AMCS ACTIVITIES NEWSLETTER

Number 33 June 2010

AMCS

ACTIVITIES NEWSLETTER

Number 33 June 2010

AMCS
ACTIVITIES NEWSLETTER

Number 33 June 2010

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, Rodolfo "Fofo" González, Mark Minton, and Al Warild.

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

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

Front cover

Kasia Biernacka descending in the J2 entrance series during the 2009 expedition. Photo by Marcin Gala.

Back cover

Alex Álvarez near the Cenote Vasija entrance to Sistema Aktun Hu, Quintana Roo. Photo by Daniel Riordan.

CONTENTS

NEWS

François Saussus and André-Marie Dawagne in Cueva Tapetzala, Puebla, during the 2010 GSAB expedition. *Gustavo Vela.*

MEXICO NEWS

Compiled by Bill Mixon

CHIAPAS

On March 30, 2008, I was contacted by a production manager at French television for Nicolas Hulot's program "Ushuaïa Nature" and asked to coordinate the logistics of their two tons of gear that had to be transported from Tuxtla Gutiérrez to the community of La Lucha, Chiapas, and the famous **Sótano de La Lucha**. The object was to record an ascent by hot-air balloon out of the pit, directed by Hulot. This was plan B, since a permit could not be obtained for Sótano de la Golondrinas.

The expedition occurred from April 1–12, with twenty-three Frenchmen and four cavers from the Instituo Politécnico Nacional in Mexico City. We rigged a tyrolean in order to lower gear, food, and the film crew with the aid of an electric winch powered by a generator. A smaller generator was used for lighting the camp area and recharging batteries. People from the community helped a lot with the work, even in temperatures of 42°C [107°F]. The cavers responsible for surface support were the same ones who had participated in the rescue of a young French caver in January 2008 [see *AMCS Activities Newsletter* 31, "Mexico News," Puebla].

The government of Chiapas lent two helicopters. The French video crew had exclusive use of one and attached a camera to it. A large number of local people, about one hundred, and animals made it possible to take all the gear to the pit. A spot near the entrance was cleared for use by the helicopter and installation of base camp. Since the French didn't like the local food, a kitchen was installed for their use.

An important note for cavers visiting the area in the future is that the French provided about 80,000 pesos of income to the local people for labor and mules, and on top of this the expedition donated 15,000 pesos to the community and left it all the French gear, such as tents, pots and pans, and stoves. Nevertheless, instead of thanking them, the locals abused them by trying to charge more than had been agreed, for tasks they hadn't done. After the French had returned to Tuxtla, the Mexican cavers were forced to leave all their own gear behind as security until they could return with more money from the organizers of the expedition. If you go to La Lucha, don't give anything away or tip the locals. Pay only what was negotiated clearly with the leader of the community.

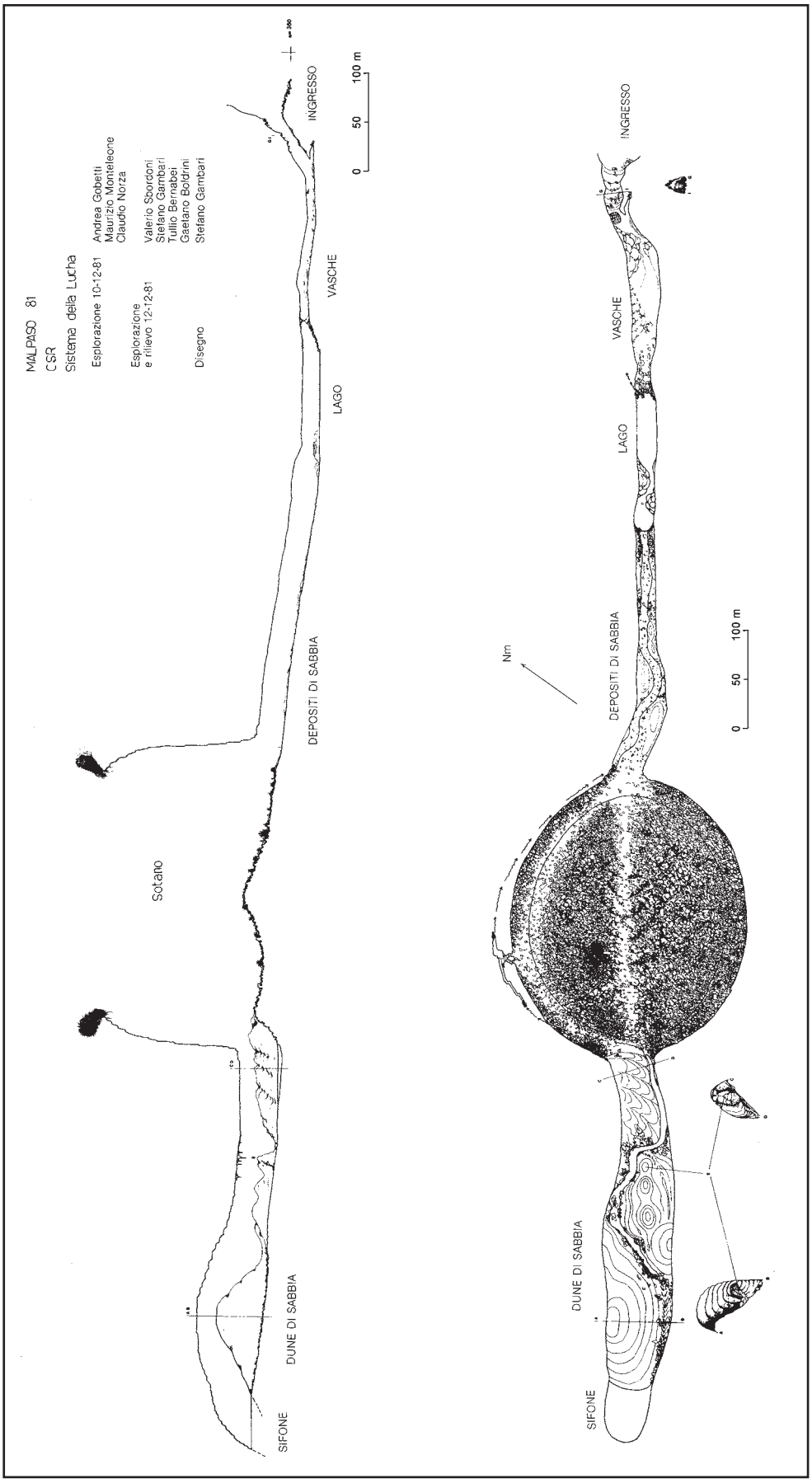
Source: Ricardo Arias Fernández, translated by Oscar Berrones. The map of Sótano de La Lucha is from *Le Spedizioni Speleologiche Malpaso '81 e Malpaso '84 in Chipas (Messico)* (Notiziario del Circulo Speleologico Romano, new series no. 1, 1986). A link to a video of the balloon ascent can be found at www.ushuaia.com/ushuaia-terre/info-planete/dossiers/ushuaia-nature/un-jou-la-terre/.

CHIHUHUA

A Spanish-language version of the *Geology* paper on the formation of the giant gypsum crystals at **Naica** (see English abstract in "Mexico News," *AMCS Activities Newsletter* 30) appeared in *Boletín de la Sociedad Geológica Mexicana*, vol. 59, no. 1, 2007, pp. 63–70. A PDF of the full paper can be downloaded from boletinsgm.igeolcu.unam.mx/epoca04/5901/%285%29Garcia-Ruiz.pdf. All issues of that bulletin, which began in 1904, are available online at boletinsgm.igeolcu.unam.mx/igl/.

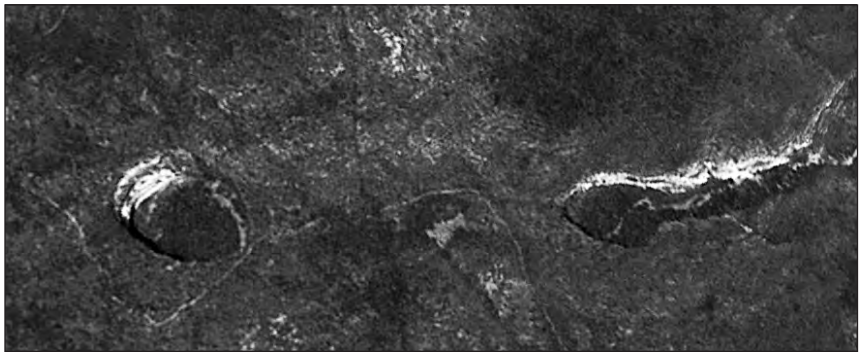
The crystals shown in the map of the **Cueva de los Cristales** in **Naica** on page 52 of *AMCS Activities Newsletter* 30 are just schematic, meant to indicate the general location of masses of crystals. The La Venta group and collaborators have since made a much more accurate map of the room, as well as surveying

Accurate rendition of the largest crystals in Cueva de las Cristales, Naica. The arrow points to the Cid Crystal, 11.4 meters long.


MALPASO 81
CSR
Sistema della Lucha
Esplorazione 10-12-81
Andrea Gobetti
Maurizio Monteleone
Claudio Norza
Esplorazione
e rilievo 12-12-81
Valerio Sbordoni
Stefano Gambari
Tullio Bernabei
Gaetano Boldrini
Disegno
Stefano Gambari
Sotano
INGRESSO
VASCHE
LAGO
DEPOSITI DI SABBIA
DUNE DI SABBIA
SIFONE
0 50 100 m
Nm

The hot-air balloon in Sótano de La Lucha, Chiapas. *Carlos Aguila Aznar*.

Google Earth image of Sótano de La Lucha and the resurgence valley.



exactly the position of 149 of the largest crystals. The largest of all, the Cin Crystal, is 11.4 meters long, has a volume of 5.0 ± 0.2 cubic meters, and weighs an estimated 12 metric tons (13 US tons). The arrow in the 3-D model points to the Cin Crystal. *Source*: "The Naica Cave Survey, by Giovanni Badino et al., *Proceedings of the 15th International Congress of Speleology*, volume 3, pages 1764–1769. The abstract of this paper appears elsewhere in this issue.

There is a two-minute video made by the BBC of the **Cave of the Crystals** at **Naica** at news.bbc.co.uk/2/hi/science/nature/8466493.stm.

The premier of the film ***Naica**, Journey to the **Crystal Cave***, took place on March 16, 2010, as part of the Festival Internacional de Cine en Guadalajara. John and Susy Pint interviewed Penny Boston and Paolo Forti, who were involved in the film. The interview is at www.saudicaves.com/mx/mexico/naica. A nice trailer for the film can be seen at www.naicafilm.com.

COAHUILA

There is an eighteen-minute video by Mike Pugliese of a caving trip to the **Muzquíz** area at www.vimeo.com/10656728. The same trip is described in an article in this issue.

GUERRERO

In April 2009, Charles Fromen, Bill Steele, Diana Tomchick, and Emily Zuber launched Proyecto Grutas de Guerrero and began exploring and mapping caves in an area about 30 kilometers west of **Chilpancingo**. This area was first visited by Club de Exploraciones de México cavers in the 60s, then by French cavers in the 70s, but has seen no work since. In 2009 the new project started mapping **Sima del Borrego**, which has the potential to be the longest cave in the state. In April 2010 they returned to the area with eight cavers, mapping **Grutas de Acatatlaca**, conducting an initial exploration of **Cueva del Tigre**, and explored farther in Borrego. They plan to return in 2011. *Source*: Bill Steele.

Ramón Espinasa reports in a post

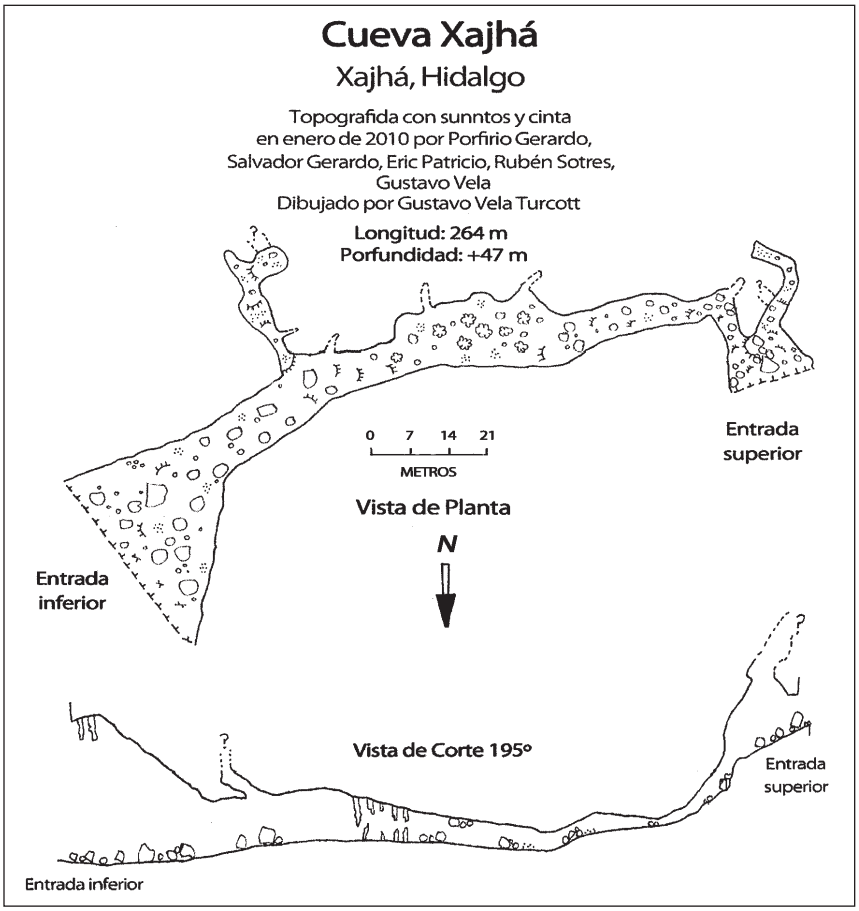
to the Tlamaqui e-mail list on August 12, 2009, that **Gruta de Acuitlapán**, a cave once well-decorated and popular with cavers that is near **Cacahuamilpa**, has been gated, with a note giving instructions about how to telephone for access. The old parking area is no longer available because of road construction, and the walk to the cave is long. It would be nice if a sign were put at the start of the trail, saving disappointment after a long walk. Excavation done to prepare the cave for tourists may have disturbed ceramic artifacts found now outside the entrance. Because of heavy visitation over the years, the cave has been heavily damaged, and it is possible that in the long run opening the cave to tourists may help prevent further damage.

In June 2009, Víctor Juárez Cruz, 33, and Cinthia Yuridia Ríos, 24, entered the **Río Subterráneo Chontalcoatlán**. On Sunday, June 28, Víctor disappeared in a waterfall, the river in the cave being high this time of year. Cinthia sought the help of the administration of **Gruta de Cacahuamilpa**. The body was recovered Tuesday by Socorro Alpino de México and park staff on the way to the stairs to the skylight. *Source*: announcement posted to Iztaxochitla e-mail list on June 30 by José Reyes Amates. Note that the Dos Bocas river caves below Cacahuamilpa are dangerous during the rainy season. "The best times for the river caves are from about Christmas until about May. Trying them during the rainy season or for three months afterward is likely to result in loss of life." —Chris Lloyd in an article in *AMCS Activities Newsletter* 25.

On August 15, 2009, the moutaineering club at UNAM was exploring **Resumidero La Joya**, Mpo. **Alarcón**, Guererro, when one of its members was caught in a flash flood and killed. There were twenty-four members in the cave on their way out when the flood hit. Most were near the entrance and able to get out safely.

Félix Mauricio Duran Nava was on rope on the third drop, of 12 meters, and died. Carlos Villagran Padilla and Kikey Fon Mejía were at the top of the drop and were washed over the edge and injured. One other explorer who had been tied in at the top of the drop was all right. The flood came up in fifteen seconds. Espeleo Rescate México was able to get the two injured cavers out of the cave and later make the recovery.

Resumidero La Joya is a well-known cave and usually not explored in the rainy season. Evidently



Patricio Angeles in Cueva Xajhá, Hidalgo. *Gustavo Vela.*

Entrance pit to Cueva de la Higuerita. *John Pint.*

the mountain climbers were unaware of the flooding danger. Another rescue in the cave occurred in 2001 and is reported in an article by Ramón Espinasa in *AMCS Activities Newsletter* 25. *Source*: Ruth Diamont. Press reports on the accident are at www.diario21.com/?module=displaystory&story_id=45150&format=html, www.lajornadaguerrero.com.mx/2009/08/17/index.php?section=sociedad&article=006n3soc, and www.eluniversal.com.mx/notas/vi_619758.html.

HIDALGO

A friend in Hidalgo invited me to explore a cave near **Zimapán**, along the Río Moctezuma. As the rock there in both Hidalgo and Querétaro is limestone, I hoped for a large entrance and miles and miles to map. The cave proved to be far from unexplored. The oldest graffiti we saw was from 1898. It turned out to be only 264 meters long, with possible dome leads. *Source*: Gustavo Vela.

JALISCO

Grupo Espeleológico Zotz in Guadalajara has a new web site at zotz.orgfree.com. *Source*: John Pint. (Beware of pop-up ads.)

La **Cueva de la Higuerita** (Little Fig Tree Cave) is located about 50 kilometers east of Colima City. The cave has a 14-meter drop along the roots of a large tree and a total depth of 22 meters. It was surveyed on May 15, 2010. *Source*: www.saudicaves.com/mx/hig.

MICHOACÁN

During the period December 25, 2005, though the following January 2, a team visited the **Dos Aguas** area. A number of small caves were pushed and surveyed, some of them potential easier entrances to the back of **Cueve del Río Durazno** [see *AMCS Activities Newsletter* 24, pages 67–70], but no connection was found. *Source*: Article by Chris Lloyd, *Canadian Caver* 68, spring 2008, pages 24–28.

Later visits during January and Easter week of 2006 are recorded in another article, in *Canadian Caver* 69, fall 2008, pages 7–10. The **Cueva de la Experanza** map, which really does lack a north arrow, is from the later article.

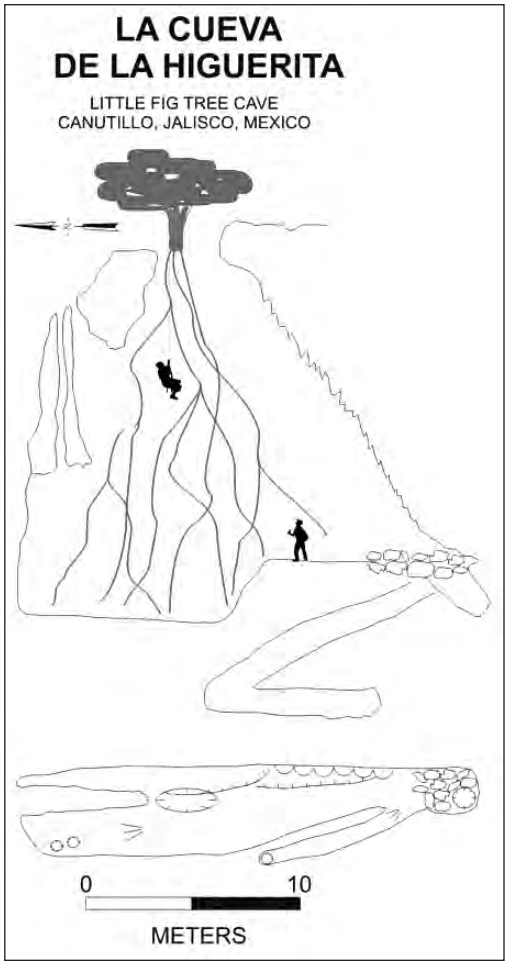
MORELOS

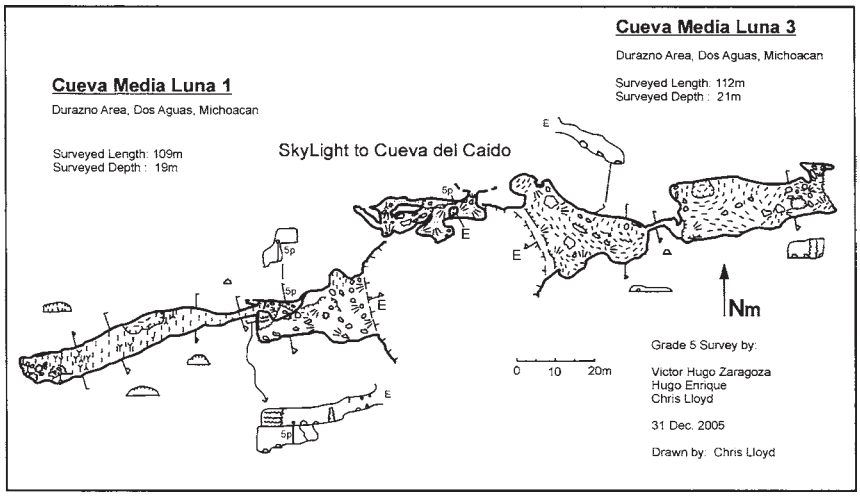
A report on a December 2005 visit to lava tubes **Cueva de la Iglesia** and **Cueva Pelona**, Morelos, is at www.saudicaves.com/mx/pelig/index.htm. It contains numerous photographs.

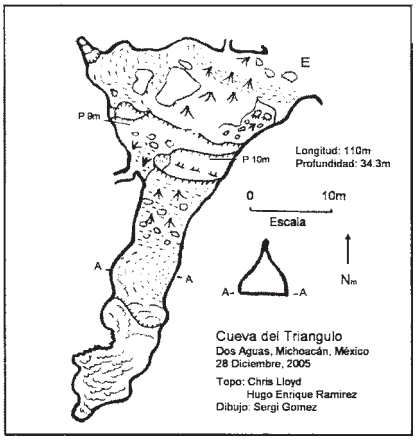
NUEVO LEÓN

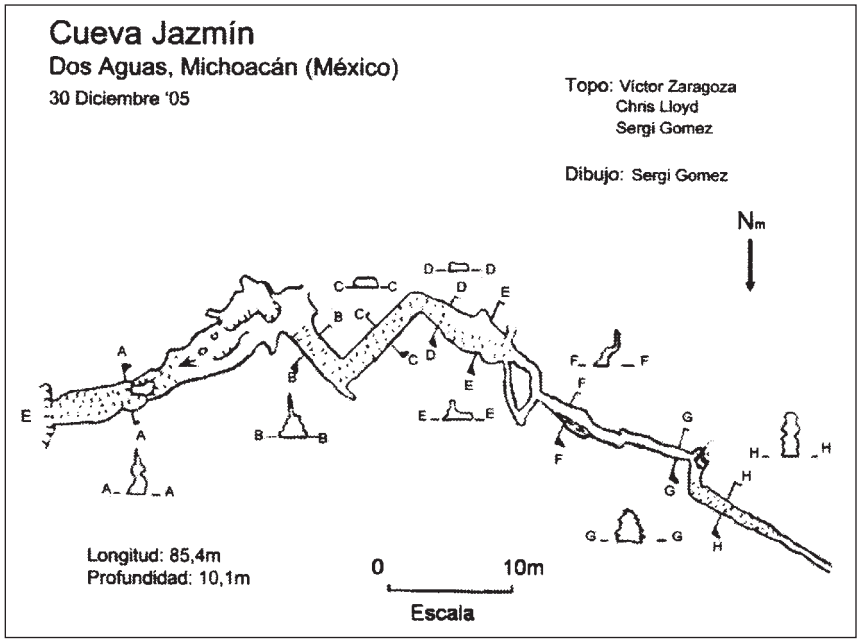
In December 2009 a team of eight cavers returned to **Sistema Los Toros** in the **Purificación** karst. The no-longer-used Soplo entrance route was derigged and the recovered hardware was moved farther into the cave. The first cave camp was established via the Zorillo entrance at a less-than-ideal but workable spot at −465 meters. From there a team of four pushed beyond last year's limit of −517 meters. Although there had been indications of improving conditions, the cave continued much as before, tight and gnarly. Eventually hammering was required to get through. A second, two-person camp trip was finally stopped where technical digging would have been required to proceed. They still had the air.

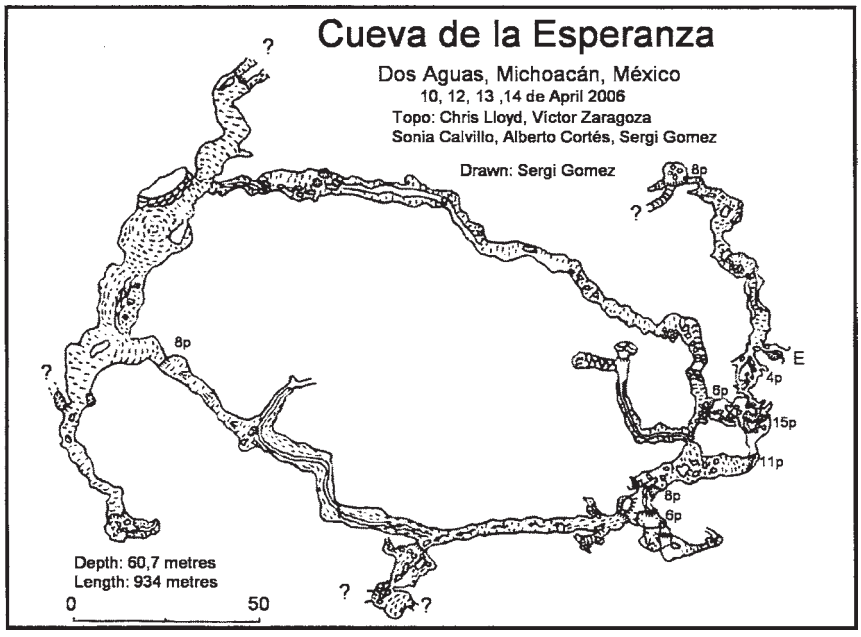
Meanwhile several bolt climbs were done higher in the cave. The most productive was a traverse around the middle of the 50-meter-deep Soplo Shaft and led to a spacious, blowing passage. This unfortunately connected back into known cave after a couple of drops. There are several more possibilities











for upper-level bypasses in the lower cave, so our plan for next year is to look for a higher route over the current end. After five expeditions Sistema Los Toros is 1633 meters long and 576 meters deep. It is undoubtedly the most technically challenging vertical cave in the Purificación area. *Source*: Mark Minton. See articles on Los Toros in *AMCS Activities Newsletters* 29, 30, 31, and 32.

The *Nittany Grotto News*, vol. 54, no. 1, March 2008, contains a long trip report on pages 4–29 on the December 2007 trip to **Laguna de Sánchez**. The maps of **Cueva de Escaladores**, **Cueva de Tecolote**, **Cueva de Lucy**, and **Cueva de Ricky** are from that article.

During a trip November 21–28, 2009, of the **Laguna de Sánchez** project sixteen caves were mapped, including eight new ones located during the trip. Aluminum tags were placed at more than seventy caves and karst features in the area. *Source*: article by Tone Garot, *Texas Caver* 56(1)2–11, 2010. The project now has a Web site at www.garot.com/LdeS.

There is an article in the *Texas Caver* for the second quarter 2009 (volume 55 number 2) by Ellie Thoene on the trip to **Los Toros** that was the subject of an article in *AMCS Activities Newsletter* 32, pages 77–82. Another article on the same trip, this one by Bill Steele, is in the *Oztotl Caver* of the Dallas–Ft. Worth Grotto, April 2009 (volume 28, number 4), pages 3–4.

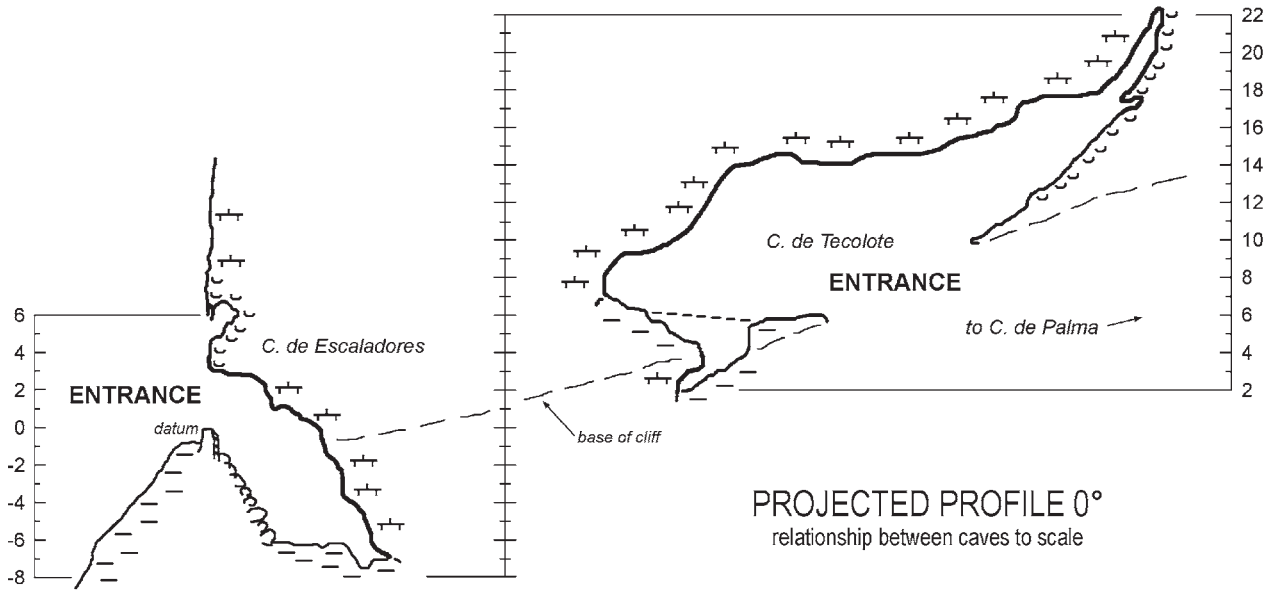
CUEVA DE ESCALADORES
and
CUEVA DE TECOLOTE

Municipio de Santiago
NUEVO LEON

C. de Escaladores surveyed length: 20.3m
C. de Tecolote surveyed length: 52.2m

Suunto and Tape survey 28 December 2007
by Bryan Crowell, Tone Garot, Jim Kennedy,
Rob Martin, Amanda Morrow, and Keith Wheeland

Map 26 March 2008 by Jim "Crash" Kennedy



PROJECTED PROFILE 0°
relationship between caves to scale

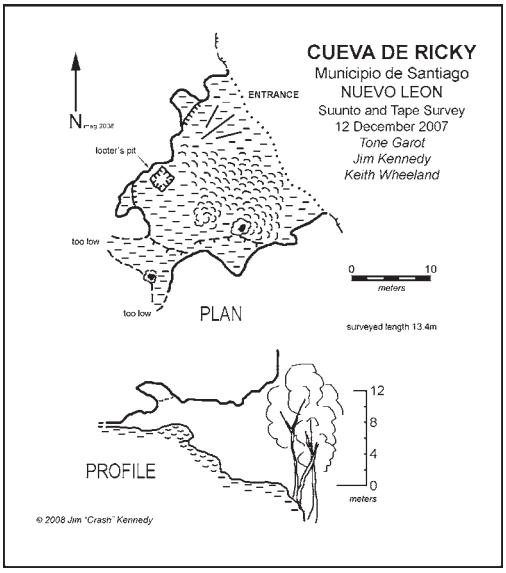

GRUTAS DE BUSTAMANTE
(GRUTAS DEL PALMITO)
BUSTAMANTE, NUEVO LEON
MEXICO
RUTA TURISTICA
TOPOGRAFOS PRINCIPALES: ORION KNOX Y JAN KNOX
CON AYUDA DE ESPELEOLOGOS DE MEXICO, ITALIA,
FILIPINAS, Y LOS ESTADOS UNIDOS
INSTRUMENTOS DE TOPOGRAFIA: SUUNTO Y CINTO DE MEDIR
TOPOGRAFIA: MAYO 1994 - FEBRERO 1997
CARTOGRAFO: © ORION KNOX
ABRIL, 1998 - DICIEMBRE, 2009
ESCALA
METROS
PIES
LATITUD/LONGITUD: 26.59911/-100.5373
ENTRADA NUEVO POR TUNEL
ENTRADA ORIGINAL
SECCION TRANSVERSAL - A-A'
SECCION LONGITUDINAL
MAPA GENERAL DE LA GRUTA
SYMBOLOGIA:
PARED EXTERIOR
PARED INTERIOR
COLUMNAS DE CALCITA
CAIDA
POZO
TECHO DERRUMBO
ESCALÓN
RASTRO PRIMITIVO
VEREDA NUEVO
COLUMNAS DE CALCITA
EXCENTRICOS DE CALCITA
DEPOSITO DE CALCITA
GOURS
ESTALACTITAS
ESTALAGMITAS PEQUEÑAS
CHARCO
CHARCO INTERMITENTE
COLUMNA CAIDA
MOSAICO
PEQUEÑAS GRANDES
PEQUEÑAS CHICAS
TIERRA SUELTA
BARRO O LODO
ALTURA PROM. TECHO (M)
PROFUNDIDAD DEBAJO DE LA ENTRADA ORIGINAL (M)

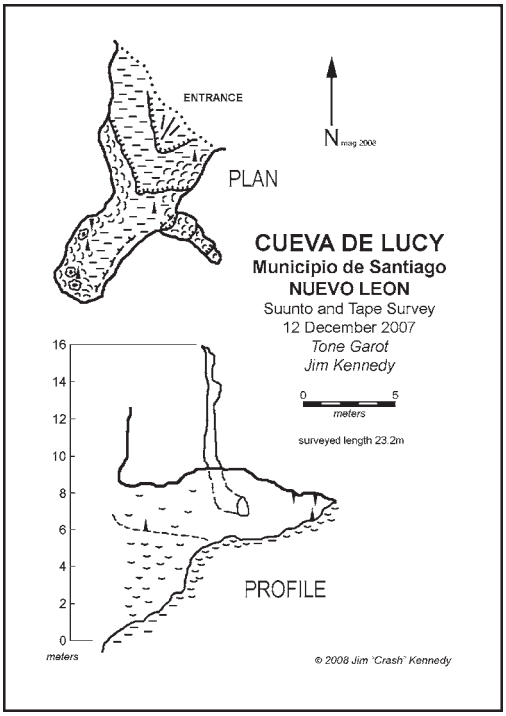
An article on the grand opening of what is now officially **Grutas de Bustamante** appeared in *AMCS Activities Newsletter* 32, pages 66–69. At that time, it was reported that the state of Nuevo León had taken over management of the cave and that caving off of the tourist trails would no longer be permitted. As reported first the Nico Escamilla, the town of Bustamante is again managing the cave, and caving is allowed again, provided that permission is granted at the Comandancia de Policia. It would probably be a good idea to arrange this in advance of a trip. Off-trail visitors must pay the admission fee of Mex$40 and be out of the cave by closing time of 4 p.m.

Orion Knox prepared a poster-size map of the entrance room showing the tourist route. A smaller version of it is included in this issue. Orion's equally detailed map of the entire main passage appeared as a foldout in *AMCS Activities Newsletter* 26.

OAXACA

During the NSS Cave Diving Section's annual workshop in May 2010, the US Deep Caving Team received the section's cave exploration award for the work done during its 2009 **J2** expedition. Jon Lillestolen accepted the award on behalf of the USDCT.





PUEBLA

During a long hike in 1983, Guy Meauxsoone discovered a region that was to become a Groupe Spéléo Alpin Belge (GSAB) working area, including the resurgences Atlixicaya, Coyolatl, and Xantilco. After a lapse of twenty-five years he continued prospecting by way of Google Earth. Finding some interesting depressions, he returned in 2007 to check them out. The following year, in January 2008, Guy and four of his French/Belgian teammates, including his son Arthur Meauxsoone, returned to explore what Guy had found. The best results are **Sótano Aguacate**, whnich ends in a sump at –150 meters, and **Hueholvastempa**, a very large pit 200 meters deep with a vegetation-covered floor but no continuation. Later in the expedition, at 2450 meters elevation, a new cave was found. **Tipitcli**, with good air flow, led down to a large room at –350 meters, and in the distance you could hear a stream. Unfortunately, during one last descent before returning to France, Arthur fell at –300 meters when a piece of the wall broke off together with the anchor, slicing off the rope. All four cavers were stranded at the bottom of the 35-meter drop, with Arthur hurt and with only Guy at the surface. After a hairy climb out of the pit, some membes of the team were able to exit, and a call for rescue was sent out to Belgian, French, and Mexican cavers. The ensuing rescue was successful, but a sad ending to an exciting expedition.

In February 2009, Arthur Meauxsoone and six French/Belgian teammates returned to Tipitcli. The cave was pushed to a length of almost 1000 meters, and a depth of 658 meters, where it became too tight to pursue. *Source*: article by Richard Grebeude in *Regards* 71, summarized by Yvonne Droms.

The objective of the GSAB expedition of January 2009 was to continue working in two major caves found and explored in 2008. With only ten team members total and just three weeks in the field, not much progress was expected, but nevertheless the expedition was successful.

On the last day of the 2008 expedition, what was then called **C 081**, a large cave with good potential to connect with **Tepetzala**, had been explored for 400 meters to a depth of 150 meters, ending at a drop over a large descending passage with good air. The 2009 expedition first concentrated its efforts at C 081, renaming it **Sumidero Natalia**. The team followed the passage down until it teed into a 15-meter-diameter paleo stream passage. Downstream, exploration stopped at a sump, and in the other direction, an easy upclimb with good air was encountered, which was left as a lead. Sumidero Natalia is now over 1000 meters long and 190 meters deep.

Efforts then switched over to the **Sumidero Tepetzala**. The first 200-meter pit series of the entrance area had to be rerigged before exploration could continue. One fossil gallery added over 500 meters of passage, ending at a sump and a climb. Another fossil passage yielded 250 meters downstream and 80 meters upstream, ending at the base of a dome, which was not pursued on this expedition. A passage off of the 80-meter pit in the entrance series

ended after 150 meters.

Following the main river downstream yielded a long, straight, horizontal fissure passage 20 meters tall by 1 meter wide, then a series of waterfalls in bigger passage. At the sixth waterfall, the rock was too fragile for bolting an anchor. A strong current that spanned the passage, as well as a lack of wetsuits, forced the team to turn around. Since the expedition was winding down, the cave was then derigged.

Tepetzala gained over 2 kilometers of passage. A return will require a cave camp, most likely at –300 meters and 3 kilometers in, about one hour away from the downstream lead.

While prospecting, the team found and explored about ten new caves, of which two continue. *Source*: Richard Grebeude in *Regards* 70, summarized by Yvonne Droms.

There is an short description in French of the 2009 **El Santito** expedition at www.explos.org/blog/2009/02/expedition-santito-2009.html. Thanks to Mark Minton for pointing this out. See also the article in this issue.

The 2010 Petzl catalog contains an article about the 2009 **El Santito** expedition starting on page 6. The on-line version is at www.petzl.com/catalogue/Petzl-Sport-catalog-2010-USA.pdf. Because of the way the PDF was made, it starts on page 5 of the PDF file. *Source*: Mark Minton. (There is an article about the expedition in this issue of the *AMCS Activities Newsletter*.)

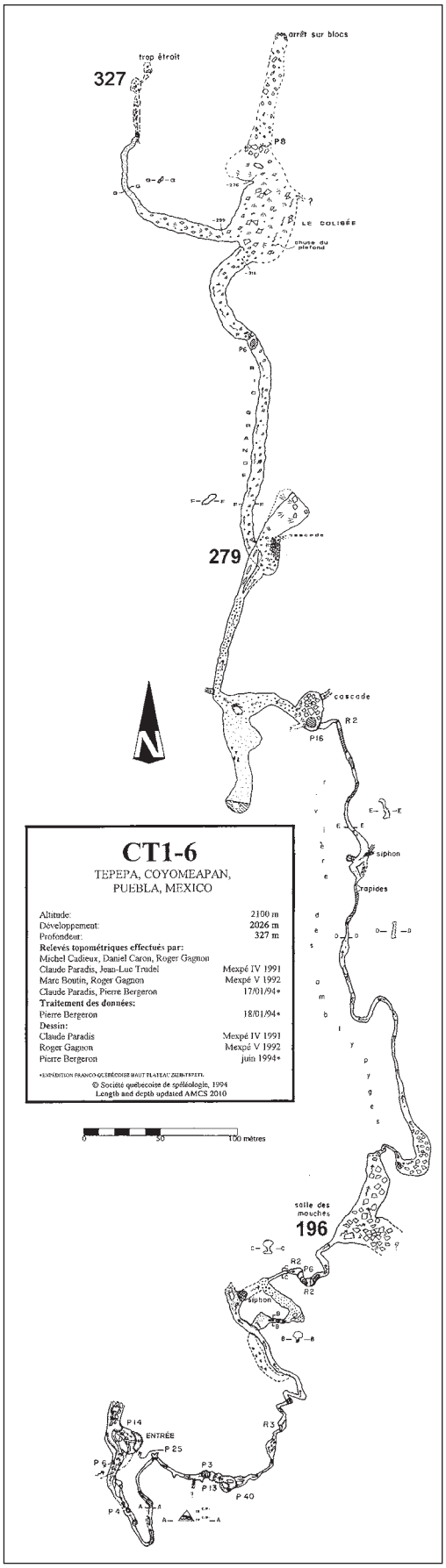
The maps of **Primera Decepción** (CT1-3) and **CT1-6** have not been previously published. They are from mexpe.org/fr/image/topo/mexpe1994/primera_decepcion_CT1_3(small).pdf and /CT1_6.pdf. The map of **Dias de Lluvia** (CT1-9) is from *Sous Terre* 9(4)9, autumn 1994. An article on the area, with an area map, is in *AMCS Activities Newsletter* 32, pages 129–132. Note that the depth of CT1-6 is incorrect in the table in that article. Both the depth and length of that cave are incorrect on the map on the web. The version here has been corrected according to information from Chris Chenier. *Source*: Mark Minton.

In early July 2009, members of the Sociedad Espeleológico Mictlan made a reconnaissance trip to the **Mazatepec** area. A first team went to the community of **Nectepec**, mpo. Cuetzalan. In a cave that is used as a water source, they explored approximately 300 meters upslope, requiring some climbing and some skirting of puddles. There is a vertical drop that was not done. The second team visited a camp called **Zapotitan** in an area full of lapiez karst, where half of the inhabitants of the area showed them three caves, in line about 500 meters long. None were seen to go farther than 30 or 40 meters, but one of them shows potential.

Members of the SEM are Aura Montiel, Raquel Aguilar, Magdelena Ortiz, Enrique Navarro, Víctor Herández, José Guerrero, and Ricardo Pacheco. *Source*: Tlamaqui e-mail list post, July 24, 2009.

The magazine *México Desconocido* has a short article on the 2007 **Akemati** area expedition by Gustavo Vela on its web site. The URL is www.mexicodesconocido.com.mx/notas/15101-Puebla:-un-viaje-al-centro-de-la-Tierra. A longer article by the same author appeared in *AMCS Activities Newsletter* 31, pages 27–36.

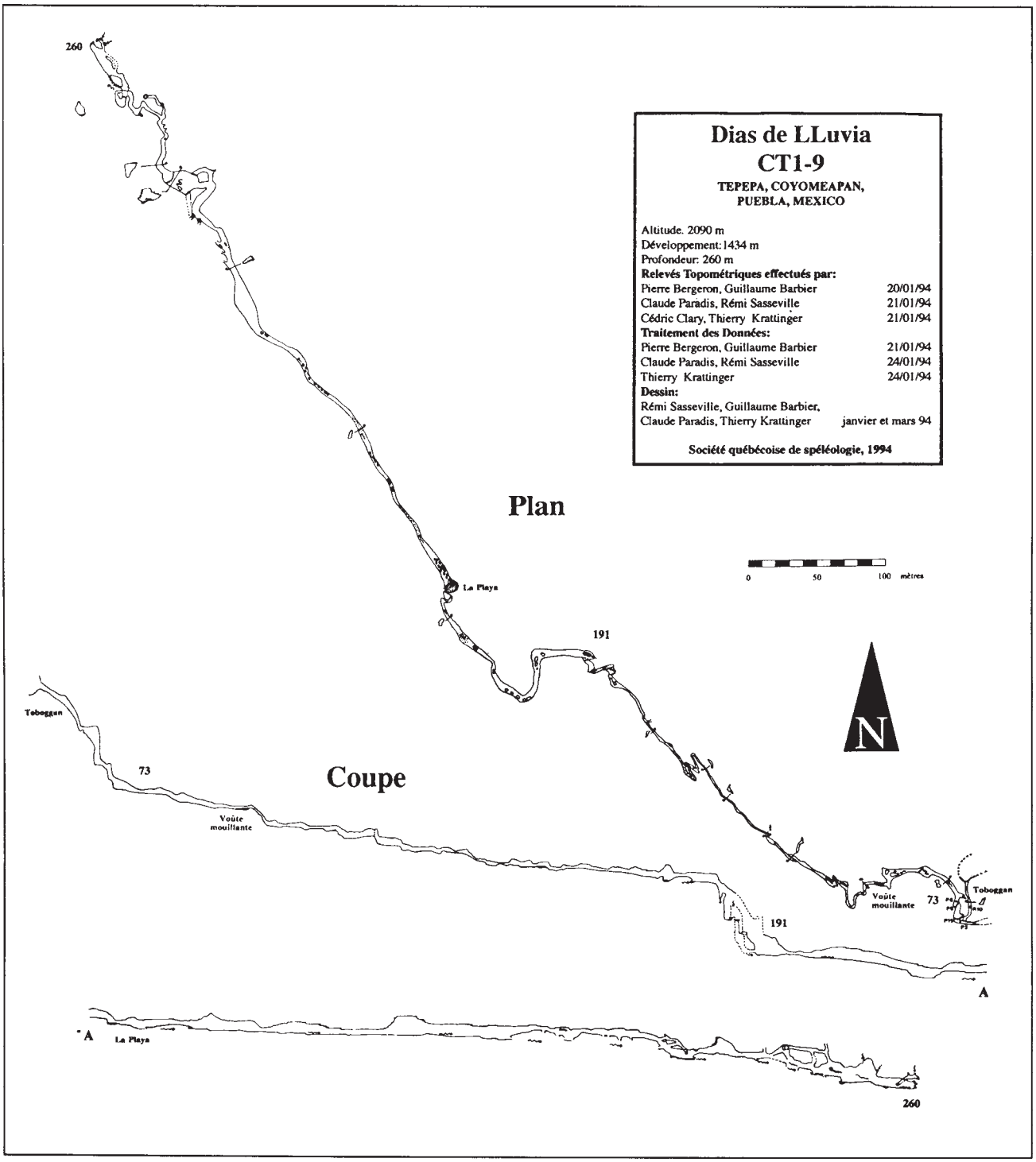
México Desconocido for October 2009 contains an article (pages 74–79) on the 2008 expedition to **Akembasis**, again by Gustavo Vela. Their artist misinterpreted the cave map that appears as a foldout in the article by Vela in *AMCS Activities Newsletter* 32; the profile in the magazine mistakenly shows two pit entrances to Akemabis.

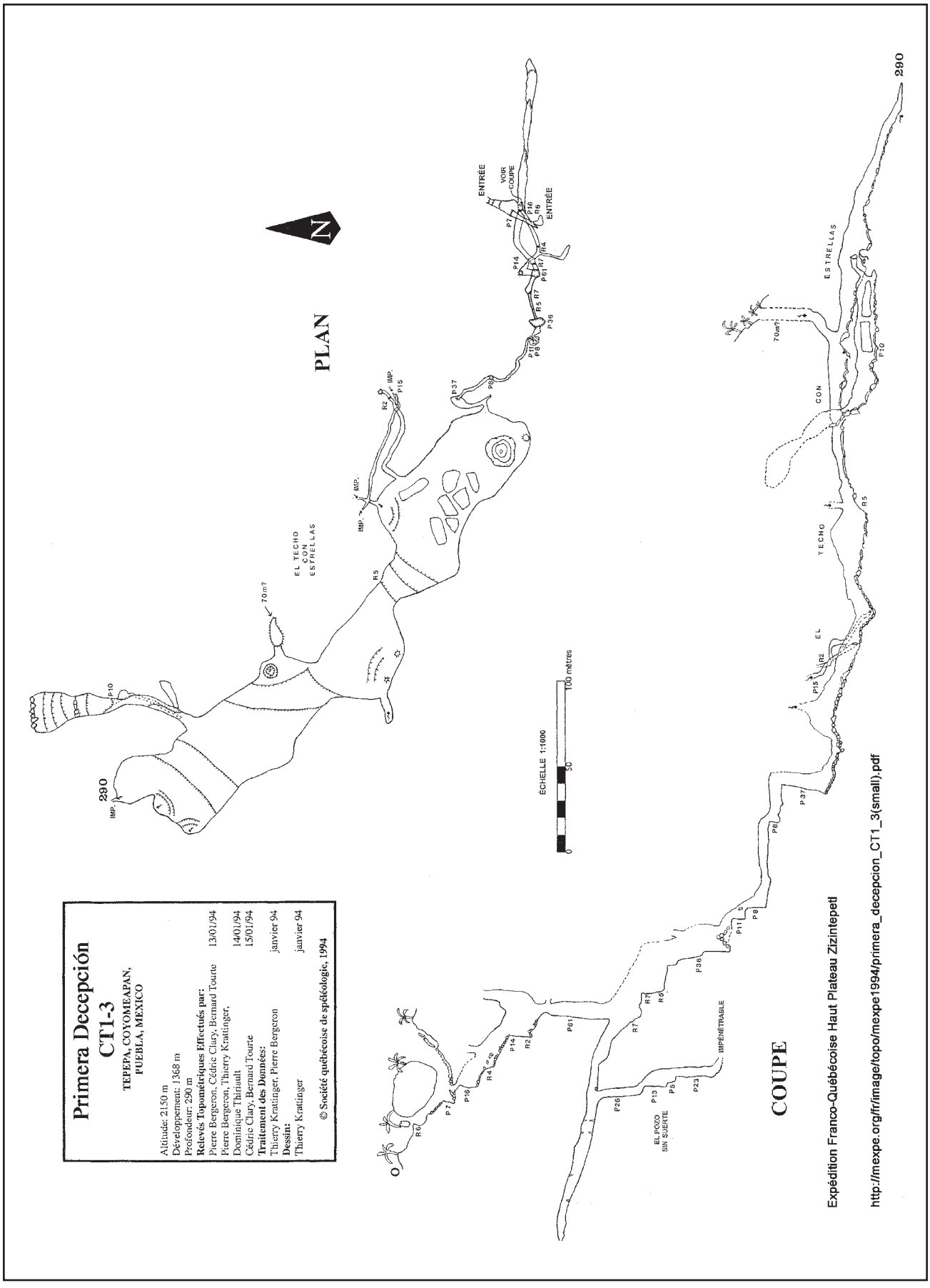


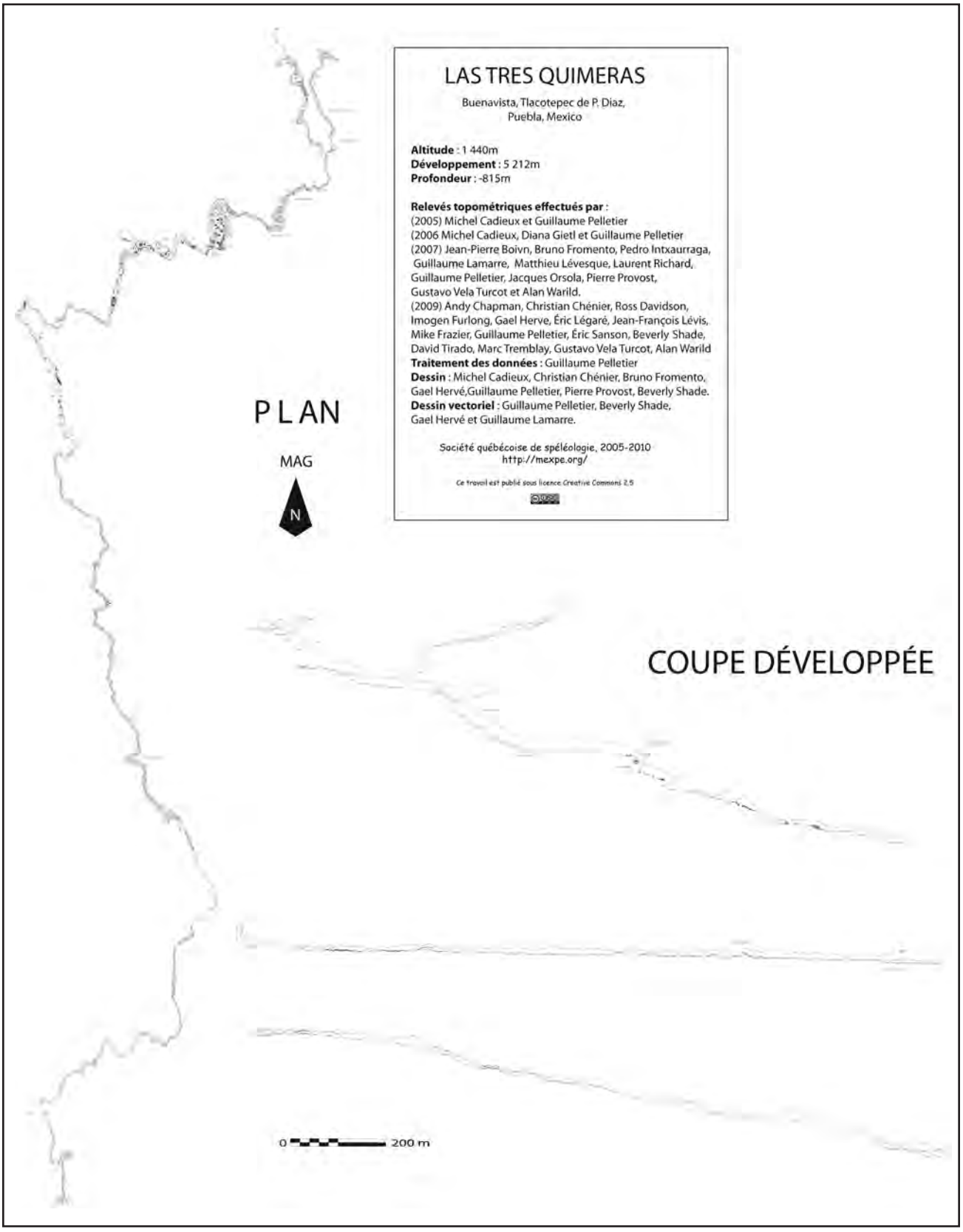
On 22 Janaury 2008, Arthur Meauxsoone (21) and Geraldine, Gael, and Stephan Girard were part of a six-person French and Belgian exploration and mapping expedition. Arthur was on an expected twenty-hour mapping trip at the –400-meter level in **Cueva El Gran Plano** when he fell. The 5-meter fall broke one foot and injured his knee on the other leg. Arthur and his team self-rescued up to between –200 and –250 meters. They had traveled for more than thirty hours before Arthur crawled into a sleeping bag to rest.

Teams from Espeleo Rescate México arrived and at one point had twenty-two members in three teams rigging. The rescue was slowed by tight meanders, where they took Arthur out of a stretcher and passed him by hand. Another obstacle was an 80-meter unstable pit, where a long tyrolean was required. They were able to complete the rescue effort on the fourth day. *Source*: *American Caving Accidents 2007–2008* (*NSS News*, February 2010, part 2). Also reported in "Mexico News" in *AMCS Activities Newsletter* 31.

A new cave in Puebla, **Tipitcli**, is reported to be 653 meters deep and




Primera Decepción
CT1-3
TEPEPA, COYOMEAPAN,
PUEBLA, MEXICO
Altitude: 2150 m
Développement: 1368 m
Profondeur: 290 m
Relevés Topométriques Effectués par:
Pierre Bergeron, Cédric Clary, Bernard Tourte 13/01/94
Pierre Bergeron, Thierry Krattinger, 14/01/94
Dominique Thiriault
Cédric Clary, Bernard Tourte 15/01/94
Traitement des Données:
Thierry Krattinger, Pierre Bergeron janvier 94
Dessin:
Thierry Krattinger janvier 94
© Société québécoise de spéléologie, 1994
PLAN
N
ÉCHELLE 1:1000
0
50
100 mètres
290
IMP.
P10
70m?
EL TECHO CON ESTRELLAS
R5
P37
P8
R2
IMP.
P15
ENTRÉE
VOIR COUPE
P7
R6
P14
R4
R7
P61
P36
P18
P7
R6
R4
P14
R2
P61
R7
R6
P36
P11
P8
P37
P8
P26
P13
P6
P23
EL POZO SIN SUERTE
IMPÉNÉTRABLE
COUPE
EL
P15
R2
TECHO
R5
70m?
CON
ESTRELLAS
P10
290
Expédition Franco-Québécoise Haut Plateau Zizintepetl
http://mexpe.org/fr/image/topo/mexpe1994/primera_decepcion_CT1_3(small).pdf


LAS TRES QUIMERAS
Buenavista, Tlacotepec de P. Diaz,
Puebla, Mexico
Altitude : 1 440m
Développement : 5 212m
Profondeur : -815m
Relevés topométriques effectués par :
(2005) Michel Cadieux et Guillaume Pelletier
(2006 Michel Cadieux, Diana Gietl et Guillaume Pelletier
(2007) Jean-Pierre Boivn, Bruno Fromento, Pedro Intxaurraga, Guillaume Lamarre, Matthieu Lévesque, Laurent Richard, Guillaume Pelletier, Jacques Orsola, Pierre Provost, Gustavo Vela Turcot et Alan Warild.
(2009) Andy Chapman, Christian Chénier, Ross Davidson, Imogen Furlong, Gael Herve, Éric Légaré, Jean-François Lévis, Mike Frazier, Guillaume Pelletier, Éric Sanson, Beverly Shade, David Tirado, Marc Tremblay, Gustavo Vela Turcot, Alan Warild
Traitement des données : Guillaume Pelletier
Dessin : Michel Cadieux, Christian Chénier, Bruno Fromento, Gael Hervé,Guillaume Pelletier, Pierre Provost, Beverly Shade.
Dessin vectoriel : Guillaume Pelletier, Beverly Shade, Gael Hervé et Guillaume Lamarre.
Société québécoise de spéléologie, 2005-2010
http://mexpe.org/
Ce travail est publié sous licence Creative Commons 2.5
PLAN
MAG
N
COUPE DÉVELOPPÉE
0
200 m

992 meters long. Its location is reported to be 18.46438°N, 97.02473°W WGS84, elevation 2457 meters. *Source*: grottocenter.org/html/file_En.php?lang=En@check_lang_auto=false&category=entry&id=7617. Tipitcli is one of only a dozen, as of May 19,2010, Mexican caves at grottocenter.org, most with no information other than locations. This European web site seeks to be a database of all the caves in the world. This goal is not likely to be very popular with American cavers.

