arrived in Jaumave, only to find that the only way from there to Joya de Salas is on a trail by horse. We then turned around and headed back toward Victoria. Stopped 12:30 p.m. high in mountains and had lunch. The ride was one of the best ever. I rode on the tailgate to see the scenery. It sure was dusty. The road in some places is one lane with 1000-foot drop on one side. At one point the road was blocked by construction, and a Cat had to clear it for us.

Got to Victoria about 2:30 p.m. and stopped to get alcohol and gloves for David. We walked around town for awhile, and John and I went into a cafe for a beer. We got back to the truck, met Bud and David, then went to a *cantina* for another beer. From here we went to Encino, where there is a road to Joya de Salas. The people in Encino said we could make it in the pickup. Well, we started out and got 4.8 miles before the road got so bad we couldn't go any farther. We had been repairing the road for about two hours to get the 4.8 miles. We decided to spend the night here. During the night, a number of trucks went by.

Thursday, January 21. Got up 7:30 a.m. and fixed oatmeal for breakfast. We are in a dense jungle, not being able to see more than 5 feet off the 10-foot-wide road. We started fixing the road again to try to get a little farther. After about an hour's digging and filling, we got to the side to let a large lumber truck by. We had talked to them the night before. They tried to pull us across with a rope, but it kept breaking, so we finally got them to take us up on the back of the lumber truck. It was really a wild ride. We rose about 1300 meters and are in pine forest now. The view over the plains is beautiful. It is rather cool up here.

At 12:40 we arrived at Julilo, up in the mountains. This is a lumber camp with sawmill and all. The guy who brought us up is letting us stay in his house. The road up here is almost impassible. We passed one large sótano on the way up. It is Sótano de María. It is quite pleasant up here. After eating lunch, we decided to hike up into the sierra for a ways. After about 2.5 kilometers we hitched a ride on an empty lumber truck going to La Perra, which is about 7 kilometers from Julilo. It was an uphill ride all the way, with beautiful scenery all the way. Once there, we found a nice little town, a little larger than Julilo, where large pine logs were sawed into planks. We hiked about 2 kilometers to the west to the edge of the range. It was fantastic. We could see down some 5500 feet to the clouds on the lower plains. The air is fresh and pine-scented, but a little rare. On this road is Agua Linda, one of the only permanent streams in the range. It is at 1900 meters.

After hiking till about 4:30, we started walking back to La Perra, and then the 7 kilometers to Julilo. It took us about an hour to walk it. We arrived back at our house at 6:30 p.m. and feasted on our meager supply of food. It is nice and cool, about 50°F. We hit the sack about 8:00 p.m. All slept on the floor.

Friday, January 22. Got up to a beautiful, cool day. The sky is clear; only a few clouds. We fixed breakfast and decided to walk up toward Joya de Salas. We got on the wrong road,

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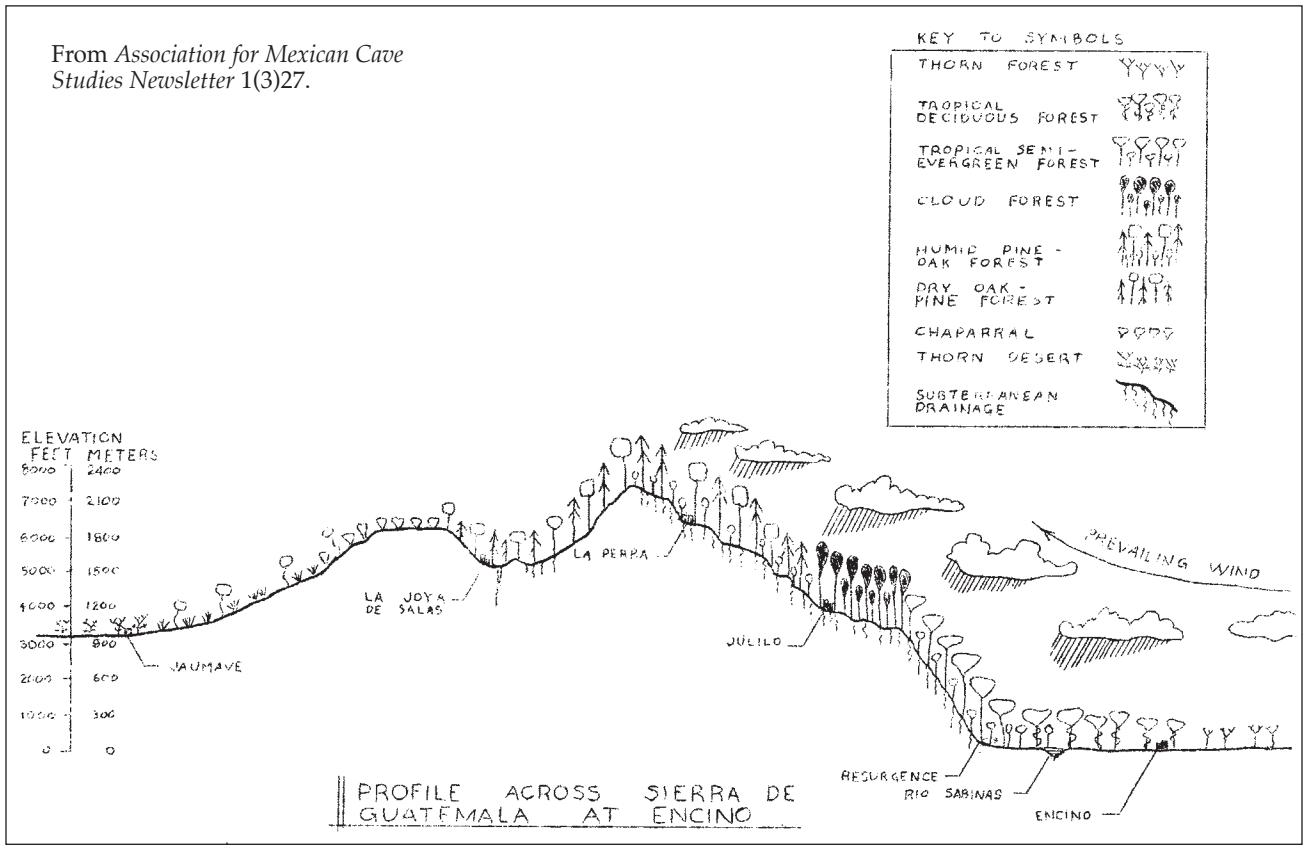
and after an hour and a half, 2.5 kilometers, and a thousand-foot rise, we ran into a lumber truck coming down. They told us we were on the wrong road and that it dead-ended. After a chat, they told us they were gong to La Perra with the logs and it is 6 kilometers to Joya de Salas from there, so we hopped on and were off to La Perra. About 11:30 a.m. we got there and watched them cut logs for awhile, got a Pepsi and some candy, then started for Joya de Salas. It is a continuous climb through beautiful mountains and pines and other fabulous plants. We checked out a couple of *dolinas* on the way, and about 3 kilometers out of Perra we found a sótano at the crest of the range, some 2000 meters high. We stopped, and David tossed the 200-foot rope in and went down. It is about 1:00 p.m., and we have patched up our feet while David was down. David reports it is about 150 feet deep and ends in a large room. We called it Sótano a 2000 Metros. He did some collecting. It is now 2:05 p.m., and we are off again for Joya de Salas. For the next three hours we had one of the most horrid hikes ever. It was downhill for about 3 kilometers at not too bad an angle, then we came to the brink of the Joya de Salas *dolina*. It was a fantastic sight. We could see the lake in the bottom and mountains stretching into the distance. From here, it was a steep downhill grind all the way. We had to descend about 400 meters to the valley floor. There was fertile soil with beautiful grass cover everywhere. The pines were spaced as if in a park. We walked about 1.5 kilometers through these meadows to the lake and the village. It is a paradise. The lake is about 6 acres in size, with scattered houses back from the shore. The whole thing is a closed valley. We spoke to one of the men, and he pointed the way to the sótano and also told us no trucks had entered or left the town for awhile. This means we have to hike 8 kilometers back to La Perra or 10 kilometers to Julilo. Either will be murder, because of the rise out of the dolina.

I had lost my helmet somewhere on the way down the trail. After we talked to the Mexican, we walked down to the lake and found a place to camp. It was in a low draw near some boulders. It was in a grassy area. We fixed a big meal, patched up our feet, and sacked out.

Saturday, January 23. We all got out of the sack 8:00 a.m. and started getting some hot food into us. It was a comfortable night, but cool out of the sleeping bag. After eating a good breakfast, we got our packs together and started for the sótano. It was only a short distance to the hole. It was not quite as fabulous as we had expected. The entrance is about 40 by 100 feet, with a 20-by-10 foot smaller entrance to one side. We went down the short drop 85 feet to a ledge and got all the equipment down to there. We drove another bolt, tied the 200-foot rope to it, and after some long thought David went down. This was at 11:05 a.m. He checked down one passage to a 150- to 200-foot drop and down another to a lake. The total entrance drop is 280 feet and still going down. It definitely has a chance to break the North American depth record. We are now waiting for David to collect and check out the other passages. David reported that one led to a 100-plus-foot drop, then a long slope. The other led 75

From *Association for Mexican Cave Studies Newsletter* 1(3)27.



David McKenzie, John Fish, and guides loading one of the burros in Jaumave before the May hike to Joya de Salas. *Orion Knox*.

feet east to a fissure drop about 80 feet deep. A third passage goes 175 feet, plus or minus, to a 5-by-5-meter by 2-meter deep pool and may continue small. While down, he collected some good biology specimens. John prusiked back to the surface, and Bud and I waited for David to come up to the 85-foot level. After a while he came up, and then I, David, and Bud prusiked out. By now there were thirty to forty people standing around. We got all our junk up and sat around and talked to them for awhile. They told us of a cave on a nearby hill. The teacher let us leave our packs in the schoolhouse, then showed us to the cave. It was small cave, stoop then crawl for about 30 meters. We named it Cuevito de la Escuela a Joya de Salas.

I came on around the ridge and stopped on a ledge overlooking the valley. I ate my lunch, a can of tuna. This valley is a real paradise. The lake has a lot of ducks on it.