Mexpé held another expedition in the Sistema Tepepa area in 2009, with participants from Canada (Québec), Mexico, UK, USA, Australia, and France. Exploration of **Tres Quimeras** was the primary focus of the expedition, during which base camp was installed next to the entrance. Several days were spent re-rigging to the –500-meter level, and considerable effort was put into drilling foot-long anchors in an area of the cave where the rotten rock would hold nothing smaller. These glued-in anchors did the job quite well, making the trip through the area much safer. Exploration was then continued where it had been left off two years before, in the main passage at –500 meters. Time required for push trips this far from the entrance (over 4 kilometers) quickly justified an in-cave bivy on a beach by the stream.

At the same time the bottom was being pushed, trips were being made to the presumed resurgence, some 800 meters below and due south, and requiring a few hours to reach by truck and then on foot. Due to the topography around the resurgence, no precise GPS location had been taken. Despite this, an approximate location was used on a PDA running Auriga software to watch live progress towards this presumed goal. This motivated at least one team to push the cave well into the early hours of the morning.

After returning from a thirty-three-hour trip (including a crash at the bivy) on April 9, the push team came out minutes before a climbing team returned from the resurgence. At around 3 a.m. that morning, the push team had turned around at the top of a pit after running out of rope. Less than twelve hours later, the climbing team reached the same point, thus making the connection.

Derigging from –500 meters was done as a pull-down. This turned out to be a very pleasant and sporting through-trip and was done in some six hours. This traverse through the cave's main active passage is 787 meters deep.

In the following days, one area above the cave higher than the known entrance was scouted. A few entrances were located, the last of which to be explored yielded what we were looking for: a higher entrance to the system. This new through-trip is 815 meters deep and is believed to be Mexico's second deepest, after Sistema Purificación.

Nearby **Sótano del Centro** was also descended for the first time, to a mud and garbage plug not far from the bottom of the 120-meter free-hanging entrance pitch. *Source*: Christian Chenier. (The map is reduced from an original 2 by 2.5 meters in size received at the last minute. I realize detail is illegible. Perhaps a publishable version will be drafted at some point.—ed.)

QUERÉTARO

In January 2010, four people were in an abandoned mercury mine about 10 kilometers from **San Joaquin**. Two of them were swept away by rockfall in a passage described as steeply descending with a pit at the end. The **Calabacillas Mine** had been abandoned for forty years. After supposedly descending 280 meters, Querétaro Protección Civil requested Expeleo Rescate México to take over the operation. After considering all the factors, it was decided to abandon the effort to recover the bodies. The family asked that the rescue group not put their lives in danger. The main hazard was the potential for severe rockfall, which is what caused the accident in the first place. There was still a large amount of very unstable rock near the edge of the pit. Explosives and detonators had been seen in the mine, where some people, including the victims, had been trying to extract ore. This caused a hazard in itself, and was evidence of illegal work that might have created additional instability in the mine. It was likely that the bodies were buried under a thick layer of rock. The initial collapse was about 7 cubic meters, and additional rockfall had occurred during the recovery attempt.

This is not the first time that such a decision was taken by the ERM and it will surely not be the last. Two previous examples are the **Resumidero Oztoquito** recovery in Puebla in 2004 [see article in *AMCS Activities Newsletter* 25, pages 45–54] after nine days of work and in **Jashib**, Chiapas, 2004, where two kids were trapped inside a cave and the operation continued for ten days [see "Mexico News," *AMCS Activities Newsletter* 28].

We [ERM] are definitely aware of our technical limits. When the required actions are outside our area of expertise, we request help. In Oztoquito we requested help from cave divers from the USA, and in the mine **5 Señores** in Guanajuato we requested help from deep divers.

The decision to abandon a recovery effort is taken after identifying the dangers under which the rescuers will work and evaluating the benefit that could result from their actions. *Source*: material from Antonio Aguirre, chairman of ERM, translated by Fofo Gonzalez.

Abstract: Seasonal Distribution and Circadian Activity in the Troglophile Long-Footed Robber Frog, *Eleutherodactylus longipes* (Anura: Brachycephalidae) at **Los Riscos Cave**, Querétaro, Mexico: Field Studies and Laboratory Studies, by Adriana Espino del Castillo et al.

Los Riscos Cave belongs to the El Abra limestone, and its geographical location is in the Sierra Gorda in the state of Querétaro, Mexico. The cave has a high faunal diversity that includes arthropods and some vertebrates, such as vampire bats and anurans, and includes the robber frog *Eleutherodactylus longipes* (Baird, 1859). The abundance of the robber frog changes non-randomly between dry and rainy seasons and is related to the search for humid conditions inside the cave. In addition, the robber frog was located in areas where some scattered light may influence

its dispersion inside the cave and therefore its activity. Frogs displayed spontaneous circadian rhythms of locomotor activity from the first days of the experimental observation in constant darkness. The average period of circadian rhythms was 24.85 ± 0.93 h indicating, in isolated conditions, a diurnal activity. When exposed to artificial light-dark cycles, the animals lacked daily activity rhythms, and ultradian activity was observed. The preference for high humidity and low illumination in the cave and a partial endogenous circadian rhythmicity confirm the troglophilic affinity of the robber frog to cave environments.

Source: *Journal of Cave and Karst Studies* 71(1)24–31, April 1009. The full paper is available at caves.org/pub/journal/PDF/v71/cave-71-01-24.pdf.

QUINTANA ROO

Abstract: Responsible Development in **Tulum**, Mexico: Considering Water Quality and Subaqueous Cave Locations, by Heidi Hausman. Duke University MS project, 2009.

Development is rapidly occurring along the **Mayan Riviera** in the Yucatan Peninsula, Mexico, with little regard to environmental regulations or well-being. In particular, fresh water must be considered when planning for future development. The sole source of fresh water in the Yucatan is from a karstic aquifer that is characterized by an extensive network of subaqueous caves, a system that is particularly sensitive to contamination. This master's project focuses on the current and future water supply for the town of Tulum, since the town's future development will have long-term repercussions on the surrounding environment. Two methods were used to determine how and where Tulum should or should not develop with regard to the protection of future water quality. Water samples collected around Tulum in the summer of 2008 were analyzed to determine the current water quality of wells and cenotes (sinkholes). Cave survey data that was collected by cave divers and the Quintana Roo Speleological Survey was used to create a map of the known cave systems. Satellite imagery was classified to determine the current land use/land cover of the area, and the extent of future development was estimated according to the Urban Development Plan (UDP) of Tulum.

Water quality results show that nitrate contamination is within acceptable limits according to Mexican water standards. These results would likely be very different if the samples had been taken during a different time of year (the dry season), when nitrate contamination is more concentrated. Chloride and sodium concentrations are well above Mexican water standards; the water supply that the city of Tulum relies upon is already experiencing salinization. It is likely that higher future withdrawals from this water source will be increasingly more saline, which may necessitate a different freshwater source for the city. Mapping of the known subaqueous caves shows that the vast majority of the network (81%) is overlaid by forest and is therefore less likely to be contaminated from the surface. Future development according to the UDP of Tulum will occur above a substantial area of subterranean caves. To protect water quality, the UDP should be altered to take cave locations into consideration. High-impact development should be resituated, and land above the cave systems should be zoned for limited, if any, development.

Source: dukespace.lib.duke.edu/dspace/bitstream/10161/1030/1/HHausman_MP.pdf (the full report).

In the *ejido* Kantemó in the *municipio* **José María Morelos**, Quintana Roo, is a cave of a surprising nature. The steady flow of a dense cloud of thousands of winged mammals announced the onset of nocturnal activity of its inhabitants. The cave, typical of the underground formations in the Yucatan Peninsula, is a cenote. Inside, the dim light of flashlights on slippery rocks slowly unravels the secrets long jealously guarded by the unfathomable darkness: wet walls with marine fossils and in the background a pool of crystal-clear water. Approaching the places where the flight of bats has its greatest density, we glance upward and see unusual characters, several snakes that glide through the vast number of cracks and cavities in the rocky vault of the cave, where the Central American rat snakes (*Elaphe flavirufa*) are preparing to catch food. They slowly drop in the dark until they are suspended by their tail ends, then sway rhythmically, awaiting their prey, and, with a quick movement, wrap a bat in their body, strangle it, and swallow it slowly. *Source*: Beginning of an article in Spanish about the biology of the cave by Arturo Bayona Miramontes and Julissa Sánchez Chávez, in *Biodiversitas* 73, bulletin of the Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (July-August 2007). The article can be found at www.conabio.gob.mx/otros/biodiversitas/doctos/pdf/biodiv73.pdf. Thanks to Peter Sprouse for calling this to our attention.

Underwater Speleology, volume 37, number 1 (first quarter 2010) contains an article on a recreational dive in **Cenote Ixchel**, a new underwater cave. Currently it has three cenote entrances, **Medialuna**, **Chaya-de-Mante**, and **Triangulo**. The QRSS web site gives its length as 1887 meters (caves.org/project/qrss/qrlong.htm).

The winter 2004 issue of *Quest* magazine contained an article by Fred Devos and Chris Le Maillot on pages 31–33 that summarizes some then-recent cave-diving discoveries in Quintana Roo. The article can be found at www.gue.com/files/page_images/expeditions/Mexico/ Coastal_cave_exploration.pdf. *Source*: Peter Sprouse.

Sistema Toh Ha, the fifth-longest cave in Quintana Roo at almost 30 kilometers, is close to a connection with **Sistema Swan Lake**, of which the dry cave **Sistema Borges**, subject of an article in this issue, is part. *Source*: Jim Coke.

On March 22, 2010, Mexican president Filipe Calderón announced the upcoming construction of an airport for the **Riviera Maya**. Calderón indicated that the airport would be the

Nadia Berni in Sisteam Toh Ha, Quintana Roo. *Radoslav Husák*.

first in Mexico to be built completely with private funds (read developers and drug lords). Calderón did not give details on the bidding process. The cost of the airport is projected to be 3.2 billion pesos ($260 million).

Calderón made his announcement in **Tulum**. The airport, in its "initial phases," would be able to handle three million national and international passengers per year. The planned airport is located about 15 kilometers northwest of Tulum (see Patricia Beddow's area map on page 83 of *AMCS Activities Newsletter* 32), on or near the Holbox fracture zone, and any chemical or waste spills could contaminate a large portion of the area's freshwater aquifer and the associated caves. The nearest international airport to Tulum now is in Cancún, a two-hour drive. *Source*: Jim Coke.

Excursion 85 of the International Congress of Speleology went to the Yucatan Peninsula after the congress, July 27 through August 3, 2009. It was organized by Patricia Beddows and Jim Coke. The guidebook is reprinted as part of AMCS Reprint 11, *Mexican Field Trip Guidebooks from the 15th ICS*. A report by one of the attendees is in the *Canadian Caver* 71, pages 34–36, fall 2009.

The April–June 2010 issue of *Underwater Speleology* (vol. 37, no. 2) contains a short report by Jason Richards on his cave-diving in Quintana Roo during January 2010. He spent much of the time making a detailed map of some 900 meters of an unspecified cave, probably **Sistema Crustacea**, and extending it by about 1200 meters of new survey. Jason and Christina Richards were then shown two promising new caves in the **Riviera Maya** area, in each of which Jason left 150 meters of virgin line. The last part of the trip was spent helping students at the Universidad Autónoma de Yucatán in Merída survey cenotes in Yucatán.

Speleofórum, magazine of the Česká Speleologická Společnost, contains articles on Xibalba expeditions to Quintana Roo by Czech and Slovak cave divers in numbers 25 through 28, 2006 though 2009. (These issues are available in the AMCS library.) An article by Zdeněk Motyčka summarizing their results appears in this issue. The additional map here, **Dzonot Zebra**, is from *Spelefórum* 25, page 44.

Sistema Pool Tunich. *Gustavo Vela*.

Dave Sieff in Sistema Toh Ha. *Radoslav Husák*.

Thecamobians and foraminifera are testate amoeba that inhabit fresh to marine water environments around the world. They have exploited every aquatic niche from the deep sea to lakes and marshes. These organisms produce a shell (microfossil) that are about the size of a grain sand, and are found in abundance in the sediment, with a tablespoon often containing thousands of specimens. They are also very sensitive to environmental change, with certain species living in specific aquatic environments. This makes them very useful for reconstructing past environments and how they changed through time. So we can retrieve a sediment core, examine the succession of microfossils in the sediments, and reconstruct environmental changes that have occurred in that location through time.

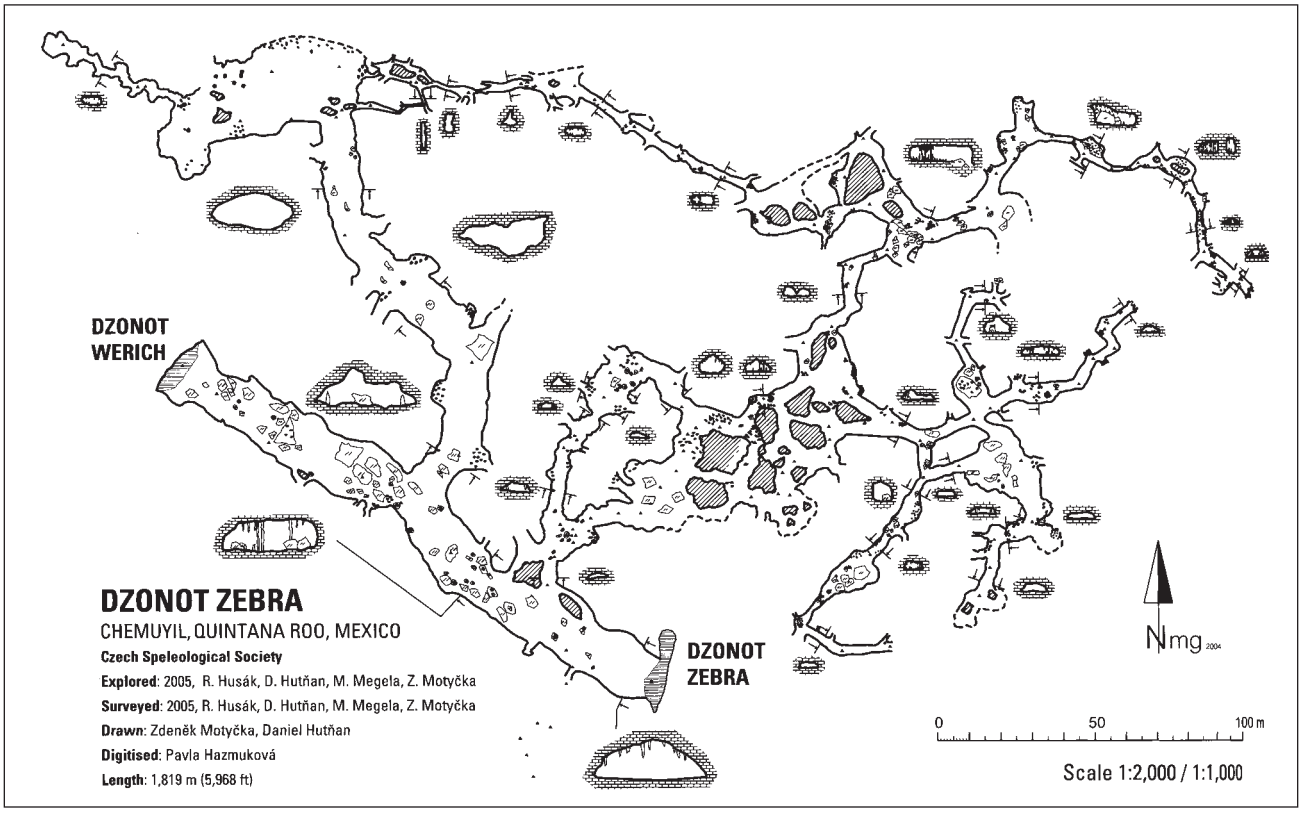
This technique of environmental reconstruction is well developed, and often used in the oil industry, having been applied in many locations around the world, from oceans, lakes, deltas, lagoons, etc. However, it has never been applied in the cave environment. We know nothing of the distribution of these organisms in cave systems and their potential for understanding the environmental evolution and paleohydrology of caves. The research is still in its infancy, but based on preliminary results showing that thecamoebians and foraminifera inhabit the cave environment, it looks promising.

The 2006 project (August 27 to September 8) retrieved sediment and core samples from **Cenotes Ponderosa**, **Aktun Ha**, and **Maya Blue**. Further analysis in the laboratory over the next year will determine the distribution of species relative to environment (e.g., salinity, light, etc.) to interpret species changes we find in the sediment cores. Radiocarbon dating will place the core sediments in a temporal context, allowing a reconstruction of the cave environment through time.

No doubt this preliminary work will pose further questions that will require further sampling and research to fully understand the cave system. However, we hope this research will make a significant contribution to our understanding of how the cave systems evolved to what they are today. *Source*: www.gue.com/files/page_images/expeditions/Mexico/ReconstructingYucatan.pdf.

Videographer Tim Bass was asked to record **Sistema Cocodrilo** on **Cozumel**, an underwater cave unusual in having Maya artifacts both pre- and post-colonial as well as Spanish artifacts from the sixteenth and seventeenth centuries, and he want to Cozumel for seven days in December 2008. The cave is like Swiss cheese, with a halocline. He had considerable difficulty due to back-scatter from silt disturbed from the ceiling and, at one point, a leaky HD camera housing. But his GEM "air extenders" (rebreathers) and bright LED movie lights worked well. *Source*: *Underwater Speleology* 36(3)22–25, July–September 2009.

Two experienced cave divers (ages 45 and 38) ran out of air and died after missing a turn while trying to exit a cave in Mexico. The two were among a group of seven cave divers who had broken into three teams for a 45-minute dive on air at depths no greater than 60 feet (18 meters). The pair was the third team to enter the



cave. Besides making an incorrect turn while trying to exit, the divers failed to use safety reels to mark a jump and apparently missed or disregarded a series of line markers pointing the direction to the exit.

On their way into the cave, all three teams used a main tunnel known as B. They passed in sequence through a T-turn, where the divers expected a jump. However, instead the cave came to a T, with three line markers showing the correct direction to turn while returning to the exit. A member of the second team repositioned one of the markers to make it more visible.

The third team called their dive earliest, as planned, since the first two teams were stronger swimmers and wanted to penetrate farther. The two divers then headed back, but turned the wrong direction at the T, apparently missing all three line markers at that spot. Their mistake led them 91 meters to the end of B tunnel, where another route leads to the A tunnel. The divers headed into the A tunnel, which also led to an exit, crossing a visual gap without setting up a safety reel to mark their path.

The divers then made a series of additional errors and apparently missed several indicators that should have told them that they were following a different path than the one they had taken on the way in. The divers made it to the end of the line marking the start of the A tunnel, about 30 feet from an exit. Rather than exiting, the team headed back into the A tunnel, passing as many as fourteen line markers pointing back toward the entrance they'd just left. The divers then swam past the unmarked jump that might have led them back to the other dive teams.

When the third team did not return from the dive, the other five divers notified local authorities and asked for help. Later that day, the divers returned to the cave and recovered the bodies. Their moves were reconstructed by the other members of the team, one of whom had entered the A tunnel after completing his dive in an attempt to find the missing divers. He noticed silt at the entrance, indicating that the missing team had recently been there, but because of low air he had to turn back before going far enough into the tunnel to find them.

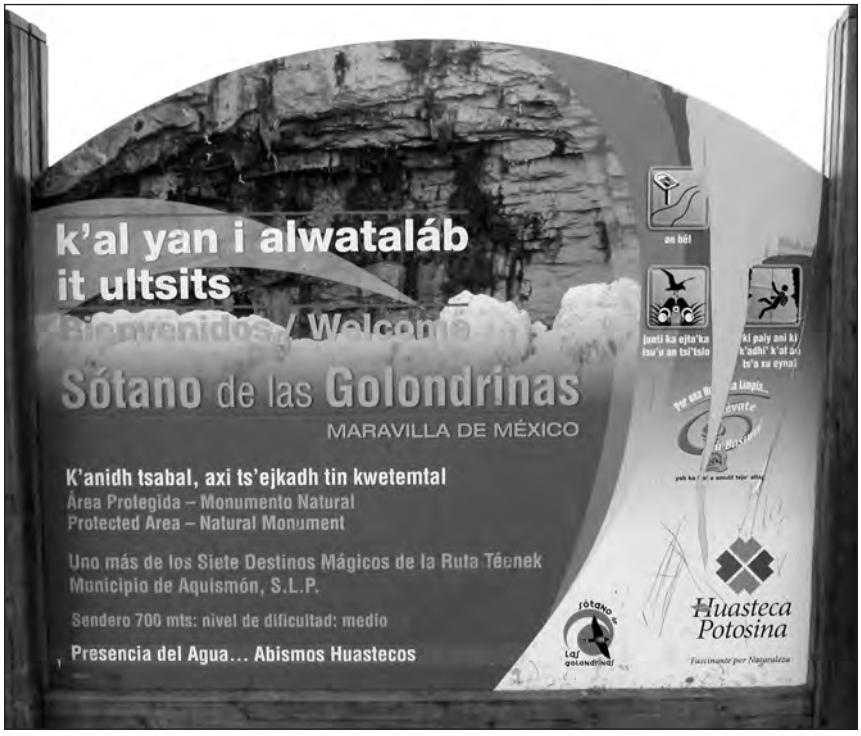
One of the dead divers had made between 75 and 100 cave dives; the other had some 150 cave dives. A cave-diving instructor with the group commented that the series of errors apparently made was inexplicable, given the level of experience of the two divers. *Source*: *American Caving Accidents 2007–2008* as a previously unreported accident (*NSS News*, February 2010, part 2). The entrance was **Cenote Maya Blue** in **Sistema Naranjal**. Another account of this accident appears in Steve Gerrard's book *The Cenotes of the Riviera Maya*, page 201.

In July 2008, during a rebreather dive from **Cenote Cristal** to **Cenote Maya Blue** in **Sistema Naranjal**, Hans Kaspersetz and another diver has a series of equipment problems and other misadventures, although they survived. The story is at www.quietdiver.com/113/kiss-classic-total-loop-failure.html, and also summarized as an incident in *American Caving Accidents 2007–2008* (*NSS News*, February 2010, part 2).

Www.quietdiver.com is a blog about diving with rebreathers, the name probably coming from the fact that rebreather divers don't make a lot of noise blowing bubbles. Many of the reports in it are about cave diving in Quintana Roo. While I haven't read much of the lengthy material, it appears that few if any of the dives reported were more than recreational dives, with no original exploration.

Sistema Pool Tunich, part of which is shown in the photographs by Gustavo Vela here and on the back cover of the last issue, has had a profusion of names. It was originally discovered by Gil Harmon when highway construction some 5 kilometers south of **Playa del Carmen** opened up an entrance about eleven years ago. He called it the **Río Cristal**, a name that may claim priority, and kept is as a secret playground for himself and his friends for some years. The Mayan name is **Yok Ha' Hanil**, and a dry part of the cave has been opened commercially as **Río Secreto** (www.riosecretotours.com).

Eventually an owner of one entrance, Señor Pool, contacted other cavers, who connected Pool Tunich to Río Cristal from the north. The



Ann Scott.

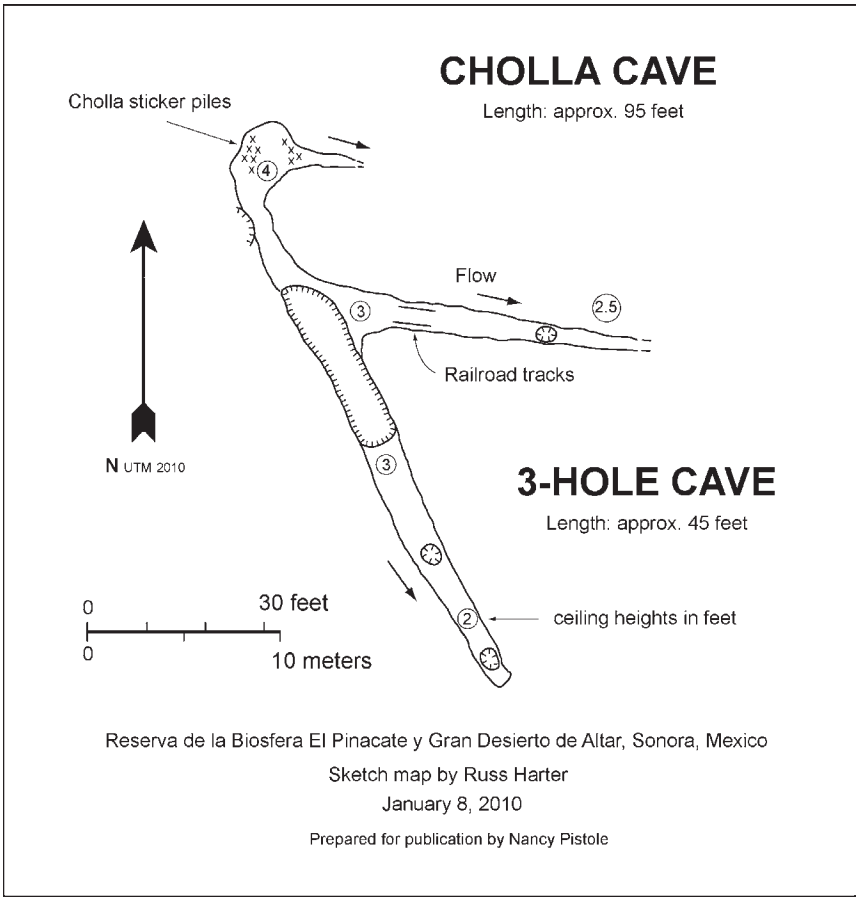
system is nearly 13 kilometers long, very impressive for a dry cave in Quintana Roo. The modern explorers include Otto Von Bertrab, Tania Ramírez, and Gustavo Vela. About 700 meters of the system are the show cave, managed by Otto.

Tania Ramírez reports that the area of the cave is in serious danger. The cave lies under several *ejidos*, and the owners seem to be mostly interested in the monetary value of their land. Playa del Carmen is growing very rapidly, and some of the land has recently been zoned residential for forty houses per hectare. (If true, that would be sixteen houses per acre.) Some construction is already occuring over parts of the cave. Given the lack of legal protections and the culture of bribery in Mexico, the danger of pollution of the cave is high. *Source*: posts to Tlamaqui e-mail list by Gustavo Vela; post to Iztaxochitla list by Tania Ramírez. A nice report by Donna and Simon Richards of a visit to Río Secreto is at www.cave-exploration.com/riosecreto/riosecreto.htm.

SAN LUIS POTOSÍ

The spring 2008 issue of the *Canadian Caver* (numer 68) contains a report by Dan Green on the November 2007 trip to the **Xilitla** area that was the subject of an article on pages 79–86 in *AMCS Actitities Newsletter* 31.

A bulletin from the public relations people at UNAM contains an article about the blind *Astyanax* in San Luis Potosí and Tamaulipas, which are reported to be endangered by over-collecting and damage to their environment. Hugo Reynosa Rosales, an researcher at the UNAM Institute of Biology, visited **Cueva Chica** in San Luis Potosí and **Cueva Pachón** in Tamaulipas and caves along the **Río Micos** in Tamaulipas (it says; the Río Micos is in SLP), encountering dramatic declines in population. The population in Cueva Chica was 540, compared to 8671 in 1971. *Source*: www.dgcs.unam.mx/boletin/bdboletin/2009_359.html.



Texas cavers visited and surveyed in **Cueva la Gloria** and other nearby caves in the **Aquismón** vicinity in January 2010. An article on the trip appears in the *Texas Caver* 56(2)12–19, second quarter 2010.

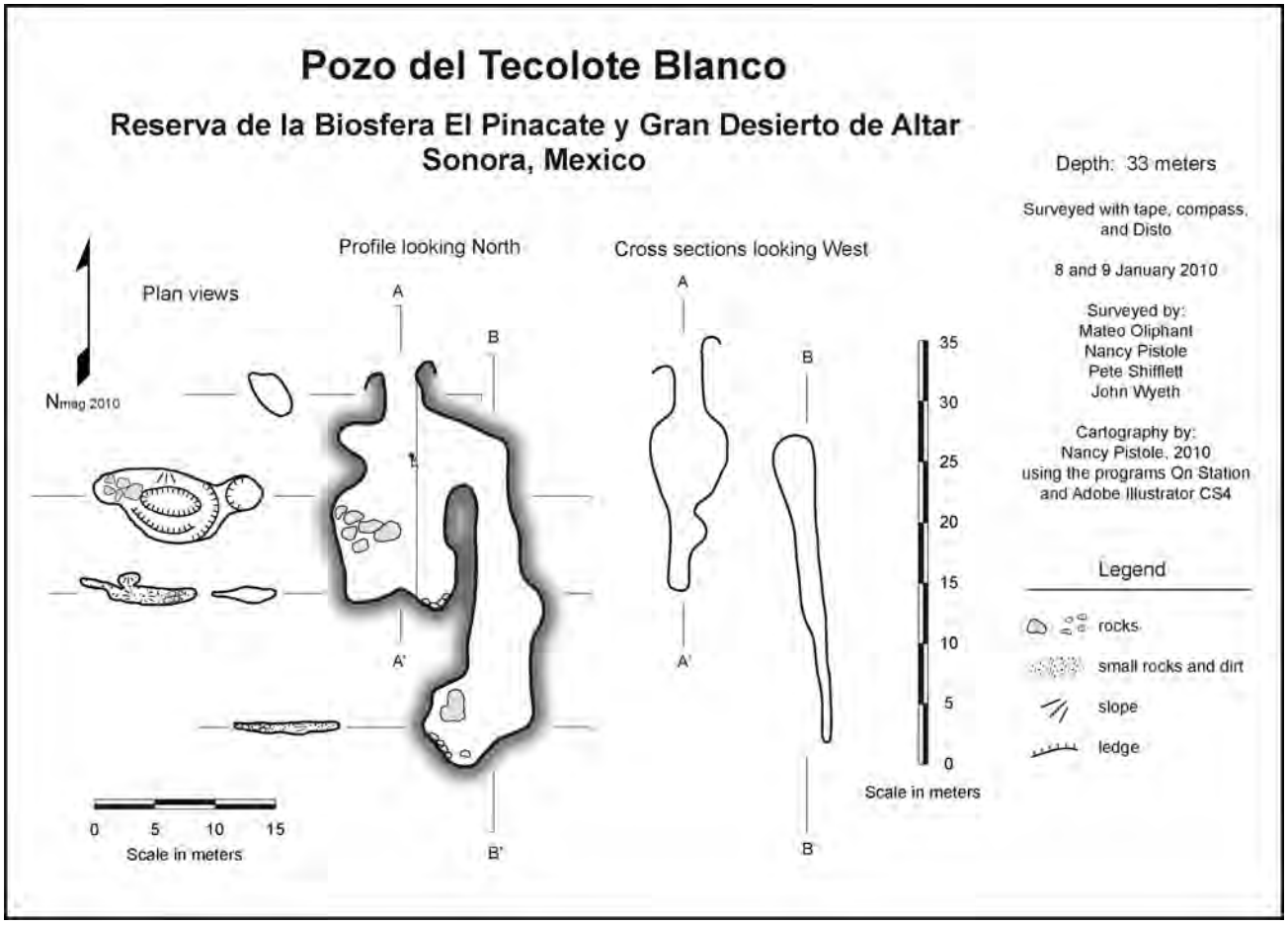
On Sunday, March 14, 2010, there was an accident in very popular **Cueva de la Puente** in the **Sierra de Álvarez**. Apparently a member of a group that was leaving the cave by the badly deteriorated metal ladders to the upper entrance was hit on the head by a falling metal bar. The victim had to be helped out of the cave by his companions. Espeleo Rescate México was notified, but they arrived to find the victim already on the surface. *Source*: report by Antonio Aguirre, translated by Fofo Gonzalez.

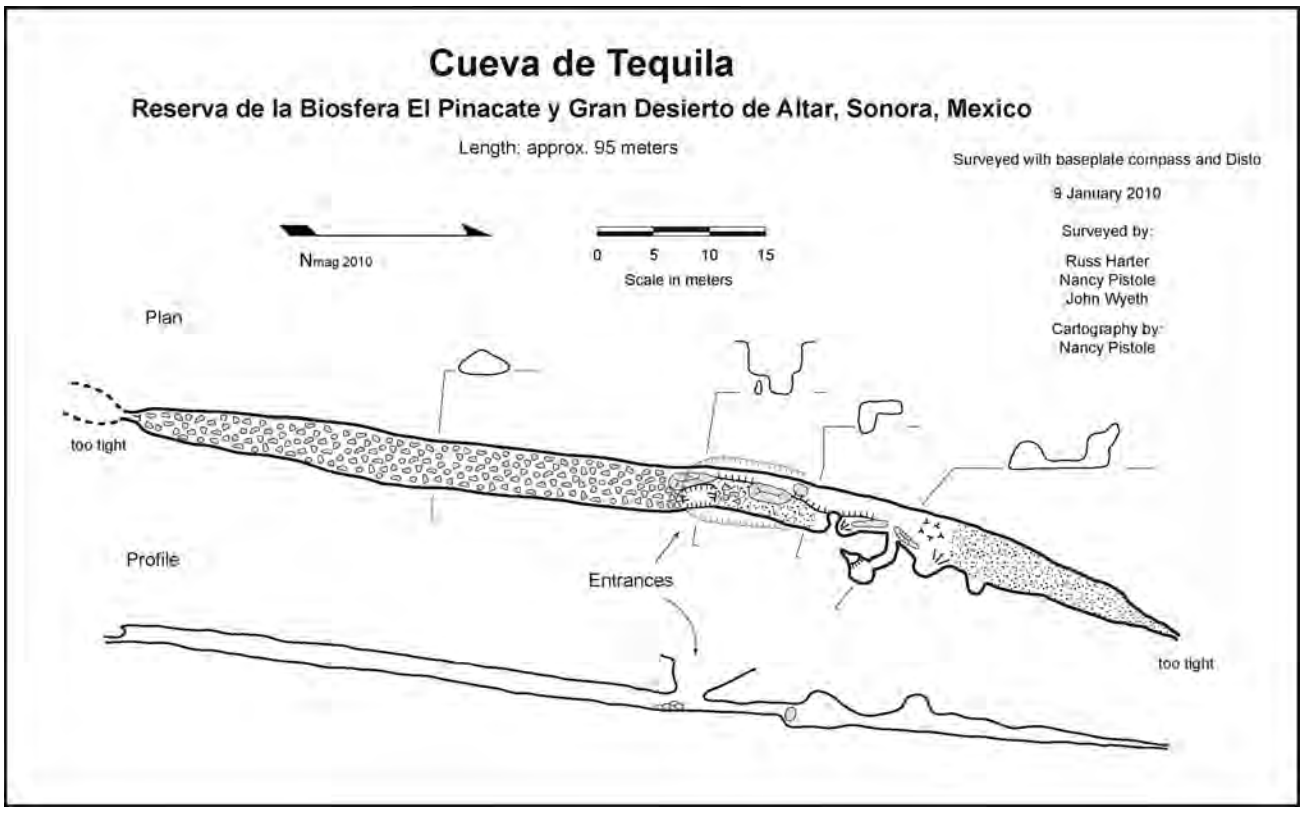
SONORA

In January 2010, a group of cavers from southern California and Tucson, Arizona, visited the Reserva de la Biósfera El Pinacate y Gran Desierto de Altar in Sonora, Mexico. There are some lava caves close to a popular trail that goes to the top of **Cerro Pinacate**. The lava tubes are located in a patch of pahoehoe lava that is about 300 meters long by 200 meters wide. The significant tubes were mapped. **Pozo del Tecolote Blanco** (33 meters deep) is the deepest spatter cone in a line of spatter cones located on the southern edge of the lava field. **Cueva de Calaveras** (153 meters long) and **Cueva de Tequila** (95 meters long) are aligned, and although they don't connect, they are probably part of the same lava-tube system. **Cholla Cave** (29 meters long) and **Three Hole Cave** (14 meters long) are also close to each other. Other caves were checked in the lava field, but no significant cave were found. There are some other known caves in the *biosfera* that deserve further investigation. *Source*: Nancy Pistole.

TABASCO

Villa Luz Park Caves: Speleogenesis based on Current Stratigraphic and Morphologic Evidence, by Laura Rosales-Lagarde, Penelope J. Boston, Andrew Campbell, and Mike Pullin.


Pozo del Tecolote Blanco
Reserva de la Biosfera El Pinacate y Gran Desierto de Altar
Sonora, Mexico
Depth: 33 meters
Surveyed with tape, compass, and Disto
8 and 9 January 2010
Surveyed by:
Mateo Oliphant
Nancy Pistole
Pete Shifflett
John Wyeth
Cartography by:
Nancy Pistole, 2010
using the programs On Station and Adobe Illustrator CS4
Profile looking North
Cross sections looking West
Plan views
Nmag 2010
A
A'
B
B'
0 5 10 15
Scale in meters
35 30 25 20 15 10 5 0
Scale in meters
Legend
rocks
small rocks and dirt
slope
ledge

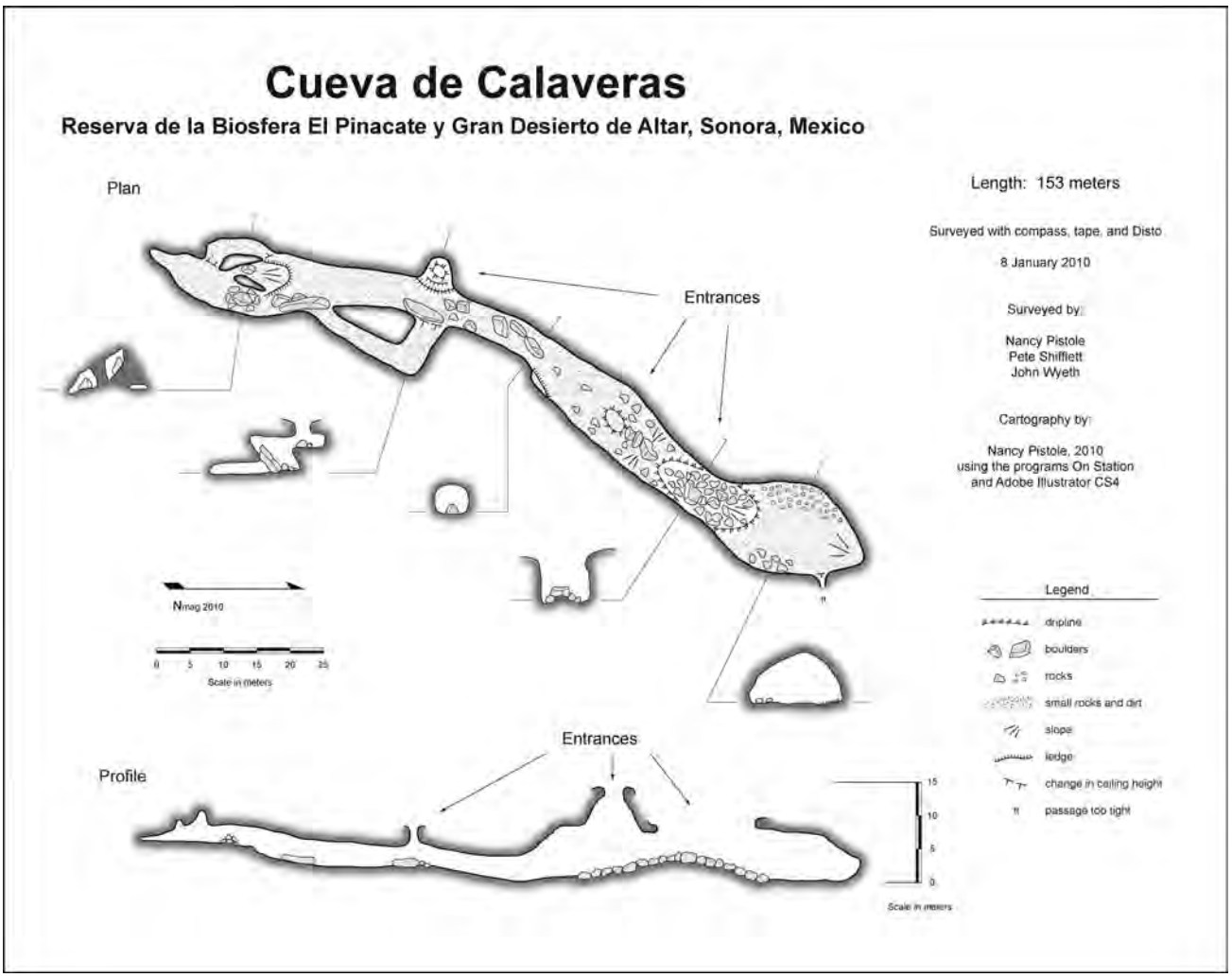

Cueva de Tequila
Reserva de la Biosfera El Pinacate y Gran Desierto de Altar, Sonora, Mexico
Length: approx. 95 meters
Surveyed with baseplate compass and Disto
9 January 2010
Surveyed by:
Russ Harter
Nancy Pistole
John Wyeth
Cartography by:
Nancy Pistole
Nmag 2010
0 5 10 15
Scale in meters
Plan
too tight
Profile
Entrances
too tight

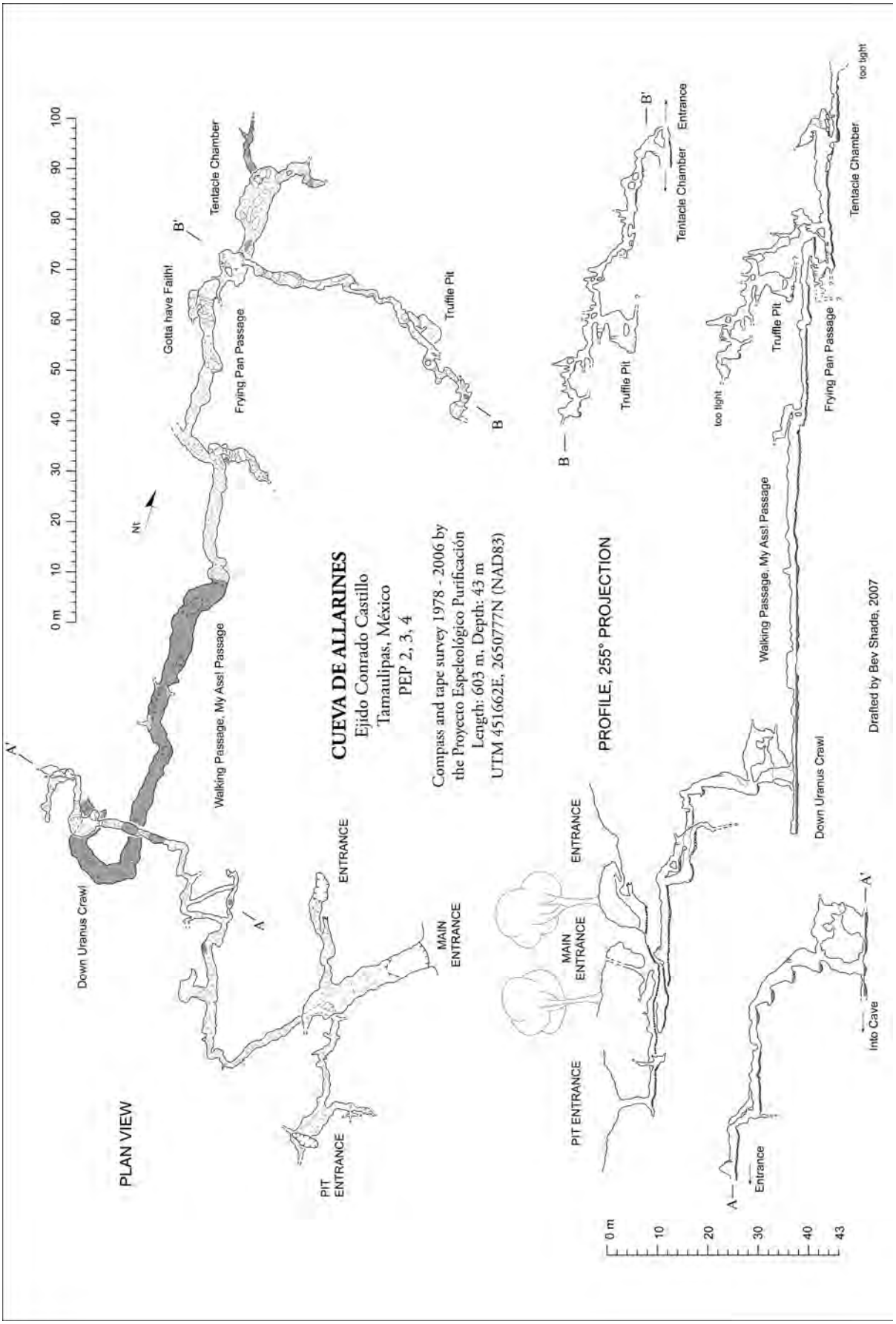
Villa Luz Cave (a.k.a. Cueva de las Sardinas) is the longest of several caves at the Villa Luz Park, a tourist destination located in the south of Tabasco state, southern Mexico. The origin of this cave has been proposed to be acid hypogenic speleogenesis due to the presence of numerous and conspicuous H_2S-rich springs both in the cave and as surface springs elsewhere in the area. In any case of suspected hypogenesis, it is critical to separate out the degree of importance in speleogenesis of the structural, hydrological, and chemical conditions and processes potentially involved in the cave's creation. We have conducted a review of the stratigraphy and the morphology of the caves at the Villa Luz Park, and the water chemistry of the caves and springs in the area. A thorough analysis of all of these features is essential to provide a more complete understanding of the origin of the system. *Source*: first paragraph of a paper in *Hypogene Speleogenesis and Karst Hydrogeology of Artesian Basins*, Ukrainian Institute of Speleology and Karstology Special Paper 1, page 245, 2009. (This entire paper is about a half a page long, and literally has as many alleged authors as paragraphs—a good (or rather bad) example of the phony "authorship" with which science is infested.)

In Mexico's **Cueva del Azufre** (the Sulphur Cave, **Cueva de Villa Luz**), a small fish called the shortfin molly (*Poecilia mexicana*) is on the way to becoming two separate species. Those that live in the dark interior of the caves are very different from their relatives that swim in the bright surface waters. They have lighter colors and live more solitary lives. Their eyes are smaller, less sensitive, and have lower levels of light-sensitive pigment. They rely instead on a hypersensitive pressure detector, the lateral line, to sense disturbances in the water.

Their differences aren't just skin deep either. Michael Tobler from Texas A&M University has been studying the mollies for years, and has shown that the surface and cave populations have started to become genetically distinct. The question is why? The caves are an open habitat with no physical barriers separating the two populations. What's stopping them, and their genes, from mingling?

Tobler has found that one of these barriers is a living one. The mollies are hunted by an insect, the giant water-bug (*Belostoma spp)*. It's about the same size as the fish and lurks close to the water's surface, waiting to stab passing prey with stiletto-like mouthparts. In the gloom of the cave, the surface fish are more vulnerable to the bug, but in the




CUEVA DE ALLARINES
Ejido Conrado Castillo
Tamaulipas, México
PEP 2, 3, 4
Compass and tape survey 1978 - 2006 by the Proyecto Espeleológico Purificación
Length: 603 m, Depth: 43 m
UTM 451662E, 2650777N (NAD83)
PLAN VIEW
PROFILE, 255° PROJECTION
Down Uranus Crawl
Walking Passage, My Ass! Passage
Frying Pan Passage
Gotta have Faith!
Tentacle Chamber
Truffle Pit
ENTRANCE
MAIN ENTRANCE
PIT ENTRANCE
Entrance
Into Cave
too tight
Drafted by Bev Shade, 2007

light, it's the cavefish that are at a disadvantage. The same predator, hunting throughout the Sulphur Cave, is keeping two populations of the same species apart.

Tobler collected the bugs and both types of mollies and housed them in large plastic bottles, which mimicked the cramped, shallow spaces of their natural habitat. He placed the bottles either within the cave or in a shaded spot at its mouth, and waited.

After a day, he found that in the light, the cave-adapted fish suffered most at the mouths of the bugs, and experienced four out of every five stab wounds. In the dark, the situation was reversed, and around two-thirds of the bug attacks were inflicted on the surface fish. Even if Tobler allowed the captured mollies to acclimatise to their environments for a day before adding the predator to the mix, they still suffered the same proportion of attacks in the two environments.

There are many reasons why species can start to split into two, even though their members occupy the same range. The two populations may become separated in time rather than space. They could grow to find each other unattractive, be unable to produce a fit or healthy hybrid, or simply become unable to mate.

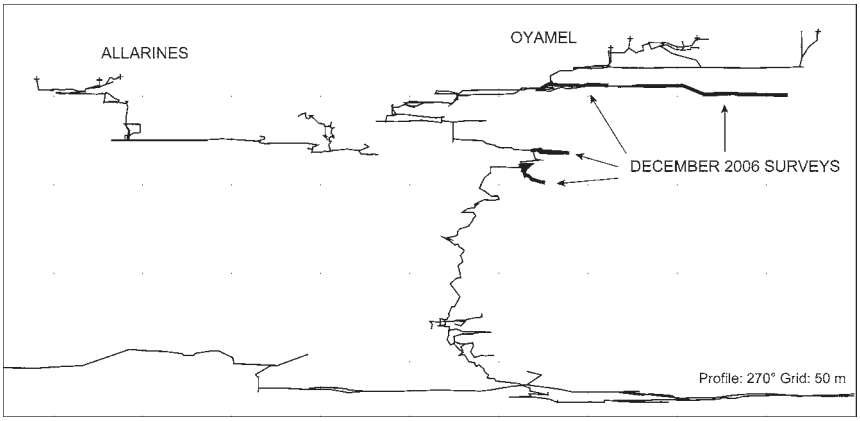
But Tobler's study illustrates one of the simplest blockades—migrants between two populations do poorly. In this case, the mollies' senses can detect a predator's threat in their home environment, but not in the alternative one. Moving from one to the other greatly increases their odds of a sticky end. Tobler plans on assessing the bug's true impact in future experiments, but for now, he believes that it's a good example of the influence that predators wield over the rise of new species. *Source*: post on May 12, 2009, by Ed Yong at scienceblogs .com/notrocketscience/2009/05/giant_insect_splits_cavefish_into_distinct_populations.php, based on paper by Michael Tobler, *Biology Letters* 5(4)506–509, May 2009 (abstract at rsbl.royalsocietypublishing.org/content/5/4/506). There is an article about these fish in *AMCS Activities Newsletter* 29, pages 64–68.

The *Texas Caver* for April–June 2009 (vol. 55, no. 2), pages 8–18 contains a long trip report by Tone Garot on the trip to caves of Tabasco in early 2009 that is also reported in *AMCS Activities Newsletter 32*, pages 70–76.

TAMAULIPAS

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

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 in the karst. Volcanic activity provides conditions that can effectively 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 in volcanogenic karst systems (VKS). 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 siurface (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. VKS examples are discussed and some potential VKS identified. *Source*: *Advances in Hypogene Karst Studies*, NCKRI Symposium 1, pages 27–39, 2009.



On a trip in mid-December 2006, cavers from Texas and Monterrey Tec camped at **Conrado Castillo** in the Proyecto Espeleológico Purificación area. They surveyed some additional cave in the **Oyamel** section of **Sistema Purificación** and pushed a final lead in **Cueva de Allarines**, which went for only 16 meters before becoming too narrow. The water heads toward Oyamel, only about 60 meters away according to the surveys. *Source*: *Death Coral Caver* 14.

Inspired by Charles Fromen, the discover of Sistema Purificación in the 70s, to begin a project to systematically search for the highest possible entrance to this nearly 100-kilometer-long cave system, Bill Steele and Diana Tomchick organized an expedition to **Mesas Juárez** the last two weeks of 2009. Sixteen people camped at an elevation of 2600 meters and found several new pits and caves. Of particular note was the discovery of and initial exploration of **Pozo Panqueque**, to a depth of 206 meters. Steele and Tomchick

plan to return to Mesas Juárez again at the end of 2010. *Source*: Bill Steele. There is a report on this trip in the *Texas Caver* 56(2)3–11, second quarter 2010.

A blind fish that has evolved a unique technique for sensing motion may inspire a new generation of sensors that perform better than current active sonar.

Although the fish species *Astyanax fasciatus* [*Astyanax mexicanus*] is blind, they sense their environment and the movement of water around them with gel-covered hairs that extend from their bodies. Their ability to detect underwater objects and navigate through their lightless environment inspired a group of researchers to mimic the hairs of these blind cavefish in the lab.

While the fish use these hairs to detect obstacles, avoid predators, and localize prey, researchers believe the engineered sensors they're developing could have a variety of underwater applications, such as port security, surveillance, early tsunami detection, autonomous oil-rig inspection, autonomous underwater vehicle navigation, and marine research.

"These hair cells are like well-engineered mechanical sensors, similar to those that we use for balance and hearing in the human ear, where the deflection of the jelly-encapsulated hair cell measures important flow information," says Vladimir Tsukruk, a professor at Georgia Tech. "The hairs are better than active sonar, which requires a lot of space, sends out strong acoustic signals that can have a detrimental effect on the environment, and is inappropriate for stealth applications."

Tsukruk and graduate students Michael McConney and Kyle Anderson conducted preliminary experiments with a simple artificial hair cell microsensor made of SU-8, a common epoxy-based polymer capable of solidifying, and built with conventional CMOS microfabrication technology.

They found that the cell by itself could not achieve the high sensitivity or long-range detection of hydrodynamic disturbances created by moving or stationary bodies in a flow field. The hair cell needed the gel-like capsule—called the cupula—to overcome these challenges.

"After covering the hair cell with synthetic cupula, our bio-inspired microsensor had the ability to detect flow better than the blind fish. The fish can detect flow slower than 100 micrometers per second, but our system demonstrated flow detection of several micrometers per second," says Tsukruk. "Adding the cupula allowed us to detect a much smaller amount of flow and expand the dynamic range because it suppressed the background noise." *Source*: Georgia Tech press release, March 25, 2009, found at laboratoryequipment.com/news-flow-sensors-based-on-fish-hair-032509.aspx.

Abstract: How Long Does Evolution of the Troglomorphic Form Take? Estimating Divergence Times in *Astyanax mexicanus*, by Megan Porter, Katharina Dittmar, and Marcos Pérez-Losada.

Features including colonization routes (stream capture) and the existence of both epigean and cave-adapted hypogean populations make *Astyanax mexicanus* an attractive system for investigating the subterranean evolutionary time necessary for acquisition of the troglomorphic form. Using published sequences, we have estimated divergence times for *A. mexicanus* using: (1) two different populations-level mitochondrial datasets (cytochrome b and NADH dehydrogenase 2) with both strict and relaxed molecular clock methods and (2) broad phylogenetic approaches combining fossil calibrations and with four nuclear (recombination activating gene, seven in absentia, forkhead, and a-tropomyosin) and two mitochondrial (16S rDNA and cytochrome b) genes. Using these datasets, we have estimated divergence times for three events in the evolutionary history of troglomorphic *A. mexicanus* populations. First, divergence among cave haplotypes occurred in the Pleistocene, possibly correlating with fluctuating water levels allowing the colonization and subseqent isolation of new subterranean habitats. Second, in one lineage, *A. mexicanus* cave populations experienced introgressive hybridization events with recent surface populations (0.26–2.0 Ma), possibly also correlated with Pleistocene events. Finally, using divergence times from surface populations in the lineage without evidence of introgression as an estimate, the acquisition of the troglomorphic form in *A. mexicanus* is younger than 2.2 (fossil calibration estimates) to 5.2 (cytb estimate) Ma (Pliocene).

Source: *Acta Carsologica* 36(1)173, 2007. The full paper, pages 173–182, is available at carsologica.zrc-sazu.si/downloads/361/porter17.pdf.

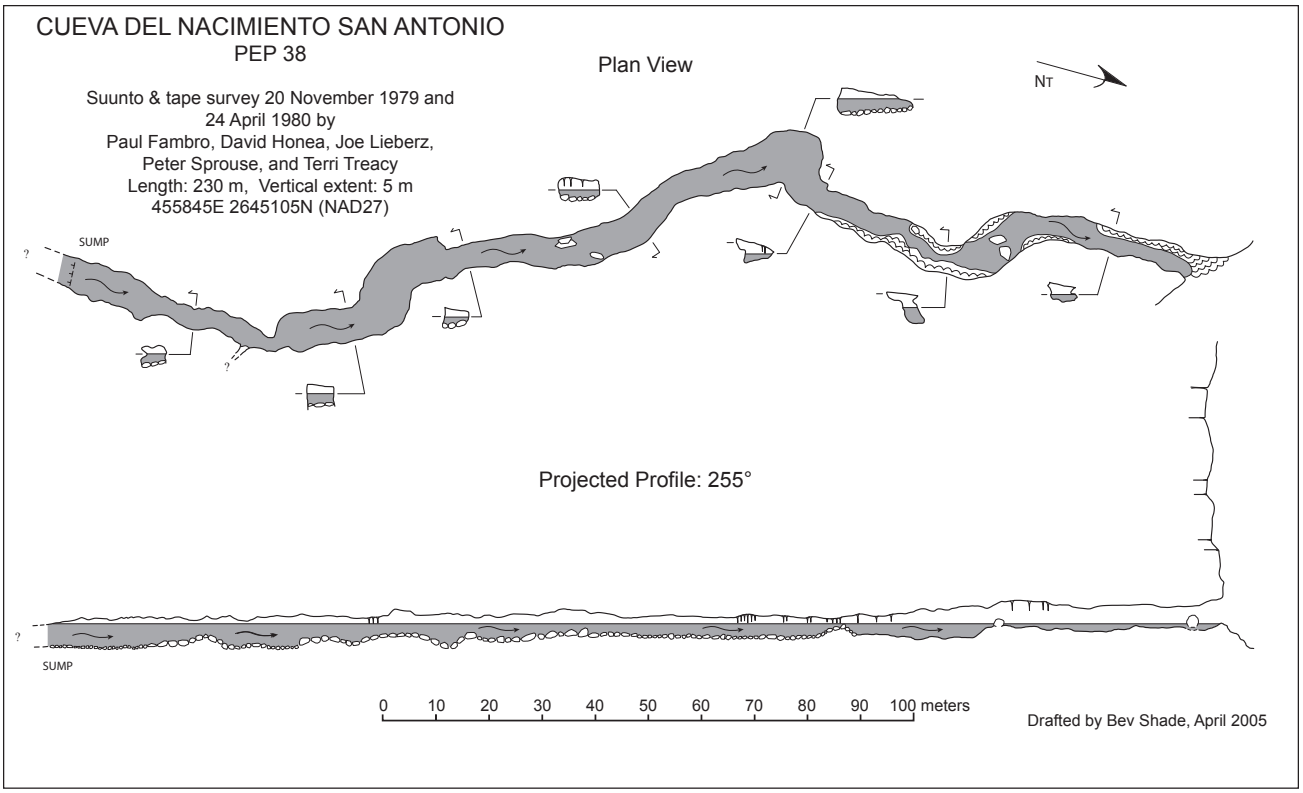
The **Nacimiento San Antonio** issues from a cave at the base of a cliff. The cave goes horizontally 230 meters upstream, until the passage dips competely underwater. The passage is an active streamway 5 meters tall by 5 to 8 meters wide. The cave lies about 800 meters west of **Paraíso Difícil**, in the Arroyo San Antonio. It was surveyed on 20 November 1989 and 24 April 1980 by Paul Fambro, David Honea, Joe Lieberz, Peter Sprouse, and Terri Treacy. *Source*: Bev Shade in *Death Coral Caver* 14.