I went on down to where the rest were talking to the teacher and talked for awhile. The population is about three hundred, although it looks less. We then went and got our packs out of the school and set up camp in the schoolyard. From there we found our way to the local store, which is just one room in a house. A really beautiful girl was there to sell us the candy and Doble Cola we bought. The best candy was a sugar-coated peanut. They had a number of things for sale, including Colgate toothpaste. Bud bought some Nescafe. We then went to the schoolyard and ate some candy and talked till 5:25. It is really great up here. While we were talking to the Mexicans, a teacher told me of one Los Angeles student who got lost in the mountains. The whole village looked for three days before finding him.

About 6:00, we hiked down to a sótano we had seen on the way in, and David and John went in to check it. The upper side, where Bud and I stayed, is about 100 feet above the floor. There were some small leads going out, but the longest was about 30 feet long. From here we went back to the schoolyard and fixed supper. I ate the last of the C-rations tonight. David and I went down to the little store and got another Doble Cola. This was our Saturday-night celebration. We went back to the camp and built a campfire and sat around and talked till about 9:00 p.m. The weather is still beautiful, but quite cool. One of the people in the village just came in to visit us. We are just sitting around talking.

We sat and talked till about 10:30 or so, then hit the sack.

Sunday, January 24. Boy was it cold! When we crawled out about 7:30 a.m. or so, there was frost all over our sleeping bags. Bud was the first up and had a nice fire going before I even had the guts to stick my head out. Well, we finally all got up and ran around the schoolyard for awhile getting warm. Each of us is running pretty low on food, so our diet is not the best. I ate another Mexican chocolate bar. We have decided to split up, with Bud and I going by way of La Perra and John and David going straight to Julilo by way of La Capa. Our way will be 15 kilometers, while theirs is around 10. We all went over to the store for a last Doble Cola, then we were off. Bud and I figured we would be dead by the time we had made the steep climb out of the Joya de Salas valley. We hiked up over the small ridge in the valley, then across the beautiful meadow. This time we followed the road pretty closely to make sure we didn't get lost. The hike was fairly easy, with gentle switchbacks on the way up. We only rested twice between La Joya and the rim of the valley. All the work of the past few days at high elevation must have really done us some good. Our packs were a little lighter, so that helped some. We had gotten used to the 6000-plus-foot elevation, so we didn't get out of breath as often.

We looked around the crest for

View back down into the Jaumave valley in May. *Orion Knox*.

Topographic map of the area, showing the approaches to Joya de Salas from both the east and the northwest. Base map is part of the 1:250,000 topo F14-2 (Ciudad Victoria); some labels have been added. The trail Knox followed from Jaumave is not shown on the map, but is on the 1:50,000 maps F-14-A-38 (Jaumave) and F-14-A-49 (Gómez Farías). It climbs the east slope of Arroyo Las Vacas, passes close to the point elevation 2020 meters on the map, and runs southward about halfway between Cerro El Cantaro and the Joya de Molina trail that is shown. The grid on the map has 10-kilometer spacing.

David's logbook for awhile without luck. After a rest, we took off again. We hiked and hiked till I thought I would drop, until we finally got to the abandoned camp about 3.5 kilometers from La Joya. We rested there and started off fresh in a few minutes. We made terrific time from there to La Perra. We arrived really pooped and headed to the store for some Pepsi. Here we collapsed for about thirty minutes with Pepsi and candy. The lady told us the road David and John were on was very complicated and that they might get lost. She also told us there was a truck going down as soon as it was fixed and loaded. Bud and I didn't want to ask for a ride, so we stared walking. The next 7 kilometers was a nightmare. I got the first 4 kilometers with only the usual tired legs, but the last 3 were really torture. First my feet hurt from bruises, then my ankles began to hurt and weaken and my calves and knees began to ache. The last half kilometer, I figured if I stopped I'd never get up, so I forced one foot to fall in front of the other. When we finally staggered into Julilo and up to the house, we found David and John waiting for us. We collapsed on the floor and didn't think we would ever be able to walk again. I began to get a chill and thought sure I was coming down with the flu. I was really in sad shape. Bud got the idea after awhile to go to the store and get a soda. My feet felt like pure pain each step I took. We got the Pepsi, then went back to the house to get things packed to head down as soon as a truck came down. We waited till about sundown, when a loaded truck from La Perra came by on the way to Encino. We piled all our junk on and were off on one hell of a wild ride. It got dark about half way down. We had a full load of railroad ties, a drum, and a 50-gallon butane bottle. There were three young guys taking the truck down. It was really fantastic. We finally got to our truck about two or three hours after leaving Julilo, so we figured we had averaged only 2.5 to 3 miles per hour at best. We got the truck repacked and started for Encino. The road didn't give us too much trouble.

Back to the highway after four days in the mountains, we headed for Victoria. I slept most of the way, and when we got to Victoria I didn't even feel like eating. We then drove about 30 miles north of town and set up camp. Three of us slept in the back, and Bud in front.

David McKenzie rappelling the entrance pit while villagers watch from the other side of the entrance. *Orion Knox*.

Monday, January 25. Got up to a beautiful day. We were all tired, so decided to go for Austin. We went back by way of Monterrey and Laredo, with no outstanding events except that we got across the border with no trouble, even with Bud's and my cactus and pine. Finally get to Austin tired and happy at 11:00 p.m.

We have been planning this trip since our mid-semester break. David McKenzie, John Fish, Runi [Burnett], and James Reddell tried to go Easter, but all the trucks were also taking the Easter vacation, so there was no transportation from Encino.

We plan to go in from the west side of the Sierra de Guatemala, from the Jaumave valley. We will try to get someone with burros to take us the 35 kilometers to La Joya, where the sink is. Our leaving date is May 26, 1965.

Wednesday, May 26. Went to Scholz Garden last night and don't feel too good today. Not much has gone well yet. The rope and Brunton didn't come in, and Runi dropped out, so it will be David, John, and I to La Joya. We will take Ed Alexander to Victoria and drop him off there.

2:30 p.m. Things are going slowly, and we still haven't gotten packed. We still have to get David's food and film. We are going to use a Brunton from the geology department. We seem to have tons of grode to take.

5:05. Still in Austin, running around looking for equipment. Still have to go to Gulf Mart for food, and I still need a gas can. I sure am sleepy. Found I had made four Bs and a C in grades.

7:30. Finally leaving Austin.

8:30. Got to New Braunfels and found Krauss's closed, so went to Y-Cafe and had chicken-fried steak. My car is loaded to the top with grode. Sure hope I don't break a spring. We have about 2000 feet of rope. We've decided to go across at Laredo.

Thursday, May 27, 12:45 a.m. Arrived at Laredo and got gas. We are now headed for the bridge.

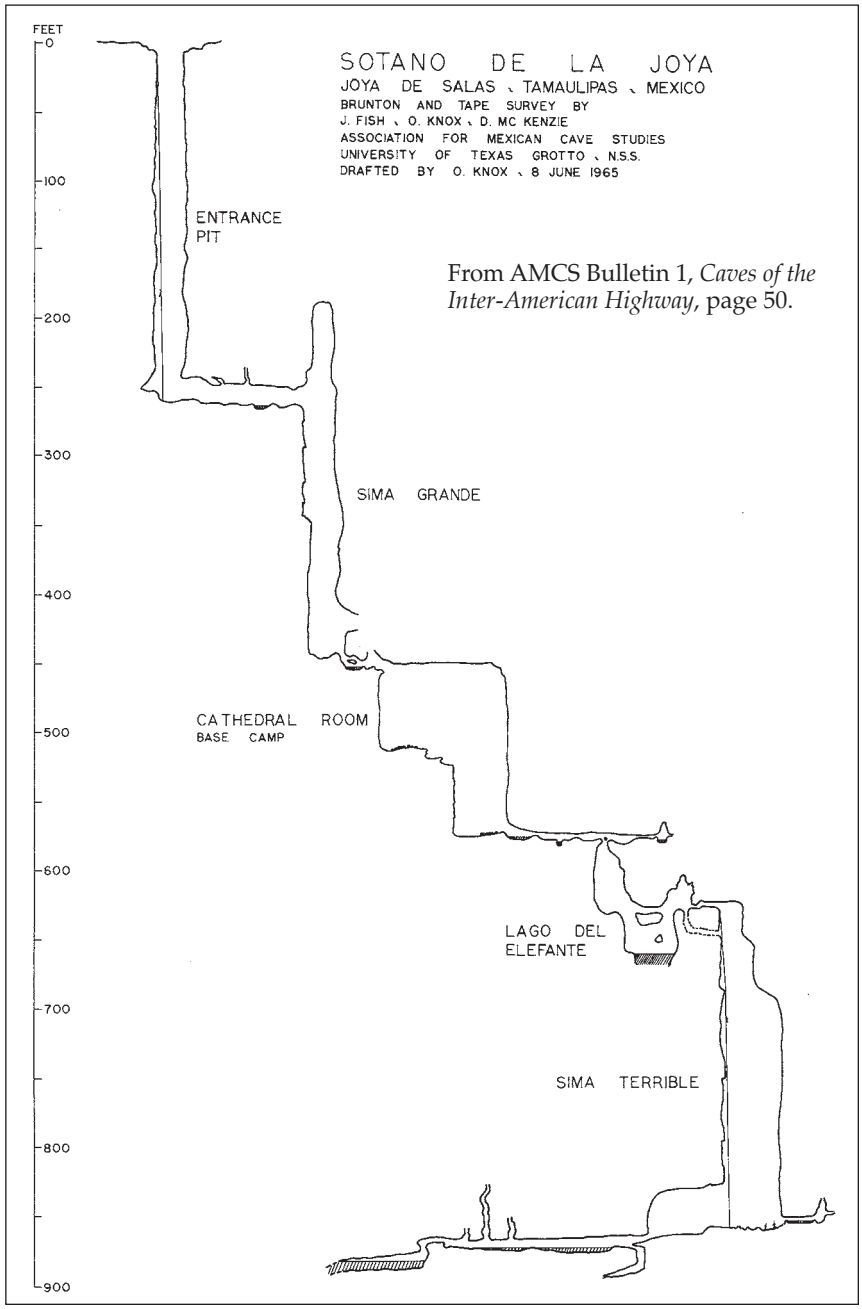
Got to bridge, and we went across and started getting our papers ready. They told me I needed a birth certificate, but would let me in anyway. I got the car papers and one of the border guards took me over to the insurance office, where I got that straightened out. It cost 79 cents a day. Got inspected and took off. Town was dead at this time of morning. We drove on about 85 miles to just past Salinas Hidalgo, where we camped.