VERACRUZ

The weekend of February 27, 2010, cavers from UNAM visited the village of **San José Independencia**, near Zongolica, to do Tomas Quiaua (= **Tomasa Kiahua**, see *AMCS Activities Newsletter* 12, pages 62–64) and other caves in the vicinity. While some of the party was in a vertical cave named **La Calabaza**, some locals dropped rocks on them, and this continued while they were climbing out. Permission to visit the caves had been obtained. *Source*: March 1 post to tlamaqui e-mail list by Amilcar Jiménez.

A collection of photographs of a visit to **Sótano de Tepeapulco**, near **Xalapa**, Veracruz, by the Sección Veracruz of the Club de Exploraciones de México is at espeleoveracruzano.com/album/thumbnails.php?album=119. *Source*: Tlamaqui e-mail list, May 4, 2010.

Between 10 and 11 a.m. on March 28, 2008, an unnamed farmer was removing weeds from his land and



marking the border when, through carelessness, he fell into a pit where no one could help him. Residents nearby saw the fall and called authorities. Zongolica Protección Civil notifed Espeleo Rescate México, who arrived with seven members and were soon at the pit. They rigged two ropes and did a dual rappel, noting unstable walls on the descent. A ledge was reached at –20 meters, a third member came down, and the second pitch, of 10 meters, was rigged. The lifeless body was found at the bottom of this pitch. The body was packaged and rigging set for a haul from the surface, in order to avoid rock-fall. *Source*: *American Caving Accidents 2007–2008* (*NSS News*, February 2010, part 2). This accident is also mentioned in "Mexico News," *AMCS Actitities Newsletter* 31.

The Speleology Commission of the Club de Exploraciones de México, Sección Veracruz, has been prospecting and exploring caves since 2005 on the **Río Naolinco** lava flow, originating from El Volcancillo around eight hundred years ago. When we noticed the vulcanospeleological potential, we decided to create the **Jilotepec** Project with the aim of locating caes of volcanic origin. To date we have explored the following caves in the Municipio of Jilotepec, and we believe many more caves are to be found.

Cueva La Virgen 0715940, 2172136, 1388 m

Cueva Los Cochinos 0715940, 2172136, 1388 m

Cueva La Envidia 0715940, 2152163, 1379 m

Sistema del Falso 0716398, 2172490, 1358 m

Cueva del Tirantes 193817, 965631, 1384 m

Cueva de la Higuera 193817, 965631, 1384 m

Cueva Huichila (Río subterráneo vulcanico) in process of exploration

Hoyo del Becerro 193613, 965822, 1667 m

Source: English abstract of a report by Guillermo Gassós Vargas at www.oztotl.com/ps/reports/Jilotepec.pdf or espeleojarocho.blogspot.com/2007/07/proyecto-vulcano-espeleolgico-jilotepec.html. A similar article is at www.espeleoveracruzano.com/proyectos.php?idm=0&idt=20. Both articles contain maps, but they are too low-resolution and too compressed to be reproduced.

The Sección Veracruz of the Club de Exploraciones de México has a catalog on its web sites of 240 caves in the state. Clicking on a cave name brings up a box with information such as a very brief description, length, depth, "locality," and *municipio*, but no exact locations, for the protection of the caves and their visitors. Go to www.espeleoveracruzano.com/catastro.php.

"Mexico News" in *AMCS Activities Newsletter* 32 reported that a farmer guiding people to **Cueva Pintada**, near Paso Panal in Mpo. **Paso de Ovejas** was killed by bees.

A couple of months after the attack, cavers located the shelter cave, but there were still bees in the area and they could not stay. Later, Roberto Calderon and Ismael Méndez of the Coordinación de Espeleología del Club de Exploraciones de México, Sección Veracruz quietly gained access and produced the video at www.youtube.com/watch?v=3piSmqJR0SA. The cave contains red rock art. *Source*: post to Tlamaqui e-mail list by Guilermo Gassós, October 28, 2009.

On October 24, 2009, the Veracruz section of Espeleo Rescate México was notified that a child, 12-year-old Eloy Panzo, had fallen into a pit while chasing rabbits the night before. The pit is about 700 meters from the community of **Samarrontla**, which is about 20 minutes from **Tehuipango** in the Sierra Zongolica. The body was recovered about 11:00 p.m. from the pit, which has a total depth of about 120 meters. According to the report, the source and author of which I've lost track of, the pit is located at 18°00′07″ N, 97°04′10″, but this is south of Teotitlán in Oaxaca, a long way from Tehuipango.

Evidently **Sumidero de El Popoca**, with a 70-meter waterwall in its entrance pit, is being touted as a tourist attraction. A guide can be found in the town of **Totomaxapa**, and the tour "requires no more than a modicum of fitness and a strong desire for advanture." (Translated from locuraviajas.com/blog/un-ro-tragado-por-la-tierra-en-el-sumidera-del-popopca/.) On March 28, a group of three men and three women were unable to climb out of the pit and had to be assisted by the Veracruz team of Espeleo Rescate México. They were OK, aside from being cold and wet. Their lone guide did not have the skills or equipment to get them out of the cave. *Source*: Antonio Aguirre Álvarez.

On February 22, 2010, a twenty-year-old male fell into a pit in **Tepecuitlapa**, a small town in Mpo. **Mixtla de Altamirano**, about three hours from Zongolica. The patient was rescued from the pit and transported to Zongolica for medical treatment. He was only badly bruised, although he had rolled down a 15-meter slope and fallen into a 30-meter pit. *Source*: Antonio Aguirre. There is no word on the cause of the accident.

YUCATÁN

During exploration of cenotes for planning Circuito Ecoturístico de Homún, cave divers found a site of pre-Columbian relics and a habitat of turtles.

Archaeologist and diver Sertio Grosjean Abimerhi, **Homún** mayor José Clemente May Echeverría, and *comisario* of the *ejido* Manuel Jesús Dzul Rosado reported the new finds in an interview. In a cenote in the middle of the jungle some distance from the town, underwater explorers discovered four skulls and eight ceramic vessels on the floor. The pre-Hispanic objects were covered almost entirely by sediment. The divers who entered the cenote, including Grosjean Abimerhi, Enrique Soberanes Juárez, and Raúl Vázquez, did not touch anything. They called the cenote **Aluxes** because of mysterious occurrences during the dive. Don Elmer, their guide, told them that the Aluxes did not want them to leave because they had not done the Maya ritual to ask permission of the mythical Maya beings. INAH was informed and will investigate the treasures

In another cenote, called **Doncella** and not entered, they saw many good-size turtles gathered on the shores of an island.

The cenotes for the ecotourism project have already been selected. **Cenote Akulá** will be the main attraction and the headquarters of the tours. Seven kilometers of new roads will connect the cenotes in the circuit, which will also include **La Piscina**, **Cueva Manitas**, **Balmí**, **Kanunchén**, **Cholul**, **Guadalupana**, **San Antonio**, and **Kancabchén**.

The cenotes not only protect Maya treasures and human remains, but they are also important ecosystems for turtles, fish, blind shrimp, remipedes, and eels. The mayor said that there are 360 cenotes registers in the *municipio* of Homún, and that in May the town had begun to regulate visitors to the cenotes to avoid looting and ecological damage. Source: article by Joaquín Chan Caamal in *Diario de Yucatán*, 18 May 2009, www.yucatan.com.mx/noticia.asp?cx=51$1401010000$4076147&f=20090518.

In March 1993 a full-cave and nitrox instructor suffered an oxygen convulsion during a deep air dive in a sinkhole in Mexico and drowned.

Resumidero de El Popoca.

His partner, who had experienced CNS toxicity warning signs during the dive, and a safety diver survived. The two later recovered the body.

The team had planned a 20-minute dive on air to a depth in excess of 230 feet (70 meters), the depth of a halocline in a cavernous open-water sinkhole near Merida in the Yucatan Peninsula. Because of the difficulty in obtaining helium mixes in Mexico, the team decided to conduct the dive on compressed air, followed by oxygen for decompression. Both were experienced deep divers. A weighted descent line was rigged for navigation and for staging oxygen and extra air cylinders. The safety diver was to descend with the team to 220 feet, ascend to a shallower depth, and wait for the rest of the team.

After a long, slow descent past the halocline, the team tied into the descent line to explore the well at a leisurely pace. Informed sources estimated their maximum depth to be close to 300 feet (92 meters), a PO_2 in excess of 2 atmospheres. The surviving partner experienced a tingling in his lower lip and turned back to call the dive, only to see the other diver heading back as well. When he reached the line, he sensed that the other diver was in trouble. The victim grabbed the line and began a

hurried hand-over-hand ascent. The partner reached the diver and gained control, and they began to ascend together. The diver continued to pull on the line, creating slack and getting himself tangled. His partner cut him free. The diver then darted upward, got tangled again, and apparently convulsed. By the time his partner reached him, the diver's regulator was out of his mouth. At that point they were still deeper than 230 feet. After repeated attempts to force the regulator back into the diver's mouth with no success, the surviving partner realized the diver was gone, left the body entangled in the line, and ascended to complete the decompression. Following decompression, the partner and the safety diver were able to pull up the line and recover the body. *Source*: *American Caving Accidents 2007–2008* as a previously unreported accident (*NSS News*, February 2010, part 2). This accident is briefly mentioned in "Mexico News," *AMCS Activities Newsletter* 20, with the names of the divers. The location, not named in the *ACC* account, was **Cenote Ucil**.

More than 300 caves and cenotes have been registered by the National Institute of Anthropology and History (INAH) at the **Puuc** Region in Yucatan, which are part of more than 2000 existing in the area; archaeological vestiges of ritual and domestic activities have been found inside them. The project "Caves: Register of Prehispanic Cultures Evidence in Puuc Region" propelled by INAH in 1997, is focused in preserving Maya archaeological heritage deposited in these natural spaces, as well as determining their location, dimensions and topographic features by satellite. Information from caves verifies uses and customs found in historical sources.

Eunice Uc Gonzalez, researcher at Yucatan INAH Center and woman in charge of the project, declared that data base counts to present with information regarding 300 underground spaces. "We have found masonry walls, lintels and jambs, petroglyphs, material such as grinders, bowls and dishes, and in some cases, mural paintings on caves' walls".

For over 11 years, the specialist conformed a classification that divides underground caves in three groups, according to the use given by ancient Maya people: Ritual spaces, domestic work spaces, and mines that have been named chamber-deposits.

Each category has particular physical features that have helped researching ancient Maya quotidian life in Puuc Region, which extends at the south and southeast Yucatan State and includes Uxmal, Chacmultun and Oxintok archeological sites.

After explaining that *aktun* is how caves are called in Maya language, archaeologist Uc mentioned that ritual caves were used exclusively by priests: Prehispanic mortar walls found at the accesses prove this information.

Lintels that cover special chambers with petroglyphs and blue paintings, color related to the sacred, have been found. In different accesses to caves, hands, deer and Chaac representations were found, indicating ceremonies took place there.

"Priests entered to contact divinities, and caves were considered by Prehispanic Maya communication portals between human and divine spaces".

The sacred water, *suhuy ha*, never touched by human hands, was found in caves; 16th century historical sources mention how this water was collected from stalactites in grinders carved especially for this purpose.

Contemporary Maya people still recover the ritual liquid used in ceremonies in caves like **Aktun Usil** and **Calcehtok**, in **Maxcanu** municiplity, and **Aktun Sabakha**, in **Tekax** region.

In **Aktun Usil** cave, a group of red paintings was found. Epigraphy revealed designs are cardinal points and numbers, pointing out that the cave was an astronomical space, where probably calendars related to agriculture and society were created.

Eunice Uc mentioned that domestic work spaces are those caves with natural light entrances, where Prehispanic grinders and other stone carved recipients, ceramics and other vestiges were found, were dwelled. An example of this is the **El Ramonal** cave, in Tekax municipality.

The third type of caves was used to extract minerals and clay, used to make ceramics or to finish houses. **Aktun Ho'on**, in Tekax belongs to this kind.

According to 16th century historical sources, every determined period of time, all domestic tools had to be destroyed. Thrown away pieces were disposed at caves, and this material helps to date each place's occupation.

The project includes expert reports of new caves found by inhabitants. These reports have been conducted at Tekax, **Oxkutzcab**, and **Oxkintok**. Routes to be explored by speleologists have been proposed, and anthropologists train local inhabitants to protect and take care of the caves. *Source*: dti.inah.gob.mx/index.php?option=com_content&task=view&id=3341&Itemid=337; the Spanish version is at dti.inah.gob.mx/index.php?option=com_content&task=view&id=3339&Itemid=329.

On December 28, two female French tourists in their twenties, Delphine Bigote and Marie Charlote Renaud, were abandoned in a cenote near **Homún** when their guide was unable to get them out of the pit. Both the guide and the women had been stung by bees. The guide called for assistance, refusing to give his name, and a team was organized by URION member and cave guide Mario Alberto Novelo Dorantes. That evening, after removing some bee hives, the rescuers retrieved the tourists within 30 minutes. The location of the cenote, which has a relatively small entrace a little over 3 meters in diameter, is given as 20°44′31″ N and 89°14′59″ W. *Source*: post to Iztaxochitla e-mail list by Mario Novelo Dorantes, January 3, 2010. Several press reports on this event can be found by Googling "Marie Charlote Renaud." One is at www.yucatan.com.mx/noticia.asp?cx=51$140101120$4220428&f=20100105. The cenote supposedly has no name, but the cenotes around Homún have been studied intensively, so the name may just not be known to Novelo, who seems to have generated the publicity for this incident.

On February 6, 2010, a group from the Tekax office of URION (Unión de Rescate e Investigación de Oquedades Naturales) dug into a cave near **Akil** that proved to contain a wealth of archaeological material as well as attractive formations. *Source*: yucatanalamano .com/noticia/encuentran-un-museo -subterrneo-en-grutas-de-akil.

MISCELLANEOUS

There is an interview with Mexico City caver Gustavo Vela Turcott, illustrated with photographs, at www .saudicaves.com/mx/Gustavo/.

The link given in "Mexico News", *AMCS Activities Newsletter* 29, to nice PDF road maps of Mexican states produced by the Secretaría de Comunicaciones y Transportes no longer works. The maps may be elsewhere on the Web, but I don't know where. Louise Power has pointed out another source of road maps, at www.maps-of-mexico. com. These maps are not terribly convenient to use, as each state is divided into several GIFs, but, unlike the older official highway maps, they do show some contour lines, approximately like those on the 1:250,000 series topo maps.

On June 4, 2009, Mexican cavers Gustavo Vela and Franco Attolini created a new e-mail list because of their frustrations with other Spanish-language lists. It is called Tlamaqui, Nahuatl for *free*, for the uncensored nature of the forum, in contrast to certain others. The main goal is to create an open area for different opinions and points of view, but of course following the basic rules of on-line communities. It will be moderated only when necessary. It is a place created by cavers for cavers. If you are interested in caves and caving in Mexico and other Spanish-speaking countries, I'm sure you will enjoy it. If you have a Yahoo ID, you can join on the web at groups. yahoo.com/group/tlamaqui/join; otherwise you can send an e-mail to tlamaqui-subscribe@yahoogroups. com. *Source*: post by Fofo Gonzalez to TexasCavers list.

Abstract: "Systematic revison of the troglomorphic North American scorpion family Typhlochactidae (Scorpiones, Chactoidea)," by Valerio Vignoli and Lorenzo Prendini, Bulletin 326 of the Amerian Museum of Natural History. The scorpion family Typhlochactidae Mitchell, 1971, endemic to eastern Mexico, comprises nine troglomorphic species specialized for life in hypogean and endogean habitats. Due to their cryptic ecology, inaccessible habitat, and apparently low population density, Typhlochactidae are poorly known. Only 29 specimens have been collected in 40 years. Four species are known from a single specimen, two species are known only from the male and three only from the female. We provide an illustrated revision of the family based on a reexamination of most specimens in the world's collections, including new specimens collected after the original descriptions and older specimens not previously described. Based on results of a recent cladistic analysis, Typhlochactidae are elevated, for the first time, from their former rank as subfamily, first of Chactidae and, more recently, of Superstitioniidae. Alacraninae, new subfamily is created to accommodate *Alacran* Francke, 1982. *Stygochactas*, new genus, is created to accommodate *Typhlochactas granulosus* Sissom and Cokendolpher, 1998 in a new combination. *Sotanochactas* Francke, 1986, *Stygochactas* and *Typhlochactas* Mitchell, 1971 are retained in subfamily Typhlochactinae Mitchell, 1971. Diagnoses of the family and subfamilies are presented, followed by a key to the genera and species, revised diagnoses of the genera, revised diagnoses and descriptions, tabulated meristic data, and distribution maps of the species. Descriptions and diagnoses are illustrated with ultraviolet fluorescence and visible light photographs, providing a visual atlas to the morphology of these remarkable scorpions. A review of their taxonomic history is provided, the importance of trichobothriotaxy for their systematics discussed, and several misconceptions in the literature clarified. *Source*: hdl.handle.net/2246/6000, where there are links for free download of the bulletin.

Blind scorpions that live in the stygian depths of caves are throwing light on a long-held assumption that specialized adaptations are irreversible evolutionary dead-ends. According to a new phylogenetic analysis of the family Typhlochactidae, scorpions currently living closer to the surface (under stones and in leaf litter) evolved independently on more than one occasion from ancestors adapted to life further below the surface (in caves). The research, currently available in an early online edition, will be published in the April issue of *Cladistics*.

"Our research shows that the evolution of troglobites, or animals adapted for life in caves, is reversible," says Lorenzo Prendini, Associate Curator in the Division of Invertebrate Zoology at the American Museum of Natural History. "Three more generalized scorpion species living closer to the surface evolved from specialized ancestors living in caves deep below the surface."

Scorpions are predatory, venomous, nocturnal arachnids that are related to spiders, mites, and other arthropods. About 2,000 species are distributed throughout the world, but only 23 species found in ten different families are adapted to a permanent life in caves. These are the specialized troglobites.

This study concentrates on the family Typhlochactidae that includes nine species of scorpions endemic to the karstic regions of eastern Mexico. These species were initially grouped together by Robert Mitchell in 1971 but were elevated to the rank of family for the first time last year, based on morphological data published by Prendini and Valerio Vignoli of the Department of Evolutionary Biology, University of Siena, Italy, in the *Bulletin of the American Museum of Natural History*. Prendini, Vignoli, and Oscar F. Francke of the Departmento de Zoologia, Instituto de Biología at the Universidad Nacional Autónoma de México, Mexico City, also created a new genus, *Stygochactas*, for one species in the family and described a new surface-living species, *Typhlochactas sissomi*, in a separate *American*

Museum Novitates paper. All species in the family have adapted to the dark with features such as loss of eyes and reduced pigmentation. The family contains the most specialized troglobite scorpion, *Sotanochactas elliotti*, one of the world's smallest scorpions, *Typhlochactas mitchelli*, and the scorpion found at the greatest depth (nearly 1 km below the surface), *Alacran tartarus*. Three of the species (including *T. mitchelli*) live closer to the surface and are more generalized morphologically than the other six, making this family an excellent model with which to test and falsify Cope's Law of the unspecialized (novel evolutionary traits tend to originate from a generalized member of an ancestral taxon) and Dollo's Law of evolutionary irreversibility (specialized evolutionary traits are unlikely to reverse).

For the current research paper, Prendini and colleagues gathered data for 195 morphological characteristics, including a detailed mapping of the positions of all trichobothria (sensory setae) on the pedipalps, among the species of Typhlochactidae. The resulting phylogenetic tree shows that adaptation to life in caves has reversed among this group of scorpions: two of the less specialized, surface-living species, *T. mitchelli* and *T. sylvestris*, share a common ancestor with a much more cave-adapted species, and a similar pattern was found for the third less specialized, surface-living species, *T. sissomi*.

"Scorpions have been around for 450 million years, and their biology is obviously flexible," says Prendini. "This unique group of eyeless Mexican scorpions may have started re-colonizing niches closer to the surface from the deep caves of Mexico after their surface-living ancestors were wiped out by the nearby Chicxuluxb impact along with non-avian dinosaurs, ammonites, and other species." *Source*: press release from the American Museum of Natural History, www.eurekalert.org/pub_releases/2010-03/amon-pao031210.php.

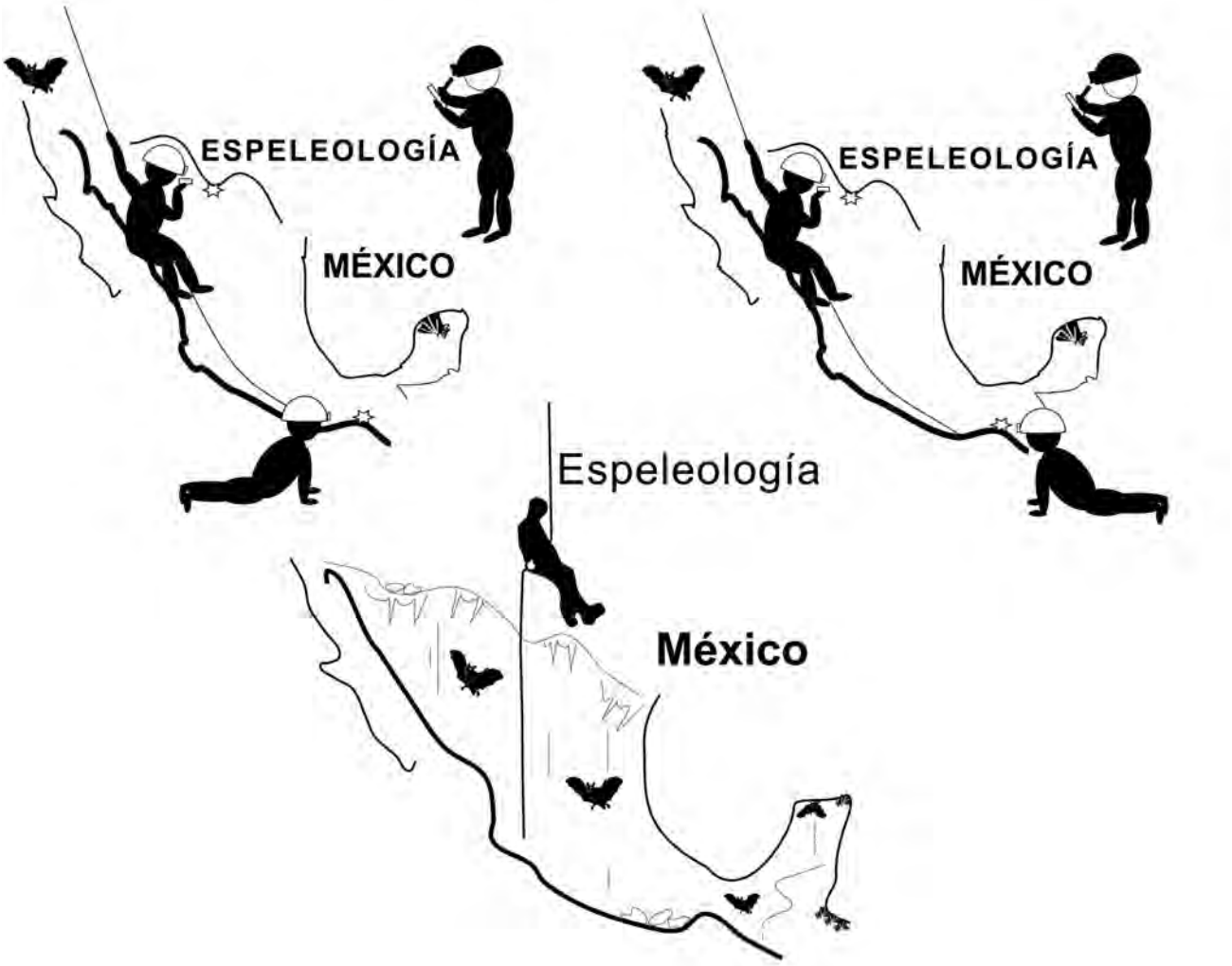
"Universo subterránea: las cavernas de México," by Carlos Lazcano, appeared in the May 2009 issue of *México Desconocido*, pages 26–43. It is heavily illustrated with color photographs and diagrams. The Spanish text of the article, describing the main cave areas of Mexico, can be read at www.mexicodesconocido.com.mx/contenidos/home.html?p=nota&idNota=83367. The article includes Carlos's list of the twenty most spectacular caves in Mexico. The top ten are listed on the magazine's web site at www.mexicodesconocido.com.mx/interior/index.php?p=nota&idNota=83379, with links to photographs. (But two of the photos don't appear to be of the caves named.)

A 2002 dissertation by Michael Denneborg, "Der Einfluss regionaler Grundwasserfließsysteme auf die Initialphase der Speläogenese tiefer Karstsysteme," contains two chapters about Mexico. Chapter 4 is titled "Speläogenese des **Sistema Cheve** in der **Sierra Juarez**." Chapter 5 is "Speläogenese der tiefen Karstsysteme in der **Sierra El Abra** und der **Sierra Tamaulipas**." The full 143-page PDF file can be downloaded from sylvester.bth.rwth-aachen.de/dissertationen/2002/089/02_089.pdf. *Source*: pointed out to us by Jim Kennedy.

Las 20 cuevas más espectaculares de México

1. Cueva de los Cristales, Naica, Chihuahua
2. Sótano de las Golondrinas, San Luis Potosí
3. Sistema Cheve, Oaxaca
4. Sistema Huautla, Oaxaca
5. El Popoca, Veracruz
6. Sistema Purificación, Tamaulipas
7. Sistema Sac Actun, Quintana Roo
8. Sistema Ox Bel Ha, Quintana Roo
9. Sótano del Barro, Querétaro
10. El Zacatón, Tamaulipas
11. Hoya de las Guaguas, San Luis Potosí
12. Yaax Nik, Yucatán
13. Sastún Tunich, Yucatán
14. Juxtlahuaca, Guerrero
15. Cueva de las Sardinas, Tabasco
16. Cueva de las Canicas, Tabasco
17. Sistema de la Lucha, Chiapas
18. Sótano de Agua de Carrizo, Oaxaca
19. Sistema Cuetzalan, Puebla
20. Sistema Ocotempa, Puebla

Carlos Lazcano



T-shirt designs by Yazmin Avila Flores, Roberto Carlos Legaspi Balderas, and Laura Rosales Legarde.

Mark Minton
May 2010
Depth in meters

DEEP PITS OF MEXICO

1	El Sótano (de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de la Culebra	Entrance drop	Querétaro	336
4	El Zacatón (mostly underwater)	Entrance drop	Tamaulipas	335
5	Sótano de Tomasa Kiahua	Entrance drop	Veracruz	330
6	Sótano de Alhuastle	P'tit Québec	Puebla	329
7	Nita Xonga	Psycho Killer	Oaxaca	310
7	Sistema Nogochl (Akemabis - El Santito)	Pozo Ratoncitos Ahogados	Puebla	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	Sima Dos Puentes	La Ventana	Chiapas	250
12	Hálito de Oztotl	Entrance drop	Oaxaca	250
14	El Santo Cavernario	El Santo Tiro (Pozo Fabian)	Puebla	245
15	Sótano del Aire	Entrance drop	San Luis Potosí	233
15	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
17	Sistema Ocotempa	Pozo Verde	Puebla	221
18	Live in Busch	Entrance drop	Oaxaca	220
18	Sistema Soconusco	Sima de la Pedrada	Chiapas	220
18	Sótano de los Planos	Puits Tannant	Puebla	220
18	Sótano de Eladio Martínez	Entrance drop	Veracruz	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	Kijahe Xontjoa	Son On Jan	Oaxaca	210
27	Unnamed pit	Entrance drop	Chiapas	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	Nita Gatziguin	Entrance drop	Oaxaca	200
32	Fundillo de El Ocote	Entrance drop	Chiapas	200
32	Sistema de la Lucha	Entrance drop	Chiapas	200
32	Sistema H3-H4		Puebla	200
32	Hueholvastempa	Entrance drop	Puebla	200
38	Sima La Funda	Entrance drop	Chiapas	198
39	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 Tepetlaxtli No. 1	Entrance drop	Puebla	190
39	El Hundido	Entrance drop	Chihuahua	190
39	Sótano de Alpupuluca	Entrance drop	Veracruz	190
44	Cuaubtempa	Pozo con Carne	Puebla	190
45	Sótano de Puerto de los Lobos (Sótano Hondo)	Entrance drop	San Luis Potosí	189
46	Hoya de la Luz	Entrance drop	San Luis Potosí	188
47	Sótano de Hermanos Peligrosos	2nd drop	Veracruz	186
47	Atlalaquía (Sótano) de Ahuihuitzcapa	Entrance drop	Veracruz	180
47	Sima de Veinte Casas	Entrance drop	Chiapas	180
50	Croz 2	Entrance drop	Puebla	180

DEEP CAVES OF MEXICO

Mark Minton
May 2010
Depth in meters

1	Sistema Cheve	Oaxaca	1484
2	Sistema Huautla	Oaxaca	1475
3	Cueva Charco	Oaxaca	1278
4	Akemati - Akemasup	Puebla	1226
5	Kijahe Xontjoa	Oaxaca	1223
6	Sistema J2 (Ozto J2 (Faustino, Barbie) + Last Bash (Hija Puta))	Oaxaca	1222
7	Sistema Nogochl (Olbastle 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+Totot zil Chichiltic	Puebla	667
31	Sistema de los Tres Amigos	Oaxaca	659
32	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	658
33	Cueva Tipitcli	Puebla	653
34	Sótano de Tilaco	Querétaro	649
35	Nita Nashi	Oaxaca	641
36	Cuaubtempa Superior	Puebla	640
37	Sistema Soconusco - Aire Fresco	Chiapas	633
38	Sistema Atlalaquía	Veracruz	623
39	Cueva de Diamante	Tamaulipas	621
40	Sistema Coyolatl	Puebla	620
41	R'ja Man Kijao (Nita)	Oaxaca	611
42	Nita He	Oaxaca	594
43	Meandro Que Cruce (Meandre Qui Traverse, H54)	Puebla	588
44	Yometa	Puebla	582
45	Sótano de las Coyotas	Guanajuato	581
46	Sistema Los Toros	Nuevo León	576
47	Arriba Suyo Sótano	San Luis Potosí	563
48	Sistema Tepetlaxtli	Puebla	535
49	Sótano de Nogal	Querétaro	529
50	Resumidero de Piedra Agujerada	San Luis Potosí	526

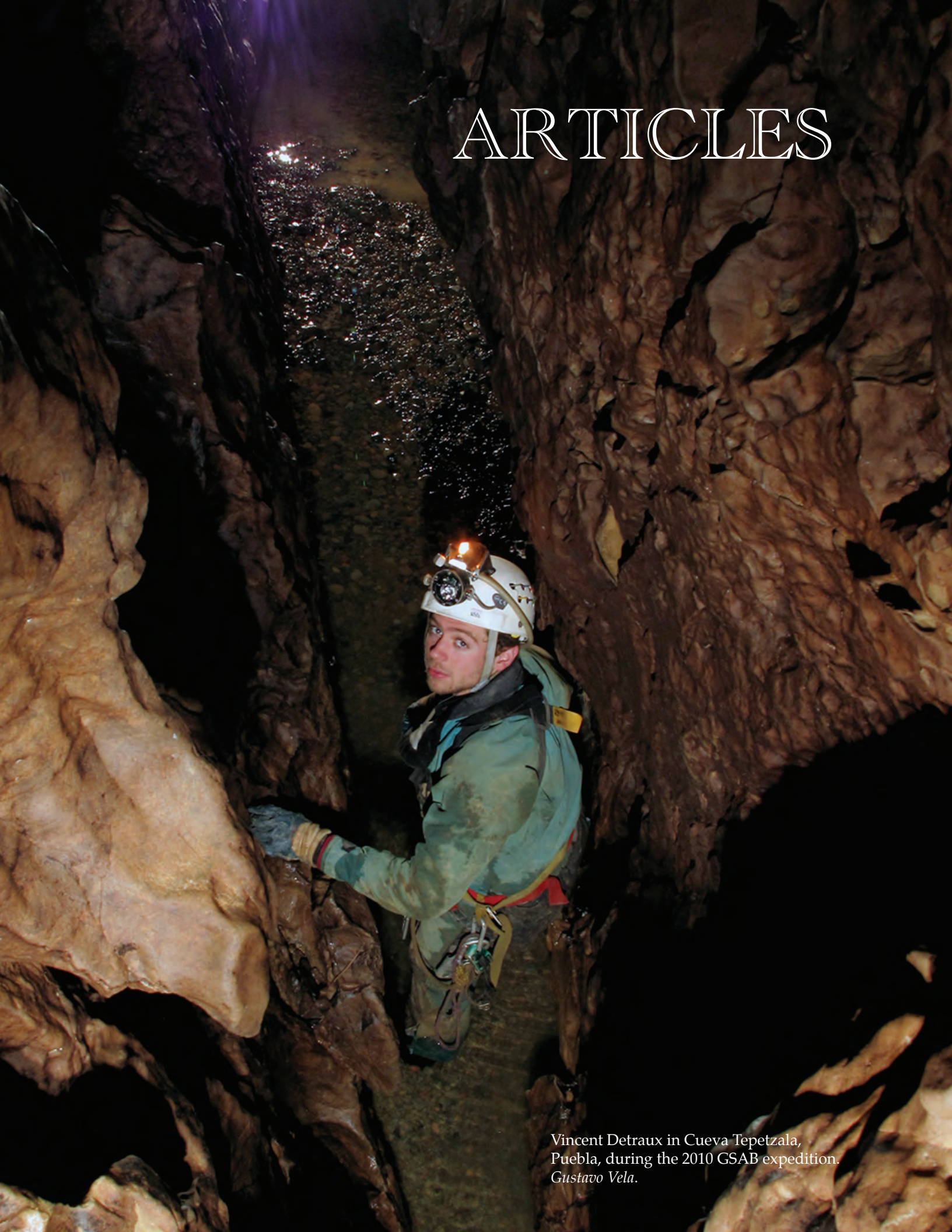
Mark Minton
May 2010
Length in meters

LONG CAVES OF MEXICO

1	Sistema Ox Bel Há	Quintana Roo	180039
2	Sistema Sac Actun	Quintana Roo	178034
3	Sistema Purificación	Tamaulipas	94889
4	Sistema Dos Ojos (Sistema Jacinto Pat)	Quintana Roo	64600
5	Sistema Huautla	Oaxaca	62099
6	Sistema Xunaan-Há (María Isabella, 3B) - Tixik K'una - Templo	Quintana Roo	44324
7	Cueva del Tecolote	Tamaulipas	40475
8	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	37676
9	Kijahe Xontjoa	Oaxaca	31373
10	Sistema Aktun Hu	Quintana Roo	29862
11	Sistema K'oox Baal	Quintana Roo	29054
12	Sistema Toh Há	Quintana Roo	29039
13	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli)	Puebla	28564
14	Sistema Soconusco - Aire Fresco	Chiapas	27793
15	Sistema Cheve	Oaxaca	26194
16	Sistema Naranjal (Najarón-Maya Blue)	Quintana Roo	24432
17	Sistema Coyolatl	Puebla	23000
18	Sistema Aerolito	Quintana Roo	18000
19	Sistema Tux Kupaxa	Quintana Roo	15917
20	Cueva de Alpazat	Puebla	15200
21	Sistema PonDeRosa (Pondazul, Edén)	Quintana Roo	15019
21	Sistema J2 (Ozto J2 (Faustino, Barbie) + Last Bash (Hija Puta))	Oaxaca	13492
23	Atlixicaya	Puebla	13000
24	Sistema Río La Venta	Chiapas	13000
25	Sistema Yok Ha' Hanil (Río Cristal, Pool Tunich, Río Secreto)	Quintana Roo	12730
26	Chjine Xjo	Oaxaca	12400
27	Cueva Pitch	Quintana Roo	12000
28	Sistema San Andrés	Puebla	10988
29	Sistema Camilo	Quintana Roo	10984
30	Cueva de la Mano	Oaxaca	10841
31	Sistema Taj Mahal - Minotauro	Quintana Roo	10600
32	Actun Káua	Yucatán	10360
33	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
34	Cueva del Arroyo Grande	Chiapas	10207
35	Sistema Dos Pisos (Ka'p'el Nah)	Quintana Roo	10110
36	El Chorro Grande	Chiapas	9650
37	Sistema Muul Three	Quintana Roo	9630
38	Sistema Tepetlaxtli	Puebla	9600
39	Sistema Chac Mol - Mojarra	Quintana Roo	9193
40	Cueva Quebrada	Quintana Roo	8921
41	Sistema Brumas Selváticas	Puebla	8870
41	Sótano de Las Calenturas	Tamaulipas	8308
43	Gruta del Tigre	Quintana Roo	8200
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

Updates and corrections: Mark Minton, 8758 Frog Hollow Road, Linville, Virginia 22834, mminton@illinoisalumni.org

ARTICLES



Vincent Detraux in Cueva Tepetzala, Puebla, during the 2010 GSAB expedition. *Gustavo Vela*.

SISTEMA J2–LAST BASH: THE 2010 J2 EXPEDITION

Matt Covington

My story begins in May 2006. That year's J2 expedition started with a mad rush into the unknown, in pursuit of a wide open lead at –1000 meters. However, at –1200 meters, exploration came to a screeching halt when the team encountered El Sifón de Los Piratas. For several weeks, teams mapped and explored side leads in hopes of finding a bypass to the sump. During one of these trips Tommy Shifflett, Jon Lillestolen, Bart Hogan, and I explored an infeeder near Camp 2a. We continued up two free-climbs, following strong airflow, and stopping at the base of a 15-meter waterfall. The airflow was intriguing, but the passage seemed to be headed upstream, not a likely place to find a sump bypass. In any case, we had no aid-climbing gear with us that day and could not continue.

Several days later, back on the surface, Jon convinced me to go with him to check out a pit that he and several Polish cavers had discovered in 2005. After searching around for a couple of hours and checking a bunch of dead-end holes, we relocated the pit, which had been dubbed La Cueva Hija Puta by Pavo Skoworodko. The entrance was tight, thus inspiring the name, but man, was it sucking in some air. We were both excited by the air, and Jon went in through the entrance squeeze and set the first rebelay. From there the cave dropped through two more squeezes and opened into an echoing pit around 30 meters deep that clearly took water in wet times. Out of rope, we retreated to the surface, stoked about having going cave. On the way back to camp, for some reason we decided to try a new route. The route down the valley bottom had been pretty grim, and we knew there was an established trail somewhere above us, if only we could get there. After about thirty minutes of bushwhacking up the treacherously steep hillside in the dark, we still had not found the trail. Going was slow, and we opted to traverse back into the valley bottom and retrace our earlier path. Inspired by this small adventure and the fact that the expedition was nearing its end, we settled on a new, more politically correct name for the cave—Last Bash. Upon returning to camp and adding the Last Bash survey to the database, we could see that the cave entrance was nearly directly over J2, and only about 500 meters horizontally from the blowing infeeder at Camp 2a. It seemed like a stretch at this point, but could these two passages possibly connect?

In a last-ditch effort to find a bypass to the J2 sump, the next day Bill Stone, Jan Matthesius, Pauline Barendse, and I headed for the bottom of J2 to push bolt-climbing leads, the final exploration trip for the year. We spent two long days beyond Camp 3 knocking off climbing leads one by one, with Bill and me trading off the lead. None of these climbs yielded any significant passage, and we decided to retreat to Camp 2a and spend our final exploration day climbing up the infeeder passage. It seemed unlikely to lead to more depth, but at least it was going passage.

The waterfall that had stopped us before is broken into two steps, with a large alcove about 5 meters up. I free-climbed the first pitch, which was easy, but very wet. Once at the top, I rigged a rope and the rest of the team followed. I then bolted up the remainder of the waterfall and squeezed into a tight passage above. The cave continued, and up around the corner I found a better place to rig a permanent line, which dropped back into the alcove below, out of the waterfall's spray.

Upstream, the passage enlarged to mostly walking size. We encountered two more free climbs and scooped about 200 meters of passage before finding another big waterfall. We went back for the climbing gear, and I began the climb while Bill and Pauline started surveying the passage below. The waterfall created a

San Francisco Chapulapa. *Kasia Biernacka and Marcin Gala.*

speleophysics@gmail.com

Team Mexipole (Wicho Díaz, Omar Hernández, Mirek Kopertowski, and Oliwia Rysnik) and their "racing spoons" in Camp 2. *Kasia Biernacka and Marcin Gala.*

tremendous amount of spray, and the chamber below it was swirling with mist. Jan, who was belaying me, managed to crouch in an alcove to escape the brunt of the wet and wind, but he certainly had a couple of cold, grim hours ahead. I bolted my way up the side wall and across an overhanging traverse, until I could swing myself around into the slot from which the water was rushing. Then I chimneyed up the wet chute for about 5 meters until it opened into a chamber. I placed one bolt, and got halfway through the next drill hole before running out of power. In that hole I placed a second, shallow bolt, which also happened to be my last. The chamber ended at yet another waterfall, with what appeared to be a narrow canyon passage emerging at the top. The cave continued, but we would not go there today. We completed a final survey shot, and I left a note on the station with the station number, our names, and the date. As I had a final look up the falls before descending, I wondered whether anyone would ever find that note from above, maybe years from now, if it could survive the high flows of the wet season.

In 2009, we returned to J2 for a major diving expedition. Amid the chaos that is a major diving expedition, the team also managed to conduct a number of forays into Last Bash. Early in the expedition, Jon, Jim Castelaz, and I returned with 50 more meters of rope. We rigged down three pitches into a roomy chamber that led to the top of a deep, sloping fissure. Some rocks we dropped seemed to go on out of earshot. It would turn out that this fissure was even deeper and more vertical than it sounded. In a series of trips later in the expedition, team members continued the push down this fissure. The ramp gradually grew steeper for about 100 meters before reaching a free-hanging drop of 150 meters. After several more steep drops, the cave reached base level at around –400 meters, becoming much more horizontal. A final exploration and survey push, by Wicho Díaz, Will Heltsley, Jon Lillestolen, Mike Pugliese, Yuri Schwartz, and Sergey Tkachenko, led to about –500 meters, where the team ran out of rope. Now the gap between Last Bash and J2 had greatly decreased. Given the amounts of air and water, it seemed likely that the two caves would connect, probably in the vicinity of Camp 2a, but there were many infeeders near there, so where exactly it would come in was anyone's guess.

After 2009, the team was pretty worn out with J2, and we needed a break from hauling loads of diving gear. Furthermore, Bill Stone, who had led most of the previous

Center: *Kasia Biernacka and Marcin Gala.* Others: *Omar Hernández.*

J2 2010 photos by Kasia Biernacka and Marcin Gala, clockwise from upper left: Oliwia Rysnik climbs rope at the start of the route up from Camp 2. The main shelter in base camp. Omar Herández at the drying rack in Camp 2. Oliwia Rysnik in a dry bypass route. Oliwia Rysnik squeezes through one of the many tight spots in the Moment of Doubt in Last Bash.

J2 expeditions, would be spending several months in Antarctica with the Endurance project and didn't have time to plan another expedition for 2010. Given this, we knew that another big diving push in 2010 was out of the question. However, Jon Lillestolen, Marcin Gala, and I decided to put together a smaller expedition, with the main goal of trying to connect Last Bash into J2. Not only might this create an easier route to the bottom of J2, but it also would bypass the Surprise Sump at –750 meters, which had flooded several times in 2009, trapping cavers beyond. If we succeeded, we would head to Camp 3 to push an intriguing lead that Yuri Schwartz and Sergey Tkachenko, two Russian cavers, had discovered near the end of the 2009 expedition. While Bill and José Morales had been diving in Sump 4, Yuri and Sergey were bolt climbing near Camp 3. They had reached an ascending passage with a large amount of airflow being sucked into it. This air was heading to a lower entrance somewhere, and just might bypass the sump and head downstream.

Jon and I arrived in San Francisco Chapulapa late in the afternoon on February 27, 2010, after driving straight through from the border. Shortly thereafter, Marcin, Kasia Biernacka, their daughter Zuzia, and Wicho Díaz arrived, having driven up from Oaxaca City that day. We settled in for the night at Rancho Faustino, the home of our good friends in Chapulapa, and the next day began negotiations with the *presidente* and *bienes comunales* to obtain permission to go up the mountain to Last Bash. Negotiations with the *bienes comunales* dragged on as one day became two days became two weeks. Two unfortunate cavers, Mike Young and Brendan Nappier, came and went in the time that it took to gain permission. Luckily, during that time we were at least able to do some caving in Ken Cave near Santa Maria Tlalixtac, where we easily obtained permission. The true heroes of this expedition were Kasia Biernacka, our best Spanish-speaker, who spent countless hours in the hot seat during negotiations, and Wicho Díaz, who made two trips up from Oaxaca City to help us get permission. Without the hard work of these two, we would not have had a 2010 J2 expedition.

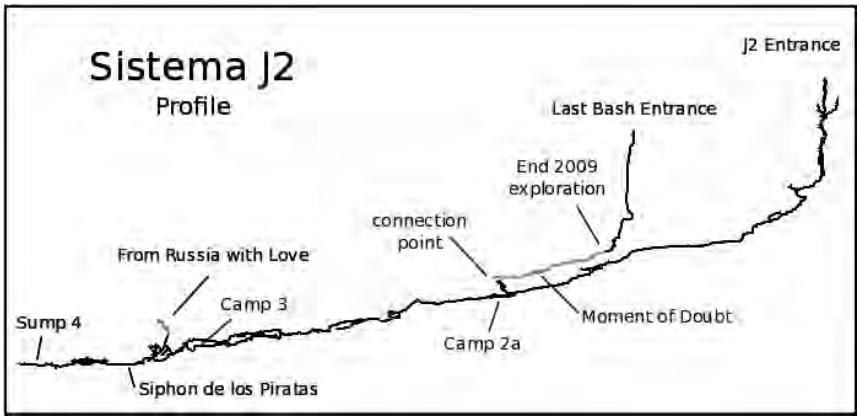
Señor Faustino Navarete Rubio (right) and his adopted son Jonas, our hosts on the mountain. *Omar Hernández.*

With permission obtained, on March 14 we finally started up the mountain with our gear, establishing a new base camp in the fields below Last Bash. It certainly had a different feel than our previous camp in the remote cloud forest. The new camp was exposed to the sun and frequented by cattle, pigs, and dogs, and every day dozens of locals would walk by on their way up to work in the fields. After splicing a T-junction into a nearby hose, we at least had running water, which we never had in the cloud forest. On March 15, Marcin Gala, Will Moffat, and Joke Vansweevelt set off on the first trip into Last Bash. Their main goal was to survey about 300 meters of passage that had been explored in 2009 but not surveyed. If they had time, they would continue beyond. Around 9 a.m. the next morning the crew staggered back from the cave. They had extended the survey to about –570 meters, but had no time to continue into unexplored passage. This was quite a "warm-up" trip to start off the expedition. Clearly, pushing Last Bash from the surface was going to require some long, difficult trips. Later that day Jon, Kasia, and I headed into the cave. We started rigging and surveying, and after only 100 meters of narrow passage we reached a tight crack that was taking all the air and water. I climbed down into the crack and crawled along the stream for a few meters before encountering a short flowstone constriction that was too tight. We had brought 150 meters

From left: Jon Lillestolen, Omar Hernández, Joke Vansweevelt, Will Moffat, Kasia Biernacka, Marcin Gala, Bill Stone, Oliwia Rysnik and Zuzia Gala, Mirek Kopertowski, Kelly Mathis, Wicho Díaz, Matt Covington. *Omar Hernández.*

of rope, several drill batteries, and countless bolts and hangers, but we didn't have anything for enlarging passage. Stymied, we headed for the surface, emerging around 2 a.m. after fourteen hours underground.

The next morning we discussed our options, all of us now being a little uncertain about whether we would succeed in a connection. Given the difficulty of the trips, each team needed two recovery days before returning to the cave, so we all relaxed around camp for the day. The following day, Marcin, Will, and Joke returned to the cave, prepared to work on the constriction. After the hour-long hike to the cave, Will realized, to his dismay, that he had left his vertical gear in camp. While he ran back for it, Joke waited at the entrance, and Marcin decided to descend ahead of the others to start the work. Marcin arrived at the constriction and started a long two hours of hammering, half lying in the water with a shower trickling in from above. Finally, it was large enough to pass through, so he went for it. However, up ahead there was a horn that jutted out, creating a narrow spot in the air-filled portion of the passage. He had to completely submerge his body and ease under the horn in order to reach the other side. Soaking wet, and tired from the hammering, he was unhappy to find another constriction around the corner. His opinion was that this one was too tight for too long. It couldn't be passed without serious use of chemical persuasion. About this time Will and Joke showed up. Marcin was hypothermic, so he headed for the surface. Will and Joke also passed the first constriction and spent some time hammering, removing the horn and reducing the water level in the squeeze by lowering the lip of the dam that was holding back the water. They took a quick look at the next constriction, but then also headed for the surface because they were getting too cold.



Two days later, Jon and I returned, afraid of the grim lead that lay ahead, but prepared to push hard. The others had significantly improved the passage, and we only got wet up to our waists going through the first squeeze. Once beyond, Jon started working on lowering the water level more, while I scoped out the terminal constriction. Without the fog of hypothermia to bias my judgment, I could see two possible routes. Up high, it looked almost passable, and it was out of the water. Down low I thought was a little bigger, but also very wet. I would try high first. I removed all of the vertical gear from my harness and squeezed my way up into the opening, but that level quickly pinched out. From there, I thought I might be able to get back into the lower level past the wettest part. I worked my way into the widest spot, but soon my hips jammed. I wasn't going any farther. I had started to climb back out when my harness snagged on a projection. After a couple of minutes of fruitless struggle, I was beginning to wonder about my predicament. I slid back down to a spot where I could barely reach my harness carabiner and started working it open. Soon I had my harness unfastened and was making better progress slithering out of the crack. About that time Jon showed up to say, "Man. Your harness is falling off."

"Yeah, I know."

After a breather, I decided that down in the water might be the way on. I squeezed in feet first and gradually eased my way through. Awkward, but passable. Jon followed, hammer in hand, removing the most offensive projections. Next came another ascending squeeze, followed by a sharp turn into a tight chimney back down. Finally things started to look better. We got out into walking passage. For nearly thirty minutes we scooped forward through fairly easy passage, with a few short down-climbs but no rope drops. We ultimately named this passage The Bazooka Attack in memory of the shootout reportedly including "grenades, artillery, and bazookas" that Jon and I had narrowly missed on our drive across the Mexican border. As we continued on, we were starting to wonder whether we had overshot the Camp 2a infeeder. There had only been about 200 meters of horizontal distance separating the new surveys in Last Bash from J2, and we had gone much farther than that. Then the cave turned hard right, back on itself. Soon we were looking down a 10-meter drop that we could not free-climb. I turned my headlamp up and scanned the room

Zuzia. *Omar Hernández.*

below. There it was, a rope rigged to the far right wall. This was the waterfall that I had looked up in 2006, wondering if someone would ever discover it from above. We had made the connection. Sistema J2 was established.

We had left all of the survey and rigging gear back before the series of squeezes, which we later named the Moment of Doubt. Our plan was to try to survey the passage and then return to the surface. However, the only set of instruments was totally fogged. Since we had rigging gear, we decided that Jon would work his way back to the connection point, rigging all of the short drops for travel with a camp duffel. In the meantime, I would work on the Moment of Doubt with the sledge. Two and a half hours later, Jon returned, and we headed out of the cave.

The first goal of the expedition was accomplished, but time was running out fast, and we still wanted to push leads out of Camp 3. Marcin, Will, and Joke headed in for a five-day camp. Their plan was to spend some time surveying the connection route on the way down, and then to head for a day of exploration out of Camp 3. Travel was slow with the camp packs on the way in, and they didn't have time to survey. Jon, Omar Hernández, and I followed the next day. We planned on spending two nights at Camp 2a working on improving the Moment of Doubt, familiarizing Omar with the cave, and installing a data logger in the Jungle Series above Camp 2a. The Camp 3 team had a tough but successful exploration day and found a route through the tight, loose, breezy breakdown maze that had stopped Yuri and Sergey in 2009. They stopped at the bottom of a 7-meter climb that needed bolts. After a fast trip back to Camp 2a, they spent the second half of the day surveying in the connection route, and then they connected the surveys through the Moment of Doubt on the day they left the cave, a strong effort at a miserable task. Somehow this team always seemed to end up with the hardest pushes and long surveys of scooped passage.

The next trip into the cave was a six-day camp with Kasia, Omar, Wicho, Mirek Kopertowski, and Olivia Rysnik. They would spend two days exploring in the bottom. On the first day, they pushed leads in the lower passage near the sump. They also discovered that the water level in the sump had risen about 10 meters during the wet season, leaving dive gear floating in the water and one dive tank stranded near the ceiling. The next day Kasia, Omar, and Wicho started out of the cave, while Mirek and Olivia went to bolt up the climb that had stopped the previous team. They reached the top, crawled through more breakdown, and emerged into a sizable chamber, with passage going both directions. Downstream quickly pinched with flowstone, but there was an ascending stream passage that had the air.

As the others left the cave, Jon, Bill Stone, Marcin, Kelly Mathis, and I descended for a final trip to the bottom. We first went to map Mirek and Olivia's discovery and look for a way on. The ascending passage quickly deteriorated into a large breakdown maze. We spent a few hours pushing around in it, without finding a continuation. Though the air flow was enticing, the passage otherwise was pretty nasty. We had lost the air in the breakdown, and were becoming doubtful that we could find a way through. After mapping several routes through the breakdown we called it a day, not sure whether we would even return. Given the grim nature of Yuri and Sergey's lead, we named it From Russia with Love.

The next day Bill and I stayed near Camp 3, collecting data and installing a data logger. Marcin and Kelly went to bolt climb up to the best remaining lead in the bottom part of the cave, and Jon returned once more to From Russia with Love to see if he could find a way through the breakdown. Marcin completed the climb, but the lead went nowhere. Whether it was good luck or bad might be debated, but Jon found a way through the breakdown and emerged at the bottom of a 30-meter dome, which he called Perestroika Well. The passage continued, but now, nearly 200 meters above the main stream level of J2, it seemed to be heading toward the surface. We learned after the expedition that a nearby cave, Palomora, which ends in a too-tight squeeze, has a strong outward draft. The two caves are only separated by about 350 meters vertically and less than a kilometer horizontally. Will there some day be another connection to J2 through From Russia with Love? I don't know. The team that explored Charco were the last folks to push Palomora. They report that it is horrible, tight, and nasty. . . . Maybe not.

Sistema J2—Last Bash
La Expedición 2010 a J2

La cueva Last Bash fue ubicada inicialmente como una entrada angosta en 2005. Durante la expedición de mayo de 2006 a J2, la cueva fue explorada hasta la base del primer tiro. En la misma expedición se exploró río arriba una fuente de agua cerca del Campamento 2A en J2, hasta la base de una cascada. Durante la expedición de 2009 a J2, Last Bash se exploró a 500 m de profundidad, y la topografía indicaba que no estaba muy lejos del campamento 2A en J2. En 2010 una pequeña expedición conectó Last Bash con la cascada no escalada en J2. Hay varios pasos estrechos y con agua que tuvieron que ser pasados. Dos grupos acamparon en el Campamento 2A usando la ruta por Last Bash y exploraron pasajes cerca del final de J2, pero no se encontraron vías alternas a los sifones de J2.

KARST AND GROUNDWATER IN NORTHEASTERN COAHUILA: AN EDWARDS AQUIFER MIRROR

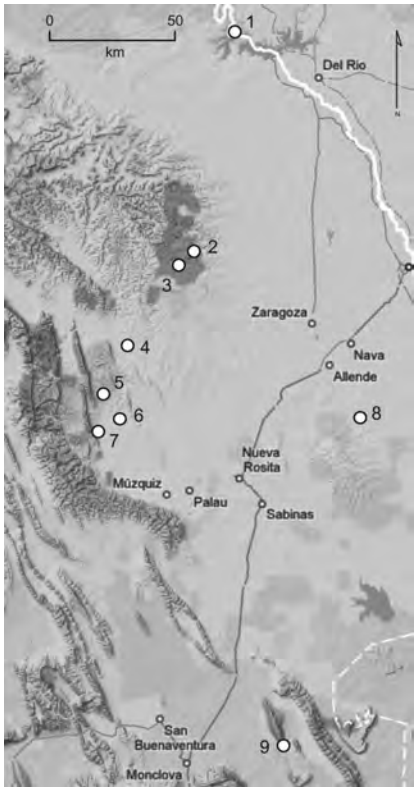
Peter Sprouse

The Sierra del Burro and surrounding areas in northeastern Coahuila contain the second largest carbonate outcrop in Mexico, surpassed only by the Yucatan Peninsula. Cretaceous limestones range from elevations of 1500 meters in the western part of the area down to less than 500 meters to the southeast. Boghici (2004) considers this area to contain just over half of the binational Edwards-Trinity aquifer. Like the Edwards-Trinity in Texas, caves and losing streams recharge via units such as the Glen Rose and Devil's River Formations, and resurge at low points in the Austin Chalk and other units. On its eastern side the aquifer is confined, and drilled wells can flow under artesian pressure. At the eastern limits across the "bad water line," wells and springs become saline (total dissolved solids greater than 1000 mg/l).

The Sierra del Burro is heavily dissected by numerous canyons. Some upland areas contain vertical caves that reach depths of more than 100 meters. These typically consist of a series of vertical drops to rubble or dirt plugs, and they contribute significant recharge. The deepest of these upland caves explored thus far is Sótano de Los Enríquez [see *AMCS Activities Newsletter* 31, pages 157–158]. Mapped in 2007, it is situated on a bench on the east side of the Sierra Santa Rosa that is at the southeastern end of a swath of Devils River Formation outcrop. The entrance pit measures 50 by 25 meters across, and is incised by surface drainage at its northern end. A vertical drop of 103 meters, longest in the state of Coahuila, leads to a plug of flood-borne soil at a depth of 124 meters.

Deeper caves such as Los Enríquez certainly recharge the aquifer, but a least some recharge reappears in canyon walls via seep-spring caves. Due to the sheer number of canyons dissecting the sierra, there are many caves exposed, some of which were likely water outlets. Cueva de San Rodrigo is one such cave that was mapped in 1998. It is located along the north wall of the Río San Rodrigo canyon, and at the entrance it is 8 meters wide and 6 meters high. The cave gradually slopes upward and becomes smaller, becoming too small to explore after 90 meters.