6:15 a.m. Got up and found we had camped at a real beautiful site in front of Rancho El Durazo. There was an impressive mountain range to our west and Spanish dagger desert to our east. I got the rest up, and we fixed a cold breakfast and headed on. Didn't get much sleep.

Drove on through Monterrey and

got gas in El Cercado at 8:45. Very cloudy, and the mountains are almost covered. After getting gas, we drove straight until there is a large peak on the west of the road, so we stopped and took some pictures. It would be fantastic to climb. The weather is very hot and sultry in the low areas. We then hit the road again and got to Victoria at 12:15, where we bought gas again and then went to the bank and got money exchanged. The weather here is hot and hazy, so we probably will not get too good photographs on this side of the range. It will probably be hot as hell in Jaumave. We plan to drive up into the mountains to eat lunch, where we hope it will be cool. Ed is going on south from here in Victoria, so we will repack car so as not to have so much weight in the rear. Up to now, we have traveled 543 miles.

3:00 p.m. Got to Coke stand on crest and had a Doble Cola. We had a long talk with him, and he told of at least two sinks in the area within 3 kilometers. He also gave us info on price of burros. They sell for 150 pesos and rent for 5 pesos a day. We drank our colas and went on down the road for a ways to where we stopped at a hole in the right side of road cut. It was only a small cave. We decided to eat here and did so. John and David both found their honey had come open in their packs. What a mess. I spotted another cave just down the bank, and John is now checking it.



From AMCS Bulletin 1, *Caves of the Inter-American Highway*, page 50.

It didn't go anywhere, so we repacked the car and headed down toward Jaumave. After a hairpin curve, we saw a couple of holes in the left side of the road. One turned out to be a 125-plus-foot cave. The other has 80 feet of passage and is 25 feet deep. We named it Hairpin Fissure, because it is near the only marked hairpin on the road.

From the hairpin cave, we continued on down the west side of the range. It is dry, but the air at this high altitude is very nice and cool. We finally got down to the desert, and it was a real dust bowl. It is bone dry. We traveled much slower here, as the road is terrible. We stopped and took a number of pictures as we went. We arrived in Jaumave at about 7:00.

Our first stop was a drug store, where David bought some alcohol and I asked about some burros. The lady sent me to another drug store to see Raul Setten, who knows someone with burros. We went to his store, where the lad told us he was over at the square playing basketball. We went over and found a very good game going. We watched till it was over, and then Raul bought me a Coke. We talked, and he took us over to a friend with burros. He had a bad foot, so he sent for another. After much talk, I offered 250 pesos if they would take us over and bring us back. They accepted with enthusiasm, and we decided to leave at 4:00 a.m. on Friday morning. We then proceeded to repack everything and take only the essentials. We finally got it down to what four burros could haul. They told us not to carry anything ourselves because the trip was a grueling one and we would be doing well to get ourselves over the mountain. All the people here seen real nice. Raul introduced me to the commander of the military garrison tonight. Our luck is running

exceedingly well. So far the car got a little hot on climb, but was all right. Going to bed now.

Friday, May 28, 4:30 a.m. Got up and are getting things ready to go. Our guide just got here. The weather is cool and much more clear today than it was yesterday.

We loaded the burros. They asked us if we were carrying a gun, and when we said no, they rounded one up. Our guide is taking it. This and the fact that there is an army garrison here makes me think there may be bandits here.

We took off, going down the Río Guayalejo and following it for some ways. It is running water about like the Salado creek, not much at least. After about 2.5 kilometers we took the left, dry fork of the *río*, which is the drainage from the Cañón de las Vacas, and traveled up this for awhile, then climbed up the left bank onto the desert. It was nice this time of morning. There was Spanish-dagger forest everywhere. It was nice and cool here. We traveled on along this trail for a good distance through nice scenery. After about 3 kilometers, started climbing up the edge of the range.

The next 6 to 7 hours were pure hell. It got hotter and hotter, and the trail was steeper and steeper. After about 2 kilometers of this, we came to a saddle where it was only a few meters to a fantastic canyon on either side. We were on a long northwest-southeast ridge that we followed for a long, long way. The scenery was great, with vast canyons and row upon row of mountains stretching into the distance. There was a blue haze, and things were just fantastic. All along the trail were Indian middens apparently untouched. All was beautiful except our physical condition. David was getting blisters on his feet, John's legs were giving out, and I was sick. I had gotten pretty hot and then drank a good bit of water. It wasn't long before I was ready to throw up. We stopped for lunch, and I lay down for awhile and got to feeling better. So I ate a can of peaches,which was a mistake, because they didn't stay down for long. I was in terrible condition for the next six hours. I didn't get any better until we got down to the head of the La Joya valley, where I stopped and got a drink and rested a while. I started feeling better and walked on ahead of the others. By now I was really feeling good and made good time all the way into the village. I walked through about 8 kilometers, wooded and cultivated. It was beautiful. Got into the village and went on to the store to get two *refrescos* and talk to the pretty girl for awhile. I then walked back to the sótano, where I met David, John, and the guide. David and John went to get *refrescos*, and the guide and I unloaded the burros beside the schoolyard, then we went and had another *refresco*. We got back, ate, and hit the sack. We had taken 12 hours 30 minutes to walk the 35 kilometers from Jaumave. We were all shot.

Saturday, May 29, 5:30 a.m. The drizzle woke us up, and we found that it looked like the rainy season had returned after ten dry days. We fixed breakfast and sat around for awhile. It is beautiful here with the rain coming down.

8:45. We have eaten, and the rain has stopped for the time being. I rappelled in at about 8:30, then David followed. We figured out how to tie off at the 77-foot level, and the first pack was lowered in at 8:45. We have about thirty people watching us now. I had to drive a new bolt at the surface, because the old one had filled in with dirt. We are going to get everything to the 77-foot level and then stay on the surface to eat lunch and survey around the entrance.

11:30. We have surveyed all the entrance and have lowered all equipment to the 77-foot level. We have about forty people looking on now. We are at the 77-foot level and are fixing lunch.

1:05 p.m. I rappelled down to the 300-foot level and am waiting for David and John to send down the equipment. There is considerably more moisture down here than before. The passages have some water in them.

The equipment has been sent down, and David and John followed with no trouble. I walked back and looked down the next drop. It looked pretty long. We surveyed around the bottom of the entrance drop and down to the second major drop. After we got all the equipment across some pools of water in the passage and to the drop, I decided to go down first because I wanted to take pictures. We decided to use the 200-foot rope, so we tied it off some 25 feet from the edge and I took off. I couldn't see anything at the bottom and began to worry about the length of the rope. After about 40 feet, there was a ledge off to one side that I swung over to. By now I was pretty nervous, even

John Fish and David McKenzie have a meal in the Cathedral Room base camp. *Orion Knox*.

John Fish in the passage over the Lago del Elefante. *Orion Knox*.

though I had my Jumars with me. I looked over the edge, and about 60 feet below I could see what I though was the floor, or at least the rope was coiled up. I went zipping on down, and before I got there realized that it was only a small ledge and there was a drop of unknown depth beyond. I stopped here, peered over, and decided it was too far for the rope that was left of the 200-footer. I pulled it up, tied on my handkerchief, and let it back down. I could see it swinging in free space.

I called up to David that he would have to drive a bolt closer to the edge and give me all the rope he could. This took about forty-five minutes, so I made myself as comfortable as possible on the damp, narrow ledge. After he finished, he let the rope on down, and I again looked over. This time it looked as if it was on bottom. I then called for all the equipment to come down to this point. This took about three cold, damp hours. Finally it was all down, and David came down to the ledge with me. After he arrived, I went on down another 90 feet to the floor of the pit. It was damp, but right around the corner it became dry, which we were all thankful for. All during this time the echoes in the cave had caused terrible communications. Another three hours went by as the equipment was lowered on down. I had checked and found the narrow fissure passage that led to the next drop.

When everything was down, David and John came down, and we surveyed on to that drop. Our next problem was to get the equipment through this passage over the pools of water. It took another two and a half hours to accomplish this. The next drop didn't look too bad, so we dropped over the 90-foot rope. I went on down to get some pictures and landed in a beautiful fluted room about 75 by 30 with a gravel floor. It made a great campsite. Again David and John lowered the duffel bags, then came on down themselves. I took a look at the next drop, and it looked to be only 50 to 60 feet deep. We set up camp, unfurled our flag, and started cooking. We really feasted here. I had spaghetti, pork and beans, olives, pineapple, and Tang, quite a meal for 550 feet underground. John is asleep, David is catching up on his log, and I'm getting sleepy and will now turn in. It is midnight.

Sunday, May 30, 6:30 a.m. Woke up in a nice warm sleeping bag. It was a very comfortable night's sleep. Sure am glad I brought my air mattress. I was the first up, so I gathered up some washed-in wood and after about thirty minutes had a nice little campfire going. This saved us some fuel. I had corn, honey, and peanut butter for breakfast. It sure tasted good. We are all in very good shape. We have named this Camp I. It is a high, fluted room, very dry with a level floor. We have packed all the equipment back into the bags and will soon be rigging the next drop. It looks like a short one, 50 feet or so. Our three duffle bags and five or so smaller packs are getting lighter as we go. Couldn't ask for better conditions.

9:45. We got the next drop rigged and tied off the rope. We got the equipment down the two short drops, about 10 feet, and David rappelled on down 50 feet to a corridor about 135 feet high. He is checking on ahead. John and I are waiting for him to come back.

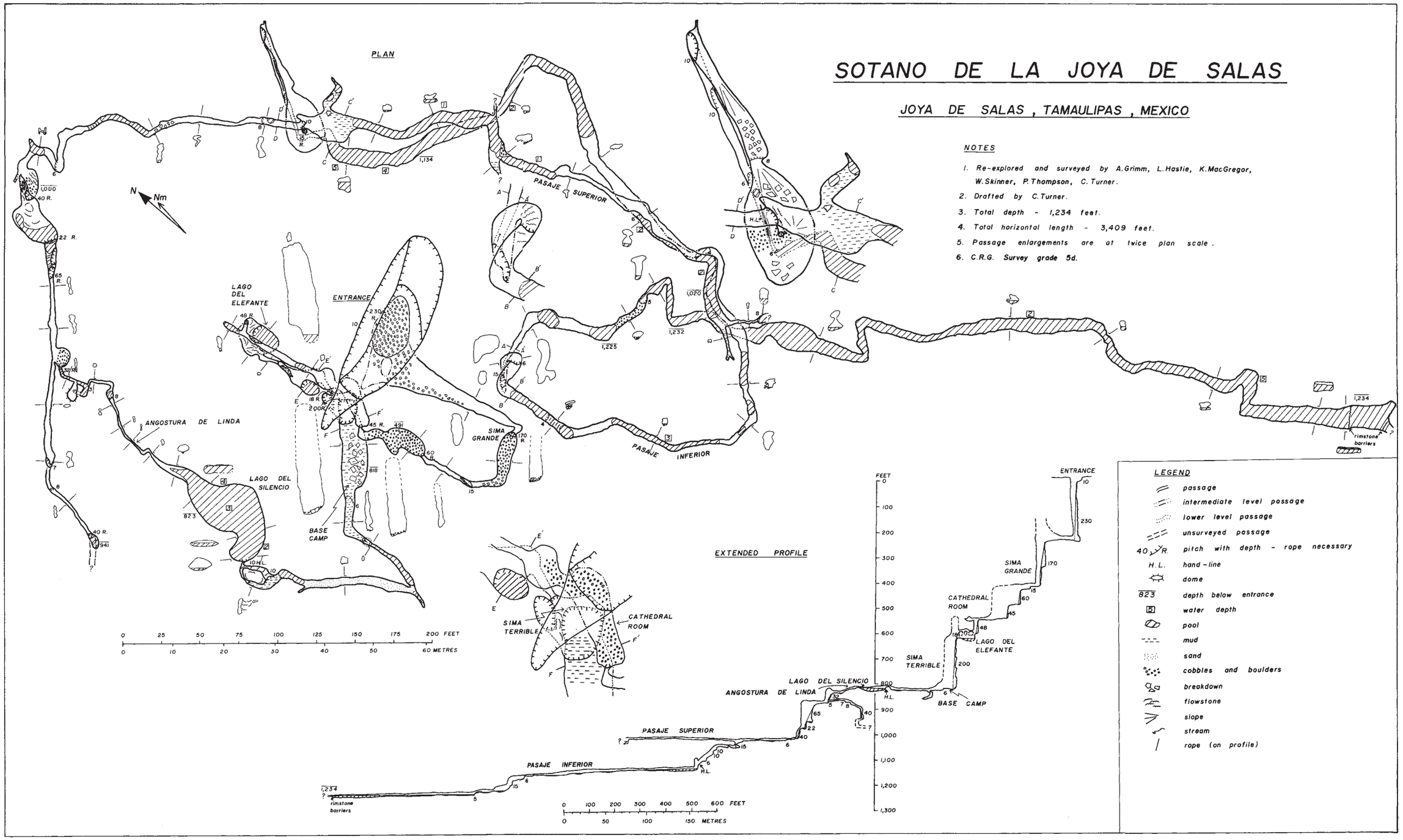
David came back and reported a duck-walk to another pit. He said he heard water when he tossed a rock in, so we decided to send down only a little rope and check it out. I rappelled in and got a picture of John coming down, and then we took off for the drop. I went first and dropped down about 50 feet, past two ledges to a pool of water. It looked bad and cold. The only way I could check it out was to go in. I checked the temperature, and it was 60°F. I went on in, and by hanging by my fingertips I was able to get wet only up to my waist. Boy was it cold. I got around a corner and found that it got wide, but by a very bad 10-foot chimney I was able to get across to a natural bridge. Here I could see that no passage went on at water level. About 12 feet above the water there was a 3-by-5-foot passage going on, and above I could see what looked like a dome room.

David dropped down to the second ledge and found a crawl going to the dome room. From there he looked around a little and found another bottomless hole. He will go down it first and wants to use the 350-footer for it. I climbed back to the rope and went over and looked. It sure looks hairy. We then prusiked back to John and then on back to the drop below Camp I. We are fixing to go up and cook a good meal before pushing on. We are not going to establish any more camps, and will take only what we need besides the rope. The time is 1:00 p.m Sunday.

2:30. We have come back to Camp I and have just finished off a good meal. I had a can of pork and beans and a can of shoestring potatoes with dried dates. We are narrowing down the equipment to rope and necessary personal gear. We will try the big drop now. So far we have gotten down about 650 feet, with a large drop ahead. All are in fine shape. David went on in to the Elephant Lake Room, and John and I lowered the rope bag in. Then John, then I rappelled in. Both David and I took pictures. We have ferried the equipment across the edge of the lake and over to the next small room. David is now fixing to start down the next big drop. It may be well over 200 feet, so he is using the 350-footer.

It is 5:40 p.m., and David is starting down.

At 6:10., David is down about 75 feet and is looking into a misty,



Canadian Caver 4(1)5, 1972

wall-less, bottomless pit. At present he is trying to build up enough courage to go on down. A rock falls for four seconds clear before starting to bounce. It is a real hellfire pit. I'm glad David is going and not me.

6:50. David talked me into coming down to the ledge. I have brought a 150-foot rope with me. The ledge is only about 5 by 4 feet, and what one sees is enough to scare the bravest. Looking over the edge, all one sees is a hazy blue mist with darkness beneath. The far wall and the depth are unreal. It is as if looking into another world. David and I talked about an hour discussing the chances, and finally David tied into the rope and eased over into nothingness. For a long while I could hear only the sound of the rope passing through the brakebars and then the shuffle of stones far below. I asked if he was on the bottom, and the reply was a weak no, that he was only on a narrow, tiny ledge about 130 feet below me, still looking into a blue mist. After a little conversation, he decided it wasn't much over 100 more feet to the bottom. Again I heard the faint hiss of the rope over brakebars. David was on the rope again. In a short time, he reported in a distorted and echoing voice that he was on another ledge some 50 feet below the last and could still see only mist, but that a rock thrown over sounded like it fell less then 100 feet. When asked it he was on bottom, the reply was a hearty, "Hell no!" Once more I could faintly hear the hiss and scrape of his feet on the wall. Here on my little ledge everything is very eerie, with John calling down once in a while to ask what is happening. I have stayed clipped into my safety loop all the while. It certainly is a lot of help to the constitution. Looking into the misty black is fantastic. The domepit must be well over 300 feet. The cave seems bottomless.

After many minutes of waiting, I can make out an echoing voice that sounds like it is mixed with the boom of cannons, saying that he had finally reached the bottom and was going to check around.

12:45 a.m. He found only a couple of very small crawls that were filled with gravel and one at about 20 feet that was half full of water. After a little collecting, he started prusiking. After about 30 minutes he came over the ledge where I was. We had a short chat, and I started on up to the Elephant Lake Room, where John was. I went up to the edge with no trouble, but there I couldn't get one Jumar over, so after a few minutes of work I gave up and took it off and put it over the edge. This is a little nerve-racking. David came on up, and I climbed down and looked into the Elephant Lake crawl. It has a drop in it after about 8 feet. It looks very promising. We decided to leave all the rope down, as there are a number of good leads left. We all then prusiked to Camp I and fixed supper. I finally got time to brush my teeth for the first time in about five days. It is midnight, and we are all going to sleep. We have reached about 870 feet deep to date. It is truly a fantastic cave.

David McKenzie at the top of Sima Terrible. *Orion Knox.*

Monday, May 31. With no sun to wake us up, we overslept a little this morning. I got up at 11:30 a.m. and started fixing my breakfast. I had macaroni creole, peanut butter and honey, fruit cocktail, and dried apricots. We were all a little sore from yesterday's workout, but are still in excellent shape thanks to our great camp. We have all the conveniences of home, Primus stove, lights, good food, and comfortable bed. We have all eaten now and are going to go back down to the 640-foot level and start checking some of the other leads. We have been checking all the leads around the Elephant Lake Room, and every one drops into the Sima Grande, the big pit. It seems if anything goes, it will have to be down there. We have talked it over and are now going down to the bottom again. Now we have a way around that eliminated about the top 30 feet of the drop. David has just rappelled down to the Ledge of Fate, and I'm going to follow.

I'm on the Ledge of Fate, and things are just as eerie as yesterday. I have driven a bolt, and we have tied the rope off to it rather than the formation. It sure is impressive, with the blue mist drifting around. David is down, and I'm now going over.

Boy, was that ever a rappel. Once over the ledge, there is nothing but blackness below. I could faintly make out David's light. After what seemed a tremendous length of time and rope, I finally came to the bottom. I was in a 40-by-20 dome that is really beyond description. I went to the north first, and David said it ended. I want about 150 feet and through some grody crawls and found nothing. There was one pit at the bottom. It had a little trickle of water running in. David and I started down a passage he had seen on the wall that had water in it. David went first, and I followed. It was about 60 feet till we got out of the water and found a very nice dome about 80 feet high. Thankfully the water temperature was now 62° at this depth. We waded back to the big dome, and by this time John had come down, so we talked him into going down the grody little pit in the other passage. We rigged the 12-or-so-foot drop, and he went on in. It was a drop into a sloping passage that went for about 25 feet and dropped about 12 feet to a mud fill that is the bottom of Joya de Salas. It sure is a disappointing end for such a fantastic cave. We hit bottom about 4:30 p.m. We estimate about 900 feet from the entrance to the bottom of the grody little pit. We took a couple of victory pictures and started back out. David went first,

then John, and finally me. It wasn't nearly as bad as I though it would be for a 250-foot drop.