As the canyons progress downstream, water flow can be pirated into such features as El Abra, currently the longest surveyed cave in the state at 1841 meters of passage, surveyed between 1998 and 2002. The entrance is a hole in the floor of Cañón San Dabe in horizontally bedded bedrock at the top of the Glen Rose Formation. Water pours into this entrance during wet periods, and also comes in from a sump just below the shallow entrance pit from an unknown source. This stream flows at a gentle gradient through the main route of the cave to the limit of exploration at another sump. The cave trend underlies the surface canyon, which at this point runs north, though its ultimate destination is eastward toward the Río Bravo (Río Grande). The downstream sump lies 700 meters north of the cave



Karst sites of the Coahuilan Edwards-Trinity Aquifer: 1. Goodenough Springs. 2. Cueva de San Rodrigo. 3. El Abra. 4. El Hundido. 5. Sótano de Los Enriquez. 6. Embudo de Huevos. 7. Nacimiento Kikapú. 8. Cueva de La Azufrosa. 9. El Hundido de El Mulato.

petersprouse@yahoo.com

Slightly revised from a paper in the proceedings of the Fifteenth International Congress of Speleology, volume 3, pages 1690–1691. The English abstract appears elsewhere in this issue of the *AMCS Activities Newsletter* and is not repeated here. Additional photographs are from the poster presented by the author at the ICS. The cave maps are new.

Hundido del Mulato is a large-diameter pit that drops 90 meters to a streamway, with further drops in the downstream direction toward the aquifer. It is situated in an isolated outcrop of the Buda Limestone surrounded by alluvium. Normally, local drainage would enter the pit, but high aquifer levels can cause water to come out of it, making this an estavelle. During regional flooding in August 2008, water flowed out of this pit, forming a large lake with a raised fountainhead, evidence of significant hydraulic head originating in the Sierra del Burro to the north.

entrance. El Abra is quite shallow, with a depth of 16 meters. A Texas analog for this cave is 5650-meter-long Indian Creek Cave in Uvalde County. It also sinks in the bed of a canyon at the top of the Glen Rose Formation, and, after an initial vertical drop, it is a horizontal stream passage that meanders underneath the bed of the surface canyon.

Groundwater rises at perennial springs in an arc around the northeast, east, and southeast sides of the Sierra del Burro, emerging from the Austin Chalk and the Salmon Peak Formation. The largest of these is the Nacimiento Kikapú, which rises in gravels from the Austin Chalk as the source of the Río Sabinas. None of these perennial springs has been found to be enterable. However, Goodenough Springs in Val Verde County, Texas, may discharge waters from Coahuila. Though now inundated 45 meters below the surface of Lake Amistad, this cave has been explored by divers to a depth of at least 115 meters below its entrance (Stafford et al., 2009). There is also the prospect of Edwards-Trinity groundwater traveling extensively to the southeast. Batzner (1976) concluded this in his study of the Lomerío de Peyotes, a low anticlinal ridge of Austin Chalk that extends southeast through the municipality of Villa Unión for 100 kilometers.

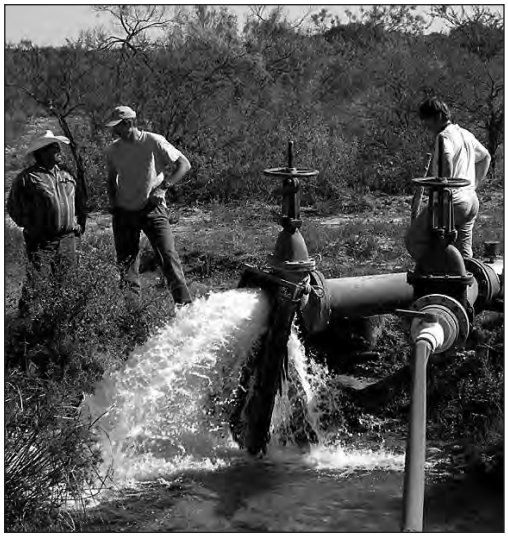
A cluster of sulfur and freshwater springs occurs on the east side of the Peyotes anticline near Villa Unión. Cueva de La Azufrosa is situated just above these springs and may have a shared genesis. Mapped in 2005–2006, this cave is a horizontal rectilinear maze with a small freshwater stream. Although the cave continues in the direction of the springs beyond the current 431 meters of mapped passage, dense populations of Ghost Faced Bats (*Moormops megalophylla*) prevent further human exploration.

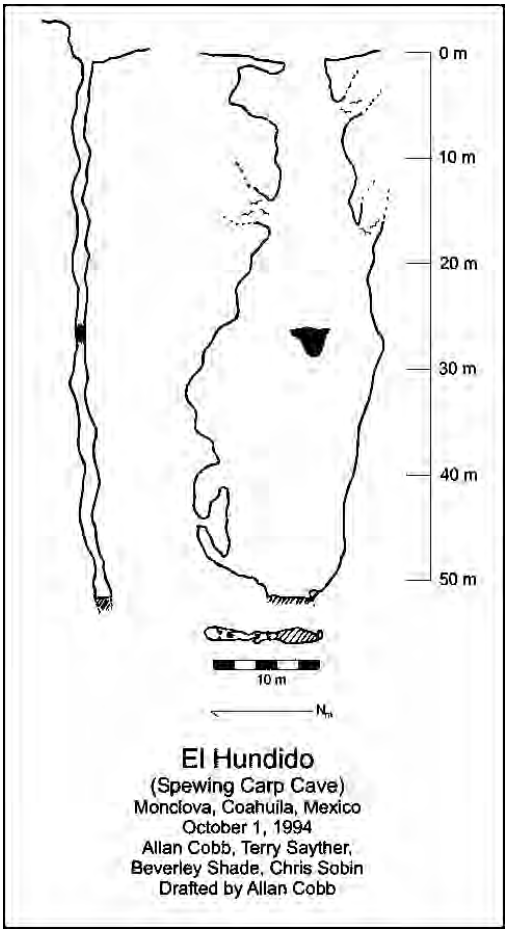
Two intermittent resurgence caves north and northwest of Múzquiz are sites of particular importance to the karst hydrology of the area. Embudo de Huevos was seen to be a resurgence on satellite imagery and was investigated in 2008. It is a funnel-shaped estavelle in a drainage that takes local runoff, but primarily acts as a resurgence, with a prominent drainage leading from the site. The depression is 25 meters in diameter and 15 meters deep, formed in alluvium on top of what is probably the Austin Chalk. The bottom of the sink is a jam of rounded limestone cobbles over an apparent pit. It is possible to drop pebbles down the pit between the jammed cobbles, and airflow comes out of it. Attempts to excavate the entrance were thwarted by collapse.

El Hundido is another estavelle, situated in an isolated outcrop of the Buda Limestone near El Mulato that is surrounded by alluvium. It is a large-diameter pit that drops 90 meters to a streamway, with further drops in the downstream direction. During regional flooding in August 2008, water flowed out of this pit, forming a large lake with a raised fountainhead, evidence of significant hydraulic head originating in the Sierra del Burro to the north. [See *AMCS Activities Newsletter* 32, pages 146–148.]

A study in the 1990s of the stygobitic catfish *Prietella phreatophila* by Hendrickson et al. (2001) sheds further light on aquifer connectivity.

Artesian well at Rancho Veinticuatro, municipality of Zaragoza, Coahuila.





Mexican blindcat *Prietella phreatophila*.

Unlike the two species of blind catfish that live at depths of up to 600 meters in the Edwards Aquifer below San Antonio, Texas, these fish live at the top of the aquifer and have been found in five caves across the study area. These sites are in a north-south line 170 kilometers long. There are anecdotal reports of blind fish being expelled from another occasional resurgence at the south end of the Sierra la Rata, an isolated plunging anticlinal ridge east of Monclova. Also known as El Hundido, this is normally a 50-meter pit to a bat-guano-covered sump. On 17 September 1988 Hurricane Gilbert, the second most intense Atlantic storm on record, flooded Coahuila. Local witnesses reported a tall fountainhead issuing from the pit and carrying white fish. Efforts to obtain fish from the sump in July 2008 were unsuccessful. If *P. phreatophila* were confirmed at this site, it would suggest an aquifer extent of 270 kilometers.

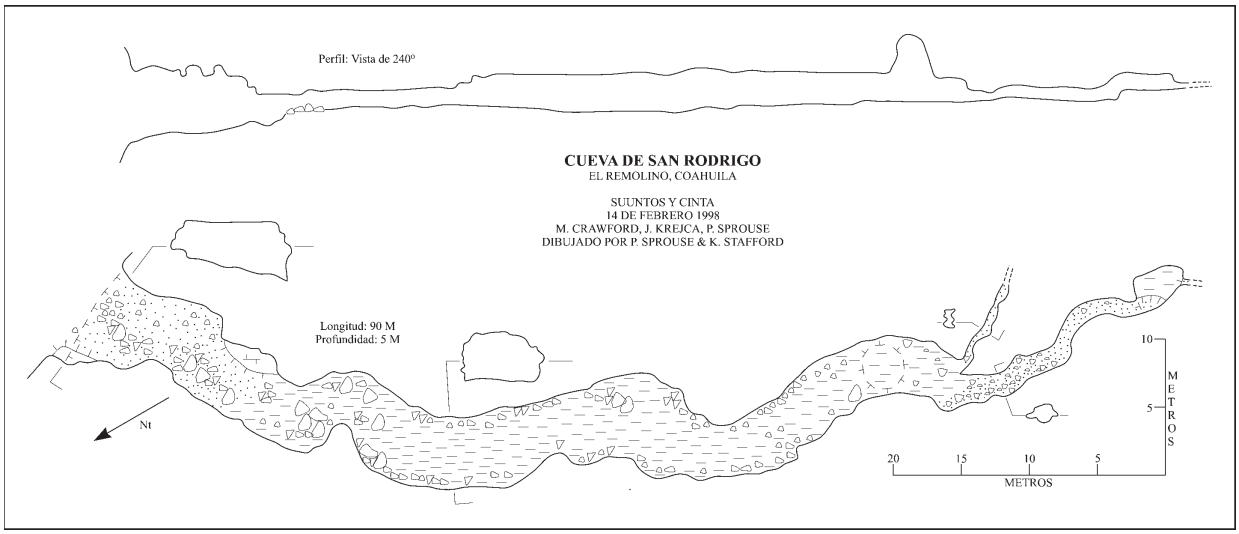
The Edwards-Trinity Aquifer of northeastern Coahuila contains recharge caves and springs that mirror similar features in the same rock units in the Edwards-Trinity Aquifer of Texas. Most of the area remains unexplored for caves, but caves will play a crucial role in the understanding of this productive and increasingly important aquifer.

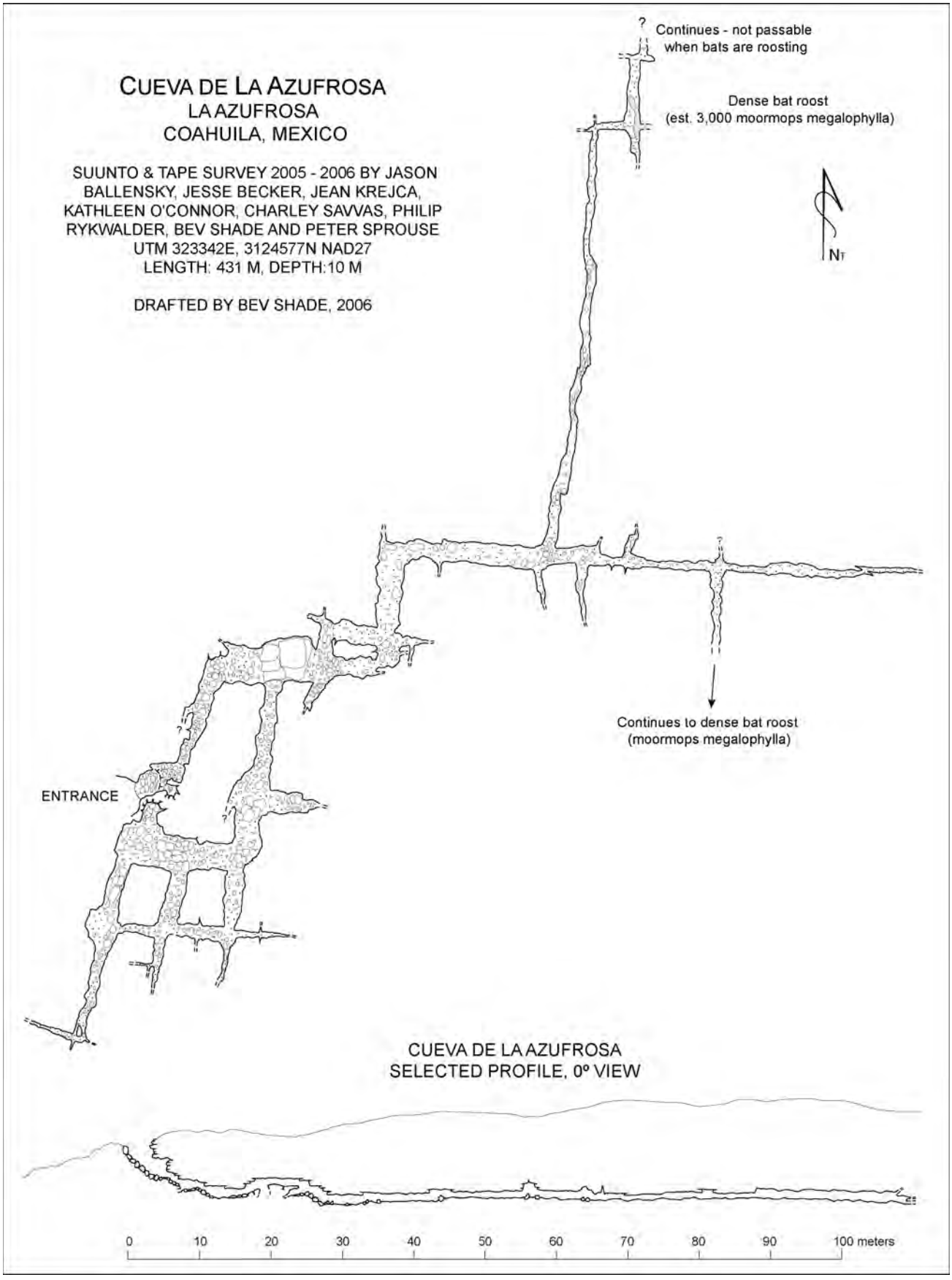
Batzner, J. C. (1976). The hydrogeology of Lomerio de Peyotes, Coahuila, Mexico: Unpublished M.S. thesis, University of New Orleans, 64 p.

Boghici, R., (2004). Hydrogeology of Trinity-Edwards aquifer of Texas and Coahuila in the border region, *in* R. E. Mace, E. S. Angle, W. F. Mullican III, (eds.), *Aquifers of the Edwards Plateau Conference*, Report 360 proceedings, Texas Water Development Board, Austin, pp. 91–114. (Available online at http://rio.twdb.state.tx.us/publications/reports/GroundWaterReports/GWReports/R360AEPC/Ch04.pdf)

Hendrickson, D. A., J. K. Krejca, and J. M. R. Martinez (2001). Mexican Blindcats, genus *Prietella* (Siluriformes: Ictaluridae): an overview of recent explorations. *Environmental Biology of Fishes* 62:315–337. (Reprinted in A. Romero (ed.), 2001, *The Biology of Hypogean Fishes*: Kluwer, Dordrecht, Netherlands, p. 315–337.)

Stafford, K. W., L. Land, A. Klimchouk, and M. O. Gary, (2009). The Pecos River hypogene speleogenetic province: a new basin-scale paradigm for eastern New Mexico




CUEVA DE LA AZUFROSA
LA AZUFROSA
COAHUILA, MEXICO
SUUNTO & TAPE SURVEY 2005 - 2006 BY JASON BALLENSKY, JESSE BECKER, JEAN KREJCA, KATHLEEN O'CONNOR, CHARLEY SAVVAS, PHILIP RYKWALDER, BEV SHADE AND PETER SPROUSE
UTM 323342E, 3124577N NAD27
LENGTH: 431 M, DEPTH:10 M
DRAFTED BY BEV SHADE, 2006
? Continues - not passable when bats are roosting
Dense bat roost (est. 3,000 moormops megalophylla)
NT
Continues to dense bat roost (moormops megalophylla)
ENTRANCE
CUEVA DE LA AZUFROSA
SELECTED PROFILE, 0º VIEW
0 10 20 30 40 50 60 70 80 90 100 meters

and west Texas, USA. National Cave and Karst Research Institute Symposium 1, *Advances in Hypogene Karst Studies*, pp. 121–135. (Available online at http://www.institute.speleoukraine.net/libpdf/Stafford et al_2009_The Pecos river hypogene speleogenetic province_NCKRI Symp_121-135.pdf.)

El Abra is the longest mapped cave in Coahuila, with 1841 meters of passage. The entrance is in a canyon floor at the top of the Glen Rose Formation. Water pours into this entrance during wet periods and also comes from an unknown source through a sump just below the shallow entrance pit. The stream flows at a gentle gradient through the main route of the cave to a sump.

Karst y el agua subterranea en el noreste de Coahuila: un reflejo del Acuífero Edwards.

El noreste del estado mexicano de Coahuila tiene una de las zonas kársticas más extensas del país, sin embargo el karst y el manto acuífero han recibido relativamente poca atención. La zona occidental (de recarga) cuenta con porciones superiores de cordilleras de rocas del Cretácico Temprano de más de 1500 m de elevación, que descienden hacia el este y sur y se sumergen por debajo de porciones del Cretácico Tardío con menor desarrollo kárstico. Esto define un acuífero confinado, donde los pozos pueden fluír bajo presión artesiana. De tal manera, es similar al Acuífero Edwards, más allá del Río Bravo, en Texas, con litologías y componentes kársticos similares.

Se han explorado más de 60 cuevas en la zona, la mayoría a partir del año 2000. Las zonas altas de la región tienen cuevas verticales que probablemente contribuyen a la recarga del acuífero, pero varios manantiales por filtración en las paredes del cañón descargan parte del agua prematuramente. Los cañones mismos son zonas importantes de recarga, como ejemplo está El Abra, una cueva horizontal con un río interno que es la cueva más larga de Coahuila, con 1841 m de longitud. En la región inferior de la zona de recarga, cerca de la zona artesiana, hay varias cuevas que son tanto de recarga como de descarga, dependiendo de la temporada o condiciones. Estas tienen entradas que son dolinas semejantes a embudos grandes que terminan en tiros verticales de hasta 90 m, llegando a corrientes subterraneas. Normalmente estas cuevas reciben agua, pero durante periodos de lluvias intensas en la zona de recarga se pueden convertir en resurgencias.

Video Review

Facing Darkness. 2006, 45 minutes. *Axis Mundi*. 2009, 48 minutes. DVD videos directed by Nathalie Lasselin. Pixnat, Quebec. US price $25.99 postpaid each or both for $41.99, from www.shop.pixnat.com.

Facing Darkness is a 2006 documentary offering a general perspective on the world of cave diving. The film offers a 45-minute orientation to speleogenesis, equipment, and the inherent risks and rules of the practice, according to some big names in the community. Although my review is from the perspective of a caver and individual working in the film-production business, my aim is to hold the documentary to the standards of the broad demographic of those not in those circles. Since the scope of the information is extremely wide, the appeal of the documentary is better suited to those not privy to the cave-diving world. The dialogue is mostly interview material, with occasional narration provided when necessary. The bulk of the interview content is articulate and interesting, and those chosen seem knowledgeable in their fields. Jim Bowden's contribution to the documentary is well suited, relevant, and accessible. His poetic musings and personal commentary should appeal to just about anyone, and at times is downright beautiful. For me, his presence is one of the driving appeals to the film. I question whether some of the information, especially regarding the formation of underwater caves, could not have been delivered in a fashion more accessible to the average viewer. Some of the scientific ideas are fairly straight-forward, but come across as heavy and technical. In my opinion, carefully prepared narration would be a better way than interviews to deliver scientific information.

My chief complaint with *Facing Darkness* lies in the non sequiturs in the information presentation. The ideas were vague and poorly communicated, sometimes complicated by sloppy editing. An illustration of the relative depth of Sistema Zacatón, Mexico, was inserted far too late in the story, and Bowden's description of his dive experience loses some of its gravity as a result. Other instances of confused information delivery are scattered through the film. The surface material was occasionally poorly lit and composed, sometimes failing in minor professionalisms such as leveling the camera during interviews. This is in stark contrast to the clarity and beauty of the underwater photography. The in-cave cinematography is mostly well done. Saturated colors, interesting passages, and compositions free from silt and cloudiness were all vital to the primary mission of the documentary. These rich landscapes are complimented by the dramatic and flawless orchestral score done by Mathiew Lavoie, which adds a level of professionalism to the work and perfectly accents the underwater environment. *Facing Darkness* is a sincere and honest project that feels as though it fell short in post-production, but it still deserves a look if you are willing to look past the poor structure of the information.

Axis Mundi (2009) is Nathalie Lasselin's second documentary and the follow-up to her 2006 project *Facing Darkness*. Her approach to this piece is a more organized and thoughtful one, and the end result is a product of higher production value. The film follows a group of cenote divers as they travel in Yucatán in search of archeological data. Character introductions are well done and establish a solid connection between the viewer and the protagonists early in the film. Some of these shots feel contrived, if only for the sake of aesthetics. This doesn't affect the merit of the documentary but it certainly comes off as slightly cheesy to me. Camera work is appreciably better in *Axis Mundi*, and the entire film is very well shot. Lasselin's technique has undoubtedly improved, and the result is a much more beautiful documentary. Underwater footage is eye-candy: sharp, clear, and professional. Information is communicated principally through an irritating narrator who was unable to pronounce some of the most frequently used words in the film. I cringed every time I heard her refer to cenotes as "see-notes" just seconds after the word was used correctly by one of the explorers. In spite of the pronunciation inconsistencies, the film is still very linear and very easy to watch. This is partly because the information is more coherent, but also because the characters work very well on camera. The expedition members worked exceptionally well together, and this adds human dynamics to the story. The particularly accessible nature of *Axis Mundi* gives it the appeal to cavers and non-cavers alike. In my opinion even younger viewers would enjoy the material.

My chief complaint concerning the documentary is the lack of information about the scientific merit of the team's work. Other than taking photos of skulls and pottery, we have no clue what they are doing other than having a good time. The culmination of the expedition is the videographing of a massive underwater formation never before filmed. While the footage gathered during this dive is especially beautiful, it seems like a cheap climax to me. I'm left with the impression that it was included solely to offer the audience an impressive ending. The source of my conjecture is that this is the only cenote the team had visited in the past. The film closes with the crew making their ascent from this cenote, and we are left with no idea how this work is beneficial to anthropology, geology, hydrology, or any other facet of science. We know there is a marine biologist included in the expedition, but she says all of ten words on camera, none of which concern biology. Wouldn't it have been easy to get some closing scientific remarks about what data they are collecting and how it's relevant? Regardless, judged on the basis of entertainment value I would recommend the film. At a minimum, *Axis Mundi's* cinematography of these pristine and incredible places is well worth viewing.

—Michael Pugliese

EL SANTITO 2009

Gustavo Vela Turcott

Franco dangled in his harness 20 meters off the ground. He asked me to confirm that the rope wasn't rubbing on rock anywhere above him, as he was about to swing way off to one side before continuing his descent in order to avoid the small cascade that was landing on him. The two of us were at –985 meters in El Santito. We had already been exploring more than eight hours, and, like the fools we were, we were still descending.

It was the third year running that we had met in the Sierra Negra in the south of Puebla, Franco Attolini, Al Warild, and I and a group of our caving friends, with the intention of continuing our sporting descents of caves in the area. Our group of thirteen, as in previous years, was mainly Mexican cavers, as well as cavers from Australia, Spain, the USA, France, and Switzerland, making the expedition a Mexican-international one.

While some of us shopped for food in Tehuacán, Puebla, others went on to Ajalpan to get permission from the Protección Civil. In true Mexican style, we combined our resources and put in equal amounts of rope and anchors, as well as money to pay for the costs of food, petrol, caving equipment, and hiring mules to carry our gear up the two-hour climb to base camp. In all we had a ton of gear, and so we needed a "mule fund" to pay for our gear carry.

Once up the mountain, we set up our camp for all of March 2009 in our friend Doroteo Cuello's front yard. While some organized the camp and equipment, others did warmup trips into the nearby caves. The weather refused to cooperate and remained unstable, with mist and rain that made it less than ideal for cave exploration. A lot of surface water can cause a dangerous rise in underground flow, which in the worst cases can lead to floods and accidents.

Even so, we started down El Santito, but with more care than usual in rigging down to the deep point of –527 meters that we had reached the year before. This would take us some five days, dividing the work among groups of two or three, with a different group descending each day. I could clearly remember our first expedition here in 2007. We searched and searched for Olbastle Akemabis and along the way found several caves that looked like they could continue. One of these was only 15 meters from the track and had an entrance some 3 meters by 4 meters. We descended about 30 meters to a narrow slot with a strong draft coming out of it. As we knew that it wasn't Akemabis, we left it, but didn't forget it, and looked elsewhere on the mountain. The irony was that we were at a top entrance of Akemabis, but wouldn't know it until two years later. [See *AMCS Activities Newsletter* 31, pages 27–36.]

In 2008 we returned to the cave, believing that it would connect with El Santo Cavernario, which had reached –593 meters and whose entrance is only 30 meters away. As it was so close, we had called our new cave El Santito. Two years later we still haven't found a connection between these two caves, even though, with further discoveries, their closest points are now only 10 meters apart. [The 2008 trip is reported in *AMCS Activities Newsletter* 32, pages 47–52.]

gustavo@vela-turcott.org or
turmalinero@yahoo.com
Translated from Spanish for the AMCS by Al Warild.

From left: Al Warild, Mike Frazier, Franco Attolini, Marcela Ramírez, David Tirado, Flo Guillot, Phil Bence, Bev Shade, Gustavo Vela, Greg Tunnock. *Gustavo Vela.*

Photos by Gustavo Vela.

Above: Guillaume Pelletier on a traverse just above a 49-meter pit.

Top left: Tototzil Chichiltic, the new top entrance to Santo Cavernario.

Bottom left: Bev Shade enjoying a trip into El Santito.

Below: Marta Candel in the second pit in El Santito.

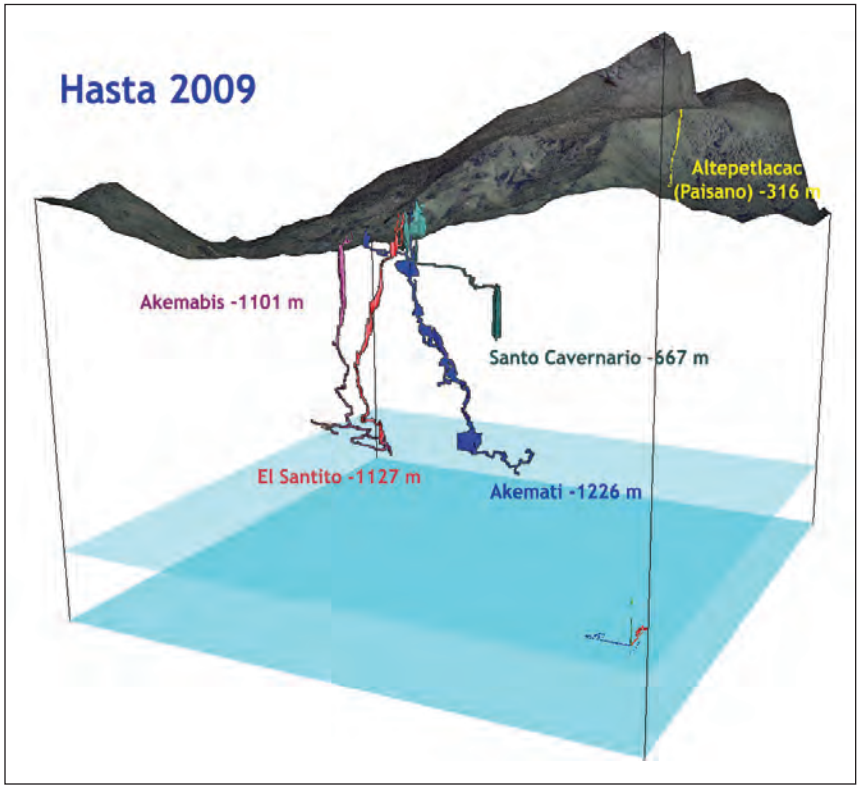
Guillaume Pelletier at a stalagmite in a fossil passage. *Gustavo Vela.*

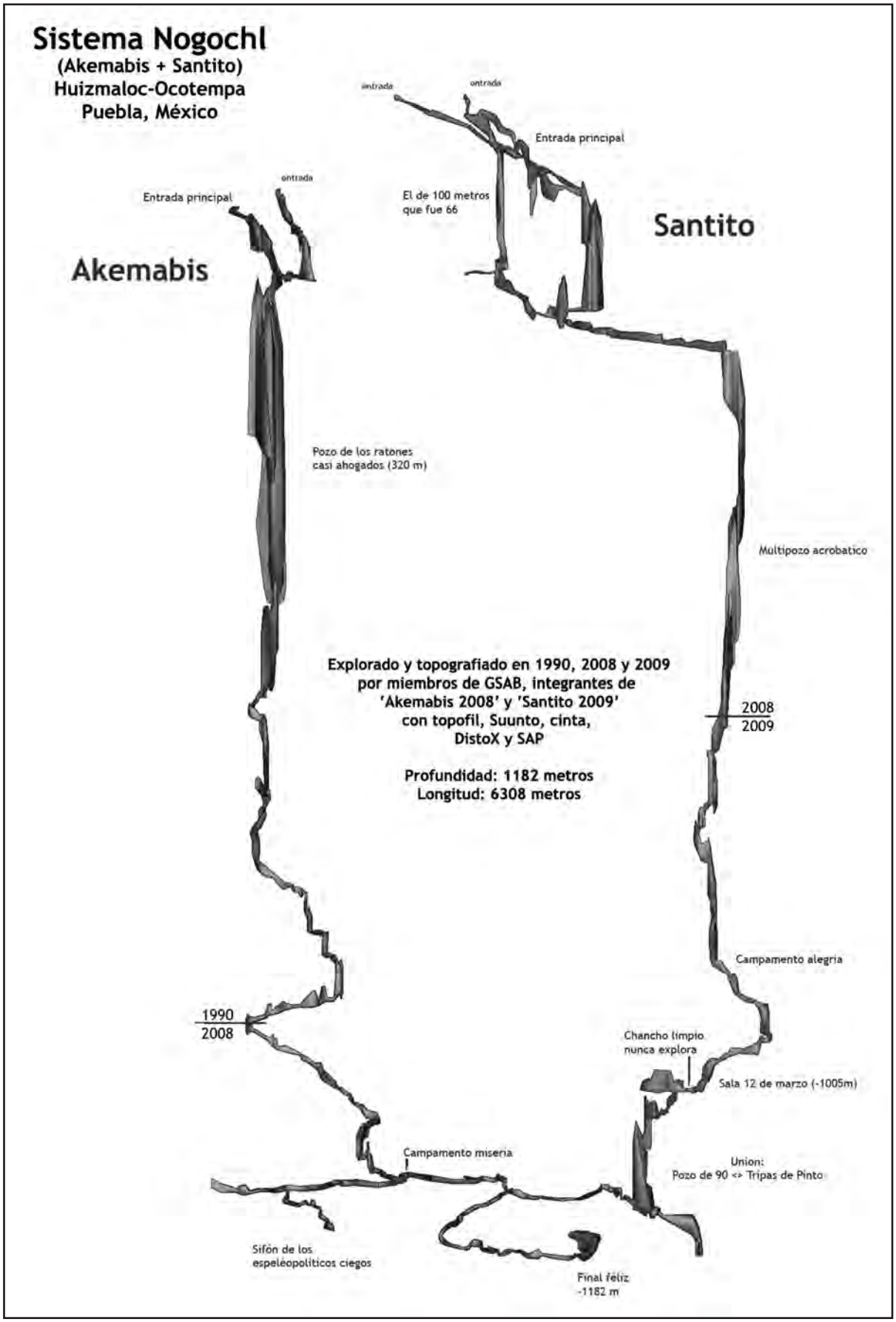
Marta Candel making the traverse in the 66-meter pit. *Gustavo Vela.*

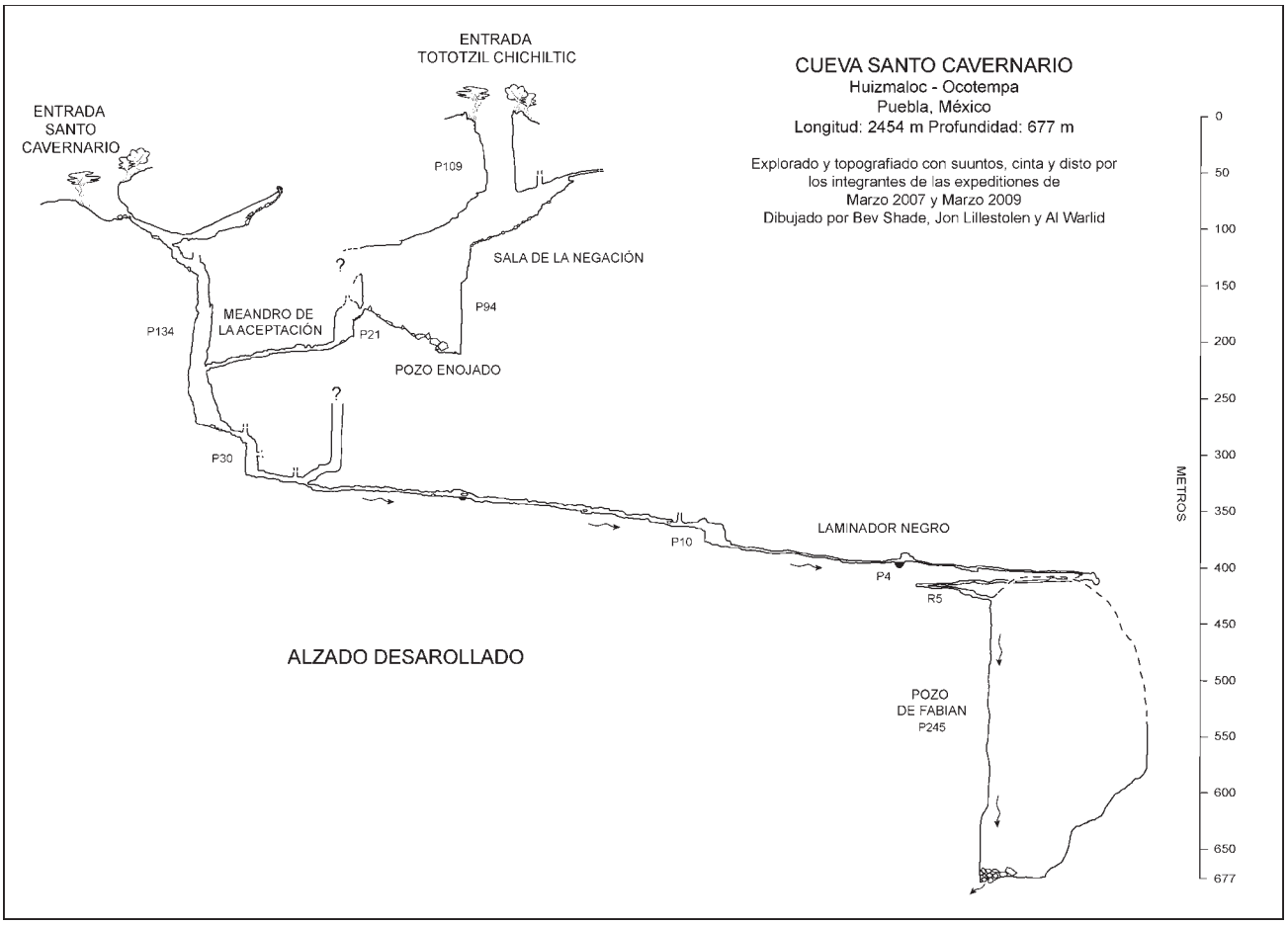
While our 2009 exploration in Santito was underway, some of us found time and enthusiasm to climb higher up the mountain to a plateau at 2200 to 2400 meters to continue prospecting and push Olbastle Altepetlacac (Nahuatl for *Cueva Paisano*). It took two hours to climb up to and one and a half hours to descend from this cave, which we had found and explored to –40 meters in 2008. We spent some long days climbing to the plateau and pushing Paisano, first to –80 meters, then –110 and –170, where it continued. Eventually, by the end of the expedition, six pushes had reached –316 meters here. At two points it appears to close down, but it opens up and continues. Such a strong breeze must go somewhere, so exploration continues.

With the rope rigged to our previous deep point in El Santito, the exploration became more interesting. Bev Shade, Greg Tunnock, and Al Warild explored from –527 to –620 meters. At –500 meters the water sinks into a small crack, so from there on, as the cave becomes drier and drier, the risk of a flood diminishes. The next day Ignacio (Nacho) de Rafael, Mike Frazier, and I explored and mapped to –692 meters. The day after, Phil Bence and Flo Guillot explored to –805 meters. The major part of their new passage was a 70-meter pitch with a lot of loose rock and huge blocks just ready to fall, so the rigging became more technical in order to avoid the hazards. The next day another group of three descended. Their journey from the surface to the lead, exploring to –918 meters, surveying, and returning to camp took some 20 hours. The cave continued.

On rest days we explored smaller caves near camp. One such cave we called Corsario; it connected to Santito down and across a large pit. The connection added 10 meters to Santito's depth.

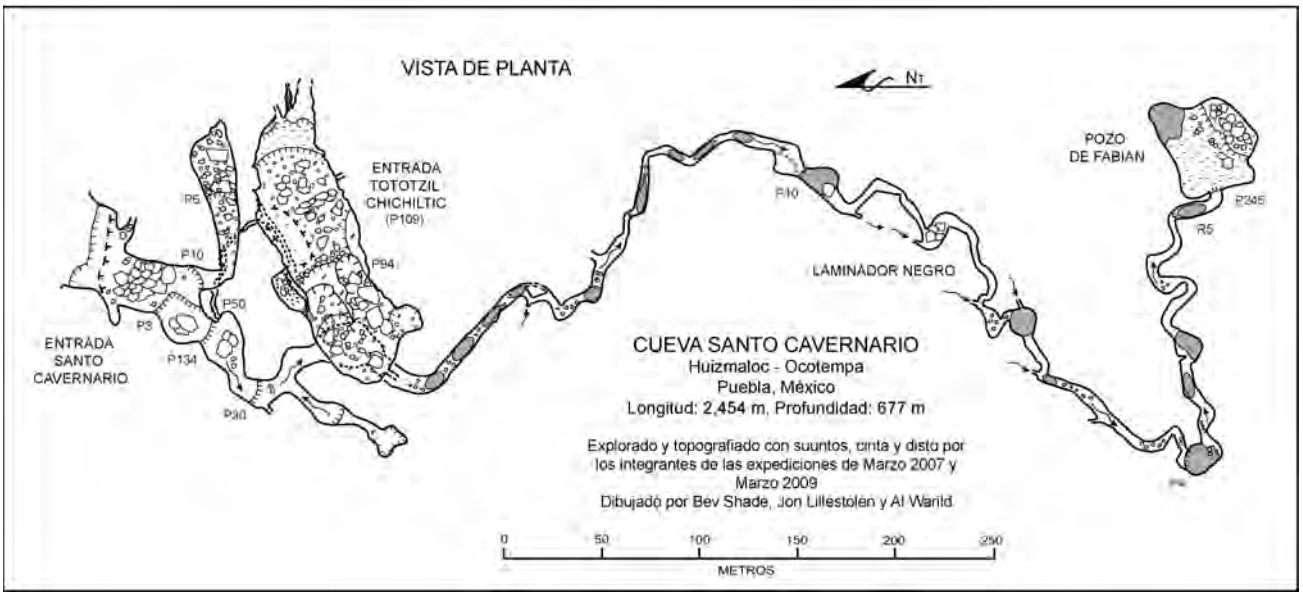



Sistema Nogochl
(Akemabis + Santito)
Huizmaloc-Ocotempa
Puebla, México
entrada
entrada
Entrada principal
entrada
Entrada principal
El de 100 metros
que fue 66
Santito
Akemabis
Pozo de los ratones
casi ahogados (320 m)
Multipozo acrobatico
Explorado y topografiado en 1990, 2008 y 2009
por miembros de GSAB, integrantes de
'Akemabis 2008' y 'Santito 2009'
con topofil, Suunto, cinta,
DistoX y SAP
Profundidad: 1182 metros
Longitud: 6308 metros
2008
2009
Campamento alegria
1990
2008
Chancho limpio
nunca explora
Sala 12 de marzo (-1005m)
Campamento miseria
Union:
Pozo de 90 <> Tripas de Pinto
Sifón de los
espeléopoliticos ciegos
Final feliz
-1182 m



By mid-expedition we'd almost reached a kilometer deep, the weather continued to be unstable, and our enthusiasm continued to grow. It was March 12, and by chance it was Franco Attolini's and my turn to continue the exploration beyond –918 meters. We rigged six pitches, including Franco's pendulum at –985, and explored to –1005 meters deep—without a bivouac. The water returned at –940 meters. We gobbled a snack and began the long eight-hour climb to the surface.

That March 12 brought something that Mexican cavers have been dreaming of for years. For the first time we had passed the –1000-meter level in a cave explored by Mexican-organized expeditions. Of the nine other thousand-meter-deep caves



in Mexico, eight had been found and explored by expeditions from other countries with only minimal or no Mexican participation. Olbastle Akemabis was explored mainly by Belgians in 1990 and finished by our Mexican-international expedition in 2008.

After Franco's and my push, there were only two more trips in El Santito, one more without a bivouac that reached –1037 meters and a final one that reached –1127 meters with a bivouac at –918. There, on March 15, El Santito connected with the final chamber, Las Tripas de Pinto (Pinto's Guts), in Olbastle Akemabis. (Pinto was a dog that, while friendly by day, spent its nights raiding our kitchen and spreading rubbish from one end of camp to the other. Somehow it survived, with its tail still wagging.)

With the joining of these two 1000-meter-plus deep routes to the same end point, we decided to call the cave Sistema Nogochl, which means *cuello* (neck) in Nahuatl, the local language, and is the name of the families that live in the area around the cave entrances. The final length of Sistema Nogochl (Akemabis plus Santito) is 6308 meters, and the depth from the top of El Santito to the bottom of Akemabis is 1182 meters, equivalent to five 230-meter Torre Mayor towers in Mexico City, one on top of another.

In the final days of the expedition, we found a 100-meter pit above Santo Cavernario and called it Totozil Chichiltic (red bird). We descended to a large room floored with huge blocks and another pitch. During the next push we mapped down another drop and along a horizontal passage, finally stopping at yet another drop. On the final day we continued the survey down that drop and, as expected, connected to Santo Cavernario, adding 74 meters to its depth to give a total of 667 meters deep and 2439 meters long. We were out of time and had to leave several passages unexplored.

With such great results, we'll be returning to the area to continue discovering more caves and having more good times with our friends in this unknown part of Mexico.

The members of the expedition wish to thank the mountaineering shop Limite X for their support; Ajalpan Protección Civil; the communities of Ocotempa and Huizmaloc for their help and support and for allowing us to explore their caves; and Laurencio for allowing access to his land. And a special thanks to Doroteo and Apolonia Cuello for allowing us to live in their front yard, for the handmade tortillas, and for allowing us to explore their caves.

Participants: Franco Attolini, Karim Pacheco, Marcela Ramírez, David Tirado, and Gustavo Vela (Mexico); Phil Bence and Flo Guillot (France); Simon Burnell (Switzerland); Ignacio de Rafael (Spain); Mike Frazier and Bev Shade (USA); and Greg Tunnock and Al Warild (Australia). Attolini, Vela, and Warild were the organizers.

Expedición Cueva El Santito 2009

La expedición de marzo 2009 fue ¡todo un éxito! Durante cuatro semanas estuvimos en la Sierra Negra, en el estado de Puebla, fuimos 13 espeleólogos aunque en distintos periodos del mes, la mayor asistencia fue en la primer semana (11 personas) y en la última semana solo fuimos siete. Como en las expediciones anteriores fuimos los mexicanos el grupo mas numeroso (cinco), también hubo dos australianos, dos franceses, dos estadounidenses, un español y una suiza. La cueva El Santito que habíamos dejado a –527 metros de profundidad el año pasado se fue mas y mas profundo. En varios viajes de instalación colocamos la cuerda que habíamos dejado en la cueva (y que se conservó perfectamente), unos viajes mas y se iniciaron las puntas de exploración. Fue el 12 de marzo cuando la suerte nos mandó a Franco y a mi a continuar con la punta a –918 metros que habían dejado Bev, Al y Greg el día anterior. Ese día nos toco instalar 6 pozos y explorar hasta –1005 metros de profundidad ¡sin vivac!, en una punta de 18 horas.

Será un día simbólico para la expedición y para los espeleólogos mexicanos ya que por primera vez en una expedición mayormente de mexicanos rebasamos la cota de los 1000 metros de profundidad ¡explorando!. Después de la punta que hicimos Franco y yo, se hicieron dos exploraciones mas; una sin vivac hasta –1037 metros y una mas, ya con vivac (instalado a –918 metros) explorando hasta –1127 metros. A este nivel la cueva se conectó al Sótano de Akemabis en la galería terminal "las tripas de Pinto". Ahora es un sistema de –1182 metros y dos rutas de mil. Decidimos llamarle Sistema Nogochl.

Cueva el Paisano llegó a –335 metros pero se cerró en su parte final, pero tiene varias incógnitas por explorar a diferentes niveles. Así mismo se continúo con la prospección en las cercanías de la Cueva El Paisano y se encontraron otras entradas que serán revisadas en las siguientes campañas. También se prospectó a los alrededores del campamento, tanto zonas bajas, y al este, donde se encontraron entradas prometedoras.

En la última semana de la exploración encontramos el tan mencionado y anhelado pozo del "tío loco". Lo nombramos "el pozo Totozil Chichiltic" (Pájaro Rojo) que exploramos y topografiamos hasta –240 metros aproximadamente y finalmente se unió con el Santo Cavernario a –180 metros. La unión de las dos cuevas le dio 74 metros de altura, ahora esta cueva tiene –667 metros de profundidad.

YUCATAN UNDERGROUND

Patricia Beddows

The Yucatan Peninsula is an extensive low-lying carbonate platform situated between the western Caribbean and the Gulf of Mexico. The peninsula includes the Mexican states of Quintana Roo, Yucatán, and Campeche, as well as most of Belize and part of Guatemala. The total area is equal to that of Florida, one sixth the area of the province of Alberta, and almost three and half times greater than the area of Switzerland. The whole surface is carbonate rocks, with older Paleocene and Eocene limestone (65 to 34 million years) in the interior grading out into bands of progressively younger rocks. For about 10 kilometers inland and outward from the coast, the limestone is Quaternary in age, less than 2.6 million years. The coasts are mantled in white, unconsolidated carbonate sediments, which of course are the beautiful beach sands. All of the Yucatan carbonate rocks are geologically young and still very porous. Rainwater quickly infiltrates through the rocks, leaving no flowing surface water to form rivers over the whole lowland Yucatan. Groundwater is, however, accessible via the thousands of sinkholes, called *cenotes*, dotting the landscape. As cavers, we know that water flowing through soluble carbonate rocks creates caves, and this is very true in the Yucatan Peninsula. Ongoing exploration in this vast area is proving it to be one of the world's great tropical-karst landscapes.

patricia@earth.northwestern.edu
Reprinted slightly revised from the *Canadian Caver*, number 71, fall 2009.

The cenotes provide access to the shallow water table, generally less than 10 meters below the ground surface, except in the western section in the Sierrita de Ticul. The *sierrita* rises 100 or more meters above the lowlands, and the water table is therefore somewhat more than 100 meters below the surface, which certainly made year-round access to potable water difficult for the Maya who thrived in this land without rivers. The cenotes in the older rock in the middle of the peninsula are steep-walled, with large 10- to 100-meter-wide chambers extending below the water table to depths often in excess of 100 or 150 meters. The shallowest point in these cenotes is always in the center, at the top of the breakdown pile from ceiling collapse. However, these pit cenotes in the lowlands rarely contain more than 500 meters of lateral passage, and underwater exploration is often impeded by silt, breakdown, and the depth limits of scuba diving. A great number of these pit cenotes are along the Ring of Cenotes that overlies the edge of the deeply buried Chicxulub impact crater of 65 million years ago, at the time of the great dinosaur extinction. The depth of the impact crater is 500 to 2000 meters below younger carbonate rocks, depending on your exact location. The geomorphology of these lowland pit cenotes, their lack of connection with horizontal caves with active flow, and the alignment of a great many of them in concentric rings over the impact crater, all point to the pit cenotes being formed by deep-seated dissolution. Cores from wells drilled to more than 2000 meters in the search of oil have revealed sulfate-rich deposits, such as anhydrite, that would have formed in the shallow seas that flooded back into the impact crater after the meteor strike. Even a small amount of sulfate effectively increases carbonate dissolution, creating large voids, the ceilings of which progressively collapse upwards. Some voids eventually breach the ground surface, forming a pit cenote. From a caving perspective, if you like bouncing pits, cave diving to 100-plus meters, and exploring massive void spaces, then you should certainly head to the north and west sections of the Yucatan Peninsula.

You most likely know the Yucatan Peninsula for its amazing horizontal underwater caves, yet cave diving there began relatively recently, in the mid-1980s. Even today, exploration is concentrated within a thin strip only about 10 kilometers wide along a 150-kilometer stretch of the Caribbean coast starting south of Cancún and extending into the Sian Ka'an Biosphere reserve, just south of the town of Tulum. Within this stretch are at least 182 horizontally extensive submerged cave systems with a combined length in excess of 800 kilometers and an average maximum depth of 16 meters (see http://www.caves.org/project/qrss/qrlong.htm for an up-to-date listing). Included here are the three longest flooded cave systems in the world and an additional twenty-two systems longer than 5 kilometers, firmly making the Caribbean coastline the preeminent place in the world for underwater

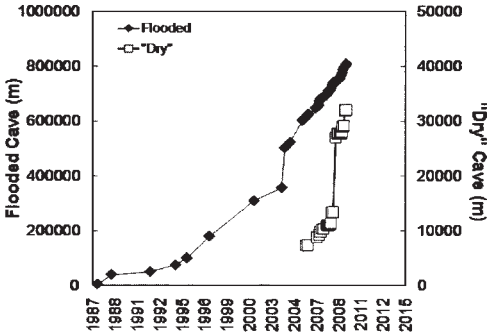
cave systems. Hydrogeologically, the aquifer behaves as a single continuous and interconnected unit. It is conceivable that with further connections between systems, such as Sistema Ox Bel Ha (180 kilometers; see *AMCS Activities Newsletter* 25, pages 40–46 and *Underwater Speleology*, volume 28, number 4, pages 4–8) and Sistema Sac Actun (178 kilometers, now including Sistema Nohoch Nah Chich; see *AMCS Activities Newsletter* 30, pages 39–42) around the town of Tulum, we would have the second-longest cave system in the world, but with all mapped passages being completely flooded. Some of the cenotes opening into these horizontal caves are water-filled oases in the jungle, but a great many of these along the Caribbean coast are small collapse windows big enough to allow entry into the cave, but not collapsed enough that the blocks obstruct entrance to the passages beneath. These horizontal caves are the true underground rivers of the Yucatan Peninsula, with water flowing through them at rates of kilometers per day.

The peninsula is flanked on the east, north, and west sides by the Caribbean, the Atlantic, and the Gulf of Mexico, and these marine waters pass under the whole of the Yucatan peninsula. The aquifer system is therefore a very large coastal-type system, with a thin lens of fresh water replenished by infiltrating rainwater floating on top of the intruding marine water. The fresh-water lens is about 10 meters thick at the coast and increases to 100 to 150 meters thick in the middle of the peninsula. By comparison, the Florida fresh-water aquifer is nearly 100 meters thick near the coast. The formation of the extensive horizontal cave systems is largely due to the process of mixing corrosion; the mixing of fresh and saline waters generates unsaturated water inside the aquifer that is capable of dissolving the carbonate rock. The cave-forming level is therefore at the base of the fresh-water lens. The flow of water allows for the initiation of conduit formation at the coast, and with continuing mixing along the fresh-saline interface, the conduits enlarge and grow inland, ultimately forming anastomotic and fracture-guided flooded cave networks. Continuous networks with widths of 1 to 100 meters are known to extend about 10 kilometers inland from the Caribbean coast, and these drain the extensive interior of the peninsula to numerous high-flow coastal springs and *caletas* such as that of Xel Ha. The 10-kilometer inland limit of known extensive flooded systems is thought to result from the concentration of cave-diving exploration effort along the coastal Highway 307, where access is easier, but geological or hydrological controls are also likely to be important factors, particularly the increasing age of the rock with distance inland. Although no significant cave passages have yet been reported on the north and west coasts of the peninsula, the very large springs at the intersections of the Ring of Cenotes with the northwest coastline attest to karstification around the whole peninsula.

Multiple levels of cave passages are found in the caves along the Caribbean coast, and these are related to the rising and lowering of the fresh-water lens as global sea level varied over geological time. The caves formed underwater at the fresh-saline mixing zone, but then when sea levels dropped they were drained and left above the

Stefan Doerr in a dry cave in Quintana Roo. *Andreas Kuecha.*

Patricia Beddows examines a highway drain that discharges directly into a cave in Puerto Aventuras. *Aaron Addison*.



Tabulation of reported flooded and "dry" caves in the state of Quintana Roo, based on the annual *AMCS Activities Newsletter* prior to 2003 and the Quintana Roo Speleological Survey web site since. Note that the scale on the left axis for the flooded caves, is 20 times that on the right axis for the dry" caves.

water table, and it is during this time that the abundant stalagmites and stalactites formed. With a return to a warm period and the melting of the glacial masses, the shallower caves were re-flooded and became the flow routes again. Deeper levels of cave now completely filled with saline water have been accessed, such as at The Pit (–119 meters, Sistema Dos Ojos), the Blue Abyss (–74 meters, Sistema Sac Actun), and the Hoyo Negro (–60 meters, Aktun Hu; see article in this issue). These deep sites in the Caribbean coastal caves, as well as the deep pit cenotes in the interior, show that extensive cave development occurred at lower sea levels, including the –120-meter level reached less than twenty thousand years ago. Other deep passages likely exist in the older, buried limestones. It is unknown how many times the Yucatan caves have been drained and re-flooded, but the abundant drowned speleothems in the upper tiers of passages clearly show that the original formation of the caves dates back to earlier periods of high sea levels, which last occurred 120 and 330 thousand years ago.

The multi-phase development of the Yucatan caves, tied to global sea levels, is quite distinct from cave formation in continental karst, or even of cave formation on small islands. In continental karst, the caves form at and below the water table. As the landscape ages and valleys deepen, lower caves and fissures become more efficient and integrated and eventually drain the upper, older levels of caves. The net result is a neat stacking of older dry passages on top of deeper and progressively younger caves, until you reach the level of active karstification at and below the water table. In contrast, the sea-level control on the Yucatan cave development has resulted in cave formation on top of older cave networks. Each of the underwater cave passages in the Yucatan has likely started and stopped forming at many different times, with new phases of development overprinting what was there before.

Do not despair if you are not a cave diver, because the Yucatan Peninsula also includes vast cave networks at and above the water table that are only now being explored and

Support pillars for a pedestrian overpass extend into Cueva Aluxes. *Left, Patricia Beddows; right, Pat Kambesis*.

mapped. In most small-island karst settings, karstification leads to the development of small, isolated flank-margin caves, which are dissolution voids usually measuring under 100 meters in maximum dimension. These flank-margin caves formed at the water table and are associated with the edge of the island. Similar voids formed at the water table in the Yucatan, particularly under the Pleistocene-age paleo-beach ridges. A number of these ridges run parallel to the whole length of the Caribbean coast at a distance of 1 to 2 kilometers inland. Just since 2006, the Quintana Roo Speleological Survey tabulation of dry caves has reached 32 kilometers, distributed among 34 systems (http://caves.org/project/qrss/qrdry.htm). Calling these caves dry is a misnomer, as you are often bathed in 25 to 26°C water as you move gently through the highly decorated chambers. Many of the shorter dry caves tabulated by the QRSS are in fact cavern entrances into the flooded caves and have no further potential for dry extensions. The true dry caves include the 12-kilometer-long Sistema Yok Ha' Hanil (previously known as Pool Tunich, with a section commercially developed as Río Secreto), and the 6-kilometer-long Tixik K'una, where it is clear that voids formed at the water table have grown large enough to intersect and are now being overprinted by flood pulses during the rainy season and from hurricanes (see *AMCS Activities Newsletter* 31, pages 37–44). The plan maps such as that of Tixik K'una show sections that are fracture-guided and equally the merging of chambers, all to form complex, extensive, and dense maze-like caves. The cave networks running underneath the long Pleistocene beach ridges suggest that vast reaches of dry caves are yet to be explored along the whole of the Caribbean coast.

Tourism development is continuing at a feverish pace in the Riviera Maya, the touristy name for most of the Caribbean coast. The federal government is working to decentralize the population and growth away from Mexico City by establishing a number of medium-size cities of two hundred thousand around the country, of which five are to be along the Quintana Roo coast south from Cancún to Tulum. Undoubtedly there will be impacts on the groundwater resources and cave habitat, both directly from the urbanization, but also from the rapid transport of water and contaminants away from urban point sources through the large karst conduits. Current waste-disposal practices include the injection of effluent deep into the groundwater system, where it is not necessarily confined (see "Where Does the Sewage Go?" *AMCS Activities Newsletter* 25, pages 47–52), while significant volumes of grey water and treated black water are used to irrigate golf courses. Irrigation fields and disposal wells are in widespread use in coastal regions of the world, and the Yucatan Peninsula with its fragile karst is just one of them. The cave water flows at rates of 0.5 to 2.5 kilometers per day, thus quickly linking impacts or activities at sites inland to the sensitive Meso-American Barrier Reef System, which is the second longest in the world after that of Australia. Tourists are in frequent contact with the groundwater, such as in cenotes used for swimming and recreational cavern diving and also at the beaches and *caletas*, where hotel developments and "nature parks" such as Xel Ha and Xcaret receive thousands of visitors per day. It is hoped that cave-diving exploration, and now also the exploration and careful mapping of the dry caves, will support conservation by revealing the wonders and also the environmental function of the underground rivers of the Yucatan Peninsula.

Suggested websites

Quintana Roo Speleological Survey: www.caves.org/project/qrss

Association for Mexican Cave Studies: www.amcs-pubs.org

Anchialine Caves and Cave Fauna of the World, includes a useful summary of Yucatan Peninsula biospeleology: www.tamug.edu/cavebiology

P. L. Smart et al. (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*, 105–128: type the article title into the search box at books.google.com

Yucatán Subterráneo

Una introducción a las cuevas de la Península de Yucatán. El desarrollo de poblaciones y sitios turísticos en la costa del caribe en Quintana Roo está poniendo en peligro las cuevas secas y subacuáticas de la zona.