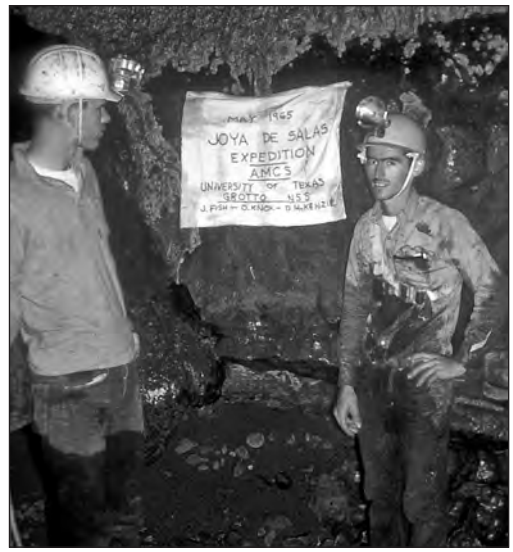
I got to the top and we started to get things together to start up out of the Elephant Lake Room. We have one duffle bag full of rope and some other, smaller packs. I prusiked up first, then David came on up. John tied on the equipment and David and I pulled it up. It sure is heavy. We hauled it over the water and back to the bottom of the 50-foot drop. John went up, then I followed, and we brought up the equipment. It is really going to be hell getting all this stuff out.

We fixed supper again. I had chicken, green beans, Tang, and fruitcake. I have been eating like a king in here. We are all tired and are about to spend the third night at Camp I. I sure am glad I brought my air mattress. It is now 10:20 Monday night.

Tuesday, June 1, 8:00 a.m. We got up at 6:00 and started fixing breakfast. Had a very comfortable night's sleep in the Cathedral Room at base camp. I had beans and peanut butter and honey with Tang for breakfast. We are now packing all our gear and breaking camp to start for the surface. We have a 57-foot climb up to the bottom of Sima Grande, which is a 190-foot pit. It is going to be a pretty grueling day.

We really had to work to get everything up the 57-foot pit. The work of getting it back over the water and to the Sima Grande was something terrific. David then prusiked up to the ledge about 90 feet off the floor, and I came on up to him. We both then pulled all the equipment up to that point,which proved to be a feat in itself. I had to lean out over the edge, clipped in with my Jumars, to keep it clear of the ledge. Once it was all up to here, I prusiked on up to the entrance passage and saw daylight for the first time in three days. It sure looked good. David then came on up to where I was, and then we pulled the equipment up a little at a time to the entrance passage. By the time we got it to here, we were exhausted. We got it over to the water, and when John got up, we ferried it across to the other side and then to the entrance. I was the first to come out the entrance, and it sure seemed like it took a long time. I had to unclip a Jumar at the top to get it over the ledge, but made it all right. While John followed on the 171-foot part, I went on to the surface. I was sure a pooped spelunker by now.

John stayed on the 87-foot level, and I pulled out the 300-foot rope and dropped the rope over the sheer part. David tied the equipment on, and with the help of some of the Mexicans, who had gathered by now, we pulled everything to the surface. John and David both came on out, and we got everything over to the schoolyard and started measuring the rope. When we got everything added up, we had about 896 feet of rope on the preliminary check. This was less than we had hoped for, but it still put us fourth in the Western Hemisphere and second in Mexico.



David McKenzie and Orion Knox at the bottom of Sima Terrible. *John Fish.*

We had something to eat, and I had a long conversation with one of the people here who is studying English. I then hit the sack for a good long sleep.

Wednesday, June 2, 7:00 a.m. Got up to a beautiful morning and had a can of pears and some Fig Newtons. We are gathering up the equipment to get it out of the schoolyard before school starts. We plan to hike around a little and head back over the mountains tomorrow.

We started walking toward the south end of the valley, and before we had gotten out of the village we had already found a pit. We called it the Tarapin Pit. It has an entrance drop of about 30 feet. David is checking it.

It went down about 45 feet and got real grody. From there we hiked on toward the mouth of what we called Seven Second Canyon and cut across some real rugged terrain. We got to the edge and found it near-vertical, so we decided that we didn't have that much energy left.

I suggested going to La Perra to get a Pepsi, and so we headed for the east end of the valley. David turned back before we got to the steep part, and John turned back some place before the abandoned sawmill. I stopped at the sawmill for a rest, then hiked on into La Perra,where I bought a welcome Pepsi. I got a few pieces of candy, then hiked across beyond Agua Linda to the edge of the range. It was really beautiful, although hazy. I could see the coastal plain and the highways and fields. I came on back to Agua Linda and filled my canteen, then went into the village and got another Pepsi and one to go.

On the way back to La Joya I checked the left at the road fork at the head of Seven Second Canyon. It went for a long way, and I finally turned back, getting to La Joya after sunset. We ate and then sacked out.

Thursday, June 3. Got burros packed and stated toward Jaumave about 6:00 a.m. All is going well and the Jaumave valley just came into sight. We are going to lunch here.

PS 2009—No additional notes were made after this point, for good reason. We reached the base of the mountains about midafternoon, and, remembering a cool and leisurely hike across the desert on the way in, finished off our water at this point. Big mistake!

We started across the yucca and scrub desert at the peak of midafternoon heat. It must have been at

least 110ºF, with little or no shade. As we staggered forward, David, with the longest legs, slowly got farther and farther ahead of me, and John got farther and farther behind. The guide and burros were out of sight behind John.

What I remember most vividly, other than the pain of blistered feet, was that the heat seemed to be radiating from inside my head to the outside, rather than the other way around. We staggered on, every man for himself. We tried to keep each other in sight, but our one thought was getting to the Río Guayalejo and water. From time to time David would stop, and we would sit under the shade of a yucca trying to cool off, to no avail. Our hands were swollen from dehydration to the point that we could not close our fists. To this day, when I pour an unfinished glass of water down the drain, I think of how I would have paid everything I had with me for that bit of water while crossing the Jaumave desert that day.

Our one other concern was that our guide was well behind us, and there was a maze of trails through the 6-to-8-foot-high scrub brush and 15-foot-high yucca. Not being able to see the town, we headed what seemed to be down slope, assuming we would eventually hit the river.

After what seemed like forever, the *río* came into sight, and we one by one collapsed into its cool water. It didn't matter that there were burros and cows standing in the stream just upriver from us. We sucked down as much water as we could hold. After some time, we staggered on into town and made our way to the square, where we sat at a refreshment stand and consumed several Cokes each. The guide arrived shortly thereafter in almost as bad shape. He was so hoarse we had a hard time understanding him.

After settling up with the guide, we drove up into the mountains, where it was a bit cooler, and made camp for the night. The next day we drove straight through, back to Austin.

El Descubrimiento y Exploración del
Sótano de La Joya de Salas

Estas son las bitácoras de viaje de Orion Knox de sus dos primeros viajes a esta cueva, en 1965. En enero, llegaron al pueblo de Joya de Salas provenientes de El Encino, en la carretera al este de las montañas, y se descendió el tiro inicial. A finales de mayo y principios de junio visitaron el pueblo de nuevo, esta vez después de una larga caminata iniciada al sureste de Jaumave, y la cueva fue explorada hasta –272 metros. El mapa incluido fue realizado por espeleólogos canadienses, quienes topografiaron de nuevo la cueva y exploraron pasajes adicionales en 1971.

A "CUELLO DE OCA" IN COAHUILA

Mónica Ponce

During exploration done at EspeleoCoahuila 2008, in Municipio Múzquiz, Coahuila, an interesting hydrological phenomenon came to my attention.

On the trips I made while preparing for EspeleoCoahuila, my main concern for the congress what that the weather would be too hot, causing dehydration as the participants explored in mountains. So I looked into hydrating and energy drinks. But I did not count on the help of a ceremony that the Kickapoo tribe did at the La Cascada spa, the host site. People say that Kickapoo dances work, and indeed they did. On the inauguration day of EspeleoCoahuila it started raining, and it kept raining till the event ended.

This made me realize how important the weather is for the formation of caves in Múzquiz. The weather can change from one day to the next. One day the temperature can be 0°C when the sun rises, and the next day the temperature can be over 50°C. The chronicler of the city, Don Jesús Santos Landois, writes in his book, *Músquiz de Sant Rosa, extractos de la historia*, "Sometimes it is cold in April and hot in January, so some travelers who visit Múzquiz get the wrong idea about its climate. In August or September we can have a hot and humid season; in October or April in an intermediate year in the weather cycle, it can be a paradise. In August during the *canícula* (dog-days), the dryness can cause dehydration; in February on cold, dry, windy days, the skin on face and hands cracks until it bleeds."

The rain raises the level of the main creeks and rivers in the *municipio*, such as the Río Sabinas, born in the Kickapoo Reserve, and the Río Los Alamos, which starts in the *predio* El Consuelo. Both of these rivers are 30 to 45 kilometers away from the seat of the *municipio*, the city of Melchor Músquiz, but underground drainage must connect to caves like El Socavón, which produces the potable water for the city. There must be infiltration along the entire valley that feeds the phreatic zone.

In September 2007, the year before EspeleoCoahuila 2008, Peter Sprouse and others were invited by Don Ricardo Enríquez to visit the Rancho Las Águilas and a pit called Sótano de los Enríquez, which turned out to be the deepest pit in Coahuila, with an entrance drop of 103 meters and a total depth of 124 meters. [See article and map in *AMCS Activities Newsletter* 31, pages 157–161.] In January 2008 we visited the same area looking for new caves.

In July we found a pit on Rancho El Mulato. It is called El Hundido (1424180E 3145735N NAD27, elev. 583 m). To explore it we descended about 95 or 100 meters to the water level. There is a large room that continues away from the base of the pit. The top part of the pit is wide, but it funnels down to a well-like shaft. The rocky walls, wet and smooth, get wider again near the bottom. We could not continue because we ran out of rope and had reached the water. Even though it is hot at the bottom, we thought there might be an opening, because we could feel fresh air. The totally crystal-clear water under my feet moved in a slow, circular motion. We could see what looked like a petrified ammonite

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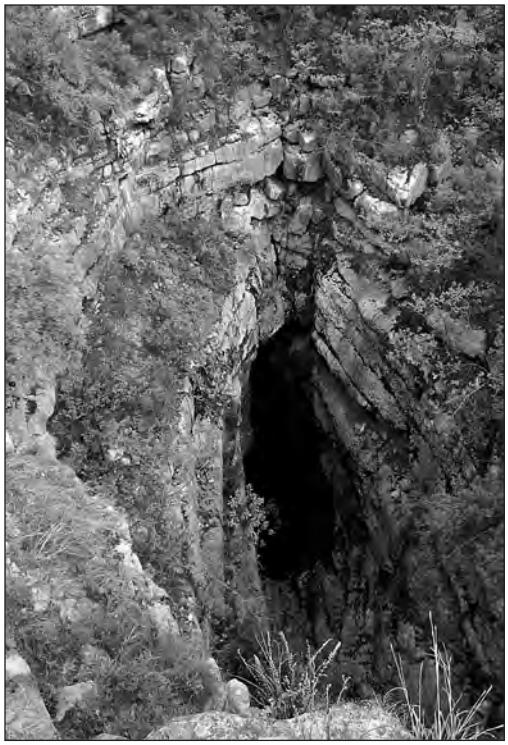
Mónica Ponce, center, with members of the Kickapoo council, including spiritual leader Chakuka Aniko in the elaborate shirt. *Mónica Ponce.*



Photos by Mónica Ponce.

Top: The road to E Hundido on Rancho El Mulato after the rains.

Middle: Sótano El Hundido.

Bottom: The tree branches surrounded by water in the middle of the lake show where the rigging point for Sótano El Hundido had been in drier weather.

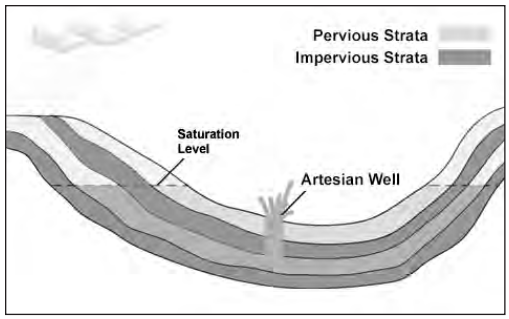
floating on the water. Ten meters up on the wall there is a small, damp cavity were we could see a small plant and a cricket feeding on a *campamocha* (walking-stick insect).

Twenty-two days after Espeleo-Coahuila, we were able to return with some new members of the Asociación Coahuilense de Espeleología, some of the founders of the caving group at Monterrey Tec, including Octavio Casteñada and biologist Javier Banda, and two cave divers, Ismael Cantú and Alejandro Gamboa. It was the beginning of August, and the rainy season was so intense that the roads had been destroyed and it took us two days to reach our objective. When we arrived, we got a big surprise: in place of the wonderful pit was a big lake.

How does this happen? What sort of phenomenon is this? What is it called? What sort of underground currents does it imply? The foreman of the ranch said the pit had filled in two days; it had been empty on Thursday, and we arrived on Saturday. He said it had not been filled by flow from creeks or rivers, but by water rising from inside, "like a giant fountain." Something similar happens to small caves in the center of Músquiz, mainly at the La Cascada spa, but it is not nearly as striking as at this pit 100 meters deep, with a mouth 50 meters across.

Once we got back to Saltillo, I asked my father, Héctor Ponce Zepeda, for help in understanding what intrigued me so much. We estimated the volume of El Hundido to be about 75,000 cubic meters, which would mean roughly 2,000 cubic meters of water per hour to fill the pit, or about 500 liters per second. Where does this water come from? How large a conduit does it come through? Could it be explored by divers? How much pressure does it take to raise the water up the shaft against gravity? The owner of the land at El Hundido has informed me that two days after we visited the lake, the water had already dropped 20 meters.

I asked for help from my friends to understand. Peter Sprouse knows this sort of cave as a karst window, there normally a river flows across



Exploration team at the entrance to El Hundido: Ismael Cantú, Mónica Ponce, David Andrade, and a paramedic. *Mónica Ponce*.

the floor, but during heavy rains overflows onto the surface. Tullio Bernabei and Professor Paulo Forti of the Italian group La Venta think that this phenomenon is relatively common in this area when caves reach the phreatic zone close to what they call a *cuello de oca*, a goose-neck, with respect to the water flow. The rapid rise is caused by greater permeability upstream of the cave in the groundwater system than downstream, so that after a hard rain, the water fills the caves because it cannot flow on down the aquifer quickly enough. After some time, depending on the details of the aquifer, the water will start to recede.

Finally, Arturo González (Museo del Desierto), Jorge Paz (Vaxakmen caving club), and Armando Hinojosa (Ingeniería NL) think this is an artesian well, up which water flows under gravity, as shown in the figure. In order for this to happen, there must be higher areas in the surroundings, and impermeable layers of rock should be arranged as shown, causing the water to flow to the lower parts. Normally the water escapes through a deep system of fractures, but in the rainy season, the well flows.

These may be just different ways of describing the same mechanism, a little bit complex, but interesting. We need to know more about the surrounding geology to give a more definite answer. That the Santa Rosa valley, "The Oasis of the North," has underground sights as impressive as this provides a new challenge to do research for EspeleoCoahuila 2010.

Un Cruello de Oca en Coahuila

Se observó un fenómeno interesante en Coahuila. Una cueva vertical nueva, El Hundido, en el Rancho El Mulato cerca de Múzquiz, se descendió primero unos 95 o 100 metros hasta el nivel del agua. Unas cuantas semanas más tarde, después de lluvias fuertes, una visita a la cueva encontró que la entrada de la misma estaba en el fondo de un gran lago.

FAUNA OF FIVE ANCHIALINE CAVES ON COZUMEL ISLAND

Luis M. Mejia-Ortíz, Germán Yañez, and Marilú López-Mejia

Caves can be classified according to the amount of water they contain, either dry or with subterranean rivers. Among the latter, in Mexico we find some with fresh water and some that are exclusively marine. Also, we can find anchialine caves, which have areas where there are interactions between epicontinental fresh water and sea water. They show gradients in salinity in their conduits. In Mexico, these caves are close to the coast and found mainly in the Yucatan Peninsula, where their entrances were called by Maya people in ancient times *dz'onot*s, now rendered *cenotes* (Álvarez *et al*., 2000).

A number of important underwater caves have been surveyed with scientific objectives, including the reporting and description of important species, mainly crustaceans (Botosaneanu, 1986; Botosaneanu *et al*., 1998; Botosaneanu and Illife, 1999; Bowman, 1973, 1977; Bowman and Illife, 1988; Creaser, 1936; Fiers *et al*., 1996; Hart and Manning, 1981; Hobbs and Hobbs, 1976; Hobbs *et al*., 1977; Holsinger, 1977, 1992; Holthuis, 1977, 1986; Kensley *et al*., 2001; Kornicker and Illife, 1989, 1998; Navarro-Mendoza and Valdés-Casillas, 1990; Proudlove *et al*., 2001; Rocha *et al*., 2000; Schmitter-Soto, 1998). Due to the difficulty in exploring water-filled caves, there are a large number of cenotes and caves that have not been investigated with the aim of learning what diversity of species live in them. Many sites on the Yucatan Peninsula are used for recreation as tourism arrives in this area of Mexico, and management planning has been made in the total absence of knowledge about their fauna. Fauna of anchialine caves show unusual distributions, but also have biogeographical relationships with species adapted to this environment on Caribbean Islands or elsewhere in the world. This paper aims to describe the species richness in four underwater caves in Isla Cozumel, as well as a preliminary review of a fifth one, in relation to the fauna of the mainland Yucatan Peninsula and other Caribbean islands.

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Isla Cozumel has an area of 482 square kilometers and is located between 20°48'00" and 20°16'12" north latitude and between 87°01'48" and 86°43'48" west longitude. It is adjacent to the northeast part of the Yucatan Peninsula in the Caribbean Sea, and the main sources of water on the island are the cenotes and the underground water table. The cenotes that were studied in this work are Cenote Aerolito or Sistema Paraíso, Sistema Cocodrilo, Cenote Tres Potrillos and Cueva la Quebrada Chankanaab (figure 1). Preliminary data were obtained from Cenote Xcan Ha. Organisms were collected during several visits to each cenote and also collected using traps with chicken bait left for twenty-four hours. Animals were identified to species level where possible, and otherwise to genus.

Cenote Aerolito. This system has 6100 meters of underwater passage and connects to the Caribbean 240 meters from the main entrance. The solution conduits contain stalactites and stalagmites, and the sediment in them is clay and mud. The water temperature averaged 25°C, and there is a halocline at 7 meters depth (figure 2a, b, and c). The crustaceans collected in this cave were *Procaris* sp. (figure 2d), *Yagerocaris cozumel* (figure 2e), and *Bahalana* sp. (figure 2f). Two species of asteroids were found. The first, *Asterinides* sp., was located in brackish water 256 meters from the entrance. These animals shows depigmentation and were only seen inside the cave (figure 3a and b). The second kind of asteroids were found in marine water 45 meters from the entrance. These animals had pigmented bodies (figure 3c and d). Specimens of ophiuroids were located in salt water 40 and 336 meters from the entance (fugures 3 e and f). The ophiurioids had pigmented bodies.

Sistema Cocodrilo. This cave is located on the east side of the island. Two main entrances are 3 meters deep. Beyond, the main passage contains stalagmites and stalactites (figure 4a, b, and c). The water

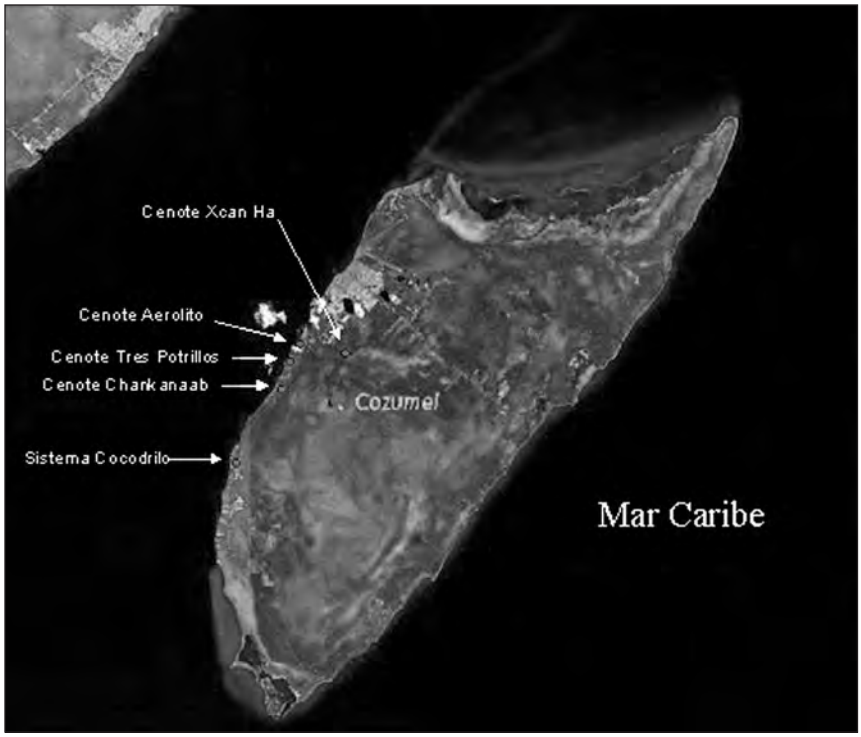


Figure 1. The study area.