SISTEMA BORGES

James G. Coke

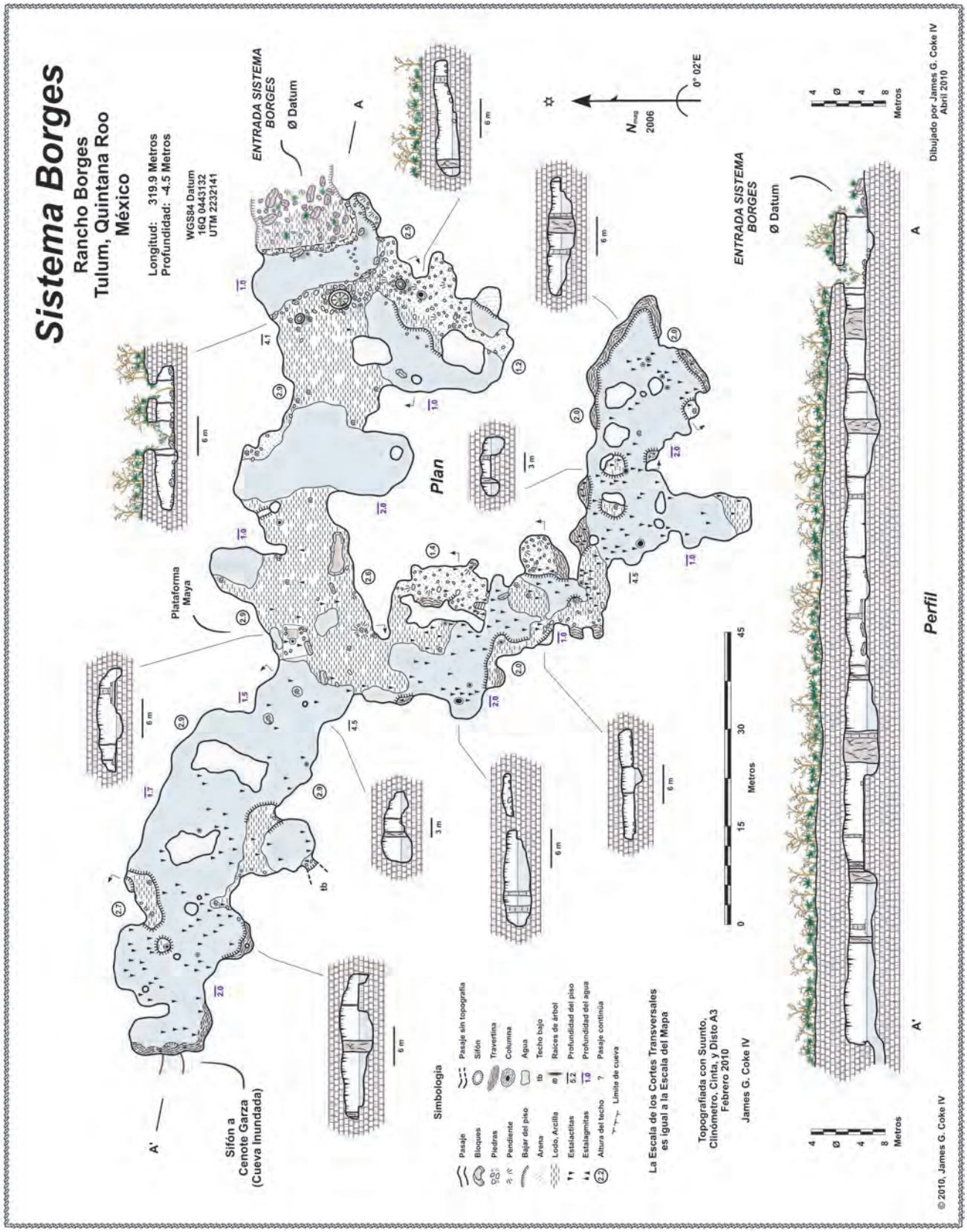
Sistema Borges is a spacious dry cave located 10 kilometers inland from the Caribbean coastline of Quintana Roo. It is one of five new karst windows that were recently discovered near Tulum by Nadia Berni and Dave Sieff. Although short in length (320 meters), Sistema Borges is an intriguing cave from a number of perspectives. Its range of environmental qualities sets it apart from other area dry caves. Borges is also well positioned geographically in relationship to other caves in the immediate area. With a few leads remaining in its dry and underwater sections, the cave could prove to be a useful asset for further exploration in this area of Tulum.

During the last months of 2008, Nadia and Dave were experiencing a serious challenge in their efforts to document and explore a nearby underwater cave system. Their momentum while exploring a new section of Sistema Dos Pisos (then 8931 meters in length) was slowing to a demoralizing trickle of hard-earned passage. In completing a thorough resurvey of the cave in 2008, they had stumbled on an innocuous lead that had been overlooked by the original explorers during 2000 and 2001. After a few exploration dives, this modest lead had opened into a long and substantial trunk passage that channeled a surprisingly strong flow of fresh water. Swimming against the current, the team eventually arrived, over a kilometer from the entrance cenote, at a huge breakdown room, a dark void containing a maze of countless pillars and columns that stretched far beyond the range of a primary light. Given the breadth of the unexplored chamber ahead, the strength of the freshwater flow all but disappeared. This discovery was an exciting and well-earned reward after many months of tedious resurvey missions. But the breakdown room also signaled the end of easy exploration. Once the current had been lost within the large volume of the room, straying into a maze of dead-end side tunnels was likely.

Cave divers are limited by the volume of breathing gas they can carry into a cave. Experienced divers reserve at least two-thirds of their beginning gas supply for their exit from the cave. Additional tanks are added to the normal two to increase the distance a diver can reach from the entrance safely. More tanks equals more volume, but it comes at a cost of effort spent both in and out of the cave. Dos Pisos involved days of hiking eight to twelve tanks to and from a distant cenote. Used scuba cylinders were exchanged for charged cylinders, while broken equipment was repaired in the jungle. Discharged batteries were exchanged for fresh batteries, and empty survey reels were loaded with fresh knotted guideline. The checklist for the next exploration dive was endless. With each dive increasing the distance from the cave entrance, it was obvious that any future progress would depend on finding another entrance to this section of Dos Pisos. With determination and a bit of luck, searches finally revealed a side passage near the breakdown room that ended in a large cenote. Cenote Monkey Dust, named for a troop of resident spider monkeys, was situated within an extensive depression. This was the perfect location to stage further explorations in the Dos Pisos cave. Its only drawback was that the new cenote was located on another landowner's ranch.

It did not take much time to find the owner of Monkey Dust. Most ranching families are well-established citizens of Tulum, and a few families are related by marriage. They prefer to live and work in town, using their property as a minor source of income. A ranch can be used to grow corn, citrus, beans, and gourds. Small-scale lumber or gravel-quarry operations can also be found on larger tracts of land. Ranches near the coast usually avoid water-intensive crop or livestock activities due to the high level of chlorides in the aquifer. Today there are a few elite ranch owners who use their properties as important sources of income. Thanks to the explosive growth in ecotourism on the northeast coast of Quintana Roo, these owners conduct an immensely profitable business based on the growing popularity of cenote water sports. If they are fortunate, their cenotes will attract a constant stream of paying snorkelers and cave divers who come to explore their crystal-clear water and mysterious cave entrances. It is a business that many ranchers dream of, but most are unable to join the ranks of this elite club for lack of an attractive cenote. The discovery of Cenote Monkey Dust and its parent depression was a colossal stroke of

chac@consolidated.net


Sistema Borges
Rancho Borges
Tulum, Quintana Roo
México
Longitud: 319.9 Metros
Profundidad: -4.5 Metros
WGS84 Datum
16Q 0443132
UTM 2232141
ENTRADA SISTEMA BORGES
Ø Datum
Plataforma Maya
Plan
Perfil
Simbología
Pasaje
Bloques
Piedras
Pendiente
Bajar del piso
Arena
Lodo, Arcilla
Estalactitas
Estalagmitas
Altura del techo
Pasaje sin topografía
Sifón
Travertina
Columna
Agua
Techo bajo
Raices de árbol
Profundidad del piso
Profundidad del agua
Pasaje continúa
Límite de cueva
Sifón a Cenote Garza (Cueva Inundada)
La Escala de los Cortes Transversales es igual a la Escala del Mapa
Topografiada con Suunto, Clinómetro, Cinta, y Disto A3
Febrero 2010
James G. Coke IV
Dibujado por James G. Coke IV
Abril 2010
Metros
© 2010, James G. Coke IV

luck for Don Eduardo. After hearing of the new discoveries on his land, Eduardo invited Dave and Nadia for a tour of his ranch. He pointed out a few collapsed karst features and minor dry caves with silted-in pools of water. None of these, however, held any promise for exploration. He ended his tour with a short hike through a grove of tall *zapote* trees that were being harvested for lumber. Within minutes the trail arrived at a maze of limestone slabs and solitary boulders. Just ahead lay a dark and wide dry cave entrance. Skylights in the roof beyond the main entrance added a splash of shadows and light to very large, going cave. Nadia and Dave entered the cave for a quick look, while Eduardo remained outside of the cave entrance looking very uncomfortable. His generation still harbors deep superstitions about caves and the spirits they possess.

A few months later, Dave and Nadia invited me to spend a morning looking at cenotes and caves on Don Eduardo's property. This was an intriguing opportunity to visit a more inland region, beyond the coastal environment. With distance and elevation from the coast, the character of the jungle changes from a dense scrub thicket to a tall, more mature forest. The terrain also begins a transition from the flatter coastlands to a slightly rolling landscape pocked by occasional fields of hummocks. The size of dry caves in this region is different from that of those found closer to the sea. After stopping at a few depressions and caves, we finally arrived at the edge of the old *zapote* grove. An attractive pit marked the beginning of the trail to Borges Cave. The path turned sharply to the west, descending into a small, U-shaped collapse. As the depression narrowed, small caves started to appear on the valley side-walls. They grew in breadth and length as the walls of the valley grew higher. We looked in one or two entrances; they showed a few promising holes leading back beyond the twilight zone. The Borges Cave entrance, an impressive sight, loomed just beyond the maze of collapsed ground. I surveyed to the first skylight just inside the entrance, where we dropped off our extra gear. As we moved deeper into the cave, a couple of bats cried out in protest at our intrusion, and I sank knee-deep into a foul slurry of mud, water, and guano. The cave floor was a little more solid closer to the north wall. I continued the survey, collecting about 80 meters of preliminary data and sketch before it was time to go. This was enough data to answer our initial questions about the cave. I also knew that I would be back to have a more thorough look.

Exploring and mapping the Borges caves was one of my priorities during February 2010. We had plotted the small bit of cave survey I had collected, comparing the positions and tunnel orientations between Sistema Borges and Sistema Dos Pisos. It was no surprise that Dos Pisos stood a little over 650 meters northwest of the Borges entrance. Nor did this appear to be an insurmountable gap. The last 2009 survey station had been set on top of a large boulder resting on the shore of a crystal-clear pool. A large, half-flooded trunk passage veered to the northwest from this survey station, headed directly towards Dos Pisos. Another large passage struck off towards the southeast, just beyond the opposite bank of a muddy and deep lake. Before either of these leads could be explored, though, there were a few details in the 2009 survey that required some attention. A minor tunnel near the entrance needed to be surveyed and sketched. The sketch between the final 2009 stations was also missing. This segment would require some time, as it included a puzzling artifact that required careful documentation.

During our first trip to the cave, we had stumbled on a simple Maya structure that was well within the dark zone of the cave. The structure appears to be a two-tiered platform that is roughly 2.5 meters square. It is aligned to the cardinal points, with the front of the platform facing due east. This alignment is very common among the Maya structures in the area, whether they are found on land or in a cave. The platform was also nearly intact; a single corner of a slab appeared to be deliberately broken. We did not detect any obvious pot shards, artifacts, or petroglyphs associated with the platform. Artifacts may be buried in the mud surrounding the structure, but we have no business disturbing these archaeological sites. The actual purpose of the platform is anyone's guess. Caves and their gods played a central role in the spiritual and cultural life of all Maya people. It is the actual location of the platform in Borges that is the perplexing question. We have documented a wide range of Maya structures and artifacts in the dry caves of Quintana Roo. In every case their structures were placed near the cave entrance, within the

The entrances to Sistema Borges. *Jim Coke*.

The Maya platform. *Jim Coke*.

zone of natural light. The platform in Borges is the sole exception, as it is well inside the dark zone of the cave. We are aware of many Maya structures that are found deep within the dry caves in the state of Yucatán. The Borges platform suggests the possibility that local customs were influenced by a distant social group of Maya.

With all the survey loose ends tied up, it was exciting to launch an inner tube and paddle up the northwest trunk passage to the first new survey station. As exploration in the tunnel developed, most of the survey proved to be a repetitious cycle of getting in and out of water that was too deep to wade through. It was hard to find a balance between being too warm or too cold. A full 3-millimeter wetsuit was comfortable in swimming passage, but it was too thick and would lead to overheating in the dry portions of the cave. Normal cave apparel offered little insulation in the water; after a short time, repeated full immersions became very uncomfortable. A thin wetsuit top with an inner tube for flotation combined to provide an enjoyable way to traverse longer stretches of swimming passage. Most of the tunnel contained banks of mud and sand along the walls. These were a convenient refuge from the cool water. They were formed by deep taproots that pierced the cave ceiling in their search for the aquifer. In time, the taproots grow a dense floating mat of smaller roots, which trap mud and sand to form substantial banks. They are surprisingly solid, ample for permanent survey stations and comfortable for concentrating on sketching. They also afford the best position for inspecting the underwater floor and walls for sumps. There is no question that a generous volume of fresh water moves through this section of cave. Underwater roots undulate in the flow, while Mexican tetras, a fish normally found in cenotes, were seen swimming against the current in the semi-flooded passage. The presence of the tetras was a sure sign of a nearby sump. This was quickly confirmed, as the dry passage came to a premature end at a vertical flowstone wall, surprising since both ceiling heights and passage widths were constant right up to the terminal pool. The only lead that remained was 2 meters below the water surface on the west wall. Tumbling bottom sediments and fish darting side to side for food particles betrayed an invisible current that was pouring out of the sump. Was this water derived from somewhere in Dos Pisos, or was Sistema Borges a whole separate cave?

Elsewhere in the cave, explorations towards the southeast exposed two tunnels that were unlike the rest of the cave. A dry and rocky side passage paralleled a larger wet passage, until they converged in a muddy junction room. The wet passage, though, had completely lost the fresh-water flow, even though it was a logical extension of the northwest tunnel. Without a steady supply of dissolved oxygen, the Mexican tetras and other aquatic cave life were absent. The flooded tunnels in this area were floored by waist-deep silts mixed with new and old guano deposits. It would have been very difficult to explore this section without an inner tube. As its ceiling sloped down to meet the water table, I looked around the pools for a sump, but none exists. This passage has obviously been filled in with sediment, and water is forced to filter through the silt to reach a drainage path in the strata below. I hoped the main flow from the northwest leaves by another route I had overlooked.

It took a few hours to explore the shallow pit entrance near the *zapote* grove. A 4-meter descent ends on a debris cone that is centered within a small chamber. A single lead to the north ends in yet another small room with a hardpan floor. Two low passages continue north from the room, and a third passage to the west showed a hint of daylight at its end. This new entrance was on the sidewall of the U-shaped collapse; the small pit cave was just a relict side passage of the now-collapsed main trunk.

That evening I spoke with Nadia and Dave about the new developments in the Borges dry cave. They told me of another cenote they had found on the eastern edge of the Monkey Dust depression. During earlier explorations, Nadia, Dave, and Rob Greaves had found going

The shallow pit entrance to a small cave. *Jim Coke*.

underwater cave at Cenote Garza that was headed towards Sistema Borges. Within eight days they had connected two new cenotes and had explored nearly a kilometer of cave in what is now called Sistema Swan Lake. That day they had found 600 meters of underwater passage from Cenote Garza that surfaced in a pool with a vertical flowstone wall. They had found my last survey station in the northwest, and, more importantly, they had also found the downstream sump I had overlooked. The downstream sump is currently surveyed to a depth of 9 meters, directly beneath the farthest section of the southeast tunnel.

There are a total of 1636 meters in the underwater Swan Lake portion and Sistema Borges , which together are now called Sistema Swan Lake, and there are still dry and underwater leads towards Dos Pisos and other unexplored territories.

Sistema Borges

El Sistema Borges es una cueva seca en Quintana Roo, pero contiene varias pozas profundas. Hay una plataforma maya antigua en la zona oscura de la cueva. Recientemente, espeleobuzos encontraron una conexión entre la entrada del Cenote Garza y el Sistema Lago de los Cisnes, en el sifón corriente arriba en la sección noroccidental del Sistema Borges.

Book Review

Huautla: Thirty Years in One of the World's Deepest Caves. C. William Steele. Cave Books, Dayton, Ohio; 2009. ISBN 978-0-939748070-9. 6 by 9 inches, 269 pages, hardbound. $24.95.

The typesetting is amateurish, the color and black-and-white photos were indifferently prepared for printing, and the cover might charitably be called cluttered. I can tell the text got a lot of editing, but it could have used a little more. Still, it reads well enough.

That said, this is an important and valuable book. Way too few first-person accounts of exploration by American cavers have been commercially published. Sistema Huautla was the first of the deep caves in southern Mexico found and explored, and it is essentially tied for deepest cave in the Western Hemisphere. Steele was one of the principal explorers in the caves in the Huautla area during the late seventies and early eighties and as much time as he could spare from work and family since. He was on the trips in the spring of 1980 that made Li Nita the first thousand-meter-deep cave outside of Europe and then, barely a month later, connected it into Sótano de San Agustín to create the Huautla system. Being short-roped and trapped deep in San Agustín for several days in 1977 and the famous 1994 diving expedition from the point of view of those on the surface are among the other tales in the book.

This is a personal narrative of Steele's trips to Huautla, based on the logs he has kept of all his caving over the years. It is not meant to be a complete history of the project, and I probably made a mistake by leafing back to try to understand what was going on. (The worthless maps scattered throughout the book don't help.) Take it for what it is, and just sit back and enjoy the stories of hard caving in deep caves.—*Bill Mixon*

Cover Art Salon

Photographic

Artistic Excellence

15th INTERNATIONAL CONGRESS OF SPELEOLOGY
KARST HORIZONS 2009
KERRVILLE, TEXAS USA

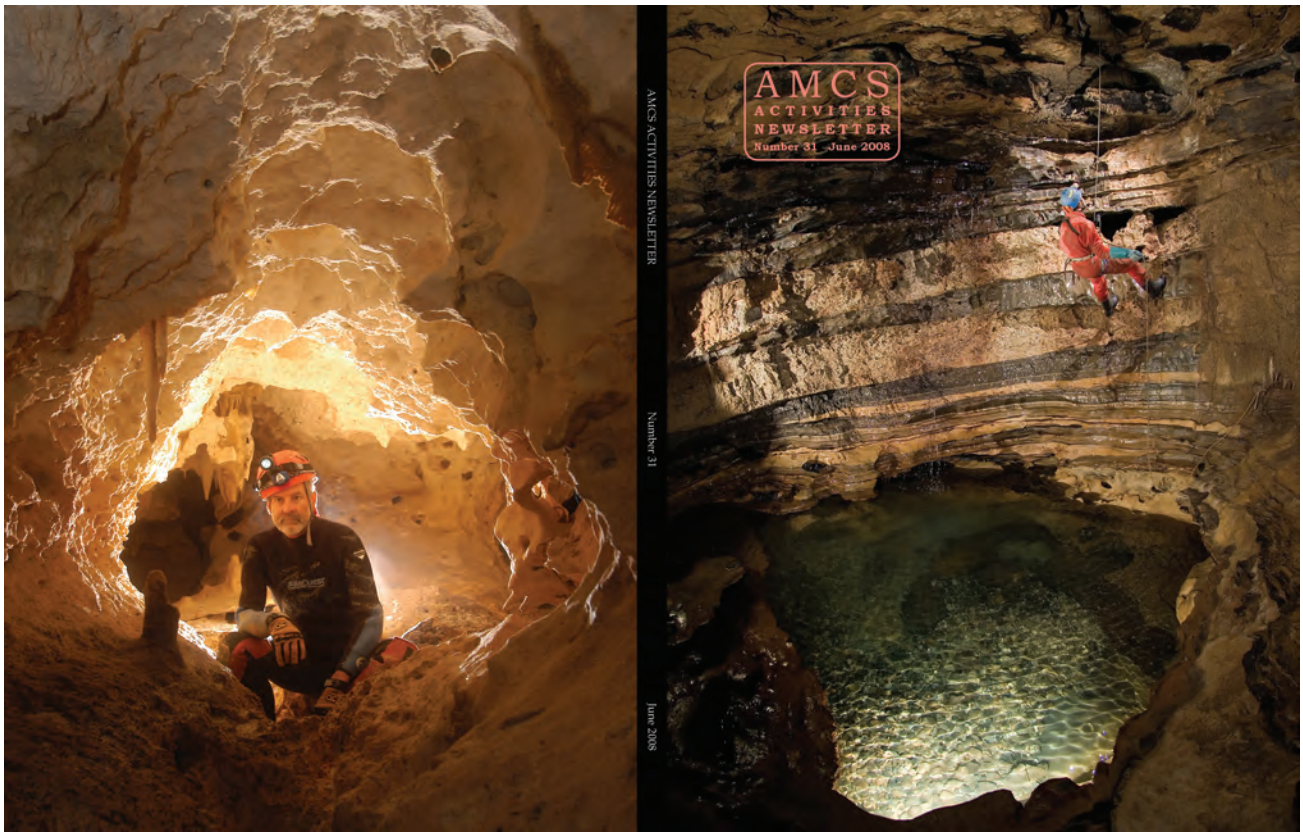
23 July 2009

3rd Place

AMCS: Vol. 31

Design: Bill Mixon

Photography: Simon Richards & Gustavo Vela Turcott



MÚZQUIZ

Geoffrey Hoese, Mónica Ponce, Ellie Thoene, and Philip Rykwalder

A carefully spaced shout up a deep pit: "NEED . . . MORE . . . ROPE!"

EspeleoCoahuila 2008 was a pleasure to attend. We camped on the edge of town, in a very nice park with springs and adjacent facilities for presentations. Attendance was good, with a fair number of familiar faces from Texas, Coahuila, and other parts of Mexico. Mónica Ponce was a flurry of activity, and did her usual great job in organizing and coordinating the loose conglomeration of anarchists we know as cavers.

Unfortunately it rained, as it seems to do more often on caving trips in desert climates than it should. Although the rain had an impact on everyone involved, with muddy springs, flooded tents, and near impassable roads, it held a particular import for me. I'd flown there in a small plane, just making it to the small strip in Múzquiz in time to be socked in by a fully overcast sky with ceiling so low that our hikes up nearby canyons would edge into the clouds.

I was grounded, and I spent the next few days anxiously watching the sky, looking for an opportunity to fly. My main goal was aerial scouting over many of the nearby mountains and valleys, where we knew there were many caves to be found. I'd been on a number of trips to the area over the previous ten years or so, typically following Peter Sprouse, who is a wizard at sniffing out leads and organized and tenacious enough to be able to follow through by finding landowners, arranging access, and coordinating the trips to find and document the caves that (almost always) resulted. In September 2007, such a trip had been to nearby Rancho las Águilas, where we found pits of a scope rarely found in Coahuila. They were large enough to be good finds in other, pit-rich areas of Mexico, but here, close to the border, within a day's drive from home, they were particularly interesting.

Thus the desire to fly. We knew there were more out there. Google Earth imagery wasn't quite up to snuff. We could see some of the larger features we already knew and had tantalizing hints of others, but the blurry dark spots weren't clear enough to organize a trip around. After three days there, a brief respite from the clouds presented itself, and I took the opportunity. Unfortunately I was headed home, as the cloud bases were still lapping at the mountain ranges, and the forecast was showing more bad weather to come. That turned out to be a good call, as reports from the returning cavers over the next couple of days were of lower clouds and heavy rains.

Peter brought his secret weapons to bear, the years of organized data and acquiring contacts and hints of leads. He'd acquired aerial stereo photographs of the area that showed interesting possibilities. Serendipity played a part, as it often does, and in early October 2009 he called, telling me he had no trips planned, but his car papers were expiring and he needed a trip to the border to turn them in. We decided a three-day weekend was in order, with several possibilities. High on the list was a pit he'd visited in the past, a pit reported to be a geyser of water during high floods, with fish being washed out. His previous visits to the pit were stymied, though, as the high level of bat activity prevented anything but entrance observations, the accumulated guano indicating at best that the reported flooding was extremely rare. With reports of heavy rains in the area over the past year, along with our soggy experiences in Chihuahua, we thought perhaps it was worth another look.

Ultimately, though, access was gained to a ranch farther to the northwest, up the central valley across the range of mountains we'd had such success with in 2007. As it was just the two of us, we planned a basic reconnaissance trip to reach the area, establish relationships, and find leads, with minimal or no actual caving . We drove to Múzquiz in the evening, spent the night in a hotel, and met our hosts in the morning.

As happens often, we got a late start. Our hosts, Manolo the landowner and his friend Rodolfo, were driving out from town for the weekend and had a number of things to get together before they left. We were consoled by spoonfuls of caramel from one of dozens of five-gallon buckets, made from goat milk from Manolo's other ranch. Eventually we

Hoese: gbh@io.com
Ponce: espeleocoahuila@gmail.com; thanks to Jenni Arburn for editing assistance.
Thoene: ellie.thoene@gmail.com
Rykwalder: livetocave@hotmail.com; thanks to Susan M. Williams for comments and editing.

Linda Palit and Peter and Terri Sprouse ready to hike up onto one of the mesas. *Mónica Ponce*.

headed out. The San Rafael Ranch is hours from town, not too far distant, but as much of the driving was on dirt, mud, river cobbles, or just bulldozed rock, going can be slow. One drives through the village of Nacimiento de los Kikapú and leaves the pavement for a series of mud paths to an outwash plain of canyon cobbles, where the road reconsolidates and follows the wide wash up a broad valley. We followed our hosts through a number of gates, some locked, some not, until we reached the main ranch house, an old, low building that was reportedly there when Manolo's grandfather acquired the ranch some one hundred years past. A much older ruin of a rock cabin remains just behind the small, newer building.

Due to various detours and stops along the way, we didn't arrive at the ranch until after 3 p.m. After a period of getting oriented and a bit of driving around, Rodolfo joined us for a short reconnaissance hike up an old bulldozed trail, starting a few kilometers from the ranch house. It was after 4, and we had a few hours of light left in the day. We drove to the head of the trail, once a bulldozed road, but now heavily overgrown. Peter drove 50 meters or so up the trail, but soon realized that with only one 4Runner on the trip, it would be a better option to walk.

We first noted a couple of small entrances on or right next to the trail. Turning over rocks laid over the holes by the ranchers to keep stock from falling in, we dropped rocks and listened to seconds-long bounces. I headed behind a bush for a private moment and found a 1-meter-diameter hole in the rock. Peter had a few aerial leads marked in his GPS, which give us a destination, but we didn't make it to them before we were finding nice pit entrances. Over the next four hours we honed our rock-drop depth-guessing skills, estimating depths first on the order of 10 to 15 meters, eventually increasing to 50 meters. We hedged our guesses, not willing to commit to higher numbers for fear of being found ridiculously over-optimistic. Over that four-hour period we found fifteen entrances, ranging from less than 1 meter in diameter to sinkholes over 10 meters across, ignoring anything less than 5 meters deep.

Over the next day and a half we hiked over 20 kilometers, exploring the mesas on the north and south sides of a canyon heading generally to the west. There's about 100 meters of elevation gain from the canyon floor to the tops of the mesas. We were lucky in that we found good cow trails on the slopes, with a couple of exceptions where we painfully bushwhacked through the acacia, establishing which canyons were good to use to reach the tops of the mesas and which weren't. We met the owner of the adjacent land, who was working on a corral on his land, because we hadn't realized where the boundary was. It was helpful that one of his ranch hands, remembered guiding us to caves on Rancho las Águilas a couple of years before. Peter establishes a strong rapport, and we got permission to continue and contact info for the next trip.

We logged over thirty entrances, some that we guess to be on the order of 100 meters deep or more. Our hedging continued, as bounces obscured a clean count. We found beautiful larger sinks surrounding nice entrances, surprising entrances in flat expanses of limestone, and a fair number of plugged entrances, either large, circular dirt floors or exposures of clean rock that clearly take water.

Our hosts were extremely friendly and gracious, fed us well, and made us feel at home. They encouraged our return. They hope that we find water, but we feel that, as much, they enjoy our excitement at the caving possibilities and are infected with a desire to know what happens next.—*Geoffrey Hoese*

Two years ago in July, we celebrated EspeleoCoahuila 2008 in Múzquiz and tried to locate caves near the town. EC was a congress organized by Peter Sprouse and me. The original idea was to have a lot of expert cavers conduct a survey and participate in an important project during the camp. We had discovered that the quality of the previous cave surveys and other documentation for the area was not good. People had been more interested in exploring than in surveying, but there was no time to make another survey. We found some caves, but people had destroyed the formations. It is very sad to see how the people in the city feel proud when the cave is totally destroyed.

Anyway, we decided that EspeleoCoahuila had to change plans. It was a good conference, but we needed not only a forum to show our work, but also opportunities to explore and make new discoveries.

Some of my best experiences are to explore with Peter Sprouse. Every year he has a new project in my country. The common dream of cavers is to make connections

between caves and find deep caves. With Peter's leadership we can find the answer to our dreams.

The plan of the Austin Cavers was to organize a large expedition with participation of both Mexican and American cavers. In February 2010, we went to Múzquiz. The expectations of the twenty people who came to Múzquiz were high. They have a modern system to find caves. Peter worked on that; he put the coordinates of all of the possible cave locations into the GPS, and then they only needed to read and interpret the GPS information to try to find a cave.

At the time I could not participate in the caving, but I was able to participate from the bench. I had a lot of activities to do at the campsite. The big expedition was not a vacation, it was a hard job. Everyone had things to do early in the morning. They had a brief meeting with Peter Sprouse, and after they received their instructions the teams worked together. One person needed to bring the electric drill and its heavy battery. Two or three other people on a team each carried 25 or 30 meters of rope; more rope was available if they needed it. The leaders used the radios and the GPS units, and another person scouted or climbed the difficult areas ahead. Three people formed a survey team for the caves. One would handle the Suuntos (clinometer and compass), another the tape, and another sketch the cave. The day before, a group had carried a long rope up onto the plateau for later use. When they were all ready, we said goodbye, and they disappeared into the brush.

Joe Datri in Pozo La Thrasha. *Jean Krejca.*

Between rocks and the hooks of *uña de gato* they cleared the way. The machete sounds like a sword hitting a rock, the day is windy, the birds talk together, and we can hear the voice of the leader of a group on the radio. Someone forgot a survey bag and had to return to the camp. At camp, I cleaned the area, brought the firewood, prepared food, obtained water, talked with the neighbors, and obtained permission to explore more areas. I had a radio in camp so I could hear the leaders of the groups, but then the voices disappeared. In my free time I drew plants and animals and used binoculars to watch the birds; I knew what type of bird it was. I was nervous. Jean Krejca had told me that bears might come to the camp, because there are a lot of bears in the area. When I talked with the owner I asked him if bears ever appear near where we were camped. When I had to go to the bathroom I first looked all around the area, and then sang and made noise, in case a bear was nearby.

The time passed very slowly, and the hours are eternity when you are alone in camp. I would have liked to be caving, but on my last caving trip, to Powell's Cave, I hurt the area where the Mediport for my IV cancer treatments is, and the doctor told me, "Moni, you cannot explore in the caves," but she didn't say anything about traveling and waiting in camp. This trip was good for me. I saw some of my friends from Saltillo, I traveled with Linda Palit and Michael Pugliese, and I got to work with my best friend Peter Sprouse and the other American cavers, so I had fun.

When the sun went down and it was time for the teams to come back, I worried about the new people, who didn't know the area and might get lost. If they didn't have a good sense of direction, they could be a long time getting back to the camp site. So I prepared a blinking LED light and put it in the highest part of the camp so people could see it and feel secure that they were going in the right direction. The first group appeared in the middle of the night with very tired faces, but big smiles. They started to talk very fast, and I didn't understand all of it, only catching some of the words. Then another team appeared, bringing small insect specimens and rock samples. Groups continued to return into the night. They ran for their tents looking for food and a drink of water, prepared their food, and took chairs around the fire to talk about the caves.

Peter and Michael Pugliese took a picture of one cave spider on a rock and were able to identify it. One group had not returned. I asked Peter if we needed to go find them, and he said, "Well, if the battery in their GPS is working, they are fine. If the battery is dead, maybe they need to spend the night out there and try to use the stars." Oh my God! Peter only smiled and told me that we can trust that they have a good sense of direction at night.

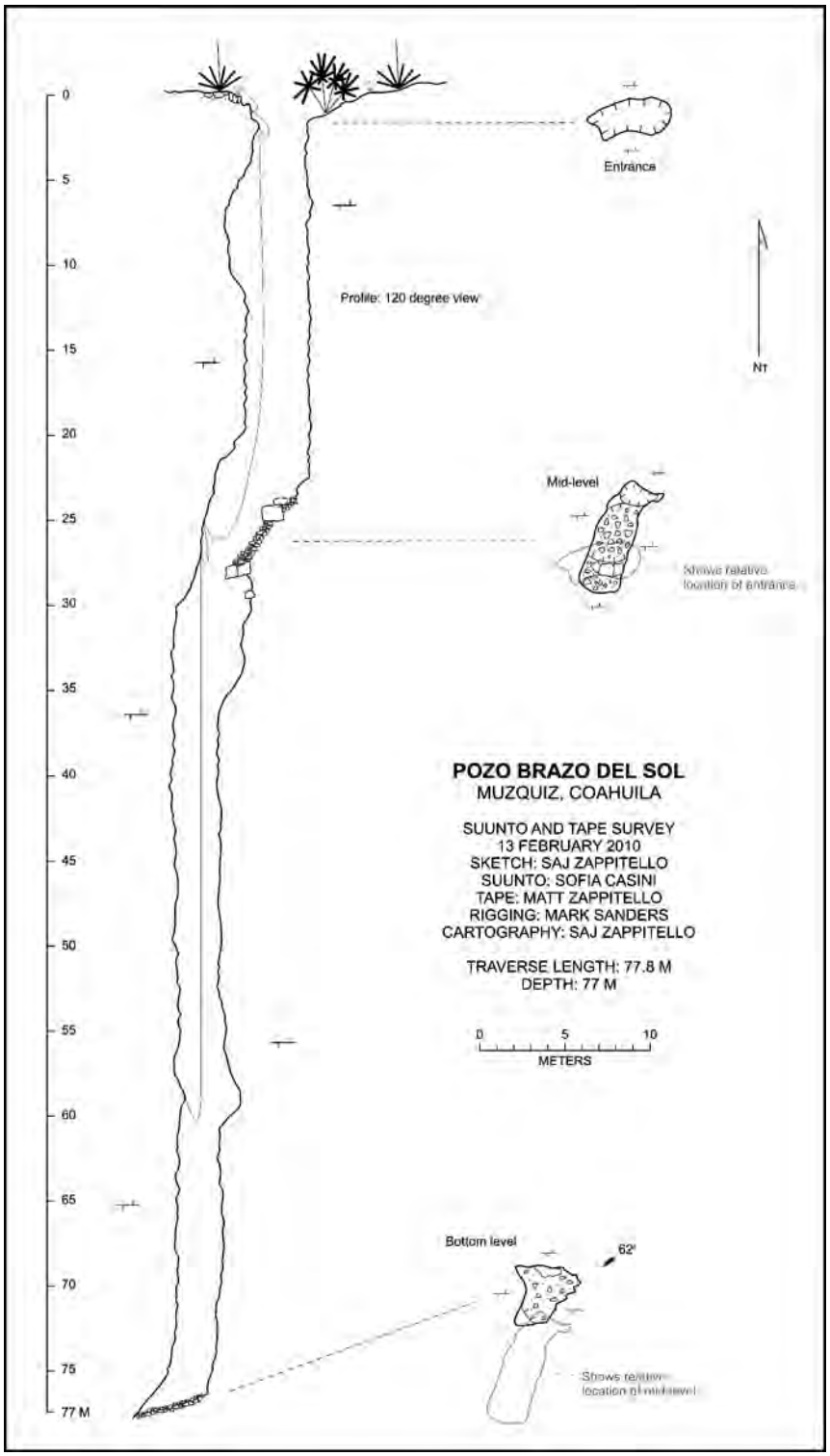
I didn't go to sleep early that night. I waited until around 3 a.m., when the last group appeared. I made them cups of hot chocolate and coffee and prepared food for them. They looked very tired, ate and talked a little, and then went to sleep.

Each of the next two days, people prepared their things and received more directions from Peter, then disappeared into the countryside. Every day they had a big area to cover and record new cave locations in the GPS, looking for a big gift from the Coahuilense land.—*Mónica Ponce*

In January 2010, I was at the Posse after a UT Grotto meeting when Peter Sprouse asked me if I wanted to go to Mexico in February. I had just been to Mesas Juárez in the Purificación area of Tamaulipas with Bill Steele and crew, where

we discovered and mapped a cave over 200 meters deep. The taste of exploration was fresh on my lips, so I said yes before even checking my calendar. I had planned to go to Mexico again in April, but still had a few vacation days, so I got cleared to go on February 10–15. My vacation days would be consumed in the first four months of the year, but I didn't care, I had a goal—cave.

I rode to Múzquiz, Coahuila, with Geoff Hoese, Aimee Beveridge, and Paul Bryant. The trip was golden, and we had good music and equally good company the entire ride from San Antonio to Rancho San Rafael, where our caving headquarters were located. When we arrived, everyone set up camp on autopilot, and everything was finished with daylight to spare, so we all headed up the trail to stash rope at a central junction, one hour's hike, of trails to the many caves in the area. From the junction, those who had been to Múzquiz before went separate ways to find the cave locations they had been obsessing about since their last trip. Caves were claimed for this short expedition, and we were soon back at camp, chatting livelily around the fire.



The first full day of caving, and we were all up early and ready to go. Jean Krejca claimed me for her team, and we scanned the prospects and picked Joe Datri for our third team member. Peter gave us three GPS locations to check, and we were all eager to get on the trail. With the help of our good friend GPS, we headed to the cave with the deepest estimated depth, based on scouting results from a previous trip. Jean was gracious enough to teach me how to rig, and I was more than excited to get the opportunity. Jean kept book, Joe was on instruments, and I rigged. It was easier than I thought it would be, but still very complicated to do when on rope.

I set the first bolt and waited precariously on a ledge for Joe and Jean to join me so I could get further guidance. When Jean and Joe made it to the ledge, I got back on rope and started to set the second bolt. Due to my inexperience, it took plenty of time, and Jean pulled out an apple and a soda and made herself at home by setting up a small stove to warm up a hot cup of tea. We eventually made it down the second drop, and the cave ended in a mud plug. Jean stayed to finish the sketch, and she derigged on the way out. When we were packing up at the entrance, she asked me for the bolt kit. I had left it in the cave. Without a fuss, Jean rerigged the cave, got the kit, and was out in forty-five minutes. We called the cave La Thrasha because of the bushwhacking to get to it.

The other two caves were Enough Ants Cave and Pozo Ni. Just like La Thrasha, they were short and went nowhere. With no daylight left, we headed back to camp, where

Ellie Thoene.

everyone stayed up until the last group came back so we could get all the juicy details. Two teams had located and surveyed in deep caves that day, and the race was on to see who would get the most depth.

On the second day I decided to join one of the deep-cave teams under the guise of helping Mike Pugliese schlep around his camera equipment, but with the real aim of getting a taste of some booty. I could tell immediately that the cave had way more potential than the little pits we had surveyed the day before. I looked on as Philip Rykwalder and Ron Rutherford rigged and mapped the cave and got excited when Philip shouted from below that all the rope we had wasn't enough. He was left hanging in the middle of a vast pit. We headed out and back to camp, and much later the other deep team came back to report they had gotten to the bottom of their cave and found it would take a bit of dedicated poking around through breakdown to find a continuation.

On the third day, we were all beat, but we still wanted to get some cave. I went with Jean, Joe, and Barbara Luke to Pozo No Bueno to finish a survey that Peter Sprouse, Terri Sprouse, and Linda Palit had started. The entrance to the pit was wide, and we had to crawl down a slope just to get to the drop. Barbara continued to rig the cave, and Jean was the disciplinarian as I learned the fine art of sketching. The cave was one drop with many rebelays. The room at the bottom was just big enough for the others to lie down in to take a nap while I finished up the sketch. After that was done, Joe took the opportunity to set up some fun shots of all of us stacked up on the wall. On the way back to camp in the dark, our navigation skills were way off, and we ended up happily thrashing around the mesa trying to find the trail.

The Múzquiz trip was a great experience for me. The area is amazing and full of so many pits with lots of potential that just the thought of going back gives me goosebumps. I was delighted to cave with many people I never had the pleasure of going on expeditions with before. I got some hands-on experience rigging and surveying virgin cave. Everything was structured so that our big, happy family worked like a well-oiled machine. It was a great opportunity, and I am very glad I took it.—*Ellie Thoene*

In February 2010 I visited Rancho San Rafael in the desert of Coahuila for the first time. I've always been drawn to deserts. Granted, desert caves tend to be nondescript and on the small end of the spectrum. They're often hot and overly sharp, and the approaches tend to be a bit epic. And sometimes they might be little more than your best opportunity to encounter wild pigs or buzzards in confined spaces. But stories of 200-meter-deep caves on the ranch had trickled back to me, and I was anxious to see these deep desert caves for myself.

After leaving Austin, we had a late-night border crossing and spent a night in Múzquiz, Coahuila. In the morning we drove through the desert and set up an impromptu camp in the middle of a dirt ranch road. That afternoon I hiked up a dry arroyo to the plateau to help shuttle some 500 meters of rope to Pozo Que No Es. First found and entered in the fall of 2009, Pozo Que No Es had been explored past the –200-meter mark, and multiple leads still existed. Additionally, my short hike would help me learn the karst and familiarize myself with the area's geography. From camp I hiked up a gently ascending arroyo lined with leathery agave, gnarled live-oak trees, and a wide assortment of prickly desert life. As we ascended the narrow, rocky trail, the arroyo narrowed, and we saw scratches on trees made by the black bears that live in the area. At the arroyo's upper limit we popped out onto a gently undulating plateau populated by the area's characteristic plant life: Mexican palm, sotol, agave, catclaw, and ankle-biting yucca.

On the way through and around all of these dagger-like plants to Pozo Que No Es, Ron Rutherford and I bounded about with child-like glee at the sight of so many entrances. They were concealed in cracks, stowed under live oaks, cozied up next to bushy sotols, out in the open or tucked in the bottom broad sinkholes. They were on karst pavements, in the shadow of Mexican palms, and hidden in the brambles of scrub. There were pits everywhere!

Walking among them, I realized that some seemed deep, while others appeared shallower. Rocks thrown down a number of them indicated depths of about 20 meters, but I knew that the deepest caves in the area were over 200 meters deep. I wanted to be sure that the caves I chose to explore during the trip were on the deeper end of the spectrum, and I

held hopes that I'd in fact find the deepest. Wandering about, I wondered how I'd go about selecting a deep one in a sea of so many pits.

As we walked I talked to Matt Zappitello about the caves, as he had been to the area before. We chatted about the geology, and I asked him which leads seemed the most promising. He recommended that I visit an unexplored entrance named SR-27, and we took a quick walk over to it.

In my time dealing with caves, I have come to understand the language of the Earth and her caves. In certain cave passages I've heard invitations, while in others I've heard threats. Some caves have called at me with insults, sneers, and rejections, while others have sung merry, happy songs. As I approached SR-27, I ducked under a desert palm and brushed fronds away from my face and stood on the edge and listened.

It was a simple pit entrance. Not a ragged entrance in the Sierra de El Abra, not an ominous drop in the jungle. Just a simple pit. The pit seemed deepish, at least –100, as rocks clattered and bounced for long enough to instill me with hope and fear. I felt a hot blast of air emanating out of the entrance, which I took as a good sign. As I gazed at the entrance, a certain feeling came over me, and the cave uttered a calm message of warning. Welcome, but beware. My fate for the coming days was sealed. With so many pits to choose from, I decided then that I'd lead a team to SR-27 the next day.

Philip Rykwalder. *Ellie Thoene*.

In the morning I collected a team of two others, Ron Rutherford and Mike Pugliese, and we hiked up the arroyo to the plateau. With a hammer drill, a bolt kit, and perhaps 200 meters of rope, we geared up at the entrance to SR-27. I set a bolt and started rigging my way down. After placing a few rebelays, I landed on a ledge at about –60 meters and hailed the rest to join me. It would prove to be one of the few places in the entire cave one could get off rope.

As I sat on the landing resting, the others rappelled down to me, and I assembled a few more bolts to continue rigging down. The ledge was wide-ish, and the pit continued down at my feet for an undeterminable distance. Typically in desert caving I wouldn't carry more than a handful of bolts in my bolt kit, perhaps eight or ten. That morning while I had been assembling my bolt kit, Matt Zappitello peered over my shoulder. Having previous experience with the vertical caves of the area, he smiled and calmly suggested that I take more bolts. Just a few more. I was surprised to hear him say that, so I decided to go overboard. I packed almost thirty. And it was a good thing, too. By the end of that and the following days I had placed that many and a few more that Ron had scrabbled up from the depths of his pack.

Continuing from the ledge down a few more rebelays for another 60 meters, I landed on a small natural bridge that neatly divided the pit in half. Though it made for awkward rigging, I tied a double bowline and used the bridge as a rebelay to conserve bolts, and we continued down another pit. At day's end we found ourselves at the bottom of a blind pit approximately 180 meters below the entrance. All day long I had rigged down with all the rope I could carry. Yet, many times I had found myself dangling at the end of a rope and yelling up a pit, "NEED . . . MORE . . . ROPE."

Surveying out that first day, I counted two side passages still in need of exploration and realized that SR-27 would take at least a few days to fully explore. I thought that I'd be lucky to finish it in the three days of this short trip.

Walking back to camp in the waning yellow light of late afternoon, I estimated SR-27's current depth at 180 meters. That was somewhat deep, but knowing the area had deeper caves, I wanted it to go deeper. I wanted to certainly push it past –200 and maybe even to –300 meters. In fact, I wanted it to be the deepest in the area, if not Coahuila. With plans and dreams swirling in my head, I rested up during the night and prepared myself for another day in SR-27.

The next day my team carried yet more rope into the cave in the hopes that we'd go even deeper. Ron and Mike had come with me again, and Ellie Thoene joined us. We four descended to the –120-meter level and the most promising lead, and after a tedious few hours of rigging we found that it went down only a short 12-meter pit to a squeeze. I painfully went through it and dropped another pit before I realized that I had merely found an alternate route down to the pit series I had rigged the previous day—a morning's work wasted. Wriggling back up into the short pit and facing the disappointment that our best lead didn't go, I heard Ron say that he'd found two more leads.

I was perplexed. Ron was clipped in at a series of three short rebelays, and I didn't remember any leads near him. When I climbed up and joined him, I realized that he'd free-climbed up a short series of ledges and found a pair of leads, one of which blew tons of hot air. It was enough air to make one look his fellow cavers in the face and smile. It seemed to be the source of the hot air that I'd felt at the entrance two days before. Ron was extremely keen to explore the blowing lead first, rather than the other, a window into a side passage, which made sense. It was perhaps more air than I'd ever felt blow up a pit before, leading us to believe that there is much passage beyond it.

But, something in me said *go*

through the window. That little piece of me that listens to the song and voice of the Earth. Ignoring common sense and Ron's not-so-quiet grumbling, I slipped a leg up through the window and pulled a few coils of rope in behind me. After gardening rocks off a pair of nasty ledges, I set a few bolts and started rigging down a ragged, dangerous offset drop. If Ron's discouraging tone wasn't enough to make me doubt my choice of entering the window, the pit I was staring down was as hazardous as they come. At its top was a huge pile of rubble, and the pit's shape would focus all rocks down onto cavers below. Any misstep by a caver at the top would shower all below with fist-sized rocks, surely a recipe for injury and disaster. It was a lethal situation, and I knew that as the first one down I was the one most likely to be crushed by falling rock. Doubt built inside of me, but something inside me had told me to go through the window, and I couldn't help but obey.

As a younger caver I had held my emotions hidden behind a thick shell of cast-iron and plate. I was cool and composed regardless of the exposure, regardless of the depth or danger, regardless of how scared I truly was. Weakness, vulnerability, and anything resembling fear was hidden behind this impenetrable shield. At times my emotions were a calmly bubbling pot, merrily simmering away. In certain tight squeezes the pot might boil mightily and my emotions threaten to overflow, but the pot remained firmly lidded. In the heat of many moments I felt like a pressure cooker. Inside was a tumultuous hell, but on the outside I exuded the image of a polished piece of chrome. At some point during my caving career, however, I felt like I had been tested by all that is caving. Tempered, if you will, by darkness, by flooding waters, by being lost, by every fear that I'd faced. By some stroke of luck and perhaps a smidgen of wit I had faced so many dangers and come out on top, which still surprises me. All of a sudden it seemed natural to reveal my inner emotions to those around me, my fellow cavers.

It was in this new sharing of my emotions that I told everyone how scared I was as I descended the lethal drop. The fear on my face was transparent, and I rappelled in a desperate, lathered sweat fully expecting rocks to slam into my shoulders, helmet, and back at any moment. I was looking for ways to keep people on rope out of the rock-fall zone. I had in mind a protective ledge to hide under or a small side passage to hide in, and I was coming up short and getting a bit desperate when I located a small alcove. Rigging up into it, I found a phone- booth size shelter where someone could safely wait on rope while someone else rappelled or climbed. My arms were shaking badly from my fear, but, calmed by the knowledge that we could safely continue, and thinking that I had done us all a favor, I took out my hammer and scratched on the rock, "Have you kissed your rigger today?"

At the bottom of the dangerous drop I got off rope and found a narrow canyon continuing past a downclimb. Pulling the rope's tail down with me, I called to the others and told them to bring the remaining two ropes with them. Beyond 30 meters of the narrow, horizontal canyon passage and another short climb down there was a triangular hole that led to blackness. Another pit.

The passage was washed clean, and there were no rocks to throw down the pit to gauge its depth, so I took out my hammer and chipped a piece of wall away. I held it out over the abyss and held it there. And then I let it fall free.

My free-fall equation is two seconds equals a pit depth of 13 meters, three seconds is 34 meters, four seconds is 64 meters, and five seconds is a 105-meter-deep pit. I counted zero, one, two, three, four . . . . The rock fell and boomed and clattered and smashed its way down for an eternity. It just kept going and going. Its bouncing around so much messed up my free-fall equation, but the fact that it just kept going buoyed me incredibly. I sat back and quickly estimated that I was about 150 meters below the entrance. The pit I had just dropped a rock down seemed at least 100 meters deep. Could SR-27 be 250 meters deep? I was elated and quickly searched my mind for the deepest cave in Coahuila and came up with El Volcán, at –372. The difference between a –250 and a –372-meter cave is significant, but we weren't done yet.

An hour later fear was ripe in my throat, as I was about 60 meters down into the pit, swinging on the end of our last bit of rope and still staring down a black hole, with no bottom in sight. I chipped another rock away from the pit's wall, and when it fell it told me that there was much more to this pit; I'd need much more rope to reach its base. As I changed over to climb out, I knew

Jean "Creature" Krejca in Pozo No Bueno. *Ellie Thoene.*

that we had a deep one on our hands. We walked home that night around midnight, and I was grinning, realizing that my dream of a deep cave might be realized after all.

The next morning I went to gather more rope to continue deeper into SR-27, though by then rope had become a scarce commodity around camp. Since SR-27 was a large vertical passage that divided into three parts like an inverted pitchfork, we named it Pozo Tridente. Currently it had over 250 meters of rope in it, while Pozo Que No Es had over 500 meters, not to mention the many other caves being explored. Others around camp grumbled and jokingly whispered that I was a rope hog, but I knew that I had to secure more rope. We grabbed a number of shorter ropes and headed up to Pozo Tridente for the third and final day of caving on the trip. Ron Rutherford came again, along with Paul Bryant. Since Pozo Que No Es wasn't going to be pushed that day and we hadn't been able to wrangle much rope from camp, I had Paul go over to it and derig the 80-meter rope from the entrance drop. Down in Tridente at the end of our nylon highway I set more bolts and continued down. I rigged a 17-meter rope that took me down to a small ledge, and immediately below that I tied in a 40-meter rope and headed down a free-fall drop to a breakdown floor. Only a small tail of rope lay on the floor. Later, while surveying out, we would find that the entire shaft, which we coined the I'm Scared Well, was a little over 100 meters deep.

As Paul and Ron came down to join me, I ate a bite, then continued rigging down a small slit between breakdown boulders. The cave continued through an extremely awkward horizontal slot. The passage got muddy, and I knew the bottom was close. Beyond two more tricky, shorter pits and after a tight squeeze, I set a rebelay and, looking down the pit I was about to descend, saw the reflection of my headlamp in a pool of water. The pool had thick calcite rafts that sank in the shallow water as the tail of my rope tipped them. On the bottom of Pozo Tridente I sank to my knees and drank deeply from the water as the other two joined me. I knew we had reached the bottom. I had no idea how deep the cave was, but later we calculated that it is 339 meters deep, surpassing Pozo Que No Es, nearly 300 meters deep.

After a short break we started the arduous task of surveying out. As Ron and I surveyed, Paul followed and derigged the many ropes and rebelays behind us. Above I'm Scared Well we reconvened, stretched in our harnesses, and split up the growing pile of gear three ways. We continued up the ugly drop, taking advantage of the safety of the alcove I'd rigged into, and up and out the window. By then hours of hauling ropes up pit after pit had passed, and the three of us were beyond exhaustion.

Hours and hours later I pulled myself up onto the surface and stared up at the night sky. I was sopping wet with sweat, it was late in a cold desert night, and the temperature was near freezing. The cave wasn't finished yet, as we still had Ron's blowing lead to explore, but it would have to wait for now. We all packed up and headed down through the blustery night to the warm campfire that awaited us.—*Philip Rykwalder*

Múzquiz

En febrero de 2010, espeleólogos de los Estados Unidos y de México regresaron al rancho en el desierto cerca de Múzquiz, Coahuila, donde se habían ubicado varios tiros en mesetas en ambos lados de un valle que desciende de las montañas. Todas las cuevas de la zona son prácticamente completamente verticales, sin desarrollo horizontal, aunque las cuevas son una serie de tiros interrumpidos por repisas o con ventanas hacia la continuación por tiros adyacentes. La cueva más profunda hasta el momento es Pozo Tridente, de 339 metros. Pozo que No Es tiene 250 metros de profundidad.

2009–2010 COLIMA-MICHOACÁN EXPEDITION

Peter Ruplinger

It was another super Mexican adventure. Mike Forman, Rodney Mulder, and I left the day after Christmas and arrived three days later at Coahuayana, Michoacán. Coahuayana is about 40 kilometers south of San Gabriel, Colima, where we had mapped several caves on previous trips. [See *AMCS Activities Newsletters* 23 pages 77–84, 28 177–180, and 32 89–91.] It is just 12 kilometers west of Palos Marías, where we have been mapping Cueva de la Canoa.

Cueva de la Canoa is a river cave. It's long, with a low ceiling, which makes it backbreaking to survey. This was our fourth attempt to reach the end. On this trip we also hoped to clarify a discrepancy of about 10 meters in our previous mapping.

In Mexico permission is a big thing. Palos Marías has a new mayor, so before entering the cave I had to meet with him. He was standoffish at first, but soon warmed up and gave us permission. We entered the cave's tight little opening early the next morning. After several hours we reached the end. That was a relief. I had feared it might continue for several backbreaking miles. We had hoped to find a lake at the end, or perhaps a large decorated room, but all we found was a series of challenging spots where the ceiling was only 3 to 5 centimeters above the water. We were forced to duck under several times to push on to the end. So, with the exception of solving the 10-meter discrepancy, the Cueva de la Canoa map is complete. I'm not going to lose any sleep over the discrepancy.

peter@ruplinger.org

After our seven-hour backbreaking ordeal in the river cave, we decided to kick back and relax the next day at the beach. Snorkeling, we saw lots of colorful fish darting among the rocks, but nothing spectacular like sharks or giant squids.

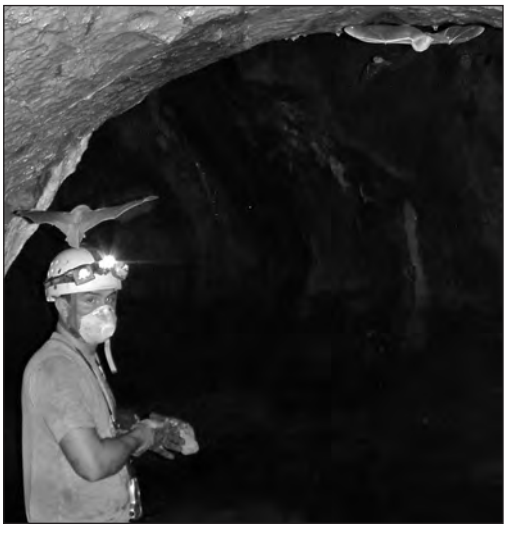
Early the next day my friend Pedro Mendoza led us up the canyon to Cueva de la Barranca Verde. He hadn't been there for years, so it took us a while to find it. The hike was beautiful. Lush green foliage lined both sides of a crystal-clear stream. Just below the trail that leads to the cave there was a 10-meter waterfall.