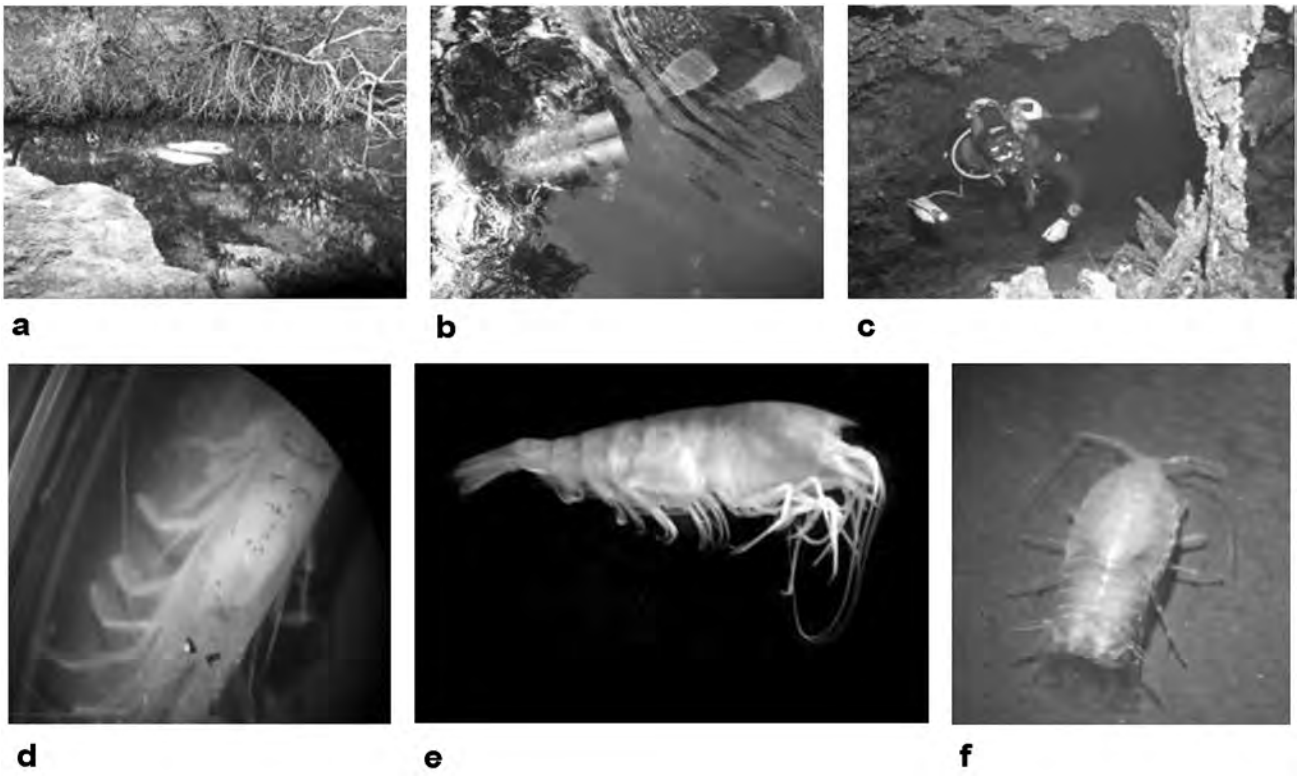
temperature has been between 20°C and 22°C. In this cave we recorded the following taxon: *Tullumella* sp. (figure 4d, e, and f).

Cenote Tres Potrillos. This cenote is 40 meters deep, with a small horizontal passage at 12 meters that is approximately 40 meters long and contains speleothems. In this cenote we recorded *Procaris* sp., *Barburia yanezi*, and *Mayawekelia* sp. (figure 5a, b, and c).

Cueva la Quebrada Chankanaab. This cave is located on the east coast of the Isla Cozumel. It has five surface openings and 2759 meters of surveyed passage. The deepest point in the cave is only –12 meters. Brackish water is discharged, in reversing tidal currents, from entrances along the coast. The organisms we found were *Procaris mexicana* (figure 6 a and b), *Mayawekelia* sp. (figure 6c), *Bahadzia* sp., *Bahalana mayana* (figure 6d), *Janicea antiguensis*, and *Somersiella sterri*.

Cenote Xcan Ha. This cave has two main cenote entrances, both approximately 20 meters deep. At the bottom is a main passage with formations (figure 7a). Here we

Figure 2. Cenote Aerolito.



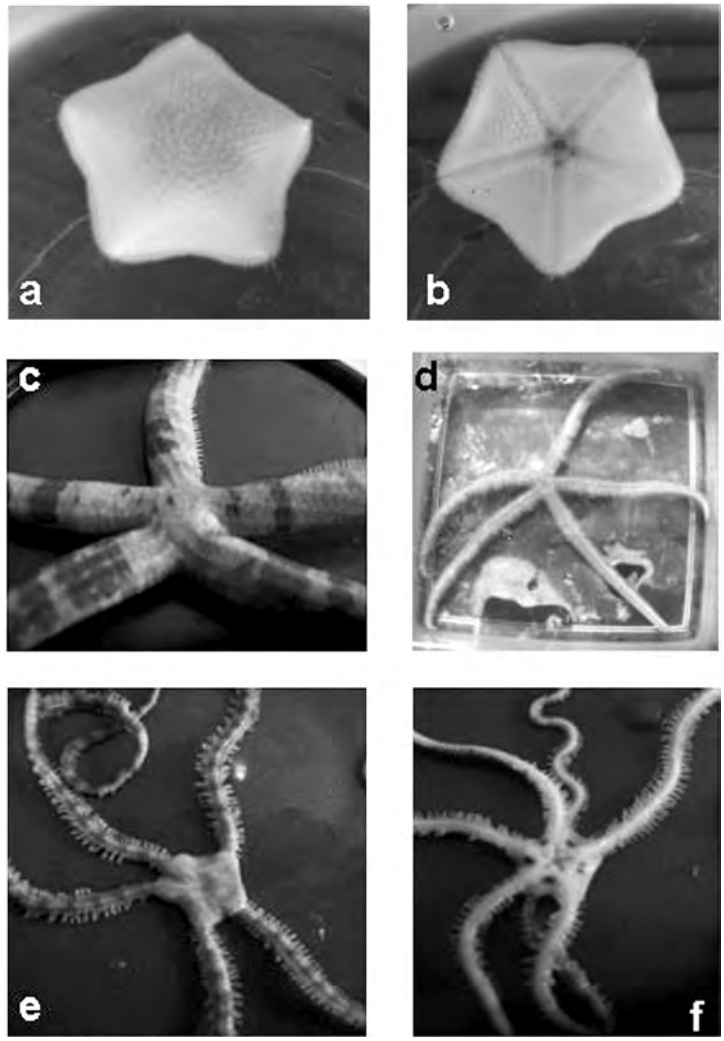


Figure 3. Echinoderms from Cenote Aerolito.

found the crustaceans *Agostocaris bozanici* (figure 7b) and *Bahadzia* sp. (figure 7c).

It is evident that the species richness in crustaceans from each cave is high, and there are members of each genus in most of the cenotes we investigated so far. Most of the specimens of the genus *Procaris* recorded on the island remain undetermined, but Sternberg and Shotte (2004) named the specimens collected from Quebrada Chankaanab *Procaris mexicana*. Members of the genus seen in two other cenotes will probably be the same species. This species is very interesting because there are phylogenetic relationships with species from the Bahamas and the Hawaiian Islands. So far, this species has not been recorded on the Yucatan mainland. Although the genus has been reported from around the world, we cannot predict whether it will be found there.

We recorded the genus *Tulumella* in one cave on Isla Cozumel in which we did not observe other crustaceans. Other termobaenaceans

Figure 4. Cenote Cocodrilo.