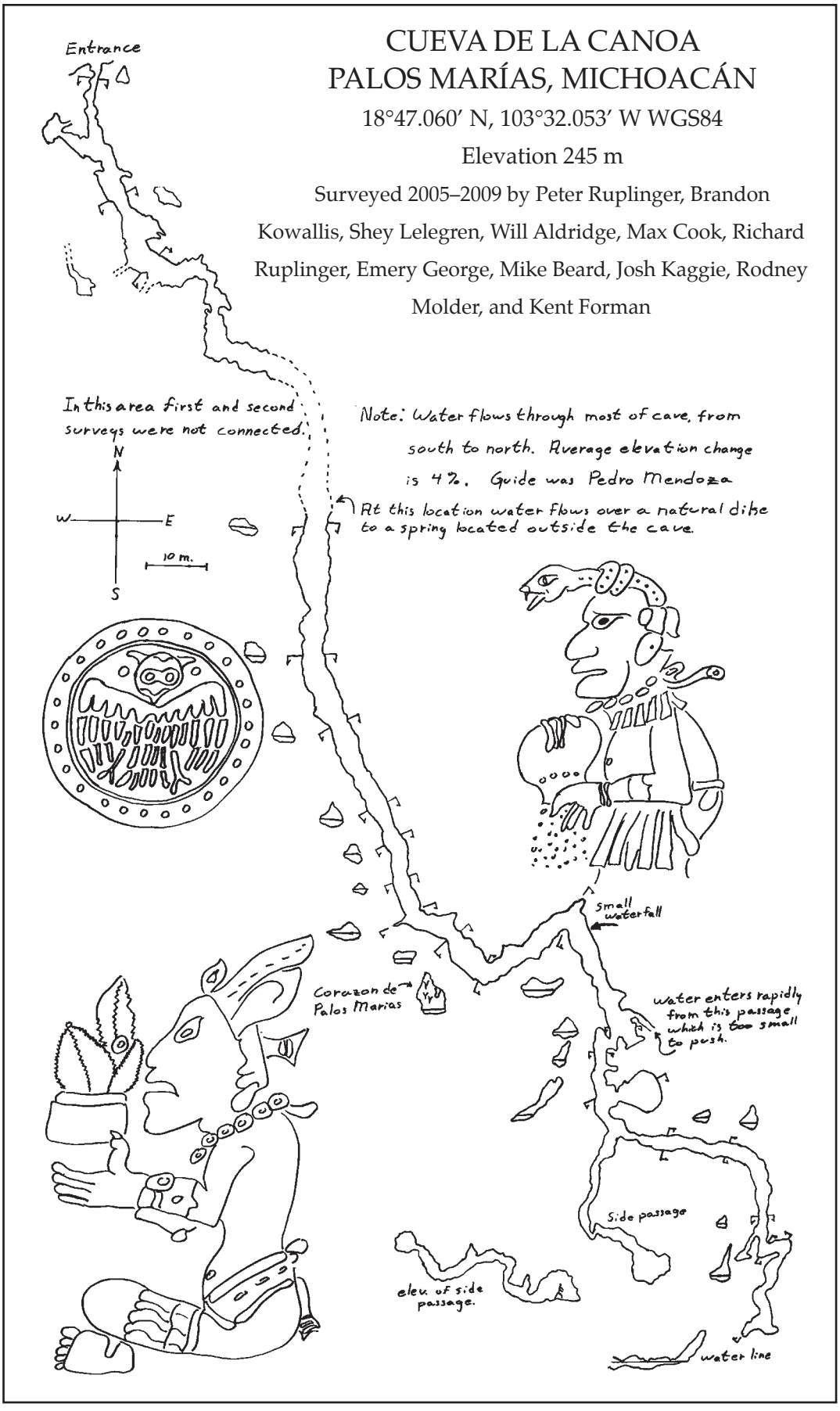
Although less than 40 kilometers south of San Gabriel, the area is much greener, and bothersome bugs are of a different variety. In San Gabriel we have been bitten by *jejenes*. These gnats are too small to see, but their bites swell and itch like mosquito bites. Walking through the Palos Marías jungle, we were bothered by tiny black, blood-sucking ticks called *garapatas*. These "seed ticks" are almost too small to see. They cling to the edges of leaves, perhaps hundreds in tight chain-like gangs. They wait to jump onto whoever passes by. I brushed a lot of them off my arms, and fortunately didn't suffer any bites. Pedro picked up a few much larger ticks on the hike. I was spared. Could it be that they don't like *gringos*?

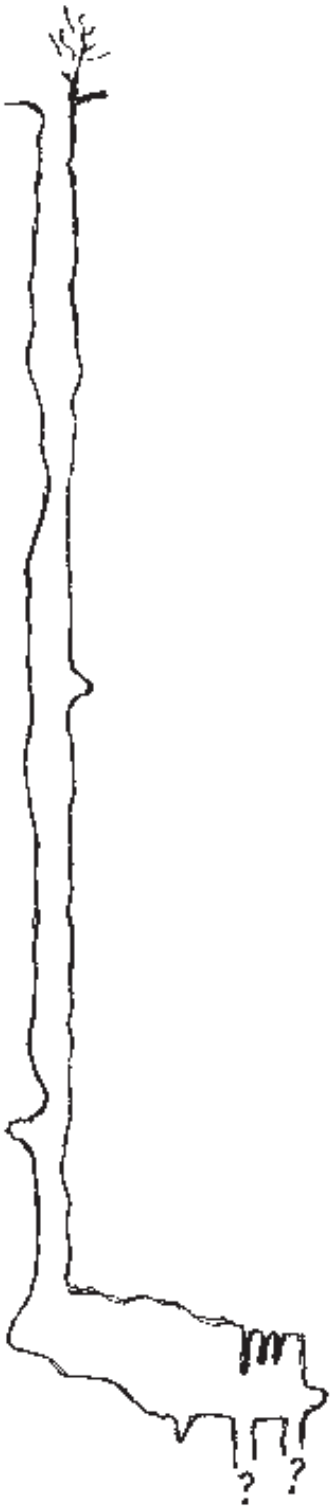
Cueva de la Barranca Verde is well known, but had never been mapped. We had to scale a 10-meter cliff on the canyon wall to reach the entrance. The cave is all walking passage, with the exception of a small room that Rodney climbed into. It was easy to map, 137 meters in all, with lots of long shots. At the end there was a room about 20 meters long, 10 meters wide, and 7 meters high. It contained tens of thousands of bats. They were hanging at about eight per square foot all over the walls, and denser on the ceiling. Here was a golden opportunity to get lots of good photos. They didn't like us interrupting their siesta and began zooming around the room. This made for even better shots. I believe they were Mexican funnel-eared bats.

The next morning I was startled to find my arms and legs covered with perhaps two hundred pimple-

Kent Forman and bats in Cueva de la Barranca Verde. *Peter Ruplinger*.




CUEVA DE LA CANOA
PALOS MARÍAS, MICHOACÁN
18°47.060′ N, 103°32.053′ W WGS84
Elevation 245 m
Surveyed 2005–2009 by Peter Ruplinger, Brandon Kowallis, Shey Lelegren, Will Aldridge, Max Cook, Richard Ruplinger, Emery George, Mike Beard, Josh Kaggie, Rodney Molder, and Kent Forman
Entrance
In this area first and second surveys were not connected.
N
W
E
S
10 m.
Note: Water flows through most of cave, from south to north. Average elevation change is 4%. Guide was Pedro Mendoza
At this location water flows over a natural dike to a spring located outside the cave.
Small waterfall
Corazon de Palos Marias
water enters rapidly from this passage which is too small to push.
Side passage
elev. of side passage.
water line



Cueva Rumbo a Chanchopa
San Gabriel, Colima
18°53.814′ N, 103°43.544′ W WGS84
Elevation 449 m
Surveyed 3 January 2010 by Rodney Mulder
Depth 120 m, bad air

like bumps. The corner pharmacist said it was an allergy. They looked more like bites to me. I got on the phone with my wife and asked her to call two friends, Jim Kennedy of Bat Conservation International and Keith Christenson. They agreed that the problem was bat mites, and, although the bites were irritating, I should fear no permanent effects. That didn't make me feel much better. Rodney and Kent also had bites, but not nearly as many. I had worn a short-sleeve shirt. Rodney had long sleeves, and Kent had prudently applied insect repellant. Surprisingly we didn't experience any bites on our heads, and we had few on our torsos. This was the most unpleasant caving experience I've ever had. The bumps didn't even begin to diminish until fifteen days later. Finally, after twenty-two days, each swelling had largely disappeared. Twenty-five days later several new bites appeared. I suspect the new bites were from hatching eggs. I washed all my gear twice in hot water. I fumigated the car and trunk. I'll never go into a room congested with thousands of bats again.

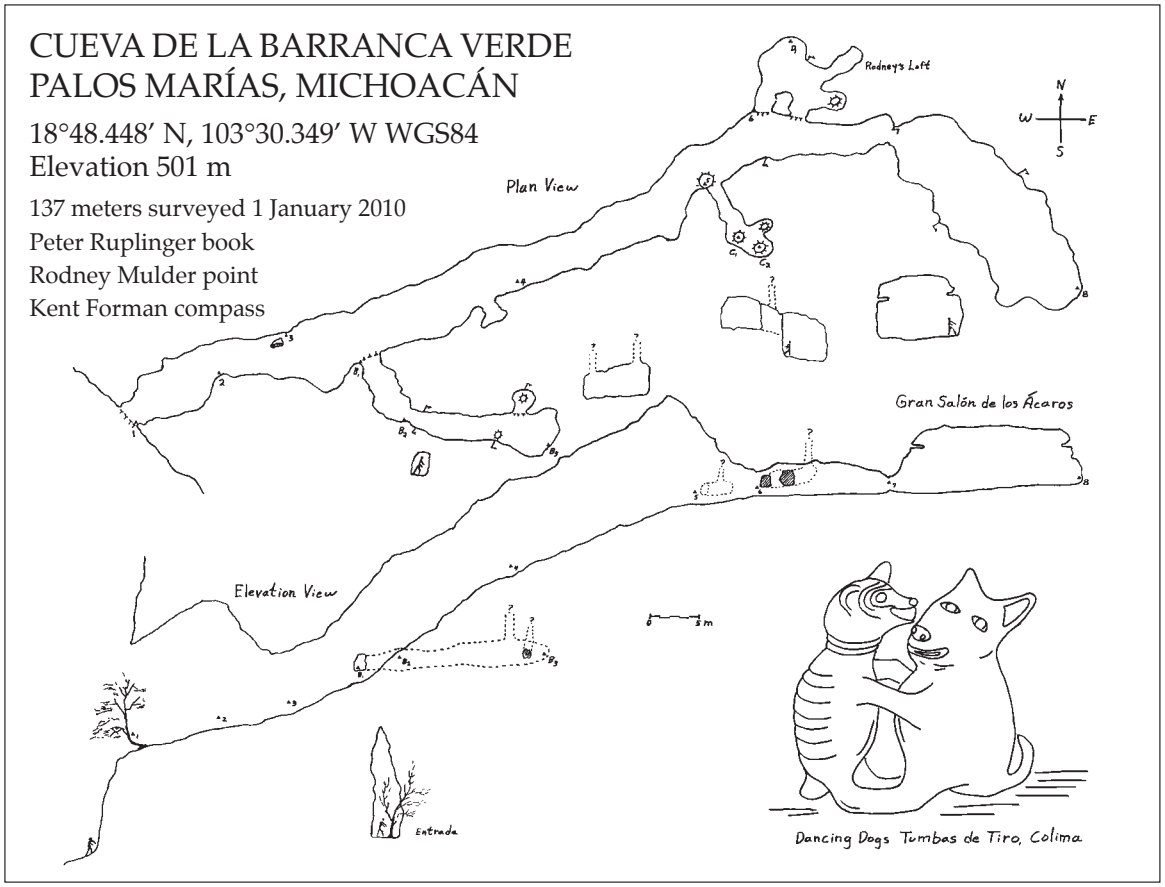
Pedro told us of another cave, Tapasón, high on the mountain above the river cave. He said it connected to the river cave, but I doubt it. We had planned on hiking to this cave the day the bites appeared. Not knowing exactly what to expect from my approximately two hundred bites, I didn't feel comfortable undergoing an exhausting hike. We went instead to San Gabriel in Colima. My friends Ignácio Veduzco and his wife were joyous to see us. They took us to two new caves. One was 59 meters deep, just one narrow, straight drop with nothing at the bottom, not even a dead cow. Ignácio said it had no name, so I named it Cueva San Ignácio in his honor. The other cave was a little wider and almost 120 meters deep. The sun was already below the horizon, so there was only time for Rodney to go down. He sketched a small, well-decorated room at the bottom and said the air was bad. Ignácio said the cave is called Cueva Rumbo a Chanchopa.

On our last day I wanted to climb the mountain and map Tapasón,

Cueva San Ignácio
San Gabriel, Colima
18°54.376′ N, 103°43.485′ W WGS84
Elevation 442 m
Surveyed 3 January 2010 by Peter Ruplinger,
Rodney Mulder, and Kent Forman
Depth 59 m

Peter Ruplinger.

The entrance to Cueva de la Barranca Verde.
Peter Ruplinger.



but Rodney and Kent were more interested in departing a day early so we could climb Vulcán Nevado de Colima. The vote was two to one, so we climbed the snow-capped volcano. On our next trip, we'll start by mapping Tapasón.

Expedición Colima-Michoacán 2009-2010

El mapa de la Cueva de la Canoa, cerca de Palos Marías, Michoacán, fue completado, y una cueva pequeña en la zona, Cueva de la Barranca Verde, fue topografiada. Algunos tiros profundos cerca de San Gabriel, Colima, también fueron visitados y topografiados.

HISTORICAL REPRINT

THE FIRST KNOWN BLIND FISH IN THE FAMILY CHARACIDAE: A NEW GENUS FROM MEXICO

Carl L.Hubbs and William T. Innes

This is a reprint of Occasional Paper number 342 of the Museum of Zoology at the University of Michigan, published December 17, 1936. This famous fish has suffered a large number of name changes, having been known variously as Anoptichthys jordani *as described here,* Anoptichthys antrobius, Anoptichthys hubbsi, Astyanax fasiatus, Astyanax jordani, *and* Astyanax mexicanus. *The last two seem to be the current favorites, depending on whether you regard the blind fish as a separate species from the surface fish* A. mexicanus. *A free PDF download of the paper is at http://hdl.handle .net/2027.42/56781.*

Among the interesting fish novelties being introduced from Mexico by Mr. C. Basil Jordan of the Texas Aquaria Fish Company, of Dallas, Texas, the most surprising by far is a blind, subterranean fish belonging to the family Characidae, of which no blind representative has ever been seen before. The new species is also the first blind fish of any group to be named from Middle America.

The source of this new blind fish is given by Mr. Jordan as a subterranean stream in the forested mountain region of southeastern San Luis Potosí, Mexico, in a region southwest of Valles drained by the Río Tampaón of the Río Panuco system. The Río Tampaón is the lower course of the Río Valles, and flows into the Río Coy, one of the main sources of the Panuco. Telling of his discovery, which was made about November 1, 1936, the collector wrote Mr. Jordan a vivid account, which we have translated freely as follows:

It is difficult to imagine how imposing it is to enter those most magnificent natural grottos. One enters first through a transom-like opening just large enough for one man (there are many entrances, known only to wild animals). After walking for about a kilometer through a narrow gallery obstructed in places by enormous fallen rocks, one arrives at a chamber large enough to contain a cathedral, completely covered with stalactites and stalagmites which present a grand aspect when illuminated. To avoid the possibility of becoming lost, we marked each passage with chalk as we passed by. At last we came to the zone of creeks and pools. The first pool which we encountered is so very deep that we could not estimate its depth, nor could we fish in it because of the low ceiling. After edging our way around this pool, by holding onto the fissures in the rock, we continued along a creek, walking knee-deep in the water, in a head-high passage, finally arriving at another large pool, also very deep, in which it was possible to see with the light the little fishes for which we had come. Strange sounds, splitting the silence, enormously alarmed the natives, and naturally me also. I trembled at the sight of the bones of deer and other animals in the caverns, especially when my companions, attributing the loss to the spirits, told me of Indians who had entered here, never to be seen again. Seeking an appropriate place, we began to catch the blind fish one by one. After making several trips into the cave, and after an infinite amount of tumbling and slipping, we succeeded in obtaining 100 specimens. After journeying by horse to the Río Tampaón, and on to Pujal by canoe, I send you 75, retaining 23 for the Department.

This is apparently a hardy cave fish, for the 75 individuals all arrived alive at Dallas, and have continued to live in warm tropical fish aquaria without showing any discomfort. The species will probably prove much more suited to aquarium culture than the blind fishes of the United States, for it doubtless came from rather warm water, while the northern fishes live in cave streams having a temperature of about 56° F. The blind characins "have ravenous appetites," Mr. Jordan writes, "and take dry food which they find quickly. Mosquito larvae are taken with much gusto, but they have some trouble catching these."

Our own experience (that of Innes) agrees with Mr. Jordan's. The fish are hardier than *Astyanax fasciatus mexicanus.* They sense the sides of the aquarium rather well, for when excited they only bump the sides occasionally and in a state of calm usually turn away about an inch from the glass. They were kept alone a few days to insure them getting food, but it was later found that they eat better in a community tank. Almost immediately they sense the placing of food in the aquarium, and learn quickly into which end of it the food is dropped. A little splashing at the surface has become the dinner bell to the blind fish, which at once become excited at the sound, dash about, come to the surface for a time to feed on particles still floating, then scour around on the

bottom for the food that has sunk. They really get more to eat than the other fishes in the tank, for they stuff themselves as though they did not know when a new opportunity to feed would present itself. They eat almost any kind of fish food, including the cereal preparations that most characins reject. These blind fish seem to be comfortable within the temperature range, of 60° to 80° F., but like most "tropicals" are susceptible to ichthyophthiriasis at the lower temperatures. This disease, however, responds quickly to chemical treatment and to an increased temperature.

An examination of the characters of the new blind fish leaves no reason to doubt that it was derived from *Astyanax fasciatus mexicanus,* the only characin that has heretofore been known from the Panuco River system, in which the new species occurs, or elsewhere in northeastern Mexico or the United States. The discovery of this blind characin was most unexpected, for *Astyanax,* a free-swimming, midwater fish, does not possess the crevice-seeking habits nor the well-developed sensory organs that are ordinarily characteristic of the ancestors of blind, subterranean fishes. The ubiquitous and abundant occurrence of the "sardina" *(Astyanax)* through the fresh waters of Middle America is the only obvious reason why it has given rise there to a blind derivative.

We are very grateful to Mr. Jordan for the gift of the type specimens, and for the privilege of making his interesting discovery known to the scientific and the aquarium world. We take pleasure in naming the species for him.

Anoptichthys, new genus

Anoptichthys agrees with the genus and subgenus *Astyanax*[1] in all apparent characters other than those associated with blindness and subterranean life. The adipose fin is well developed. The dorsal fin is short; the anal of moderate length; the caudal strongly forked, with the lobes subequal or the lower somewhat the larger. The gill-membranes are free from the isthmus and scarcely conjoined. The setiform gill-rakers are in moderate number and rather short. The multicuspid teeth are well developed in both jaws; on each side there are 4 separated, tricuspid teeth with a strong, little-compressed median lobe, in the outer premaxillary row; 5 broad tricuspid to pentacuspid incisors with a triangular base in the inner premaxillary row, of which teeth the median one is in contact with its fellow and bears 1 cusp on its inner edge and 2 on its outer margin, the fourth is reduced in size and the fifth is relatively small and located inside the front end of the single, long, knifelike, serrated maxillary tooth; also a single series of mandibular teeth, of which the anterior 3 are much enlarged, compressed, cupped incisors, decreasing in size backward but with the third and smallest one abruptly larger than the first and largest of the 6 lateral teeth; the mandibular teeth grade from pentacuspid anteriorly through tricuspid near the division between the 2 sizes of teeth to unicuspid at the dwindling posterior end of the series. The upper lip forms a thick gum overlapping and almost enveloping the premaxillary teeth. The upper jaw is rather short and is strongly angulated at one point, where the premaxillary and maxillary join. The suborbitals do not entirely cover the cheek. The abdomen, broadly rounded transversely and very gently convex in outline, is covered with ordinary scales, not specialized along the midline. The complete lateral line is gently decurved. The scales are rather large, strictly cycloid, nowhere notably specialized. A few scales extend on the extreme base of the caudal fin in 1 row of large scales near the middle rays and in 3 rows of smaller scales near the middle of each lobe of the fin; the dorsal fin is scaleless; the anal bears only 1 row of small scales, in a basal sheath. The nape is wholly scaled, except over the supraoccipital process. There is no procumbent predorsal spine.

The characters by which *Anoptichthys* differs from *Astyanax*, as already stated, are those associated with its subterranean habitat. The fish is obviously blind, for the eye is virtually structureless in external view. The eye socket is filled in with fatty tissue, though not greatly reduced in size (it is one-fourth as long as the head). This fatty tissue is divided by a subvertical fissure extending from near the middle of the eye socket to a point where the fissure divides to form a short crease forward and backward, most distinctly forward, along the lower margin of the orbit. There is also a crease along the anterodorsal margin of the orbit, just behind a narrow fleshy ridge that separates the orbit from the enlarged posterior nostril. The internarial flap, markedly elevated, is half as high as the orbit, and becomes thickened into a large slightly bilobed mass ventrally. The olfactory lamellae extend across only about half instead of virtually the entire floor of the narial pouch, and do not bear flaps toward their distal point of attachment. The infraorbital canal is little modified; the pores on the preorbital are sessile, without side branches extending to the front edge of the bone. The fatty mass that fills the orbits extends over the broadened top of the head, and seems to contain sense organs. The snout as seen from above is much broadened and shortened, with a prominent angle before each nostril. The scales are very thin. The pigment of the body is obsolescent.

Anoptichthys, eyeless fish.

Orthotype.—*Anoptichthys jordani,* new species.

Anoptichthys jordani, n. sp.
(Plate I)

The following description is based, except as indicated, on the holotype, an apparently adult specimen 51 mm. in standard length, with data as already given. The paratypes are 2 individuals which remain alive in Mr. Innes' possession at the time of writing. The figure is taken from one of the live paratypes.

The body is rather sharply compressed; the greatest width, near the broadened head, is half the greatest depth, which is uniform from below origin of dorsal to a vertical half the

[1] See Carl H. Eigenmann's monograph, The American Characidae, Mem. Mus. Comp. Zool., 43 (1917–21), Pts 1–3.

Plate 1. *Anoptichthys jordani*, the new blind characin from Mexico. Photograph by William T. Innes of a live paratype in his possesion.

length of the head farther forward; the greatest depth measures 3.15 times in standard length (about 2.8 times in the paratype figured); the least depth of the caudal peduncle is two-thirds the length of the peduncle and two-fifths the length of the head (slightly deeper in paratype). The anterodorsal contour is weakly convex before the eye, very slightly concave above the eye, and rather strongly convex between occiput and dorsal.

The head is not greatly widened posteriorly (the greatest width is slightly more than half the length of the head) but is so nearly oblong as seen from above that the width below the front of the eye socket is still almost half the head length. The mandible is somewhat oblique, very strong and projecting in the uninjured paratype that is figured; in the holotype the mandible is very steep, more nearly vertical than horizontal, and is much shorter than the upper jaw, presumably because the right side of the jaw has been greatly injured or naturally atrophied, causing the dentition to be abnormally reduced on this side. The length of the head, including the broad opercular membrane, is contained 3.45 times in the standard length (about 3.6 times in paratype). Measurements into the head length are as follows: length of orbit, 4.0 (twice the horizontal projection of the snout) ; length of the nearly transverse snout, 4.3; width of head across the fatty eye-socket mass, 2.3; least preorbital width, 16.0; distance from orbit to angle of preopercular margin, 2.5; length of upper jaw, 2.6 (these measurements are about the same in the paratype figured). The suborbitals fail to cover the cheek by a space considerably wider than the least preorbital width. The suborbital chain is very irregular and asymmetrical, possibly as the result of injury; not counting the preorbital, the bones are in 2 series, numbering 5 + 2 on the left side, 3 + 1 on the right side.

The gill-rakers, on the first arch, numbering 5 + 12, are scarcely more than half as long as the gill-filaments.

The dorsal fin has 9 rays, not counting an anterior ray which is about half as long as the longest one; the anal, 18 principal rays (a paratype has 21) ; the caudal, 19 principal rays; the pectoral, 13 rays; the pelvic, 8 rays. The rather high, obtusely pointed, very slightly falcate dorsal fin is inserted approximately over the end of the pelvic base, just midway between base of caudal and tip (or middle) of snout; its length when depressed is twice the length of the fin base; and is contained 1.25 times in the distance to the short-based but flaring adipose fin, and 1.1 times in the head. The anal fin has a relatively short base, contained 1.2 times in length of head. The length of the upper lobe of the caudal enters the head 1.15 times; the pectoral fin, which extends very slightly beyond the pelvic insertion, 1.3 times; the pelvic, which reaches distinctly beyond the anal origin, 1.6 times (these fins are apparently smaller in the specimen figured).

The scales in the lateral line to caudal base number 35; from origin of dorsal downward and backward to, but not including the lateral line row, 7; between lateral line and anal origin, 6; between lateral line and short pelvic axillary process, 5.

In life the fish, as described by Mr. Jordan, is "clear pink to flesh in color." The 2 live paratypes remotely resemble the new albino *Mollienisia latipinna;* they are silvery yellow with a faint flush of pink, with the abdomen more of a lemon yellow, and show no trace of dark markings. The yellow flesh in the anal region is visible through the transparent scales. Elsewhere a few scattered scales are transparent. A pink color shows through such scales, over the vertebral column. When viewed by transmitted light, the region of the spinal column is decidedly pink. There is a tendency toward translucency except on the head and the visceral regions. By reflected light, the fish is silvery, with a slight iridescent overtone.

The type in formalin shows little color, but has the main central portion of each caudal lobe a rather faint but distinct greenish orange. The other fins show no color. The sides are silvery with a slight rosy tinge. The silver is brightest in a diffuse lateral band, under which large, merely gray melanophores are discernible under a microscope. On the lower sides no pigment cells are to be found, and no trace is discernible of the shoulder bar or of the caudal stripe. On the upper sides the ghostlike melanophores also occur, chiefly toward the edge of the scale pockets, and most thickly near the middorsal line, especially around the base of the dorsal fin. Similar color cells occur on the top of the head, and a few very minute ones remain near the margins of the orbital mass of tissue, but none are apparent on the cheeks, opercles, or lower part of the head.

El primer espécimen conocido de un pez ciego de la familia Characidae: un nuevo género de México.

Esta reimpresión histórica es la descripción original del pez ciego de El Abra, entonces conocido como *Anopthichthys jordani*. El pez es llamado ahora *Astyanax jordani* o *Astyanax mexicanus*.

The Golden Frog

We were exploring near Zongolica in Mexico when we started hearing rumors about foreigners looting the caves of gold and artifacts. Even the local kids, who until that point had been friendly and helpful, began taunting us and making signs suggesting that we were going to go to jail. While this might have normally passed unnoticed, some barmy local woman then accused us of stealing a three-foot-high solid gold frog, which she had seen us load into the back of a truck. Unfortunately it was also election time, and some local bigwig decided to make political capital out of this, and things quickly began to escalate out of control. Eventually, and much to our regret, we were forced to flee the area.

After leaving Zongolica, Howard and Debbie Limbert and I decided to check out a new area, which was difficult to get to and, as such, not much frequented by tourists. This we reached by taking a boat across a lake, followed by a hard day's walking to reach an old Missionary House, where we arranged to set up camp.

No sooner had be begun to investigate the area when we came across a promising-looking hole, which we entered by a twenty-meter entrance pitch. We'd only been in the area for a day or two, but despite keeping a low profile, the locals must have got to hear about our problems in Zongolica, and they were not pleased when they discovered we'd gone down their cave. In no uncertain terms they made it very clear that they wanted us to come back up immediately, menacingly tapping the rope with machetes as we ascended the rope. Explanations that we had official permission cut no ice, and despite showing them all the relevant paperwork, they were clearly convinced that we were looking for gold and marched us off at machete point back toward our campsite.

I knew that there was another team arriving the following day, so once back at the Missionary House I asked our captors if I could use the little chapel in the garden to write a prayed to God. Grabbing a pen and paper, I wrote 'Bugger off quick. We've been arrested." to warn them of our predicament and stuck it to the chapel door. Leaving all our gear behind, we were then unceremoniously frogmarched off toward the nearest small town, which took a good day's walk to reach and where immediately upon arrival we were taken to be interrogated by the representatives of El Presidente.

Once again, these "authorities" accused us of entering the caves in search of gold, which once again we naturally denied, and despite showing them our official permission they decided to play safe and put us in jail for the night. Next morning, they demanded to search our kit for evidence, but as this was still at the Missionary House, they said that one of us would have to go back and fetch it, while the other two remained behind. Obviously Howard and Debbie weren't going anywhere without each other, so Muggins here was marched back out of the jail into El Presidente's office, where the head honcho took one look at me and signed a piece of paper authorizing his men with the right to use firearms.

Heading out of town, I suddenly realized we were going the wrong way, and it occurred to me that they might actually be planning to execute me. As I couldn't see any good reason why I should cooperate with this, I promptly sat down. However, a bit of judicious and none to gentle prodding with a shotgun soon got me to change my mind, and I was marched off to a house on the edge of town. The owner of this place obviously had some control over the ammunition, because he passed comment about my size before producing a set of disturbingly large bullets. Despite my poor grasp of Spanish, the implication was clear that he felt that it was going to need the bigger bullets to kill this big fucked. Gulp! However, I soon twigged that this was all for show, as it was obvious that the bigger bullets wouldn't actually fit inside the small pistol.

Satisfied that I wasn't about to be murdered after all, I happily accompanied El Presidente's men back to the Missionary House. They obviously didn't get to handle guns too often, for they spent the whole trip arguing over whose turn it was to carry them and look like the big cheese. Finally we arrived at the camp, whereupon they immediately set about searching the tackle sacks, looking for the "evidence" they'd been sent to retrieve. This they quickly found in the form of two Croll chest ascenders, which they clearly mistook for gold.

In contrast to many of the locals, El Presidente's men are often very unfit, and our return journey carrying three rucksacks and five tackle bags seemed interminable. They were still arguing over whose turn it was to carry the shotgun, but this time because it was too heavy. On reaching town we headed straight to El Presidente's office, where they excitedly produced the "evidence" for their leader. He was clearly less impressed, particularly when I demonstrated how they were used to climb the ropes, and it was obvious even to him that we weren't the cave robbers he'd been promised. However, to keep face he ordered that we be held in jail for another night, although as soon as everyone was safely tucked up in bed he quietly let us out and put us on a truck headed out of town.

Arriving back in Mexico City, our local contact advised us that it would be a good idea for us to disappear for a week or so, just in case some local bigwig got the bright idea of putting us up for a show trial. He suggested Acapulco. There we met another missionary, who told us that even though he was a man of God, he wouldn't set foot in that area without a gun.

—Bob Cork

One of a hundred entertaining caving stories in *Is That So?: A Selection of Tales from Caving's Legendary Nutters, Characters, Pissheads, and Selfless, Generous, Rough Diamonds*," edited by Rob Taviner, published 2010 by the Mendip Cave Registry and Archive.

J2 2009

Kasia Biernacka and Bill Stone

No one wrote an article for the AMCS on this major expedition. The NSS News *issues for January and February 2010 contain long articles by Jon Lillestolen, Matt Covington, and Jose Morales. The material that follows has been assembled by the editor, with photos selected from over three thousand taken during the expedition—the curse of digital cameras. The first part reprints an article by Kasia Biernacka in* Polish Caving 2005–2009, *published 2009 by the Komisja Taternictwa Jaskiniowego Polskiego Zwiazku Alpinizmu (Caving Commission of the Polish Mountaineering Association) for the 15th International Congress of Speleology, pages 19–21.*

Two months in the cloud forest, a couple of weeks underground, diving at –1200 . . . exploration of a deep cave system is underway.

The first wave of team members, including Dr. Bill Stone, the leader of the 2009 J2 Expedition, left on the fourteenth of March from Bill's ranch in Texas. The rest of the team joined them in Mexico, and two days later sixteen members of the expedition set up tents in El Ocotal, a village at the foot of a mountain in the Sierra Juárez, Oaxaca. We needed four more days to pack all the gear and to get permission for caving from the local government. Finally we were ready to go to the mountain. The base camp was set up in the same place as in 2004, 2005, and 2006, a twenty-minute walk from the J2 entrance.

Biernacka: kasia@speleo.pl
Stone: bill.stone@
stoneaerospace.com

The entrance had been found five years before during a reconnaissance trip to this area. That year the cave was explored and surveyed to –391 meters. The next year a depth of 1101 meters was reached, despite finding a sump at –762. Sump 1 (aka the Ex-Sump) was passed first by a scuba diver, but eventually we were able to pass it without diving gear, with our heads partially submerged.

In 2006, exploration in J2 reached a second sump, Sifón de Los Piratas (Sump 2), at a depth of 1209 meters, and the cave had reached a length of about 10 kilometers. During exploratory diving through Sifón de Los Piratas, another sump, Sump 3, was found beyond. Passing Sumps 2 and 3 and continuing exploration of the air-filled passages beyond were the goals of this year's expedition.

We hoped that the passages beyond the sumps would lead toward the conjectured extension of Cueva Cheve, which is less than a kilometer away. A connection of J2 and Cheve would be a step toward a connection of Cheve and its resurgence, Cueva de la Mano, which would result in a depth of 2540 meters. The 2009 expedition to J2 was a part of Proyecto Cheve, led by Dr. Bill Stone and the US Deep Caving Team.

Marcin Gala and I met Bill Stone in Mexico in 2001, and since then we have participated is many of his expeditions to Mexico. This year we also invited Magda Aksman, Lucyna Cieślik, Marcin Derlatka, and Paulina Olinkiewicz to go with us to the cave hidden in a cloud forest.

Once the base camp was made, we started to check the ropes in the cave and improve the rigging in some of the shafts and passages. Then we started to transport the camp gear, the food, and the dive gear from the entrance to the Sifón de Los Piratas. This mission required complicated logistics and a coordinated effort of all the thirty members of the team. J2 is wet, 10 kilometers long and difficult. Its beginning is tight. At –762 meters we had to swim through Sump 1, which was so narrow that we had to take off our helmets. Before we arrived at Camp 2A, we had had to swim through a couple

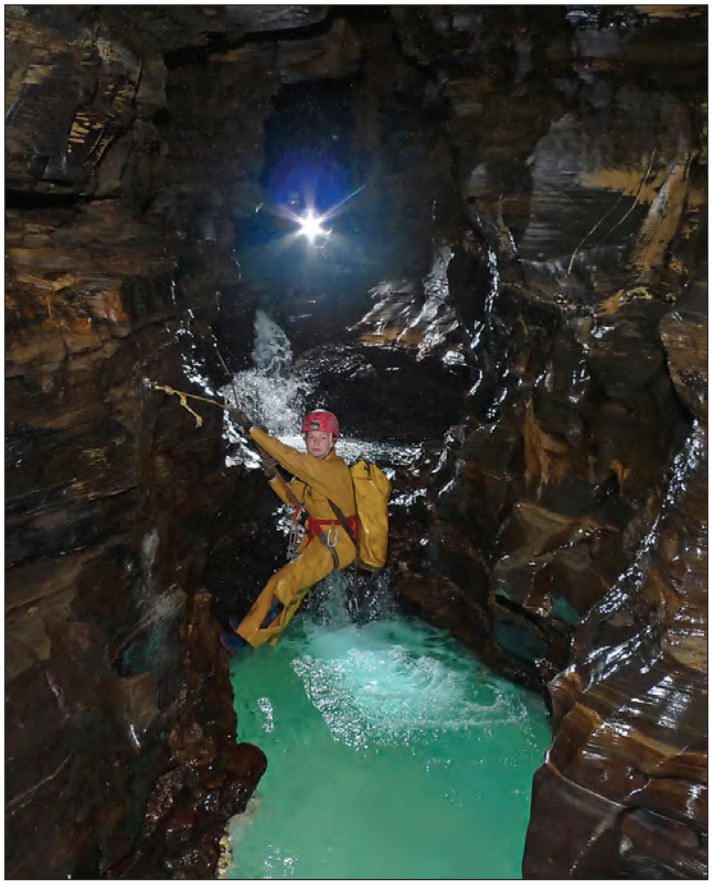
James Brown and José Morales preparing for the initial 2009 dives in Sump 2. *Bill Stone.*

Above: A trail thought the jungle. *Will Heltsley*.

Above left: José Morales talks on a Michie phone to the cave from base camp. *Mike Pugliese*.

Below left: Matt Covington passing rebelays in the Jungle Series. *Marcin Gala*.

Below: Kasia Biernacka, Yvonne Droms, and Mark Minton at the kitchen table in base camp. *Bill Stone*.



Nikki Green traverses a rope above one of the beautiful pools in the Jungle Series. *David Ochel*.

Jon Lillestolen and José Morales prepare rebreathers near Sump 2. *Bill Stone.*

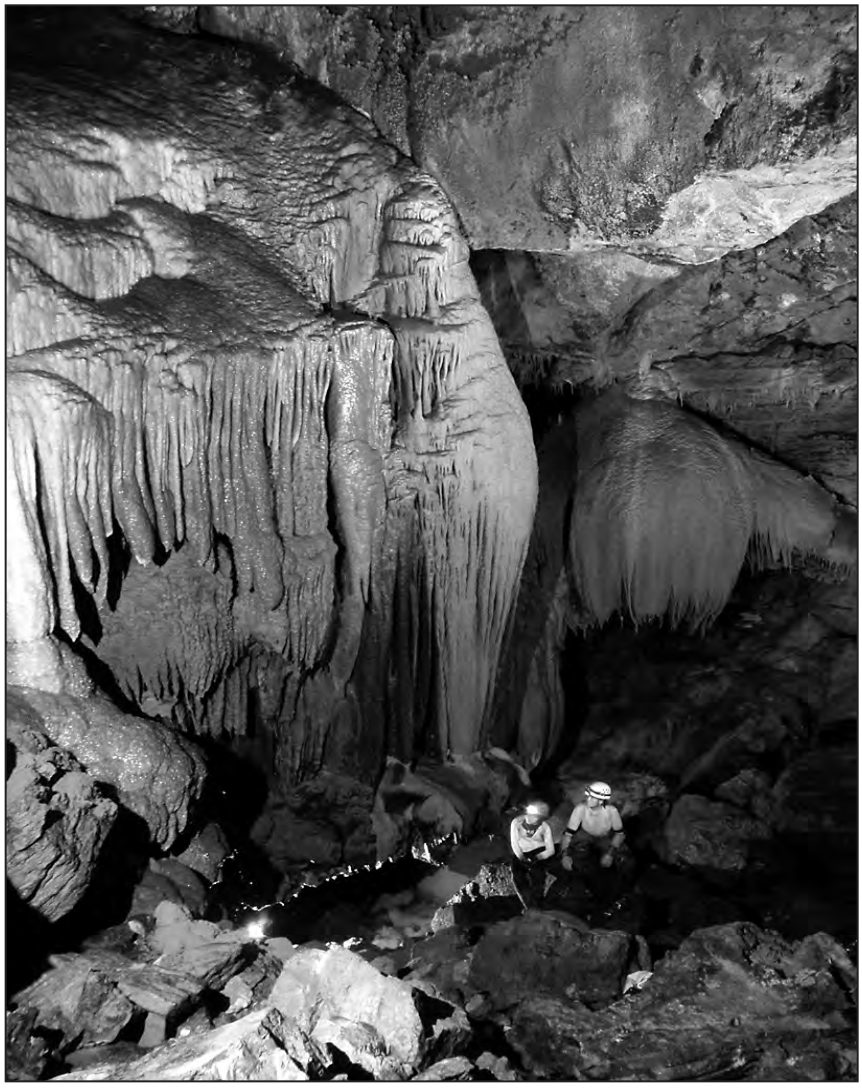
Dive platform at the Sifón de Los Piratas. *Bill Stone.*

A haul team rests in the comforts of Camp 2. *Bill Stone.*

of lakes. To reach Camp 3 from the surface, an experienced caver carrying a heavy duffel bag needs two days. From the camp it takes another two hours to get to the Sifón de Los Piratas. The rock around Sump 2 is very shattered, and therefore there is a danger of falling down and getting a piece of stone in your hand. The hauling trips into J2 took from six to more than ten days, because sometimes we shuttled the gear between the underground camps. We had to interrupt the haul trips two times because of Surprise Sump, a lake just beyond the Ex-Sump that after a heavy rain can cut off the way to the lower parts of the cave. One team had to spend two additional days imprisoned beyond the Surprise Sump.

The Polish cavers were mainly transporting gear. Marcin Gala was also responsible for the rope-work tests that all the participants had to pass before entering the cave. He also checked out the proper rigging of the cave.

The main sponsor of the 2009 J2 Expedition was Poseidon Diving Systems, which supplied us with six brand-new briefcase-size Mk6 rebreathers. The Mk6, at less than 15 kilograms, allows the diver to work underwater for over three hours at 60 meters depth. Pre-expedition training on the rebreathers took place in Texas in October 2008 and March 2009. The divers used another innovative piece of equipment, composite tanks made by Structural Composites Industries. As they weigh not much more than a bottle of mineral water, the 3-liter "plastic" tanks were a big advantage during the hauling.



La Boca del Bigoton. *Bill Stone*.

After one month of the expedition, all the diving gear had been transported to the Sifón de Los Piratas. Then the lead divers could start their job. They set the dive line and a rope to transport the camp gear through the sump, 200 meters long with a maximum depth of about 10 meters. On the downstream side of the sump they discovered a fissure that hadn't been seen in 2006 and looked like a possible way to bypass Sump 3.

Marcin Gala and Matt Covington

John Lillestolen squeezes through a tight spot in Last Bash near the 2009 limit of exploration. *Mike Pugliese*.

spent five days beyond Sump 2. They explored 830 meters of new passages, mostly looping, sponge-like, and muddy. The most promising passage was a borehole heading north-northwest. At the end they were stopped by a flowstone wall. Matt free-climbed it, but it seemed to be choked. Then they went back to the lower level, where they swam through a 40-meter-long lake (Lake 41). At the end of the lake they found another sump, with stalactites hanging underwater. As they were short on oxygen, they could not use the rebreathers. So Marcin dived the sump beyond Lake 41 with open-circuit gear. It's very short (25 meters) and shallow (7 meters). At the end of the sump he found an underwater sand dune with ripples, showing a potential flow route. On the other side, Marcin explored another 40-meter-long lake, choked at the end. He thought that there was a continuation of this lead underwater, but due to a shortage of compressed air, he was notable to continue the exploration. When we left the expedition at the beginning of May, another diving team was entering the cave. They wanted to check the underwater tunnels around Lake 41.

In Last Bash, a cave found in April 2005 in the lower part of the J2 valley, close to the junction with the Aguacate Canyon, the depth of 511 meters was surveyed. Travel in it is mostly smooth and vertical, but it has some tight and wet spots as well. It needs another 200 meters vertically and about 600 meters horizontally to connect with J2 near Camp 2A. —*Kasia Biernacka*

The following has been revised from a message e-mailed by Bill Stone to expedition members at the end of the trip. The short first paragraph is from an earlier e-mail from Marcin Gala.

As of May 5 during the 2009 J2 expedition, Matt Covington and Marcin Gala had 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 were pretty sure they had 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.

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 511 meters deep and going. It might connect to J2 around Camp 2A.

The final push was nineteen days underground, beginning on May 5. José Morales and Bill Stone spent seven and a half days of that time in Camp 4. Sump 3 was explored for 170 meters and definitely connects to the head of Sump 4, carrying flow into it. Sump 4 saw three exploratory dives. The first surfaced at 170 meters penetration in an infeeder that was not passable. The second dive searched the north and west walls of the tunnel for possible continuations. The main tunnel was 8 to 12 meters wide and up to 12 meters tall. The continuation was discovered by José in a 5-by-5-meter tunnel on the north wall of the sump about 105 meters in. On the third dive, this was pushed to 350 meters penetration in borehole 8 to 10 meters wide and 5 to 8 meters high. José surfaced in an air-bell, but the tunnel continued shallow below and appears to be rising. Another very large air-bell was discovered at about 200 meters penetration. It appears to have dry borehole heading east and west about 5 meters above the surface of the water. At this point they ran out of diving consumables, and with the team down to only eight and no backup crew on the surface, resupply was not possible. The most striking thing about the final diving push from Camp 4 and the reason it took so long to figure out what was going on is that the cave took a totally unexpected turn to a predominantly 240-degree heading, almost perpendicular to the trend of Cheve. Altogether they mapped about 600 meters of underwater tunnels to add to the dry cave surveyed by Matt Covington and Marcin Gala.

Meanwhile, Yuri Schwartz and Sergey Tkachenko worked on climbing leads from Camp 3. They climbed all of the major dome leads that had remained from 2006. All either connected back into the main passage or ended in breakdown.

While Yuri and Sergey were completing the final climb, Morales and and Stone met with David Ochel, Vickie Siegel, and Nikki Green and

Matt Covington and Marcin Gala in Camp 4, the loneliest spot on the planet. *Marcin Gala*.

José Morales and Bill Stone in Camp 4. *Bill Stone*.

began to derig upwards to Camp 2A. After two days of hauling they reached Surprise Sump and found it closed. Rains had persisted for four days and abated to heavy mists. By this time, Yuri and Sergey had packed Camp 3 and arrived at Camp 2A. They and David Ochel graciously volunteered to return to Sump 2 and retrieve two of the side-mount carbon tanks and hoods and masks to allow for an exit through Surprise Sump. Stone did the first dive and set a phone link. Then Morales and Stone shuttled people through along a 9-millimeter safety rope they had installed, and most of the party moved up to Camp 1. David Ochel and Nikki Green, who cannot dive, remained at the bivouac while we sent a team to the surface for a full-helmet dive system and food. Thanks to the new Michie phones, everyone was able to keep in contact on an hourly basis. Just before the surface team entered the cave with the emergency gear, the Surprise Sump broke, with 10 centimeters of airspace. David then pulled nine duffels of gear through the sump, in addition to the four José had hauled through earlier. It took two more days to derig to the surface.

Final calculation of the surveys gives J2 a depth of 1222 meters and a length of 11,017 meters. Last Bash is 511 meters deep and 795 meters long.—*Bill Stone*

J2 2009

La expedición al Sistema J2 en Oaxaca usó equipos autónomos de circuito cerrado y otros sistemas avanzados de buceo para extender J2 en más de 1400 metros de pasaje más allá del Sifón 2, incluyendo 600 metros de topografía subacuática en los sifones 3 y 4. Se escalaron muchos domos buscando una ruta alternativa al Sifón 2, pero ninguno tuvo éxito. Después de intensas lluvias, algunos grupos estuvieron atrapados por debajo del Surprise Sump ("Sifón Sorpresa"), que no había existido en expediciones anteriores. La longitud de J2 al final de la expedición fue de 11,017 metros, con una profundidad de 1222 metros. Durante este proyecto algunos espeleólogos exploraron una cueva nueva, Last Bash, hasta una profundidad de 511 metros. Se está acercando a la zona del Campamento 2A en J2.

BAT STUDY AT CUEVA CUATA

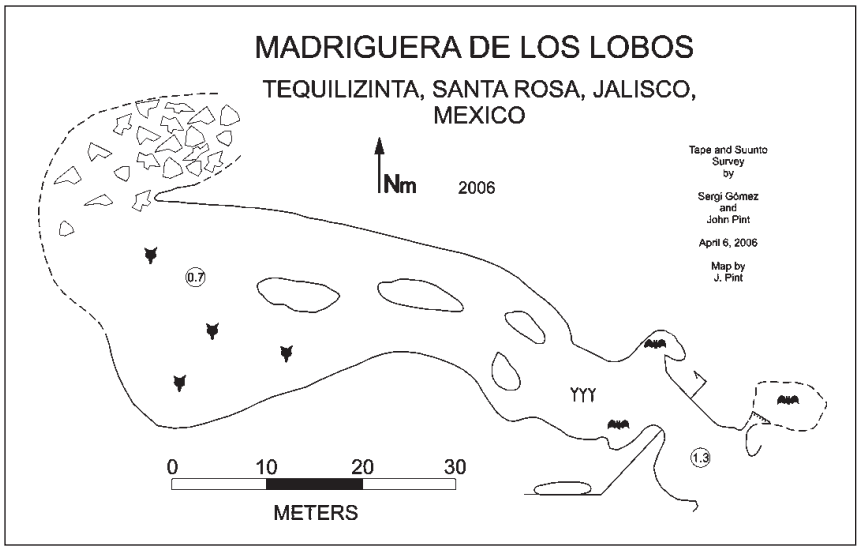
John Pint

At the urging of bat researcher Leonel Ayala, I organized a visit to Cueva Cuata, nestled in the wall of the Tequilizinta bluff in Santa Rosa Canyon. Leonel has been teaching cave biology at the Universidad de Guadalajara for some time and is now starting a new project aimed at monitoring bat populations in all the Jalisco caves he can get to. I told him the biggest bats I've ever seen in Jalisco were in Cueva Cuata, and Leonel was immediately interested. Naturally, I didn't mention that the cave is slightly off the beaten track and you have to climb on an exposed canyon wall to a point about 300 meters above the frothing and filthy Río Santiago. We headed for the cave on Sunday, October 11, 2009. In the expedition were Mario Guerrero, Memo Quiroz, Rodrigo and Bicho Orozco, Cyntia and Rodrigo Esparza, Leonel, and I.

Because Mario was in the group, our first stop, of course, was an Oxxo for breakfast. After that, we drove straight to the new *mirador* 9 kilometers north of Amatitán. From there, in the morning light, we could clearly see the two entrances to Cueva Cuata far, far away in the canyon wall. Next, we drove to La Taberna and began the long hike to Tequilizinta. The moment we left the path to head to the cave, we crossed a wide area full of *maleza* (underbrush) and pesky rocks you could easily trip over. Here the Esparzas gasped. "Can't you see this is an archaeological site?" they shouted, pointing out various ancient constructions all around us. It sure is nice to have archaeologists along on a trip. New branches had been placed in front of Madriguera de los Lobos, Wolves' Den Cave, making it easy to start the cliff-hanging walk up to Cuata. Upon arrival, Mario and Bicho immediately located a geocache hidden there over two years before. We had fun taking goodies out of the bottle and replacing them with new junk.

Leonel set up a net and in nothing flat caught a little bat that he identified as *Balantiopteryx plicata*, the gray sac-winged bat. A big altar still stands in the entrance room of the cave, and anyone who wants to know the history of our visits to Cuata and Tequilizinta should read http://zotz2.orgfree.com/subterraneo/revista6/endworld/endworld.html.

While the others admired the magnificent view from the cave entrance, Leonel and I crawled to the Black Lagoon to measure the temperatures of the water (26°C) and air (27°C) and the humidity (81%). Along the way, we stopped to listen to normally inaudible bat sounds with a device that Leonel uses to help identify bats by their calls. In both of the cave's main passages we found remains of the original walls and ceiling of this lava tube. We saw lava stalactites up to 4 centimeters long, lava levees, and lava dribbles. This cave and the Wolves' Den immediately below it are the only lava tubes we have so far found in western Mexico. Curiously, few bats were seen in the cave, although many kilos of insect-eating bats' guano had recently been

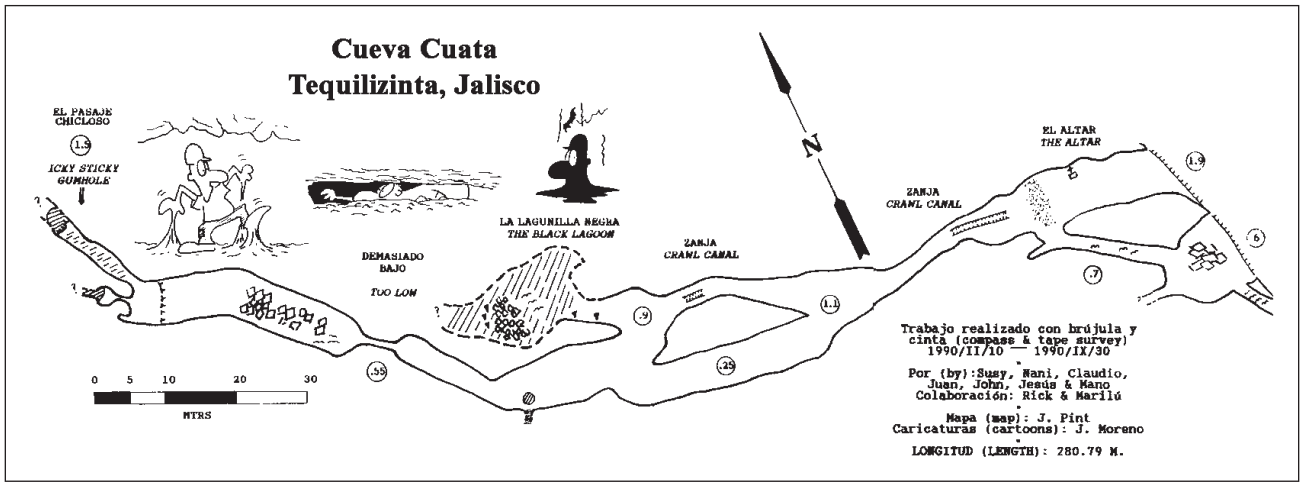


ranchopint@yahoo.com

The map of Cueva Cuata is from http://zotz2.orgfree.com/subterraneo/revista7/cuata/cuata.html. It was originally published in *Subterráneo* number 7, 1991. The map of Madriguera de los Lobos is from http://www.saudicaves.com/mx/madri/map.jpg.

The two entrances to Cueva Cuata. *John Pint*.

Lava stalactites, dripping due to the high humidity in the cave. *John Pint*.



deposited in the entrance room, and fresh traces of vampire goo could be seen everywhere deeper inside the cave. And those big bats? Sorry, no show. Nevertheless, Leonel's survey has been launched, and we hope lots of useful information will result.

John Pint.

Estudio de murciélagos en la Cueva Cuata, Jalisco

Cueva Cuata y Madriguera de los Lobos son dos pequeñas cuevas volcánicas en el Cañón Santa Rosa, Jalisco. La Cueva Cuata está bastante por arriba del piso del cañón y fue visitada para estudiar los murciélagos presentes. Se notó bastante guano, pero pocos murciélagos en ese momento.

NEW DISCOVERIES IN UNDERWATER CAVE SYSTEMS IN THE RIVIERA MAYA

Zdeněk Motyčka

Ten members of the Czech and Slovak Speleological Societies (Česká speleologická společnost and Slovenská speleologická společnost) continued exploration of underwater cave systems in the Mexican Yucatan Peninsula during February and March 2006 and again in October. The first expedition started with work in Cenote Cangrejo, where the way on had been found in 2005. Members of the expedition did several dives during the first week and discovered almost 1000 meters of new passage. During the second week they found a connection to Cenote Ich-Kin, making the total length of the system 5131 meters. The main parts of Sistema Cangrejo are three parallel 1-kilometer-long tunnels. A maze connects the middle and southern tunnels, while between the northern and middle tunnels there is only one route.

After these finds, the main effort switched to Sistema Joolis, found in 2004 and explored then to 3.5 kilometers. During several dives, 700 meters of survey were added in the Hoyt section and 1.3 kilometers in the Polo section. So the total length of Joolis is now 5.3 kilometers. Sistema Joolis has no prominent direction and consists of a labyrinth of large and small passages.

For the last two weeks, the expedition moved to Cenote K'oox Baal, which had been explored by members of the Quintana Roo Speleological Survey between 2002 and 2004. During several dives, a huge tunnel up to 6 meters high and 40 meters wide was discovered, and 3 kilometers of new cave were mapped. Bil Phillips of the QRSS continued exploration after we had to leave and discovered another kilometer and bones of a prehistoric mastodon.

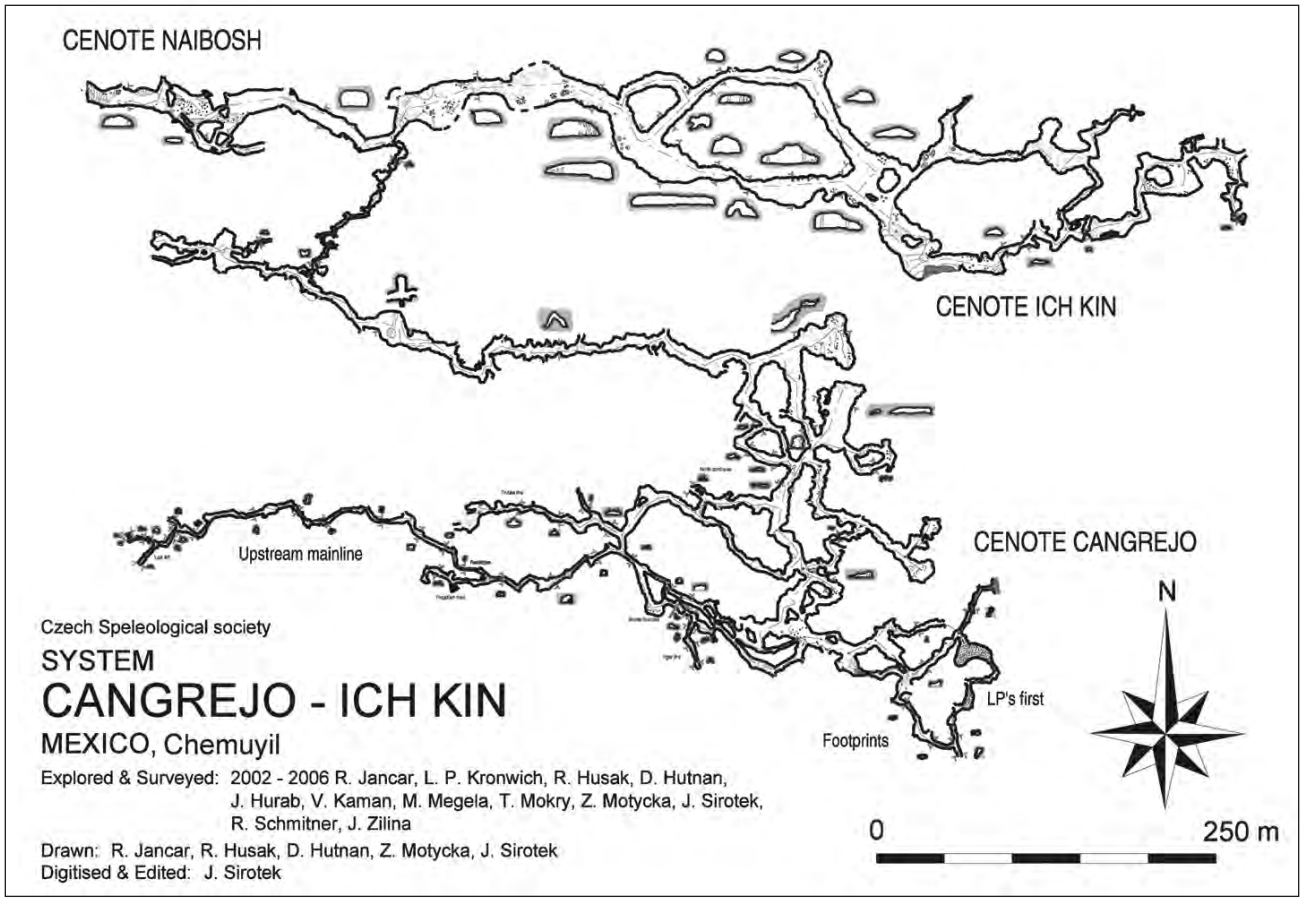
In October, another expedition began diving in a couple of the southern entrances to the system. From Cenote Castillo, more than 1 kilometer of new passage was explored. After they managed to obtain permission to enter the main entrance to K'oox Baal, exploration in the northern part resumed. The mastodon bones were documented, and then another kilometer of new cave was discovered. The total length of K'oox Baal at the end of 2006 was 9.8 kilometers.

In 2007, the main effort was focused on exploration in K'oox Baal, beginning in the western part, where a tunnel heading northeast-southwest had been found. The westernmost parts of the cave are a maze of connecting corridors, and all pushes in that directions ended in low restrictions. To the southwest, some progress was possible, but the initially huge central tunnels led to smaller passages that eventually became too small. In spite of this, 7 kilometers of new cave was found in the western and southern parts of the cave. Besides the new passages, an animal skeleton was found 1 kilometer from the entrance.

During the second part of our expedition, after evaluating the discoveries in the western part, we hoped that a similar situation might exist to the east of the main passage as well. We were successful in finding a small hole in the east wall of the main passage that led into a parallel passage, also trending northeast-southwest. The width of this passage is 30 meters and the height 6 meters. At its northeastern end is a huge collapse, while to the southwest it led to a new large cenote. Additional pushes discovered other passages to the east, but just small ones. One of them leads to the same new cenote. By the end of the expedition, we had discovered 3 kilometers of new corridors in this part of the cave, and the total length of the Sistema K'oox Baal, Quintana Roo, had reached a respectable 19,178 meters.

At the end of February 2008, another expedition to the Yucatan began, again aimed at the exploration of underwater caves in Quintana Roo. After the 2007 success, when we had added almost 10 kilometers to the K'oox Baal system, this year we wanted to focus on a possible connection between it and Sistema Joolis, because known parts of the two caves were only a few meters apart. Several dives into the northern part of K'oox Baal failed to find a route, however, and pushes in the western part of the system did not bring discoveries of any sizable new passages. Nevertheless, we managed to extend the length of the cave by almost 1 kilometer to the current 20,087 meters. [The 2010 length of the K'oox Baal system is 28,296 meters,

Revised from a paper in the proceedings of the fifteenth International Congress of Speleology, volume 3, pages 1845–1847. The English abstract appears elsewhere in this issue of the *Activities Newsletter* and is not repeated here.



according to the Quintana Roo Speleological Survey's web site.]

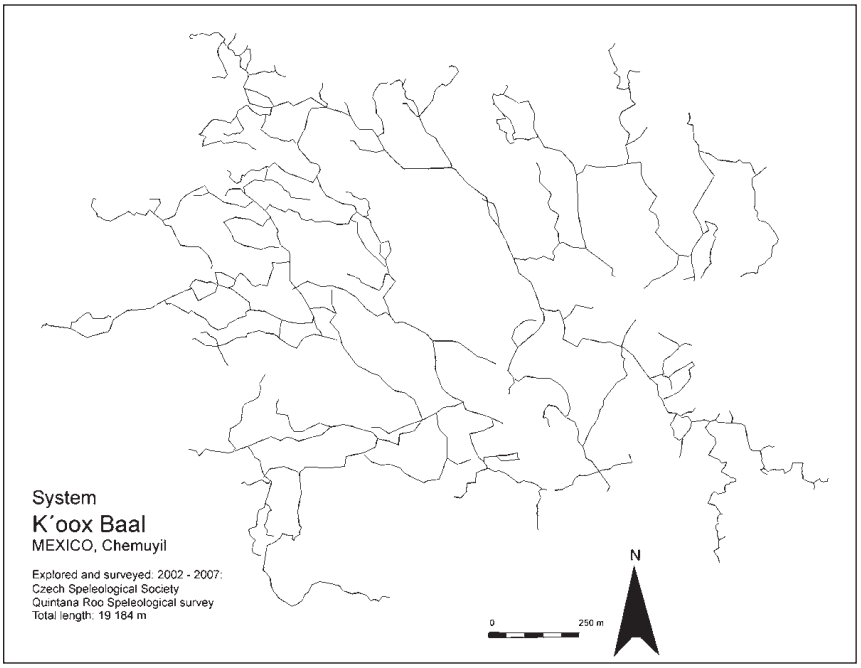
During one dive we discovered the skeleton of a large animal. This happened during a detailed survey on one of the last dives in the western part of the cave. It is an almost-complete skeleton lying on its side. The skull is 35 centimeters long and has substantial teeth. All the parts of the skeleton are covered by a thin layer of calcite, which has probably protected the skeleton from damage since the passage flooded. The animal had to live during the time when the cave was dry, probably during the last period of low sea level about eighteen thousand years ago. Experts have examined photographs of the find. Professor Oldřich Fejfar of the science faculty at Charles University in Prague identified the skeleton as that of an extinct sloth of the family Megalonychidae. But Greg McDonald, natural history consultant from the Park Museum Management Program of the U.S. National Park Service, thinks it may be a new genus.

Also, one new cenote was found. The entrance serves its owners as a water source. With their permission, we made the first dive into this cenote, which is called Agua Guadalupana by the owners. After 20 meters though a narrow, almost vertical rift, we got into larger passage. Step by step we discovered 650 meters in the next few days and connected it to Sistema Joolis, which is now 5908 meters long.

From 2006 through 2008, the Czech Speleological Society's four expeditions spent fourteen weeks in Quintana Roo and surveyed 25

The skeleton in K'oox Baal.
Radoslav Husák.

kilometers of new underwater passages. Participants were Jiří Huráb, Radek Husák, Daniel Hutňan, Radek Jančar, Vit Kaman, Michal Megela, Tomáš Mokrý, Zdeněk Motyčka, Jan Sirotek, Kamila Svobodová, and Jan Žilina. Special thanks to Bil Phillips, Robbie Schmittner, Nadia Berni, and David Sieff for their friendship and help and to all the landowners for their understanding.



Nuevos Descubrimientos en Sistemas de Cuevas Subacuáticas en la Riviera Maya

Entre 2005 y 2008 expediciones organizadas por la Sociedad Espeleológica Checa descubrieron varios nuevos sistemas de cuevas y pasajes subacuáticos en el área de Chemuyil en la Riviera Maya, que es parte de la zona costera oriental de la península de Yucatán. Estas expediciones descubrieron, exploraron y topografiaron 17 km de pasajes nuevos en el sistema Koo'x Baal, 3 km en el Sistema Joolis y un sistema nuevo fue creado al conectar los cenotes Cangrejo e Ich Kin. Fueron descubiertos varios esqueletos y huesos de animales, incluyendo el sorprendente descubrimiento de un esqueleto completo de un animal nuevo, una especie de perezoso gigante, en el Sistema Koo'x Baal. Todas las cuevas fueron topografiadas, se crearon mapas y hay un extenso archivo fotográfico.

History

NOTAS SOBRE LA CAVERA DE CACAHUAMILPA, DISTRITO DE ALARCÓN, ESTADO DE GUERRERO

por el Sr. Fernando Urbina

Con motivo de la formación de un abismo que resultó de un hundimiento ocurrido en el Distrito de Tetecala, Estado de Morelos, tuve la oportunidad de visitar esta región en compañía de los Sres. Ings. Teodoro Flores y Trinidad Paredes.

Como el hundimiento se efectuó en calizas y estando ya cerca la Caverna de Cacahuamilpa, que se ha formado también en calizas nos vimos obligados á hacer un rápido reonocimiento á dicha caverna y á los hundimientos que existen en los alrededores.

Por lo tano nuestro objeta era ver los efectos de las aguas infitrantes en esta caliza y no el hacer un trabajo detallado que permitiera dar la descripción completa de la caverna.

La forma que afecta es la de un cañón sinuoso que en los lugares donde se ha ensanchado ha formado las galerías abovedades llamadas salones. Esta forma nos dió una idea relativa del trabajo destructor de dichas aguas infitrantes sobre las grietas preexistentes.

La caverna ha sido decorada, como tadas las de su especie, por los depósitos estalactíticos y estalagmíticos que representan el trabajo de reconstrucción de estas mismas aguas. Los nombres que reciben estos depósitos son, como ya lo sabemos, de un carácter universal, y solamente dan una idea de la forma que adquirió el carbonato de cal al depositarse.

La forma general y disposición de esta caverna nos hizo presumir que seguramente fué el lecho de un antiguo río subterráneo. Algunas personas creen que fué el antiguo lecho de río Tenancingo.

Respecto á los fósiles directos ó que están continidos en las capas en que se formó la caverna, solamente encontramos impresiones de Nerinea y moldes de Acteonella en el salón del Trono.

De los indirectos ó restos de animales que se han depositado otra vez, después de la formación de la caverna, y vuelto á fosilizar no es fácil encontrarlos á menos que se hagan excavaciones.

Por lo anterior se ve que lo único que puede decirse hasta abora respecto á la edad de la caverna es: que se ha formado en capas de calizas referidas al mesocretácico y que no se conoce cuando se formó.

NOTES ABOUT THE CAVE OF CACAHUAMILPA, ALARCÓN DISTRICT, STATE OF GUERRERO

by Mr. Fernando Urbina

Given that an abyss was formed after a ground collapse in the District of Tetecala, State of Morelos, I had the opportunity to visit this region along with the engineers Mr. Teodoro Flores and Trinidad Paredes.

Since the sinkhole was in limestone and we were in the proximity of the Caverna de Cacahuamilpa, which is formed in limestone as well, we reconnoitered the cave and the sinkholes in its surroundings.

The objective, then, was to observe the effects of infiltrated water in this limestone and not to produce a detailed description of the cave.

The general shape is that of a meandering canyon that in some sections has been enlarged, forming domed halls. This shape gave us an idea of the great power of the infiltrated water flowing through preexisting cracks and fractures.

The cavern has been decorated, as in most caves, by stalactites and stalagmites, which represent the building power of these waters. The names of these deposits are universal, and they only describe the shape acquired by the calcium carbonate upon deposition.

The general shape and layout of the cave made us assume that it was an ancient underground river. Some people believe that it was the old bed of the Tenancingo River.

Regarding the fossils that are directly found in the layers of rock where the cave was formed, we only found vestiges of Nerinea and Acteonella in the Hall of the Throne.

Fossils that are deeper in the rock or animal remains buried in the silt after the cave was formed are harder to find and would require excavations.

Therefore the only thing we can say about the age of the cave is that it is formed in layers of limestone of middle Cretaceous age, but it is not known when it was formed.

Boletín de la Sociedad Geológica Mexicana, volume 5, 1909; http://boletinsgm.igeolcu.unam.mx/epoca01/1909-5urbina.pdf. A twenty-four-page article on the cave appears in volume 6 of the same journal, /1909-6-2flores.pdf.

2007, FIRST YEAR OF AKTUN HU EXPLORATION

Franco Attolini

At the beginning of January 2007, Beto Nava, Alex Álvarez, and I met for a small project in the western part of the Ejido Jacinto Pat. We had met each other years before during another diving project in Quintana Roo, organized by Nicolai Toussaint. We became good friends, because we were some of the few cave divers in the area who spoke Spanish, although not the same Spanish, because Beto is from Venezuela.

Don Ajelo, a member of the *ejido*, had contacted Alex to see if we could explore some cenotes on his land. The area had been little explored by cavers before, since roads did not exist, but a new road had made the cenotes more accessible, although good walks of at least 500 meters were still needed. That doesn't seem like much when you are carrying only a small backpack, but with two tanks on your back, weighing at least 22 kilograms, it's a different thing. And we carry more than just two tanks. Fortunately, the owner of the property had the excellent idea of buying two ATVs, which hauled the equipment easily along the narrow and rough road. With that help, we decided to begin a week of diving in one of the cenotes there, which Lucio, an employee of Don Alejo's, told us is called Aktun Hu. Being from Tabasco and not knowing Mayan, I didn't know what that meant, but Don Alejo later told us it means Iguana Cave.

It begins as a cenote, not very deep, inside a medium-size cave, an excellent, shady place with a stone floor for assembling equipment and with the water at floor level and easy to just walk down into. Lucio told us that some other people had dived there before, but had disagreements with the owner, who then sought us.

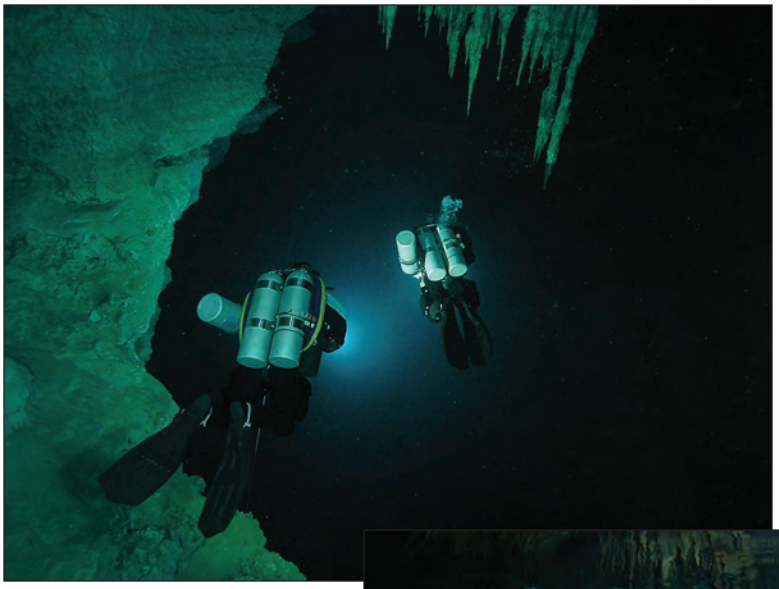
We decided to make a first dive with little equipment to see how the cave went. We wore our double-80s and each carried a stage tank of the same size. We prepared in the water, saw the line that had been laid by the other divers, and, after completing our pre-dive checks, submerged. We followed the line to a narrow place at a depth of about 6 meters and then ascended to 3 meters, where the cave suddenly opened up into a large room full of formations of all sorts. We continued along the line, passing two cenotes, the first one very small and the second medium size. Well before the second cenote, we found a group of stalagmites on the floor of the passage, surrounded by black silt. This group of formations resembled a castle, and for now the area is known by that name. The whole route is very well decorated with white speleothems, including many columns of all sizes—without a doubt a very beautiful cave. The passage is large and at some places measured 15 meters wide and 5 meters high. Having left our stage tanks and without too much gas left, we continued on to the end of the line, approximately 1 kilometer in. We could hardly believe it. The line ended exactly in the middle of a huge tunnel. We quickly took out the exploration reel and began to explore; with the little gas we had left, we could only lay some 150 more meters of line, but enough to see that the cave continued. We had laid our first 150 meters of line in a system that would quickly grow to more than 17 kilometers (57,000 feet).

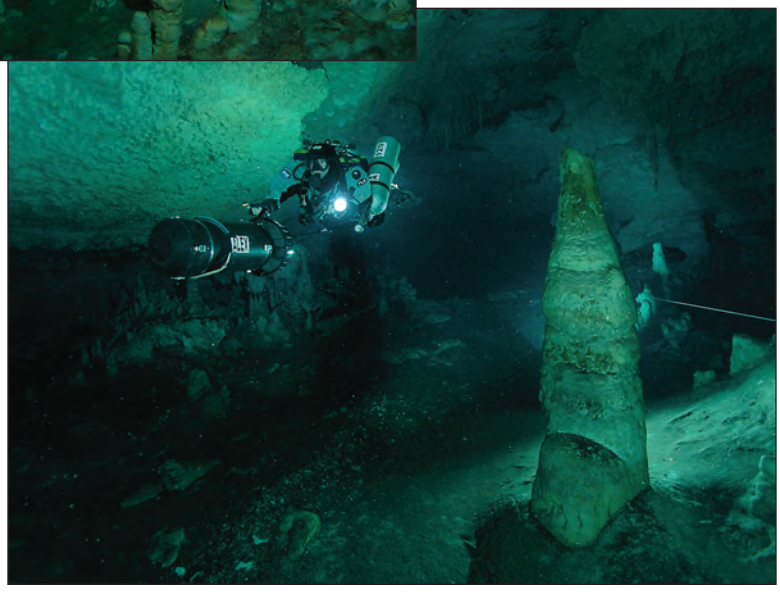
In that first phase of the project, we would survey more than 3 kilometers in Aktun Hu, including the bit more than 1 kilometer of old line.

In May 2007 we were ready for our second assault on the Cenote Virgen, the main entrance to the cave called Outland. On a long, exciting dive the day before, we had followed the downstream line originally laid by Mike Madden in 1992. That line took us through a small passage with strong current and a lot of silt. It was too small for our gear configuration, so we swam back to the entrance. Instead of going out, we recalculated our gas and followed the upstream line, which had also been laid by Madden in 1992. We were almost to the end of that line, where it loops back on itself, when we saw a small passage that the flow was emerging from. Alex tied on the exploration reel and started exploring, I followed behind surveying, and Beto was in the middle. Beto's role was crucial, because separations between divers using DPVs can easily get too large for safety in case of problems. Having Beto between us, free to handle any problems, made our tasks easier and safer. A day of big cave with not enough gas, but we were able to find at least 400 meters of new cave and left the end of the line in wide-open passage just at the formation later famous for its shape as a soda bottle.

On that second day, we decided to carry three stage tanks each, in

attolini.franco@gmail.com





Top: Alex and Franco heading down into Hoyo Negro. Middle: Fred Devos swims beneath an air-bell. Bottom: Alex at the soda-bottle formation. *Daniel Riordan*.

Alex at the bottom of Hoyo Negro. *Daniel Riordan*.

addition to our back tanks, and again use scooters. We carried a good supply of new knotted line. We were excited about what we had already seen, without knowing that today would be even better. We used our scooters to get to the end of the line upstream. That took only about twenty minutes to get to the soda-bottle formation, and we decided to continue on with the scooters, Beto laying the line, me recording survey data, and Alex in between, keeping track of both of us. We continued in very large passage that could be explored quickly, and we arrived at a cenote we had been expecting, because of the organic debris on the floor. We decided to run the line up to the surface to get a more precise survey of its position. It wasn't very large, about 4 by 7 meters at the water surface, which was 4 meters below the ground opening, a fissure about 1 by 3 meters, looking from below like a feline's eye. That's why we named it Cenote Ich Balam, Jaguar Eye. On the surface we chatted briefly to see how we were all doing and where the cave was going.

Alex had already seen which way the cave continued, and he offered to show Beto the way. I had just finished recording the data for our last station when I saw Alex in front of me, excitedly signaling me to change bottles and go down. I was confused. Down where? I could see the floor. What did he mean? Then Beto pointed to my right, and I saw that the floor disappeared. There was a large pit, so wide that our lights could not reach the other side and we could not see the bottom. Everything was black, big, and empty-looking. My heart beat strongly as I recalled the Blue Abyss in Nohoch Nah Chich [see *AMCS Activities Newsletter* 20, pp. 86–87]. We decided to call it Hoyo Negro, like the black holes of space that swallow everything. After a minute of amazed contemplation, we decided that Alex and Beto would go down to the depth limit of the nitrox-32 we had, 36 meters. They descended slowly and nearly stalled at the halocline, where they had to adjust their buoyancy to continue on down to 33 meters. Once there, they began circling the walls with their scooters, while I stayed on the line at the lip of the well to provide a reference point for their return. They spent about four minutes circling, which, as I watched from above their lights play on the walls and floor, was one of the best shows I've ever seen.

After completing their turn, they returned to the top of the well at 13 meters, where we looked around for passages at that depth. We saw two tunnels, one toward the north and the other toward the west, both quite large. We returned to Cenote Ich Balam, barely 120 meters away. We emerged very happy, with huge smiles. We still had enough gas, so we decided to cross the Hoyo Negro to the west, which we did using the last minutes of power in the DPVs. It was 35 meters where we crossed it, and that wasn't the largest diameter. We surveyed some more before returning to the entrance, where we came out still very happy, but not knowing whether that was perhaps the last important discovery in the cave.

On a much-anticipated day in June, we had all our tanks of trimix ready for the Black Hole. The day before, Beto and I had taken some stage tanks to the hole and explored a little in the area north of the pit. When the three of us arrived at the hole, we stopped, adjusted everything, and started down. We left tanks of nitrox-50 for decompression. On the bottom, at 49 meters (160 feet), Beto tied off the line, and I took out the instruments to survey. We laid line across the Black Hole, still 49 meters on the other side, although we were looking for a way to go deeper. We saw a small hole that we did not push because we were hoping for a larger way on down, but we didn't find one. We ascended and decompressed. We didn't leave terribly excited, but were happy with our achievement.

The following day we returned to descend the small hole we had left the day before and also to check the pit more carefully, because it was a large area and we might have missed something. We descended directly to the hole, and because it was a tight place, we decided that only one of us would go to the bottom and the other two would stay partway down, in visual contact. The opening seemed to just be a hole in breakdown, and it went to a depth of 60 meters (197 feet)—definitely one of the best dives I've ever made and the best discovery so far.

Before November 2007 we had four caves in the area, Aktun Hu, about 4500 meters, Cueva Seca, 1400 meters, Outland, 5500 meters, and Fenómeno, 1500 meters. First we connected Aktun Hu to Cueva Seca, and Sistema Aktun Hu grew to nearly 6000 meters. (Cueva Seca

is called that by the locals, but it is not a dry cave.) This was relatively easy, because the two caves had been very close together. Later on, we connected to Outland with a series of dives in a tunnel in Aktun Hu that headed northeast. We had originally doubted that the tunnel would go, but it went far enough to make the connection. Then a couple of dives connected Fenómeno, which was close to the northern part of Outland. After all these connections, Sistema Aktun Hu was 17563 meters long, the seventh longest and third deepest, at 60 meters, in Quintana Roo. The connection of Fenómeno with Outland opened a new door to exploration in the area, because the last dives we made from Cenote La Virgen entrance to Outland had been very demanding, lasting six hours with two scooters and five stage tanks each and complex navigation, including five line jumps and ten line Ts, 3.5 kilometers just to reach the exploration area in the northwest. Now it is only 1.5 kilometers to reach the farthest northwest, where we are exploring a peculiar part of the system, where the flow changes from coming from the northwest to southward. This unusual flow direction indicates that the final chapter on the hydrology of the region is yet to be written. We are very near the Holbox fracture zone, and it will be a real challenge to continue, because it is a very unstable area, with a lot of breakdown and water coming from a bedding plane that has so far been too small to follow.

During 2008 and 2009, several more diving expeditions extended the system, especially in the northern Fenómeno area, by another 12 kilometers, making Aktun Hu the fifth longest cave in Quintana Roo, at 29862 meters. Participants in the project were Alex Álvarez, Franco Attolini, Susan Bird, Fred Devos, Chris Le Maillot, Sam Meacham, Devin McKenzie, Beto Nava, and Daniel Riordan. Special thanks for permission and encouragement to Idelfonso Rodríguez, Ruperto Kumul, and Don Alejo.

2007, Primer año de la exploración de Aktun Hu

Durante el 2007 Alex Alvarez, Alberto Nava y Franco Attolini se juntaron para realizar un pequeño proyecto de espeleobuceo con el fin de explorar cenotes en la zona Oeste del Ejido Jacinto Pat. Se exploró el Sistema Aktun Hu y fue conectado con el Sistema Outland y Fenómeno haciendo de la cueva la 4 cueva más larga de Quintana Roo. Así mismo hicieron un gran descubrimiento de un pozo vertical de 60m de profundidad, el cual nombraron Hoyo Negro.

I. P. N.

MONTE NEGRO, OAXACA

Ricardo Arias Fernández

At the beginning of May 2008, we received an invitation from our mountaineering friend Alberto Floreán Cruz, a former researcher at the Centro Interdiscplinario de Investigación para el Desarrollo Integral Regional (CIIDIR) at the Instituto Politécnico Nacional in Oaxaca and a promoter of the natural beauty of the state. Our first visit to the *municipio* Santiago Tilantongo in the Mixteca region, Nochixtlán district, was from May 1–4. The invitation came because the authorities were interested in the possibility of finding water for the people, which is scarce in the area. On the first trip, we explored three caves located in the high area of Monte Negro, 2200 meters in elevation. The high forest, mainly oaks, is well preserved. The climate is warm, with a rainy season in the summer. Access to the area is by truck from the municipal seat. There are additional caves known in the area that we did not get to. Anyone interested should contact the authorities for permission to enter the area. Cave locations were recorded using a Garmin eTrex GPS, and Suuntos and tape were used to survey the caves.

Sótano Plan de Espino. 17°13′16.2″ N 97°21′01.2″ W, 2273 meters. About 40 minutes by road from town are some ecotourism cabins. About 800 meters farther is an area called Plan Casa de Agua, with a small sinkhole 30 meters across with a small horizontal cave at the bottom. From there, a very pleasant trail leads through the forest for about 500 meters to Plan de Espino. Keep right and continue about 60 meters to a small sinkhole surrounded by trees, which we used to rig our rope. Sótano Plan de Espino is a pit 33.6 meters deep, with a floor of mud covered by lots of leaves, pieces of wood, and skeletons of small animals. It is a very pleasant pit that could be used for ecotourism with the right gear and safety precautions.

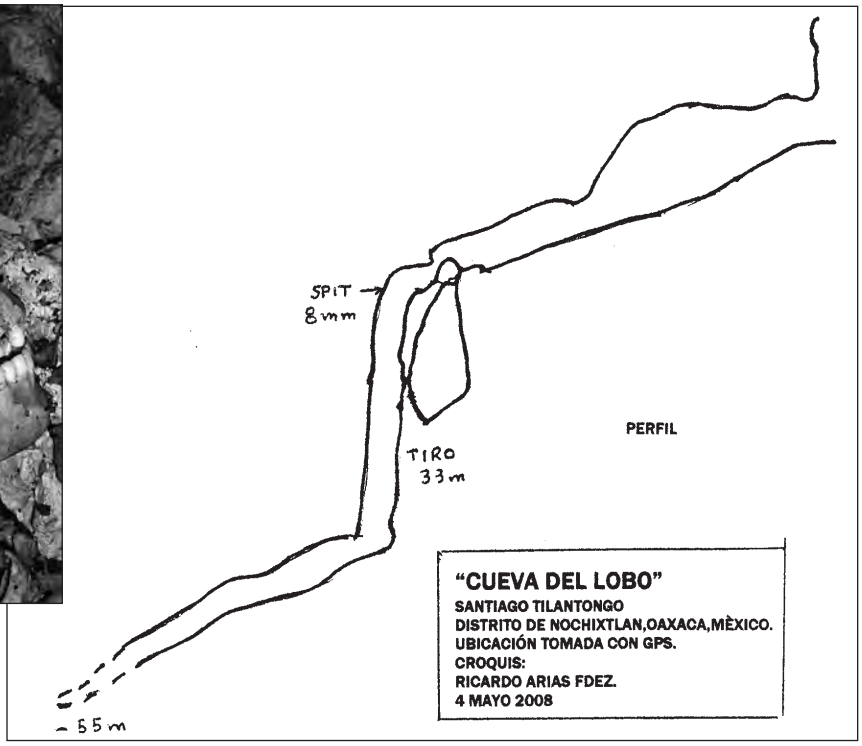
Sótano de Tierra (Sótano de los Muertos). 17°13′37.0″ N 97°20′32.4″ W, 2791 meters. In the opposite direction from the cabins is another road. The cave is about a 10-minute walk from a parking place 300 meters down this road, in a sinkhole that contains an entrance 4 meters is diameter surrounded by oaks, one of which we used to rig the cave. The drop begins with 7 meters down the slope of the conical sinkhole to a 1-meter opening, and then it opens up to a 40-meter drop into a bell-shaped room. The drop ends on a large cone of dirt, mud, and organic debris. The floor of the cave is approximately circular, with an irregular floor 80 to 90 meters in diameter. Close to the wall we found ten human skeletons, well preserved, especially the skulls. We searched the mud and crevices for signs of ceramics or other ritual objects or clothing, but found nothing. Perhaps any clothing had disintegrated because of the conditions in the cave. It is not known whether the people were dropped into the cave as a burial ritual or whether they were thrown in alive. Perhaps in the future, if the people in the community allow it, expert forensic anthropologists could study the remains.

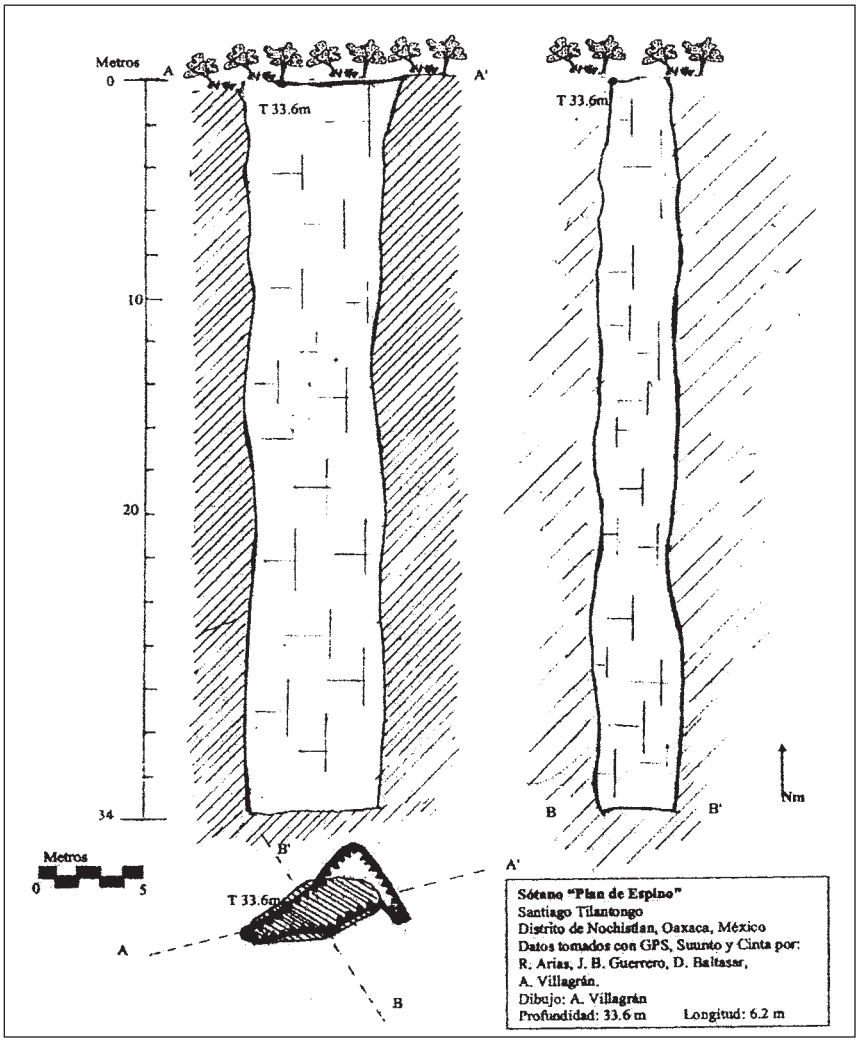
Cueva del Lobo. 17°14′03.7″ N 97°20′21.8″ W, 2624 meters. The cave is located in an impressive sinkhole 35 meters wide and 95 meters long. In a wall on its southeast side there is an entrance 4 meters wide and 5.5 meters high that seems to capture a large amount of water during the rainy season. The passage slopes downward and splits after about 30 meters. To the right, the passage becomes too narrow after 15 meters.

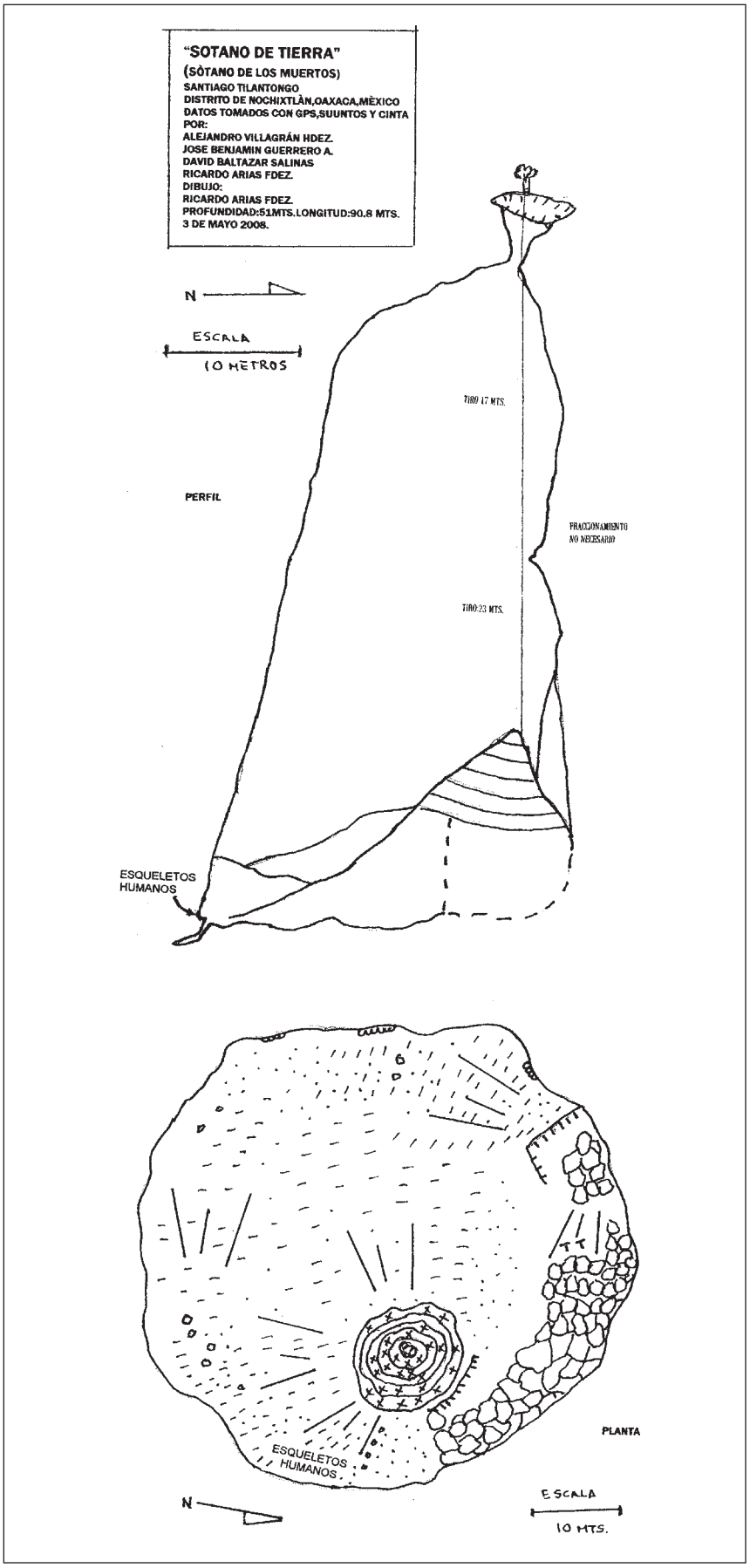
The entrance to Cueva del Lobo.
José Guerrero.

ricardoespeleo@hotmail.com
Based on an English translation by Oscar Berrones.

Skull in Sótano de Tierra.
José Guerrero.







To the left, there is a very narrow crack, and 15 meters beyond there is a short step down 2 meters to the top of a 33-meter pit, which we rigged with an 8-mm bolt. This drop gives access to a very well decorated room. At a total depth of 55 meters the cave becomes too narrow to follow.

Monte Negro, Oaxaca

Esta zona, cercana a Santiago Tilantongo, fue visitada ante la invitación de las autoridades locales en mayo de 2008. Tres cuevas pequeñas fueron visitadas y topografiadas.

PRELIMINARY DEVELOPMENTS FOR KARST PROTECTION IN QUINTANA ROO, MEXICO

James G. Coke IV

The state of Quintana Roo occupies the eastern portion of the Yucatan Peninsula, proximal to the Caribbean Sea. As a small region of the Yucatan Platform, it consists of a low-relief, pitted karst plain containing few surface drainage systems or lakes. A steady rise in elevation is observed from the coastal perimeter, 3 meters above sea level, to its inland borders with the states of Yucatán and Campeche at nearly 30 meters above sea level (Lutz et al., 2000). The sequence of limestone stratigraphy of Quintana Roo is not well documented, but it has parented a stable platform that is receptive to the mechanisms of speleogenesis. Crowned by dense tropical scrub forest, the area receives an average of over 150 centimeters of precipitation per year (Ward and Weidie, 1978; Ward, 1985; Tulaczyk et al., 1993). Approximately 10 percent of the precipitation filters through the topmost calichified limestone layer and into lower fractured strata. The remainder is lost to evapotranspiration. Acidified by atmospheric carbon dioxide and tannic acids from the calichified zone, precipitation meets a shallow freshwater aquifer where it is directed through bedding fractures and joints towards the Caribbean Sea. The process of aquifer recharge encourages conduit dissolution in the parent limestone strata, while conveying pollutants to ocean discharge vents (*caletas* and *lagunas*).

Underwater cave systems in Quintana Roo are considered to be anchialine caves. These caves contain pools of salt or brackish water that fluctuate with ocean tides, without a surface connection to the ocean (Holthuis, 1973). Anchialine caves in Quintana Roo contain an upper lens of freshwater that flows over a near-static saltwater intrusion. A mixing-zone occurs at a well-defined density interface. Both the depth of the interface and the thickness of the freshwater aquifer increases with distance from the coast. Periods of sustained precipitation, ancient sea-level fluctuations, and modern oscillations in ocean tides encourage random depth variations of the mixing zone. Investigators conclude that inherent fracture-zone speleogenesis coupled with preferential dissolution of limestone at the mixing zone produces an accelerated growth in size and complexity for these anchialine caves (Back et al., 1986).

Modern underwater cave explorations in Quintana Roo commenced in 1979. Although two small caves were mapped, reports from two independent expeditions were discouraging about significant cave development in the area. Explorations were resumed in 1985 by a small group of expatriates residing in Quintana Roo. By 1989 six cave systems were under exploration, having a combined length of over 50 kilometers. With endless possibilities for exploration, over thirty-eight cave systems (370 kilometers) were under investigation by 2001. In 2009, eighty-eight cave systems in Quintana Roo were recognized. With the addition of eighty-nine single-entrance caves, over 755 kilometers of underwater cave passage was documented in this region. Two caves, Sistema Ox Bel Ha and Sistema Sac Actun, are among the ten longest caves in the world. Three of the five longest caves in Mexico are in Quintana Roo, including the two longest caves in Mexico (Quintana Roo Speleological Survey, 2009).

The majority of explored underwater caves in Quintana Roo (over 85 percent) are situated in the *municipio* of Tulum. The municipality contains an expanding assemblage of coastal tourist resorts and services, all dependent on a substantial workforce situated in designated towns inland from the resorts. Obligations to provide the increasing population with residential zones, storm-water drainage systems, roads, municipal water supplies, and sanitation systems are overwhelming local administrations. State and local agencies have offered preliminary strategies to address future infrastructure needs. However, specific measures to provide environmentally sound designs for sewage and rubbish disposal are not outlined in the proposals. These plans also designate large tracts of jungle to be cleared for future urban and residential intensification. Georeferenced cave surveys demonstrate that proposed areas for urban expansion will intrude on territories that incorporate important caves and aquifer drainage complexes.

A further concern is mismanagement of cenote entrances and

chac@consolidated.net

This paper, without illustrations, appeared in the proceedings of the 15th International Congress of Speleology, volume 2, pages 1092–1095. It has been lightly edited. The original abstract appears elsewhere in this issue and is not repeated here.

A cenote within a resort complex. The underwater cave is beneath the building. *Steve Bogaerts*.

excavation of caves, with subsequent distress placed on the cave environment and aquifer. All cave entrances in the municipality are located on private property or on collective lands owned by a local community (*ejidos*). Both private and *ejido* landowners are eager to capitalize on an expanding ecotourism economy. Alterations to cenote entrance areas range from clear-cutting of trees and undergrowth to more damaging practices where small cenotes are excavated by heavy machinery to increase their size and, speculatively, value as tourist attractions. Freshwater currents in the aquifer transport disturbed silts and biological materials from excavation sites to distant areas of the cave. Laws that prevent cave modifications or safeguard aquifer quality are ineffective and often circumvented.

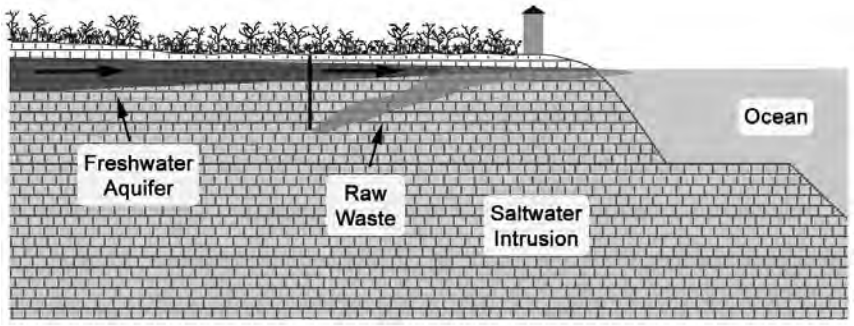
Education for local residents concerning the karst environment is clearly essential. Unfortunately cave explorers in the municipality were generally disinclined to provide more than a casual summary of their activities until recent years. Today they are assuming a more effective role in collaborative efforts with emerging citizen groups by sharing georeferenced cave maps, visual media depicting existing conditions within the cave environment, and hydrological data concerning the municipality and the city of Tulum. This knowledge allows citizens in the municipality to scrutinize applications for building permits and governmental development plans as informed individuals.

Broken building-support column in an underwater cave. *Steve Bogaerts.*

Accelerated growth in the tourist industry places key demands on the coastal karst of Quintana Roo. Physical damage to caves may occur during the initial construction of resort complexes. Government regulations calculated to limit construction above shallow subterranean voids are ambiguous and problematical to enforce. Resorts are designed as elaborate compounds of oversized buildings; these are normally sited along a narrow strip of coastal property that can include *caletas*, cenotes, and ocean bays. Limestone deposits along the coast consist of thin or unconsolidated strata of Pleistocene or Holocene origins. The water table is encountered within a few meters of the surface. Construction techniques for large building complexes on the coast call for an extensive array of deep foundation columns to maintain their structural integrity. Cave explorers have documented the consequences of this construction technique. Foundation piers have been found to pierce the surface strata into underwater cave conduits of varying size. They may continue into strata below the cavities or rest on the conduit floor, according to observations by Steve Bogaerts, Bil Phillips, and Robbie Schmittner. Many piers are shattered or contain fractures where they meet the conduit's floor. This can transfer the weight of the structure to weaker surface strata above the voids, precipitating a collapse of the cave passage and building. Resort developers are largely unaware of karst characteristics below their properties. However, their investment in developing a site for a potentially high return often overrides concerns for coincidental damages to a cave or aquifer. Nearly all resorts prohibit trained divers from entering cave entrances on their property; this prevents unwanted publicity about

the stability of their buildings and the condition of the caves below their lands.

Expansive tourist complexes rely on expeditious methods to manage wastewater and rubbish. Hotels and resorts vented raw sewage to the Caribbean Sea until this became an indefensible and illegal procedure. Deep-injection wells (*pozos profundos*), artificial wetland systems, aerobic digesting systems, and traditional anaerobic systems with leaching fields are unsatisfactory methods when disposing high volumes of solids and wastewater. The region's shallow and vulnerable karst aquifer lacks protective soil cover for traditional near-surface disposal systems. Deep-injection wells pump freshwater waste slurries into the deep saltwater intrusion zone. These slurries are inclined to rise from the containment area to the upper freshwater aquifer, allowing freshwater currents to disperse raw sewage over a wide area. Closed sewage systems require scheduled removal of residual solids to environmentally secure holding ponds lined by impermeable materials. Yet the current volume of residual solids that are produced by residential and tourist centers already surpasses the capacity of existing ponds to contain the wastes safely.



Current rubbish disposal methods are also strained. Recycling programs within resorts and the rest of the Tulum municipality are in their infancy, existing more as a symbolic gesture than as an effective campaign. Business and public participation in recycling is minimal, given a low level of public awareness and a negligible infrastructure for area-wide recycling. Rubbish disposal in the area utilizes unlined landfills that are situated in deserted limestone quarries. These quarries were excavated to within centimeters of the water table to provide materials for past highway construction. As open pits, they are attractive sites for depositing large quantities of rubbish. This includes automotive lubricants and batteries, medical refuse, construction materials, and oil-based paints. Without an impermeable barrier between the refuse and water table, rainfall extracts pollutants from the trash and delivers them to a highly vulnerable aquifer. Wells for monitoring groundwater quality near landfill areas are not employed. This practice may prove to be disastrous for the city of Tulum. Their water supply is dependent on a series of interconnected wells that draw from the same aquifer that is found beneath the present landfill. Less than two kilometers of porous limestone separates the landfill from the municipal water supply [see the map on page 83 of *AMCS Activities Newsletter* 32].

The ceiling of a cave passage has been removed to provide a snorkeling tour at the Xcaret resort. *Promotora Xcaret*.

State and Mexican federal economic policies are focused on sustaining a growing tourism industry, specifically along the narrow coastal strip adjacent to the Caribbean. To succeed in this strategy, a large and sustainable labor force is key to meeting the needs for future tourist services. Massive projects are being planned to enlarge inland urban and residential areas in the Tulum municipality. The cities of Akumal and Tulum are projected to absorb nearly one million workers in coming years. These plans raise many fears about a balanced scheme for regional planning, while ensuring a responsible stewardship of a unique and irreplaceable karst environment. Urban and residential areas in Tulum city are expected to expand threefold, yet provisions for municipal sewage, surface drainage, and secure water supply systems go unaddressed. Cave divers provide compelling evidence for pollution invading the aquifer beneath the city of Tulum at this date. By entering a cenote southeast of Tulum city, divers negotiated 900 meters of underwater cave passage to video the cave environment and collect water and biological samples 11 meters below the urban area of Tulum (Schmittner and Aviles unpublished videography, 2007). As present sewage-disposal systems for the city appear substandard, plans to accommodate further enlargement of residential areas in Tulum city are met with skepticism. Preliminary maps provided by government agencies indicate that new zones for municipal expansion will encroach on or occupy lands above several of the most significant underwater caves in Quintana Roo.

Proposed economic strategies for a steady growth in ecotourism are encouraging for landowners who maintain cave entrances on their lands. A landowner fortunate to own a popular cenote or dry cave entrance may sustain a lucrative business by charging entrance fees

Information about algae at the Puerto Aventuras harbor dolphin pen. *Donna and Simon Richards*.

Employees removing algae from the dolphin pen. *Donna and Simon Richards.*

to his property. To compete for a larger profit in ecotourism, landowners with smaller cave sites are transforming their karst windows into more impressive attractions. Cave and aquifer protection laws are rarely enforced on private property, allowing landowners greater latitude to initiate any excavation measures they choose to increase their business. This can range from enlarging their cenote pool to removing limestone ceilings above cave conduits on their property to support a variety of water-sport activities. In such cases, organic and limestone debris from the construction is carried downstream by the aquifer to distant areas of the cave. There is little doubt that these activities place enormous stress on cave life, the freshwater aquifer, and the cave environment.

Citizens of the municipality are cognizant of a seemingly uninterrupted acceleration in the urbanization and tourist development of their community. It is difficult to overlook a procession of new construction projects that occupy lands deemed worthless just years ago. Large areas of old jungle lands are surrounded by kilometers of new fencing with occasional entrance gates manned by security guards. Speculation on future property values and percentages of tourist hotel occupancy often fill local periodicals. There are companies and local residents that aim to profit from this growth. However a small group of residents find this unbridled growth unsettling. They perceive the quality of their community and environment as being surrendered to developers and urban planners stimulating a larger tourism economy. Aquifer pollution issues become paramount, as the aquifer is proven to be an extensive and important attribute for the area's environment. Collaboration with cave divers has allowed a transfer of maps and knowledge of the area's caves. This has improved the residents' knowledge of the aquifer, while strengthening their position when questioning dubious development schemes.

The karst area is clearly in peril. Documentation of cave explorations is becoming more accessible to emerging environmental groups in the municipality. Cave surveyors are sharing georeferenced cave maps and visual media of the cave environment with these groups. By communicating this knowledge and providing counsel, cavers are initiating the essential process of public education. This enhances deeper public awareness regarding issues that may threaten the vitality of local karst conditions. However this instruction must continue beyond that of a general overview of explored conduits that are highlighted by cave maps and photography. Fundamental knowledge of a karst environment must be enhanced by tutelage on the hydrological and biological components of the environment in simple layman's terms. Yet the results of collaboration between cavers and municipal residents on the area's intricacies are uncertain. Will desires for short-term economic prosperity outweigh long-term concerns for damage to the karst environment and its future economic consequences? Cavers and karst researchers are hopeful that a reasonable balance between the two will be attained before this unique karst region suffers further damage.

Back, W., B. B. Hanshaw, J. S. Herman, and J. N. Van Driel (1986). Differential dissolution of a Pleistocene reef in the ground-water mixing zone of coastal Yucatan, Mexico. *Geology* 14(2), p.137–140.

Holthuis, L. B. (1973). *Caridean shrimps found in land-locked salt-water pools at four Indo-West Pacific localities (Sinai Peninsula, Funafuti Atoll, Maui and Hawaii Islands), with the description of one new genus and four new species*. Zoologische Verhandelingen 128, 48 p. + 7 plates. (Available for download from http://www.repository.naturalis.nl/document/149069.)

Lutz, W., L. Prieto, and W. Sanderson (eds.) (2000). Population, Development, and Environment on the Yucatan Peninsula: From Ancient Maya to 2030. International Institute for Applied Systems Analysis Report No. RR-00-014, Laxenburg, Austria. 268 p. (Available for download from http://www.iiasa.ac.at/Admin/PUB/Documents/RR-00-014.pdf.)

Quintana Roo Speleological Survey (2009). http://caves.org/project/qrss/qrlong.htm.

Tulaczyk, S. M., E. C. Perry, C. E. Duller, and M. Villasuso (1993).

Influence of the Holbox fracture zone on the karst geomorphology and hydrogeology of northern Quintana Roo, Yucatan Peninsula, Mexico, in *Applied Karst Geology*, Barry Beck (ed.), Balkema, Rotterdam, p. 181–188.

Ward, W. C., and A. E. Weidie (eds.) (1978). *Geology and Hydrogeology of Northeastern Yucatan*. New Orleans Geological Society, New Orleans. 327 p.

Ward, W. C. (1985). Quaternary geology of northeastern Yucatan Peninsula, Part 2, in *Geology and Hydrogeology of the Yucatan and Quaternary Geology of Northeastern Yucatan Peninsula*, Ward, W. C., A. E. Weidie, and W. Back (eds.), New Orleans Geological Society, New Orleans, p. 23–53.

Eventos preliminares en la protección del karst en Quintana Roo, México

El estado de Quintana Roo, México, tiene varias de las cuevas subacuáticas más largas del mundo. Estas cuevas sirven como conductos de agua dulce, dirigiendo un gran volumen de precipitación pluvial hacia el Mar Caribe. La mayoría de las cuevas están ubicadas en el municipio de Tulum, donde se han documentado más de 650 km de galerías sumergidas, en una zona de 1096 km2. Los estudios más recientes confirman una gran afinidad para la espeleogénesis costera y cercana a la costa. El desarrollo horizontal en las cuevas está limitado a una zona de 11 km hacia al interior, a partir del Mar Caribe. Con muy poco relieve topográfico, esta zona está marcada por un arreglo extenso e interconectado de entradas a través de pasajes colapsados (cenotes). Las cuevas asociadas con cenotes tienen un gran desarrollo localizado en una interfase donde el agua dulce está sobre una capa intrusiva inferior, estática, de agua salada.

Los procesos kársticos y el manto acuífero de agua dulce en Quintana Roo se enfrentan a varias amenazas. Se continúan construyendo grandes desarrollos turísticos en el Caribe mexicano, y muchos están ubicados sobre cuevas subacuáticas. Los hoteles requieren también de muchos empleados, de tal forma que la ciudad de Tulum está planeando triplicar el tamaño de su zona residencial en el corto plazo para acomodar este incremento en la fuerza laboral. Estas zonas residenciales pueden estar cercanas o incluso directamente sobre sistemas de cuevas importantes. Los planes para los servicios de agua y drenaje siguen bajo cuestionamiento. También es una amenaza el incremento del ecoturismo en las cuevas. Dueños de propiedades privadas y comerciales están modificando las entradas a los cenotes para darle cabida al mayor número de ecoturistas. Dichas alteraciones pueden ser desde el simple mantenimiento de la vegetación, hasta métodos destructivos para ampliar tanto los cenotes como las cuevas.

Con la reciente creación del municipio de Tulum, los ciudadanos locales y dueños de negocios están creando organizaciones informales para investigar una manera razonable para conservar los fenómenos kársticos de la zona. Los exploradores de cuevas están proporcionando mapas, documentación fotográfica y sus comentarios y sugerencias sobre las condiciones de las cuevas y el karst a las personas interesadas.

LOWER ULYSSES: SISTEMA PURIFICACIÓN CAMP VII, MARCH 2009

Dan Green

In March 2009 a small group of cavers from Canada and Texas established a four-night camp at Sistema Purificación's Camp VII to push some leads in the Ulysses Maze. The Ulysses Maze is a horizontal area three-quarters of the way down the Angel's Staircase. It had been mapped during the first Camp VII trip in 1996, and some good leads remained. Our plan was simple but ambitious—we had about 100 hours to establish camp in the World Beyond borehole, rig the Staircase down to Ulysses, push the leads, de-rig, and return to the surface before the vehicles headed back to Austin. With a late start from Texas and a long Saturday-afternoon delay at the border, I worried about the time. Our leads, after all, were 500 meters below the entrance, and we'd never been down there before.

The ten cavers heading into the Brinco entrance Monday morning included three load haulers accompanying the campers to the World Beyond borehole. Paul Bryant decided to join us in camp, thankfully, because he knew the way down there much better than I did. (I'd been down there just once nearly a dozen years earlier, and the route was foggy.) The Crack of Doom ate some camp packs, and the group got turned around a few times, but after about eight hours we finally crawled through into the awesome World Beyond. Following a short break, the load-hauling team of Corrine Wong, Joe Datri, and Saj Zappitello dumped off group gear and turned back for the surface. After some easier going through the borehole, our remaining group of seven finally swam ashore onto Camp VII's gravel beach, our home for the next four days.

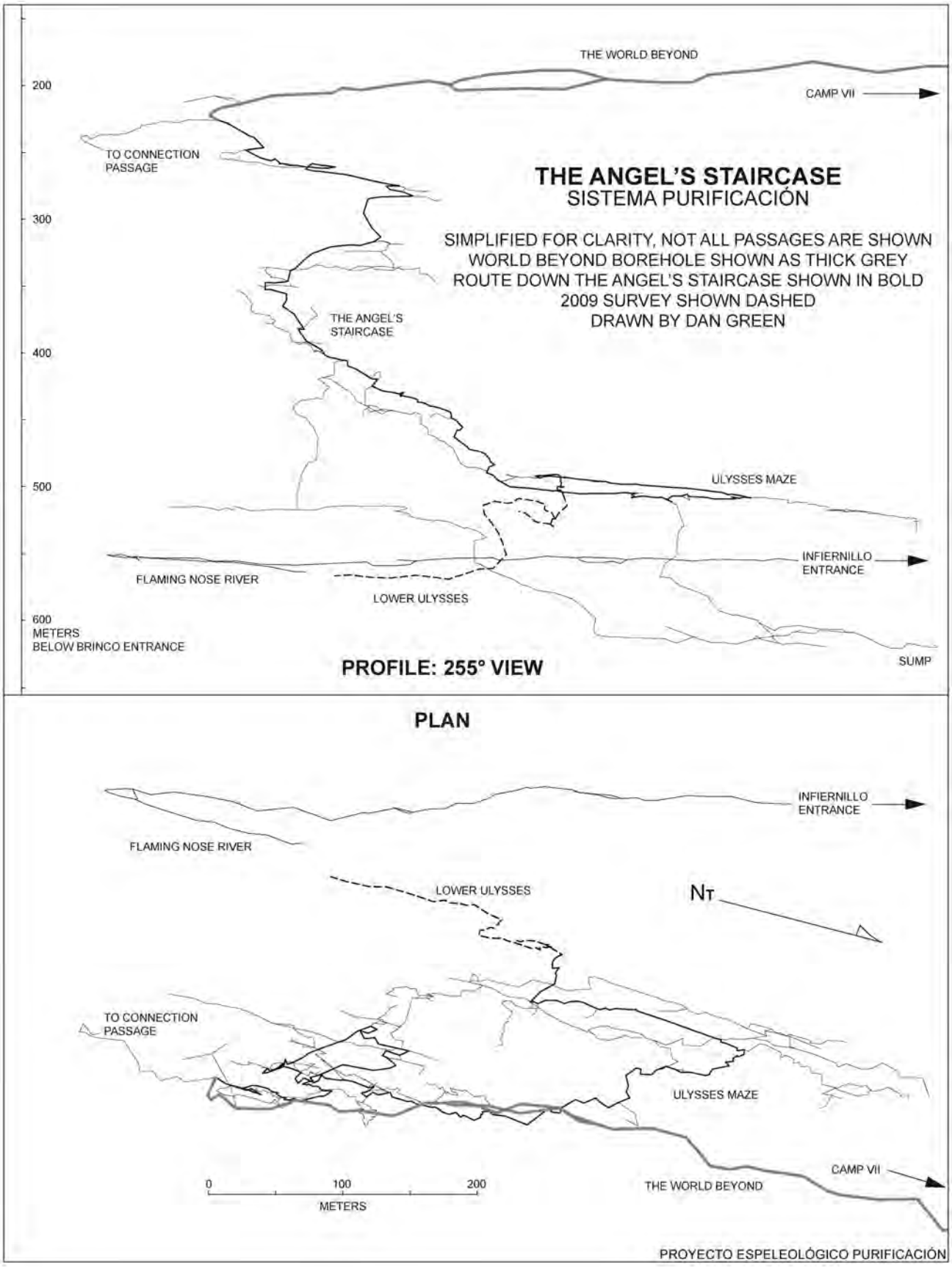
The next day we were all tired from hauling camp packs, but with the compressed schedule we continued pushing ahead as planned. I used my line plots and the old notes to navigate down the Angel's Staircase with Gavin Elsley, Colin Massey, and Katie Graham. The route-finding was sometimes challenging and took extra time, but we just kept following the water and eventually made all the right turns. The Staircase is a five-star steeply descending water passage dropping 400 meters below the World Beyond, full of flowstone climbs, travertine washes, and sharply carved canyons, with lots of climbing and swimming. All of the passage is sporting, wet, and clean—this alone was worth the trip. Gavin went out front and rigged about eight pitches down 300 meters before reaching the pools and swims of the Canal of Ulysses. We swam the canal and climbed out of the water just before the final series of pitches descends to the sump 100 meters farther below. This was our junction. A short rope led into the horizontal and mostly dry walking passages of the Ulysses Maze, an abrupt change from the passage character up to this point.