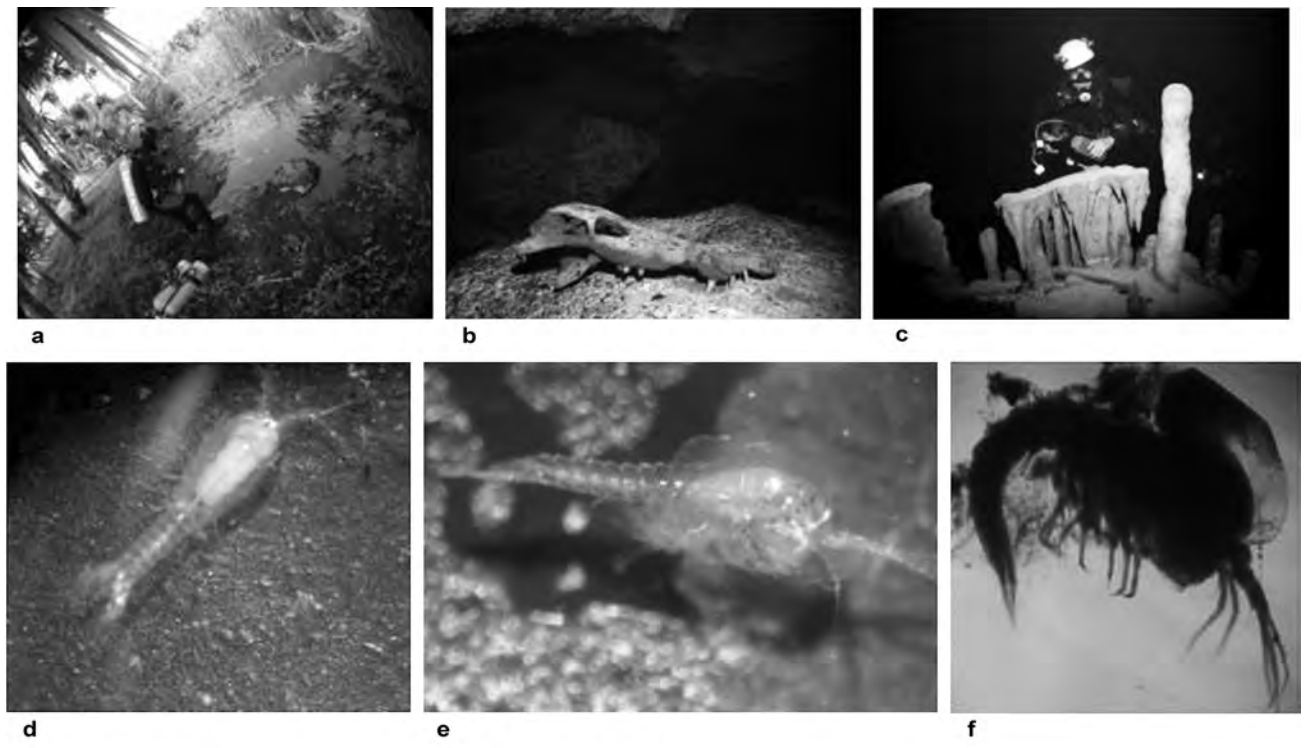
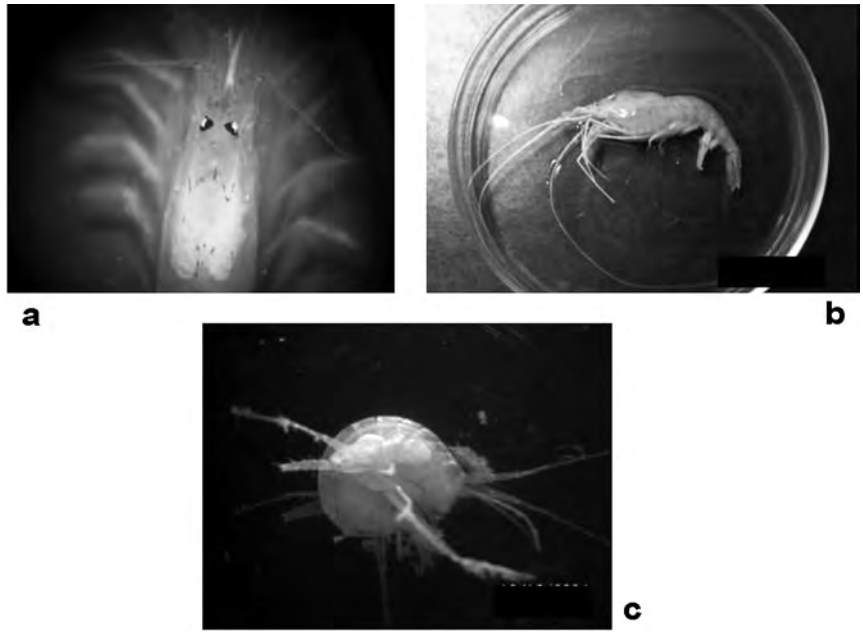


Figure 5. Cenote Tres Potrillos.



have been reported on Cozumel, specifically in Cueva Quebrada, but *Tulumella* is monotypic and has only been reported in some cave systems near Tulum, Quintana Roo. Other genera of termobaenacens have been reported, mainly from Italy, but also from the Bahamas.

The animals of the *Barburia* species reported here from a Cozumal cenote are very interesting. Previously, the genus had only one species, *Barburia cubensis*, reported from other islands, but never from Mexico. Samples of a species in this genus have been collected from near Tulum, but it is rarer, and the species has not been determined. It is very likely that this will be a species new to science.

Another interesting result is the populations of *Bahalana* spp. It is possible that the caves surveyed in this project have connections that allow genetic interchange, but it could also be that they are isolated. The next step in the study of these organisms will be the use of molecular techniques to determine whether the populations sampled are connected or isolated.

Somersiella sterri and *Janicea antiguensis* have been reported from other islands, and their observation on Cozumel helps us understands that these animals have dispersed all over the Caribbean region.

We report on only five natural, underwater caves on Isla Cozumel, and although some crustaceans species have been described and reported from these systems, there is still a lot of work to be done, because the underwater environment on Cozumel is poorly known. Water characteristics are known only from some anchialine systems (Back *et al.*, 1978; Hall 1936; Alcocer *et al.*, 1998; Alcocer *et al*. 1999; Schmitter-Soto *et al.*, 2002), and most authors have focused on describing the sites and fauna that live in this environment, and their biology and ecology (Yager, 1987; Illife, 1993 and 1992; Kallmeyer and Carpenter, 1996; Suárez-Morales *et al.*, 1996; Escobar-Briones *et al.*, 1997; Suárez-Morales and Reid, 1998). There are a few studies that discuss hypotheses about the evolutionary history of the fauna in relation to the geological history of the area (Holsinger, 1986; 1989; Wilkens, 1982 and 1986).

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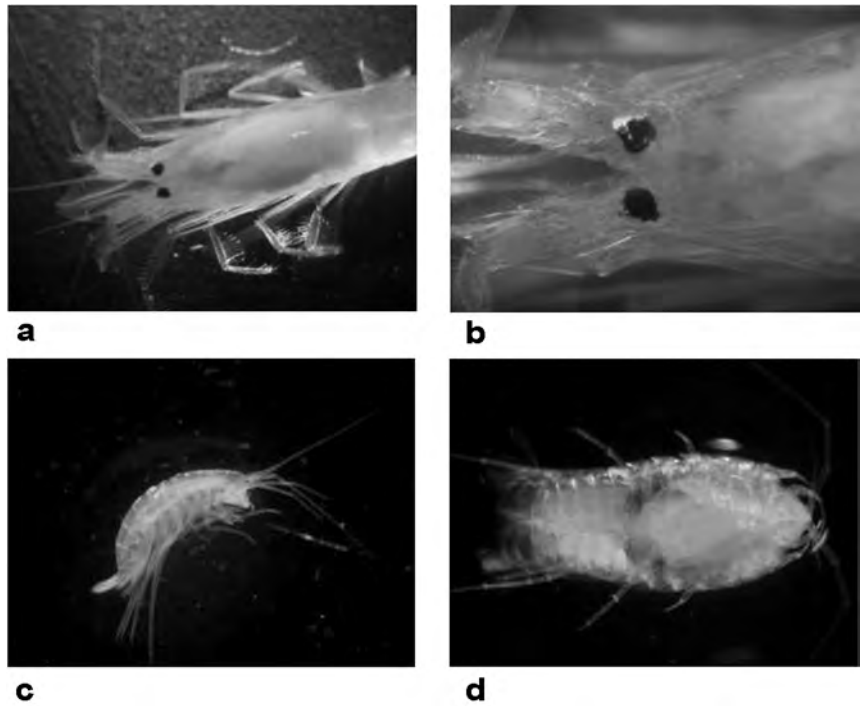

Figure 6. Cenote Chankanaab.

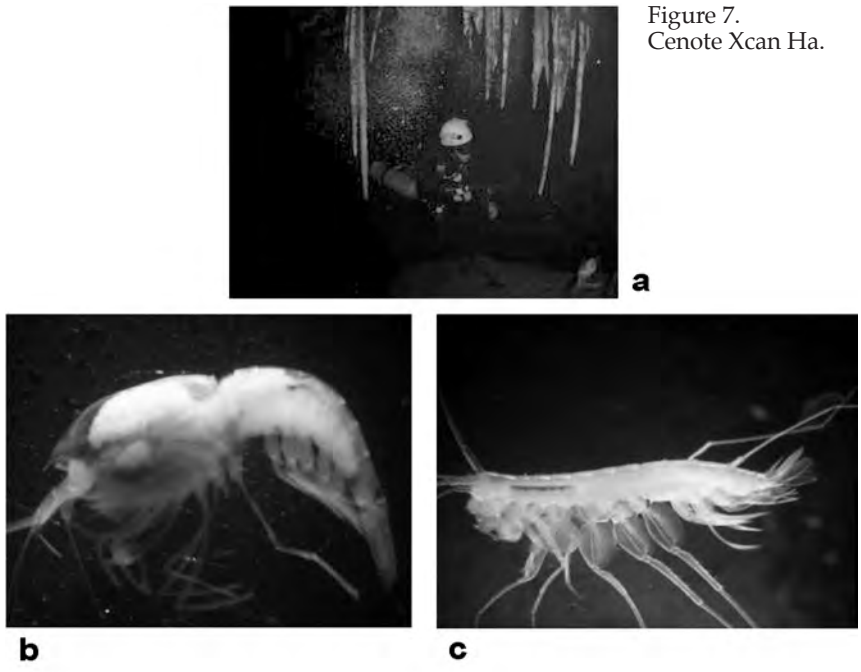

Figure 7.
Cenote Xcan Ha.

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Fauna de Cinco Cuevas Anquialinas en la Isla de Cozumel

Se recolectó fauna de cinco cuevas anquialinas en la isla de Cozumel con el fin de determinar la diversidad de especies de esta zona. Macro y micro crustáceos y equinodermos se colectaron de cada cueva mediante el uso de trampas y manualmente durante la exploración de estos hábitats anquialinos. Las principales especies identificadas fueron *Agostocaris bozanici*, *Yagerocaris cozumel*, *Janicea antiguensis* y *Somersiella sterri*. También se reporta por primera vez la existencia de equinodermos en cuevas anquialinas. Además se registraron nuevas ubicaciones de camarones anquialinos *Procaris* spp., y por vez primera se reporta la existencia en la isla de Cozumel de camarones del género *Barbouria* y termosbenaceos del género *Tulumella*, ambos con potencial de ser nuevas especies. Se discute la distribución geográfica y relaciones de estas especies con aquellas reportadas en la península de Yucatán y otras islas caribeñas.