Our leads were at the southern end of the maze, an area discovered at the end of the 1996 expedition that has pits dropping out of it. After navigating a few hundred meters to the south and mistakenly taking an off-route and horrible cheddar-shredding crawlway, we dumped the last of our ropes and rigging gear in a small junction room. Katie and I went ahead to check out the lead, following some crawly passage that suddenly opened up into the clean-washed walking tube accurately described in the 1996 trip report. The passage snaked downward, getting steeper and cleaner before the previous survey ended at station NC152,

The Angel. *Gavin Elsley*.

dan.green@telus.net

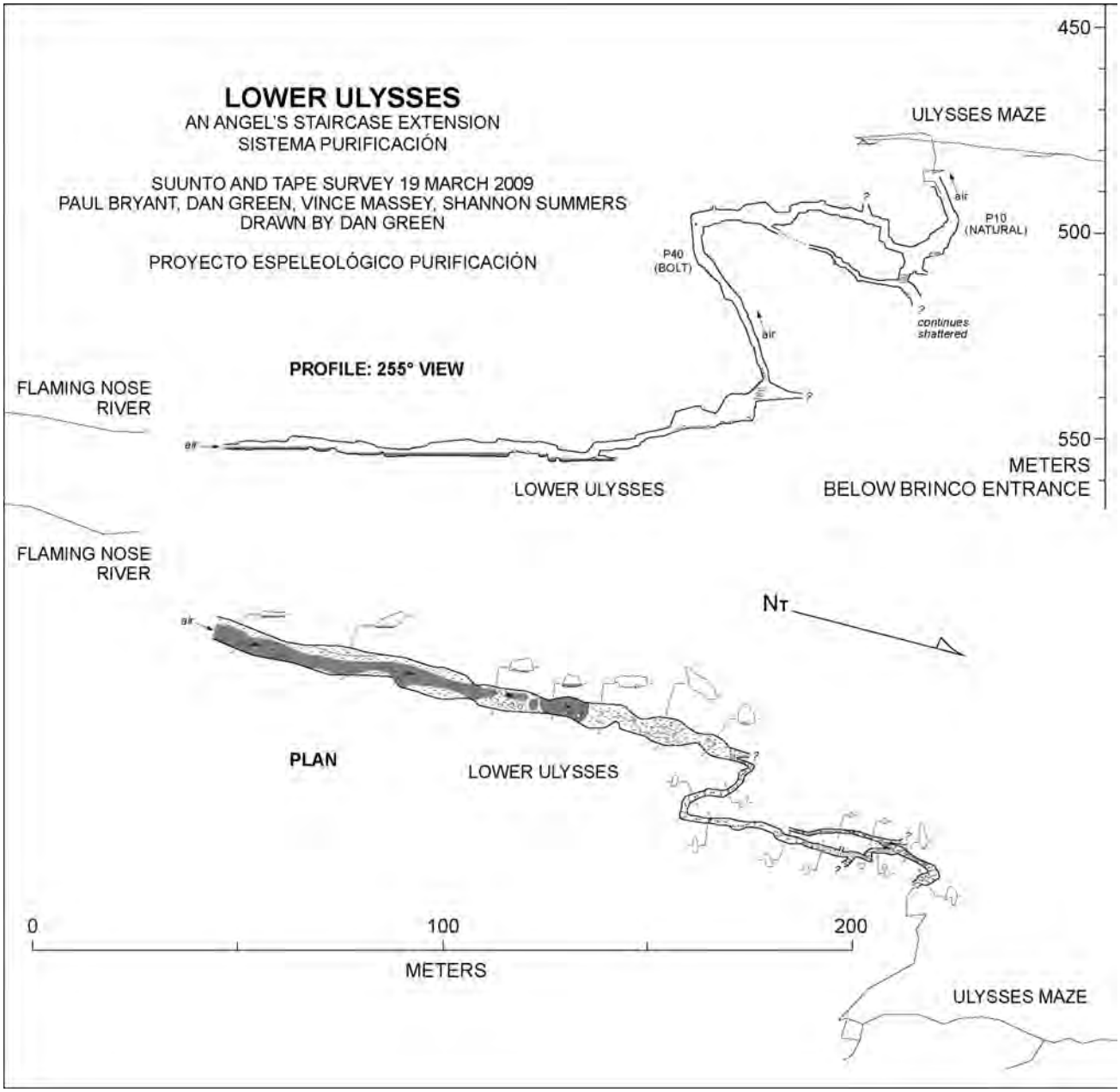
This article first appeared in *Death Coral Caver* 14, 2009.


THE WORLD BEYOND
CAMP VII
TO CONNECTION PASSAGE
THE ANGEL'S STAIRCASE
SISTEMA PURIFICACIÓN
SIMPLIFIED FOR CLARITY, NOT ALL PASSAGES ARE SHOWN
WORLD BEYOND BOREHOLE SHOWN AS THICK GREY
ROUTE DOWN THE ANGEL'S STAIRCASE SHOWN IN BOLD
2009 SURVEY SHOWN DASHED
DRAWN BY DAN GREEN
200
300
400
500
600
METERS
BELOW BRINCO ENTRANCE
ULYSSES MAZE
INFIERNILLO ENTRANCE
FLAMING NOSE RIVER
LOWER ULYSSES
SUMP
PROFILE: 255° VIEW
PLAN
INFIERNILLO ENTRANCE
FLAMING NOSE RIVER
LOWER ULYSSES
NT
TO CONNECTION PASSAGE
ULYSSES MAZE
CAMP VII
THE WORLD BEYOND
0
100
200
METERS
PROYECTO ESPELEOLÓGICO PURIFICACIÓN

where it could be seen continuing vertically for at least 10 meters. Lots of air poured up from below. It was a great lead, and we knew it would go. It took us almost four hours to climb the 300 meters back up to camp, and those fighting thick wetsuits were totally exhausted.

While we were down the Staircase route, Paul Bryant and Vince Massey spent the day investigating the Aragonite Sump passage and learning some of the route through to the bottom Infiernillo entrance. The Aragonite Sump lies at the end of a long southern passage; a delicate aragonite bush blocks the way forward. This needed some further investigation to see if there was a way around. Paul confirmed that there wasn't, and no airflow either. Back in camp, Shannon Summers had arrived solo from the surface with 60 meters of rope and his usual superhuman strength. Henry Bruns had remained in camp, guarding The Cube, a conspicuous, shapely rock, from inevitable attack.

On the third day I led a fresh team of Shannon, Paul, and Vince down to the lead. With the ropes in place and the route familiar, our fast team crossed the Canal of Ulysses after just 2.5 hours, and we were soon at the lead. Paul quickly rigged the clean pit as we started the survey. The passage soon branched along the same steep angle of fractures that defines much of the cave, with good airflow seemingly everywhere. We surveyed a few small passages in various directions until Paul climbed up into a nice walking tube and set a handline for us to follow. The phreatic passage climbed up some steps, leveled off, and got bigger, and the airflow was still great. It was some of the finest passage any of us had surveyed in Sistema Purificación, and it felt good to be heading south



Camp VII. *Colin Massey*.

into the mountain, where much more cave is presumed to be. We mapped past a few small side leads. Ahead we could hear Paul's hammer blows setting a bolt, and we knew it was getting good.

When we caught up with Paul, he was rigging a long, steep tube that eventually dropped 45 meters into a large room. We mapped down the slopes, most of which were climbable, but easier with the rope at times. Paul returned from below and announced we'd hit a river passage. Three hundred and seventy meters below Camp VII we dropped into a stream passage about 5 meters wide, with muddy banks of death coral. Upstream was south into the strong air, and downstream the water went into grim, low passage. Beyond a dozen long shots to the south in a muddy sump area, the passage got lower and continued through a watery gravel dig. The air was so strong it rippled the water. When I caught up with the sketch, we'd been pushing for almost ten hours and had mapped 320 meters. We turned for camp and made the climb up in about three hours, stumbling into camp around 2 a.m. Earlier, Wes Schumacher, Sandy Calhoun, and Saj Zappitello had arrived at Camp VII to get familiar with the area and see what we were doing down there.

Colin, Gavin, and Katie derigged the Staircase on the fourth day while some of us rested. The inexhaustible Paul showed the others the way to the Aragonite Sump. Everyone returned to camp early in the evening and, as usually happens when there are too many cavers in camp for too long, we amused ourselves with fire. Gavin remarked how the white-gas mood lighting dotted about camp was quite "atmospheric." When The Cube resisted cremation, the assault moved to the nearby Flaming Volcano. It was so bright down there that headlamps weren't needed—until the thick smoke appeared. Oh, right . . . .

We headed for the entrance early the next morning. Some of the group got drawn in by sucker flagging and wandered around Tin Can Alley with camp packs for a while, but everybody was out in four to six hours to the welcome field-house surroundings and hot showers thanks to Gill Ediger and Pete and Colin Strickland.

Our deep lead appears to be aligning with the Flaming Nose River coming in from the south. When that passage was mapped from Camp IV in March 1986 (Camp Challenger, *AMCS Activities Newsletter* 16), it ended in a sump, so either the sump is now open and we were in it, or somewhere in between is a branch taking the strong airflow. On the way down to the river passage we passed a few smaller leads that need to be checked, and there are more good pits dropping from the Ulysses Maze. A return to this area is worthwhile.

Ulises Bajo: Campamento VII en el Sistema Purificación, Marzo de 2009

En Marzo de 2009, un equipo de Canadá y Texas planearon un viaje corto a Campamento VII en el Sistema Purificación, para explorar algunas continuaciones por debajo de Angel´s Staircase. Una buena continuación en Ulises Maze a -500m debajo de la entrada de Brinco, fue topografiada por 315m hasta un rió ancho proveniente del Sur. Ellos se detuvieron en una baja y mojada estrechez, con mucho aire. Esta podría conectar con el fondo de Flaming Nose River, cual fue tipografiado en 1986 desde campamento IV, pero en 1986 era un sifón. Angel´s Staircase es emocionante, es un pasaje con muchas escaladas. En esa área hay mas continuaciones buenas y esta planeado un viaje para 2010.

CAVE HUNTING ON THE RÍO PETLAPA

Gustavo Vela Turcott

After a series of caving expeditions in 2009 and in the hope of finding caves, Al Warild and I thought we'd do some prospecting on foot and by truck in out-of-the-way corners of the Sierra Negra in Puebla. On the very last day, as we were returning to Coyomeapan, the road took us through a canyon that forms part of the border between Puebla and Oaxaca. As this is all karst, we figured that there'd be some good resurgences to be found along the canyon. Way below, we could see stretches of narrow canyon, interspersed with more accessible parts.

Studying the topo maps, we could see that the river bears the Nahuatl name Petlapa. To get a real idea of the place and find any resurgences, we'd have to traverse a considerable stretch of the river—some 36 kilometers of a river canyon that nobody had explored in its entirety. The only record of exploration was that of an Australian group that had explored a few kilometers of the southern branch in search of the resurgence to the caves around Zongolica-Chilchotla. But nobody had traversed the western branch, and we thought that it would be a great place to look for caves.

Al and I decided we could explore the entire canyon along with Franco Attolini and one more, four in total. More would be a multitude, and fewer would be too risky. The problem was that Franco and Al were off on an expedition to Papua New Guinea for a few months. I wanted to go too, but couldn't. So I was left to look after the project and find all the caves myself. In March 2010 I made my first incursion, in a party of four. One of the group had very little canyoneering experience, and after four days and a few incidents, we'd only explored 4 kilometers of canyon. So we escaped up a local hunters' trail.

We're not the best explorers, but perhaps we're the most naïve." With this message I went about putting together another group to explore farther. This time we had Ricardo "Beluga" Lugo, Guillaume Pelletier, Roberto "Chibebo" Rojo, and me, food for seven days, plenty of anchors, and 92 meters of rope. Two weeks had passed since the previous, half-hearted attempt on the Petlapa, and we were at San Juan Cuautla, this time following the correct descent path into the canyon. In pleasant sunshine we climbed into our wetsuits and started down the canyon. Right from the start the walls closed in, and the stream took on a new character, more forceful and more fun. A short walk took us to a 10-meter drop that we avoided by roping down from a tree and landing in the pool below, where the roar of the water was so loud that it made communication difficult. With all four of us and the rope at the bottom, we knew that there was no returning to civilization for at least a few days.

Before we did two of the next three jumps, we sent someone down to check the churned-up water for rocks and logs below, and beyond those we found an inflow that arrived from the sky on the right. Beluga recognized the base of the next drop, 8 meters, as the most upstream spot he'd reached two weeks before. From here on it was terrain that we'd already covered just two weeks ago, so we moved rapidly. By three in the afternoon we'd reached our "Nueva Tlalpan" campsite where we'd stopped the first night on the earlier trip. It was such a pleasant spot that Beluga wanted to live there.

The canyon continued between sheer walls, and we were pleased to see a raccoon scurry off into the bushes, although I imagine that the encounter wasn't much fun for him. At six we reached our second old campsite, "Nueva Iztapalapa,"

From left: Roberto Rojo, Gustavo Vela, Guillaume Pelletier, and Ricardo Lugo. *Gustavo Vela.*

gustavo@vela-turcott.org,
turnalinero@yahoo.com

Translated from Spanish by Al Warild.

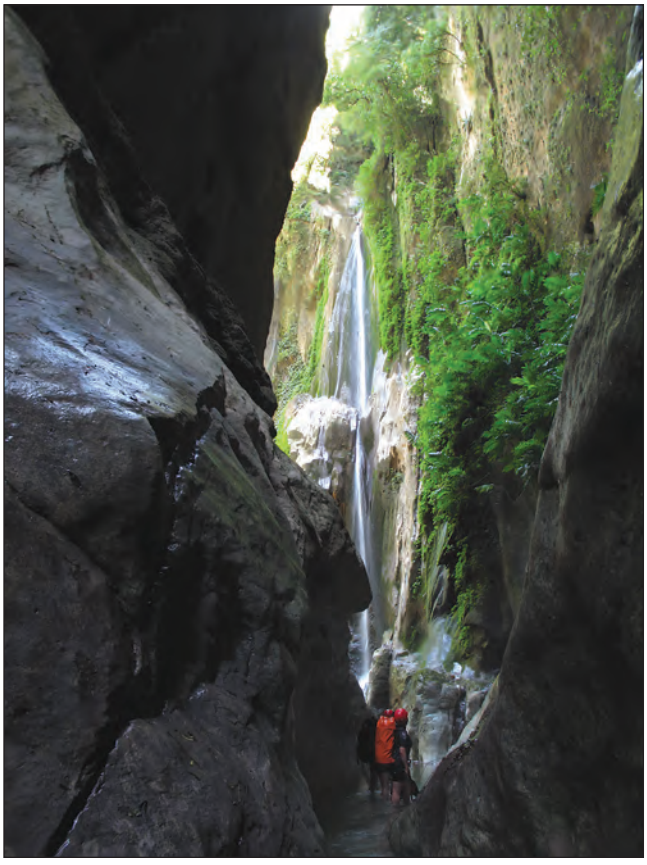
Upper left: Chibebo on rappel. Lower right: Guillaume descending a 15-meter waterfall, while Chibebo waits below. Photos by Gustavo Vela.

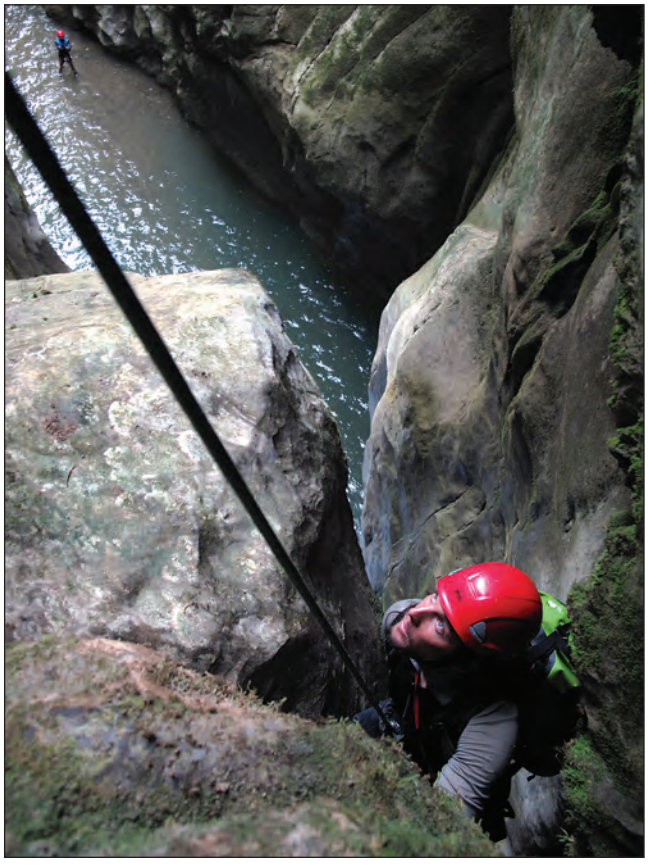
where we spent our first night this trip, although not without getting more than a little soaked. It had been raining for over an hour, and we were concerned enough that the river would rise that we marked its level, but the next morning the level was the same.

We continued down the known part of the canyon. A few jumps and a small rappel, a lot of walking interrupted by the odd swim, and we reached our first possible escape route and our "Nueva Azcapotzalco" campsite, where we had spent the last night of our previous attempt. Close to a resurgence, the sharp-eyed Chibebo spotted a reptile slipping under a rock. Without a second thought, he extracted what appeared to be a coral snake, regarded as very dangerous due to its potent venom, but he immediately pointed out that it was a harmless false coral snake. We took its photo and let it go on its way. From here on we were in unknown territory, in a hostile stretch of river with smooth-polished walls, trees way up above us, and water turbid from yesterday's rains.

We went through this part with a certain degree of tension, nervous about what was to come, with the feeling of treading a fine line between things working out and a disaster. If anybody had a problem, it would be perhaps two days' walk to the next exit before being able to seek aid for an injured person. As it was, we had left word with friends that if we were not out in six days they should raise the alarm on the seventh.

Three more small jumps, and we reached a 9-meter drop into a pool that had so much current that we had to put in a line for hauling ourselves out of it. About two in the afternoon it started raining lightly, and everything became super-slippery. The weather forecast had told us to expect moderate to heavy rain, so we didn't think too much of it.





Gustavo Vela.

Along this stretch Guillaume went first, followed by me, then Beluga and Chibebo. Guillaume put his foot down about a meter from a snake and shouted, "Look out, *nauyaca*!" This fer-de-lance is the most poisonous and dangerous of Mexican snakes. I jumped clear, with my heart just about leaping out of my chest. When Chibebo arrived, he said, "It's not a *nauyaca*, it's an *Atropoides*. It's not as dangerous, but its venom is still very strong. Instead of dying in four hours after being bitten you may last six or eight." Whew, what a relief. Chibebo said that anywhere else he'd try to catch it to show us the anatomical differences, but given where we were, perhaps not today. He said that the genus *Atropoides* is named for Atropos, the Fate in Greek mythology that cuts the thread of life.

A little way on we hit a 15-meter cascade. The rigging was complicated and the rocks slippery. It was raining, it was late, and we were tired, so we sneaked around it using a tree anchor instead of following the water.

Two pitches on, and the drizzle had turned into a downpour. We stopped and set up "Nueva Montreal" camp in a natural refuge formed by giant blocks of rock. The heavy rain didn't slow, and while Chibebo and Beluga took refuge in a hiking tent, Guillaume and I hid under a nylon fly. During the night Guillaume moved into the overhang, which now had a small river in it, while I survived in comfort under a boulder. The tent didn't do so well; by morning Chibebo, Beluga, and all their gear were soaked.

At six in the morning we got the fire under the overhang going again and dried our sleeping bags a little. We checked the water level marker we'd placed and found that the river had risen 15 centimeters. With no escape route and therefore no other option, we continued exploring downriver.

The water was really stirred up from the rain, and this made travel slow, as it was impossible to see submerged rocks, and when we did find them, they were slippery. But we persisted. A couple of more jumps that we had to check first, then three rappels and wild water in the final plunge pool. At least the sky had been clear all morning, and as the canyon began to widen a little things became positively comfortable. We made good time along the river bank and even found a small trail made by the locals to mine sand from the river. But as the day wore on the clouds returned, and by two in the afternoon some of us thought that the water flow had doubled. Light rain began to fall, and the river narrowed among house-sized boulders. We reached a 10-meter cascade where the entire river disappeared between the blocks. We'd hit a sump.

We stopped for a quick evaluation. We had known that the weather was unstable even before we'd entered the canyon, and for three days there hadn't been much break in the rain, especially at night. The flow had almost doubled in six hours. We decided to abandon exploration of the Petlapa for the moment and return on a better day. So we took a small

Buscando cuevas en el Río Petlapa

Con el afán de encontrar cuevas en el 2009, después de la temporada de cuevas y expediciones Al Warild y yo nos dimos a la tarea de prospectar a pie y en auto por algunos rincones de la Sierra Negra, sureste del estado de Puebla. Justo en el último día de prospección ya nos dirigíamos hacia Coyomeapan cuando por la terracería nos dimos cuenta de la gran barranca que teníamos a la izquierda y sabiendo que tanto del lado de Puebla como del de Oaxaca hay zonas cársticas, supusimos que había buenas surgencias por encontrar y explorar en el fondo de la barranca.

En marzo 2010 hicimos una incursión cuatro exploradores. Lo malo fue que uno de ellos no tenía la experiencia adecuada por lo que después de estar cuatro días en la barranca con algunos incidentes y explorar cuatro kilómetros, por seguridad nos tuvimos que salir por una vereda que posiblemente usen los cazadores locales.

Un mes después, en abril regresamos cuatro nuevos exploradores para continuar la exploración. En tres días recorrimos y exploramos 12 kilómetros de barranco (con cuatro escapatorias), a veces muy encañonado, otras un poco abierto, bajamos 15 rapeles, 12 saltos, cuatro toboganes, incontables nadadas. Encontramos y registramos algunas cuevas interesantes. Regresaremos para continuar con las exploraciones de las cuevas.

track and began the climb out. As a consolation, Nature let us glimpse an otter, shy, agile, and furtive. Like a ghost, it was lost in the forest.

A few hours climbing the tiny track took us to Tengoxochitl, where we met Don Moi, who explained that as it was late, there was no transport out, but he'd gladly offer us a humble shelter to spend the night. On his patio we shared coffee, frijoles, and hand-made tortillas. If we wanted to return for a week or two at a later date, we'd be welcome in his house. The people of these mountains don't have much, but they share what they have with all their hearts.

In three days we'd traversed and explored 12 kilometers of canyon and seen four escape routes. At times it was a narrow canyon between smooth walls, at other times more open. It looks like we made the right decision, because rain continued to fall in the area. (What happened to the dry season from February through April when we do such things?) We'd descended fifteen rappels, twelve jumps, four toboggans, and numerous swims. We'd seen and located numerous interesting caves, including, we think, relocating the resurgence for the Zongolica-Chilchotla caves. Best of all, we'd had a great time exploring with a like-minded group of friends.

Our trip was just part of our larger, ongoing Proyecto de Exploración en la Sierra Negra–Sierra Mazateca, organized by Franco Attolini, Al Warild, and me. If you share our interest or have any comments, get in touch. We'll be going back.

Pillow Talk

During one of the Black Holes expeditions to Mexico in the 1980s, we were out reconnoitering a new area one day when we bumped into this local Mexican caver called Oscar. He showed us quite a few local caves we hadn't seen before, and we spent so many hours wandering about looking at them all that we completely lost track of time. As a result, we eventually realized that we probably wouldn't make it back to the campsite before nightfall.

"No problema," said Oscar. "You can spend the night at my house."

So off we went. Now like many homes in that part of the world, Oscar's house proved to be little more than a tin shack. Inside lay two rooms—one for sleeping and one for everything else. Grabbing hold of a burned old enamel pan, we conjured up a quick curry from the odds and sods we could find, before settling down to sample a drop or two of the local firewater. One by one we gradually turned in for the night, grabbing whatever we could lay our hands on for bedding. Tired from a long day, we slept well, at least, that is, until daybreak, when Watto suddenly started hollering and screaming bloody murder.

"What's got into you, for Chrissakes?" we shouted, turning our bleary-eyed gaze on the normally imperturbable Watto. It transpired that in his search for suitable bedding, Watto had somehow chanced upon a surprisingly soft and comfortable pillow. Pleased with this unlikely but fortuitous find, he'd plumped it up before settling down into a deep and happy slumber. Unfortunately for Watto, this pillow actually happened to be Oscar's prize turkey, which although content enough to lie still during the hours of darkness, had as soon as daylight broke, stood up and walked outside to do what comes naturally, rudely depositing a shocked Watto's head on the shack's floor.

—Dany Bradshaw

One of a hundred entertaining caving stories in *Is That So?: A Selection of Tales from Caving's Legendary Nutters, Characters, Pissheads, and Selfless, Generous, Rough Diamonds,"* edited by Rob Taviner, published 2010 by the Mendip Cave Registry and Archive.

HISTORY

SÓTANO DE HUITZMOLOTITLA

Robert W. Mitchell

This story of a winch descent of Sótano de Huitzmolotitla is a classic of early Mexican caving. It originally appeared in the Association for Mexican Cave Studies Newsletter, *volume 4, number 1, January 1973. Bob Mitchell died on March 18, 2010.*

I have been asked by Mr. William H. Russell and Mr. Terry W. Raines to informally summarize the results of some of my trips to Mexican caves. Some of these visits to Mexico have been particularly significant or interesting and it is upon these that I wish to dwell.

Perhaps the most important of the trips was one which I made during the summer of 1958, accompanied by Dr. Francis Abernethy and Mr. Tom Hayes. It was during this trip that we first saw El Sótano de Huitzmolotitla at Tlamaya, San Luis Potosí. The "discovery" of this Sótano led in a somewhat round-about way to the eventual discovery of one of North America's deepest known caves, El Sótano de Tlamaya.

Ab, Tom, and I had headed for Xilitla, S.L.P., to meet Dr. Russell Strandtmann, formerly of Texas Tech, and a group of students. We arrived in Xilitla two or three days before Dr. Strandtmann's group, and during this time we chanced to meet a very interesting person, Señora Berta Semple, who lives in Xilitla. Explaining to her that we would like very much to see the tree ferns in the cloud forests above Xilitla, we were taken to Tlamaya to meet some good friends of hers who could probably arrange for a guide for us. These friends, later to become our dearest friends in Mexico and the friends of many a following spelunker, were Sr. and Sra. Modesto Gómez. We saw our tree ferns and were also taken to a small cave in "downtown" Tlamaya. Sr. Gómez asked if we would like to see a sótano near his house. After we finally understood that this was a cave of sorts, he led us through the coffee trees to it. Those of you who have seen an immense Mexican sótano can well imagine how we felt standing there peering down the sheer entrance drop of our first sótano. When asked if it had a name, Sr. Gómez laughed and said we could call it El Sótano de Huitzmolotitla after the name of his ranch. We dropped a few rocks and got nearly seven seconds on them. We promptly decided that some day we would make every effort to descend this sótano.

Not until the summer of 1960 at the N.S.S. Convention at Carlsbad did I say much about this deep cave to anyone. However, I then talked briefly with Bill Russell and several others about the deep pit I had seen in Mexico, but I don't think I was entirely successful in selling the idea of such a deep cave to anyone, although rumors persisted of these deep entrance shafts in the Sierra Madre Oriental and elsewhere in North America. At least I didn't witness any mass exodus to Tlamaya.

About this time. Dr. Abernethy and I decided that it was high time we entered the Sótano de Huitzmolotitla, so during the early part of the summer of 1960 we began planning our effort for August of that year. At least to us these were still the days of cable and winch and a fairly large team of people. I shall never forget our discussions on how much cable to buy. This was finally resolved by my wife, Rexell, and me by our going to Tlamaya in July of 1960 and lowering a string into Huitzmolotitla. We got about 350 feet as a good estimate, and so Ab and I bought 400 feet of quarter-inch steel cable. We borrowed a hand-cranked winch, a veritable monster which had a handle that slipped out at very inconvenient times. We organized a crew the likes of which no cave will ever see again. Since each contributed in some very important way to our visit and since each contributed such a distinct personality which so flavored this trip which will live in the minds of each of us forever, I cannot but name each of them. All were associated at the time with Lamar State College of Technology at Beaumont, Texas, where Dr. Abernethy and I taught. I was teaching biology and Ab was an English professor. A prominent student of East Texas folklore, he now is Professor of English at Stephen F. Austin State College, Nacogdoches, Texas. His love of natural history and of pure adventure ranks him as El Número Uno whenever I am making a trip, especially to Mexico. Dr. Russell Long, still of the Biology Department at Lamar Tech, accompanied us, but his efforts were directed primarily to collecting butterflies in and about Tlamaya and drinking beer with Don Modesto. This only attests to the fact that Russell had more judgement than the rest of the crew collectively. Since our team was fairly large we decided we needed a cook, so we prevailed upon the manager of our

snack bar at Lamar Tech, Mr. Starks Johnson. At the time this sounded like a great idea. The remainder of the people were students, all biology majors. There was first of all Mr. William Rhodes, who is now a chemist employed by Marathon Oil in Colorado. Dub remains one of the best friends, hardest workers, and finest field companions anyone could hope to have. Our association continues to the present. He, Ab, and I made our latest trip into Mexico only last August, a trip that will be described later. Mr. Kenneth Johnson, a graduate student of mine at the present time here at Texas Tech, made the trip. He is presently conducting studies on temperature preferences in the Mexican blind cave fishes. Mr. Charles Edwards was along. He now teaches at Port Neches High School. Mr. Leonard Tibbetts, who is now practicing dentistry, made the trip. I believe he now lives somewhere in the Beaumont-Port Arthur area. Mr. Roger Shoemake is just completing his Ph.D. in Acarology at the University of Oregon.

We arrived along with the first rains in Tlamaya in the latter part of August of 1960. We had come prepared to stay for at least a week, so we set up shop in Sr. Gómez' coffee shed, later to become somewhat of a spelunker's headquarters. Now the road to Tlamaya passes fairly close to the sótano, but the walk down the 45-degree slope to the drop is something of a chore with the kind of equipment we carried in. We had decided to set up the winch not on the last ledge before the drop but another ledge up. This placed the winch and winch operators some 20-25 feet above the drop and, I suppose, about 40 feet horizontally away from it. It was placed on the "high side" of the drop since getting to the low side was a real problem and also because there were no suitable ledges on the low side for the winch. Growing on the ledge below the winch and projecting out and over the drop was a large tree which we decided was the appropriate place for the block to support the cable. On our way through Mante we picked up about 500 feet of one-half inch sisal to use as a belaying rope. It was decided that the belayers were to take up their positions on the lip of the drop, again, somewhat below the winch position. About two days were consumed simply getting the winch into position and bolting it to a table we made for it one rainy day. But I will say that when it was finally in place it was there for all time to come. We spent most of the next day—after the rain—getting the block in the tree over the pit. Dub Rhodes and I tried to out-volunteer each other for this duty, I won. So I climbed up the tree and out on this large limb. Only when I was out 10 or 12 feet from the wall did I look down. After partially recovering from this experience, I set about trying to suspend the large block with a short length of cable. When I was about half finished, I suddenly realized that I was covered by ants. The limb was covered with them and there was simply no escape. This whole episode was quite painful.

To the end of the cable we attached a parachute harness. It was near the end of the day, but we decided to make a partial descent to test the rigging and to clear away vines, and larger plants that were in the line of descent. I went down carrying a machete. I cleared the wall down to about 70 or 80 feet when I came to rest on a tree, a very large tree anchored by three roots to the sheer wall of the pit. This thing was right in the line of descent, so I shouted up that I was going to chop down a tree and to lock the winch. After looking at the tree I decided that it would be easiest if I were to stand on the tree, chop away two roots, and then be winched upward so that I could lean down and cut the remaining root. I cut through the first root and the tree creaked and sagged slightly. The surprise came after I had cut about half way through the second root; the tree fell like a bomb. I took all the slack out of the cable in a hurry and slammed into the wall. Never have I heard such a noise as when that tree hit bottom. It literally exploded.

We were rained out the next day, but on the following day we made it to the pit early with every intention to put someone on the bottom. I must add now that we had also brought along a set of field telephones, since we thought it advisable to keep in constant contact. By now you realize that here we had three lines to be lowered simultaneously. Wishing if at all possible to avoid adding a fourth line, we decided to go ahead with a descent without a guide line which would prevent any possibility of spinning. I was lowered without incident to about 150 feet below the lip when a strong undercut was encountered. I called for everything to halt while I surveyed the rest of the drop. Then I called for some very fast cranking on the winch to get me to the bottom without delay. But after being lowered 20 or 30 feet more, everything began to spin like mad. The lowering cable, telephone line, and belaying rope all wound together, and the whole operation came to a sudden halt. The decision was made that I come up and that we attempt a descent the next day using a guide line. The trip up was agonizingly long because of the necessity to unwind the fouled lines. It was necessary to cut the telephone line several times.

By this time I had decided that someone else could have the honor of being the first on the bottom, so the next day—with a guide line—Dub Rhodes was lowered to the bottom. After some time there he was raised. All this went with little incident. The next day Ab and I both were lowered. Ab went first and with no problems, but my trip down was marked with one interesting incident. When I had reached within about 15 feet of the bottom, the telephone line snapped near the top of the drop. The sound of 350 feet of line whistling down a sótano is indescribable. As those of you know who have been into Huitzmolotitila, we found little at the bottom of the entrance drop except for another vertical pit. Beneath a large ledge we suspended a vial with the names of those of us who made the descents on this first trip. The vial has been seen by some of the spelunkers who have followed.

Along toward late afternoon I was winched out. At some time during the trip up the handle came out of the winch but Dub locked the brake so fast that I was unaware—in fact,

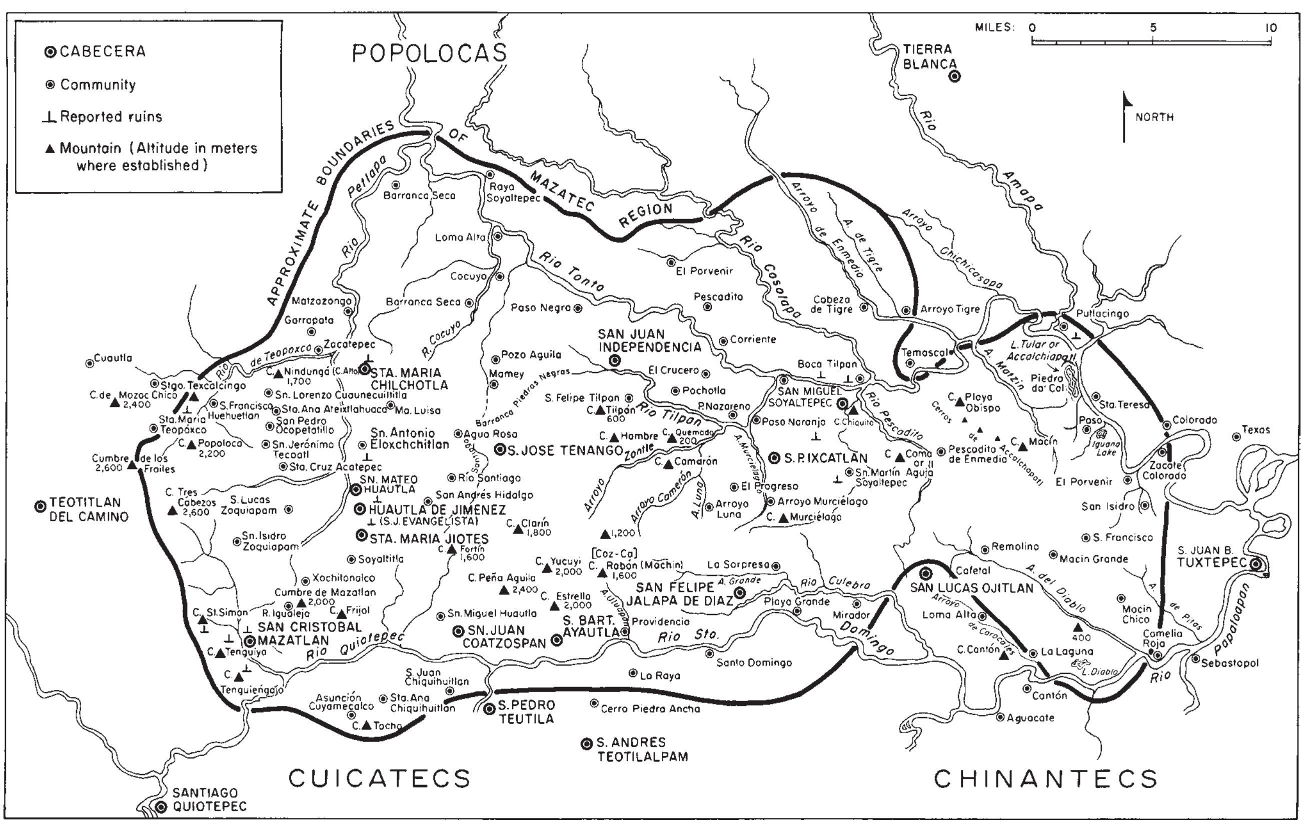
I didn't learn about this for several years. Also during this ascent the winch operators and the belayers became very unsynchronized. The belayers were not hauling up rope as fast as I was being raised by the cable. The result was a great loop in the belaying rope. I called for the people on the winch to stop cranking while the belayers took up slack. They did this very rapidly. I seem to recall that I was being very ugly over the telephone at this time. They took up the slack so fast that they raised me about three feet vertically now creating a sag in the main raising cable. I shouted into the telephone for some slack in the belaying rope so they threw me about a loop. The three feet I dropped before being stopped short by the cable was a long trip.

This venture was spiced with many other incidents and diversions, some relating to the Sótano, some not, but I have already rambled on too long about Huitzmolotitla. Initially, it seemed that we accomplished very little other than the mere act of entering the entrance drop of a deep cave. But as it now turns out, it amounted to something more. An interest in this area and its caves was generated which eventually led to the complete exploration of Huitzmolotitla and the discovery of the nearby Sótano de Tlamaya, one of this continent's deepest mapped caves.

Those of us who knew them were grieved when Sra. Gómez died in the early 1960's and again in 1966 when we learned that Sr. Gómez had been killed while driving his old pickup on the Pan Am near Valles. Xilitla, Tlamaya, and their cuevas and sótanos will never seem the same, especially to those of us who stayed at their ranch during the early days.

Sótano de Huitzmolotitla

Esta reimpresión histórica habla del descenso al Sótano de Huitzmolotitla, San Luis Potosí, en 1960, usando un malacate manual y cable de acero.



From "Colonial Mazatec Lienzos and Communities," by Howard F. Cline, in *Ancient Oaxaca*, edited by John Paddock, Stanford University Press, 1966.

BEYOND CERVAZA AND BAÑOS: A FEW SPANISH CAVING TERMS

Tone Garot and Laura Rosales Lagarde
with some additions by Jim Kennedy, Gill Ediger, Yazmin Avila, and others

http://www.garot.com/LdeS/articles/AFewSpanishTerms.asp

Names for caves and karst features

dolina = sinkhole
cueva, la caverna = cave
pozo = well (used for pits)
sótano = cellar, basement (used for pits)
hoyo = hole, pit
sumidero = sinking stream, insurgence, drain
resumidero = drain, sewer
grieta = crack, crevice
gruta = cave, grotto
sima = chasm, pit
nacimiento, manantial = spring (nacimiento is literally "birthplace")

Names for things in caves

entrada = entrance
salida = exit
pasaje = passage
sala, salón = large room (sala also is used for "camera" for some odd reason)
lodo = mud
barro = mud, clay
agua = water (note that agua is feminine, but has a masculine article)
ollas = pots
muñeco(a) = doll, referring to an archaeological statue (muñeca is also "wrist")
estalactitas = stalactites
estalagmitas = stalagmites
techo = ceiling
piso = floor
pared = wall
tiro = drop, pitch
subida = climb
restricción = restriction/squeeze
pasadizo = passage, corridor
gatera = crawlway (literally "catway")
arrastradera = belly crawl
gusanera = narrow winding passage where you have to go sideways (literally "wormway")
sifón = sump, siphon
arena = sand
grava = gravel
roca/piedra = rock
derrumbes = breakdown
caliza = limestone
calcita = calcite
yeso = gypsum
travertinos = flowstone
cortinas = draperies
fósiles = fossils
murciélago = bat
vampiro = vampire bat
guano = bat dung
pez, peces = fish, fishes (pesca = live fish, pescado = dead fish)
culebra, serpiente = snake
víbora, cascabel = rattlesnake
lagarto = lizard
salamadra = salamander
rana = frog
sapo = toad
hueso = bone
bichos, insectos = bugs (generically)
abeja = bee
avispa = wasp
araña = spider
milpiés = millipede
cienpiés = centipede
alacrán, escorpio = scorpion
mosquitos/jejenes = gnats (biting flies)
moscas = flies (non-biting)
garrapata = tick (the blood-sucking kind)
hormiga = ant
pulga = flea

Cave descriptors (adjectives)

subterráneo = subterranean
profundo(a) = deep
hondo(a) = deep
alto(a) = high
arriba = up, above
abajo = down, below
oscuro(a) = dark.
vertical = vertical
estrecho(a) = tight
angosto(a) = narrow
ancho(a) = wide
grande = big, great, extensive
chico(a), pequeño(a) = small, tiny
bajo(a) = low
largo(a) = long
corto(a) = short
lodoso(a) = muddy
arenoso(a) = sandy
resbaloso(a) = slippery, slick
peligroso(a) = dangerous

Names for equipment

equipo = equipment, gear
casco = the helmet.
luz = light, such as a headlamp or the station light. Also generically means "electricity."
cuerda, cable = rope (note that la ropa means clothes, not rope)
mochila = pack
arnés = harness
pechera = chest harness, chest block, chest roller
cola de vaca = cowstail
estribo = footloop (literally "stirrup")

puño = Jumar-type ascender (literally "fist")
descensor = descender
marimba = rappel rack
ocho = figure 8 descender
mosquetón con seguro = locking carabiner
mosquetón sin seguro = non-locking carabiner
fracción = rebelay
maillon = maillon/screw link
plaqueta = hanger
tornillo, cerrojo = bolt
taladro = drill
taladro de impacto = hammer drill
martillo = hammer
palanca, barra = crowbar/prybar
guantes = gloves
rodilleras = kneepads
libro de la encuesta = survey book
lápiz = pencil
Disto = Disto
cinta = tape, such as flagging tape or measuring tape. Also means "belt."
gafas, anteojos, lentes = eyeglasses
pilas, baterías = batteries
bolsa seca = dry bag
traje de neopreno = wetsuit
cámara = camera (also "inner tube" for some strange reason)
GPS = GPS
hilo = string, cord
cadena = chain
candado = lock
llave = key
clave = combination (to a lock), radio frequency channel or code

Names for techniques

"libre" = "Clear"(used when getting off rope and out of the fall zone)
aventar la piedra = to toss a rock into a pit
redireccionar = to redirect
rappelear = to rappel
descender = to go down
subir = to ascend, climb up
biólogo(a) = biologist
arqueólogo(a) = archaeologist
geólogo(a) = geologist
mapa = map
plan de mapa = plan view
perfil de mapa = profile view
estación [es-tah-see-on'] = survey point, station
punto [poon'-toh] = point, as in a survey point, or period, as in "punto com" (dot com)
fotografía, foto = photograph
excavar, cavar = to dig
encuestar = to survey
explorar = to explore
entrar = to enter
salir = to exit
dejar = to leave
bajar = to go down
subir = to go up
cargar = to load, to carry
caminar = to walk
gatear = to crawl (like a baby)
arrastrar = to crawl (on your belly)
levantar = to lift
empujar = to push
jalar = to pull
poner/colocar = to put
rescate = rescue (noun)
rescater = to rescue
primeros auxilios = first aid
botiquín = first aid kit

Clothing

ropa termica = thermal clothing
sombrero = hat
gorra, cachucha = cap
chaqueta, abrigo = jacket, coat
suéter = sweater
camisa = shirt
camiseta = T-shirt
pantalones = pants
shorts/pantalones corto = shorts (yes, they also say "shorts" in Mexico)
ropa interior = underwear
bragas = panties
sostén, sujetador = bra
calcetines = socks

Body Parts

uña = fingernail
dedo = finger
pulgar = thumb
mano = hand
brazo = arm
pierna = leg
cabeza = head
cráneo = skull
pata, pie = foot
dedo del pie = toe
pecho = chest
cuero, piel = skin

Miscellaneous useful words

carga = cargo, gear, load
compañeros = teammates
campamento = the camp
campo = the country (as opposed to "the city")
sierra, cordillera = mountain range
montaña = mountain
valle seco = dry valley
sendero = trail, path
cerca = fence (also means "near")
árbol = tree
serrucho = saw (to cut wood)
hacha = ax, hachet
fuego = fire
comida = food
vaca = cow
burro = donkey
borrego = sheep
chivo, cabra = goat
cerdo, puerco = pig
norte = north
sur = south
este = east
oeste = west
poniente = West
clavo = nail (for pounding in to wood)

ABSTRACTS OF MEXICO PAPERS 15TH INTERNATIONAL CONGRESS OF SPELEOLOGY

The Naica Project

Tullio Bernabei, Giuseppe Casagrande, Alicia Davila, Antonio De Vivo, Antonieta Ferreira, Giuseppe Giovine, Gonzalo Infante, and Francesco Lo Mastro. Pages 283–288.

Naica is a typical mining center in the state of Chihuahua, northern Mexico. The history of Naica is strictly connected to its mining activity, dating back to the end of the 18th Century. Since 1998, the mine has been property of the Compañía Minera Peñoles. The mine produces silver (second most productive in Mexico), gold, lead, zinc, and copper.

In 1910, at a depth of 120 m, some miners discovered an 80-meter-long cave covered with 2-meter-long selenite crystals, Cueva de las Espadas. In April 2000, the brothers Eloy and Francisco Javier Delgado, during an excavation at the depth of 300 m, discovered Ojo de la Reina, a small cave with big crystals. A few days later, the miners discovered Cueva de los Cristales, hosting giant selenite crystals. The environmental conditions were extreme (almost 50° C, 100% humidity) and the survival time did not exceed a few minutes.

In January 2001, a first visit to the cave was carried out by Carlos Lazcano, Claude Chabert, Enrique Alejandri Escoto, and Carlos Valles Carrillo. In May and October 2002, La Venta carried out two missions, reaching the bottom of the chamber filming and shooting photos. In the period 2004–2006, La Venta studied and produced specific equipment and exploration protocols for the cave's extreme environmental conditions, which may be summarized into: refrigerated suits, refrigerated breathers (heat exchangers), communication devices, medical support and protocols, logistical support, and rescue protocols. In 2006, a joint agreement for the study and documentation of the cave was signed by La Venta with Speleoresearch&Films, C/Producciones, and Peñoles Mining Company. Speleoresearch&Films takes care of the general coordination, C/Producciones of documentation, and La Venta of research, exploration, and mapping.

The Naica Project aims at understanding the origin and age of the crystals, the relationship between the ore deposits and the crystals, the speleogenetic evolution of the caves, the presence of speleothems other than the gypsum crystals, the impact of human activity, the consequences on the human organism, the possible future evolution of the caves, and the possibilities of conservation.

In order to carry out the Project, a complete scientific panel has been organized and implemented. Several universities and researchers from different countries are now involved in the project.

[An article on the Naica Project appeared in A*MCS Activities Newsletter* 30, pages 50–54.]

Minerogenesis in the Naica Caves (Chihuahua, México)

Paolo Forti, Ermanno Galli, and Antonio Rossi. Pages 300–305.

At the beginning of the 20th Century the Naica mine became world renown when the largest gypsum crystals of the whole planet were found inside. Since 2000 four new caves were discovered deeper inside the same mine, hosting gigantic gypsum crystals (over 12 m long). In 2005 an International project led by Speleoresearch & Film of Mexico City and La Venta Exploring Team from Italy started to study all the scientific aspects related to the development of these crystals. In the framework of this project, a detailed analyses has been performed on the secondary minerals hosted inside the Naica caves. This research reveals a completely unexpected mineralogical richness for an environment apparently completely filled by gypsum: 40 minerals have been observed, 10 of which are new for the cavern environment. These minerals developed in three different environments (deep phreatic, epiphreatic and aerated). The aerated environment, even though active only in a short interval of time (a few hundred years) in respect to the other two which lasted many hundreds of thousands of years, allows the highest mineralogical variability in the still now-forming compounds (35, among which 25 are exclusive of this environment).

Aqueous Geochemical Environments of Sistema Zacatón, México

Marcus Gary, Jason Sahl, Philip Bennett, John Spear, and John Sharp, Jr. Pages 370–371.

Sistema Zacatón is an isolated hydrothermal karst area in Tamaulipas, Mexico, containing a series of water-filled sinkholes, or cenotes. Water chemistry is spatially variable from one cenote to the next, due in part to the geomorphic evolution

of the karst and additionally by microbial processes taking place both in the water column and along the walls and floors of the cenotes. The deepest cenotes (Figure 1), including El Zacatón (319 m deep), have a highly homogeneous water chemistry due to convective mixing from hydrothermal water sourced from recently active local volcanism. El Zacatón and the adjacent cenote, Caracol, share similar geochemical processes dominated by the microbial cycling of sulfur and carbon, in a reducing, anoxic environment throughout the entire water column. Microbial sulfide oxidation in these two cenotes results in visible suspensions of colloidal sulfur that develop diurnally, but only in the shallow photic zones, indicating activity from anoxygenic photosynthetic sulfur oxidizing bacteria. The cenote Verde is the only body of water to have discernable thermoclines, chemoclines, and seasonal variability, which indicate isolation from the deeper hydrothermal water feeding Zacatón and Caracol. The water is oxidizing, with dissolved oxygen values from 7 mg/L at the surface to 2 mg/l 45 m deep on the bottom. Verde does contain a hydrothermal spring on the northwest wall that feeds water with similar composition to that in the other cenotes, but at a very low flow rate relative to the large volume of water in the cenote. Just east of Verde, the cenote La Pilita shares similar geochemistry with Zacatón and Caracol; it is convectively mixed and has reducing, anoxic water. The four deepest cenotes (El Zacatón, Caracol, Verde, and La Pilita) all have geochemical signatures typical of a karst aquifer with Ca: HCO_3 type water, however all contain high concentrations of dissolved carbon dioxide and methane, likely a result of microbial activity. Carbon-13 isotopes from dissolved inorganic carbon at each of the four cenotes range from −10‰ to −12‰ PDB. These values likely reflect mixing between two sources of inorganic carbon: one from dissolution of source rocks at depth and the other from microbial cycling of carbon. Based on the presence of 16S rRNA gene sequences from known methanogens, the methane is most likely sourced from microbial methanogenesis.

[First paragraph of extended abstract.]

Biodiversity and Biogeography of Extremely Acidic Sulfidic Cave Snottites

D. S. Jones and J. L. Macalady. Pages 381–383.

"Snottites" are extremely acidic (pH 0-1) biofilms found in sulfide-rich caves. We used a combination of culture-dependent and culture-independent analyses to investigate the community and population ecology of snottites from sulfidic caves in Italy and Mexico. The goal of the research presented here was to determine the composition and structure of snottite microbial communities, and to compare snottites within and among widely separated cave systems. We used a combination of 16S rDNA cloning and fluorescence *in situ* hybridization (FISH) to quantify and compare the microbial communities of different snottite samples. Then, to determine evolutionary relationships among physically separated populations of snottite microorganisms, we isolated *Acidithiobacillus* strains from different snottite samples and measured genetic distances among them via 16S rRNA gene and 16S-23S intergenic transcribed spacer (ITS) sequence analysis.

[First paragraph of extended abstract.]

An Autonomous Robotic Exploration of Deep Phreatic Sinkholes Reveals a Wealth of Microbial Diversity

Jason Sahl, Kirk Harris, Marcus Gary, Bill Stone, and John Spear. Pages 408–409.

In spring of 2007, the deep phreatic thermal explorer (DEPTHX), an autonomous underwater vehicle, explored several phreatic limestone sinkholes (cenotes) in Northeastern Mexico as part of a NASA funded project to one day search for extraterrestrial microbial life.During dive missions in the cenote, the vehicle collected water column and biomat samples at a range of depths and aspects.Samples were returned to the surface, collected, DNA was extracted from each sample, and a molecular survey of the microbial community present was conducted using 16S rRNA gene analysis. Further analysis on extracted DNA samples was carried out with a barcoded amplicon pyrosequencing approach to reveal higher resolution microbial community structure information.

[First paragraph of extended abstract.]

Detection of Sub-Travertine Lakes Using Electrical Resistivity Imaging, Sistema Zacatón, México

Marcus Gary, Todd Halihan, and John Sharp, Jr. Pages 575–579.

Sistema Zacatón, a karst area in northeastern Mexico known for deep phreatic shafts and hydrothermal water, also displays a unique travertine morphology. Some of the sinkholes are dry or contain shallow lakes with flat travertine floors; other deeper water-filled sinkholes have flat floors without the cone of collapse material commonly observed in these types of shafts. We tested the hypothesis that these floors have large water-filled voids beneath them using electrical resistivity imaging (ERI) to image both open cenotes and travertine-covered sinkholes. . Three separate flat travertine caps were imaged using ERI; (1) La Pilita, which is partially open, exposing the structure of the cap over a deep water-filled shaft; (2) Poza Seca, which is dry and vegetated; and (3) Tule, which contains a shallow (<1 m) lake. A fourth line was run adjacent to the open cenote Verde. ERI at La Pilita tested the morphology of travertine surrounding this 110+ m deep cenote. The existence of some water-filled void spaces interpreted from ERI data was verified by SCUBA exploration and new voids are inferred. The ERI lines at Poza Seca demonstrated a thin (<2 to 4+ m) layer interpreted as the travertine cap

with a conductive region (consistent with the resistivity of water) under the layer extending to at least 25 m depth beneath the cap. No lower boundary of the void is evident in the ERI data. The line at Tule also produced geophysical evidence of a large water-filled void beneath a thin (<2 to 4+ m) cap. A deep, higher resistivity layer indicates a flat lower boundary 45 m deep that may be a second cap, similar to one that exists at Verde. The ERI line adjacent to Verde hints at a deep water-filled cavity below this 45 m deep layer. These findings support the hypothesis of capped water-filled voids and may have implications for paleo-climate models of the late Pleistocene. The capped voids may provide habitats for anoxic microbial communities to evolve in isolated isothermal environments.

[This research is described in chapter 4 of AMCS bulletin 21, *Karst Hydrogeology and Speleogenesis of Sistema Zacatón*, by Marcus Gary.]

Regional Geologic Evolutionary Effects on Speleogenesis at Villa Luz Park, Tabasco, Mexico

Laura Rosales-Lagarde, Penelope Boston, Andrew Campbell, Dana Ulmer-Scholle, and Peter Scholle. Page 971.

The understanding of speleogenesis is enriched by the study of its contextual regional geologic evolution. Here we present an initial evaluation of the relationship between regional evolution and the genesis of the caves in the Villa Luz park area, Tabasco State, in southern Mexico. Evaporite rocks composed of halite and anhydrite were deposited in grabens associated with the opening of the Gulf of Mexico during middle to Upper Jurassic time. Springs rich in sulfate and chloride (up to 2,900 mg/L of SO_4^{2-} and 4,700 mg/L Cl^-) constitute the present evidence for dissolution of these materials. An analysis of the δD-$\delta^{18}O$ values that follow the meteoric water line argues against a brine or hydrothermal source for these salt concentrations. These evaporite deposits were unconformably covered by Cretaceous carbonates ranging from dolostone with interbedded anhydrite to limestone, ranging from supratidal to reef and pelagic sedimentary environments. Most caves in the area are formed in these Cretaceous carbonates, including Cueva de Villa Luz (aka Cueva de las Sardinas) and Cueva de Luna Azufre. Paleocene compressional and extensional tectonic events created basins in which carbonates and terrigenous sediments were deposited. These less-permeable beds probably act as an aquiclude that isolates the older rocks from the influence of surface water, and therefore generate hypogenic conditions. During the Miocene, platform carbonates were deposited parts of the area. In the middle Neogene (late Miocene to early Pliocene), the Chiapas Fold and Thrust Belt formed by decollement over the Jurassic salt. This event is expressed in the area as narrow anticlines offset along their flanks by reverse faults that generally overthrust the preexisting synclines. Box-shaped folds (detachment folds) and nonvergent asymmetric anticlines (fault propagation folds) are also present. The uplift associated with the last tectonic event has increased the extent of erosion and helped to define the present geomorphology of the area. This event also formed the anticline that contains the caves in the Cretaceous block. This deformation helped to concentrate the dissolution at the Cretaceous-Paleocene contact. This focus probably created, or at least enlarged, the cave passages of Villa Luz that follow the folded bedding plane with a ramiform to spongework pattern. Assuming a hypogene origin, the Luna Azufre network passages were the first to develop in a partially dolomitized limestone. Progressive uplift and subsequent erosion during the Paleocene exposed hypogenic springs in the caves and at the surface. Proximity to the source (the evaporitic beds) is suggested by an increase of TDS (up to 4,000 mg/L) in the spring water at Luna Azufre Cave relative to other springs in the area (TDS of 2,000 to 1,000 mg/L).

Today, Pliocene or younger freshwater carbonates lie horizontally over the inclined Paleocene sequence. Small caves with dendritic to linear passages have developed in this limestone following the contact. The water composition in these caves fluctuates from brackish to fresh, probably responding to fluctuations in the water table.

Preliminary Developments for Karst Protection in Quintana Roo, Mexico

James Coke IV. Pages 1092–1095.

The State of Quintana Roo, Mexico contains many of the longest underwater caves in the world. These caves serve as shallow fresh water drainage conduits, directing a large volume of inland precipitation toward the Caribbean Sea. The majority of caves are located within the nascent Municipality of Tulum, where over 650 km of underwater cave passage is documented within a 1096 km^2 region. Current research confirms the area's affinity for coastal and near-coastal speleogenesis. Horizontal cave development is limited to an 11 km zone that progresses inland from the Caribbean Sea. Displaying little topographic relief, it is punctuated by an extensive and widespread array of interconnected passage collapse entrances (cenotes). Their associated underwater caves are highly developed at an interface where the fresh water aquifer is buoyed by a lower, static salt water intrusion.

Karst features and the associated fresh water aquifer in Quintana Roo face numerous threats. Large tourist resorts continue to be developed on the Caribbean coast of Mexico; many are positioned above underwater caves. Resorts also require a substantial labor pool to support their activities. The city of Tulum is planning to triple the size of its residential zone in the near future to provide for an expanded work force. These residential areas may impinge on, or be constructed above significant cave systems. Plans for municipal water and waste services remain under question. Escalation of cave ecotourism is becoming an increasing threat to the region's caves and cenotes. Private and commercial

landowners are modifying cenote entrances to accommodate the growth of ecotourism. Alterations to cave entrances may range from simple landscaping, to destructive methods calculated to enlarge both cenotes and caves.

With the recent inception of the Municipality of Tulum, local citizens and business owners are establishing informal associations to investigate a reasonable approach to conservation of regional karst attributes. Cave explorers are providing concerned residents with maps, photographic documentation, and their insight on current cave and karst conditions.

[The full article appears elsewhere in this issue.]

Hot Cave Record in Mexico

Saúl Aguilar, Ada Ruiz, and Juan Morales-Malcara. Pages 1277–1278.

The ecology of bat shelters has been widely reviewed. Many bats require shelter to protect themselves from predators. For others, the shelter requirements are determined by physiological demands of the adults and the young, by social considerations, or by morphological aspects.

Selection of habitat is one of the main factors in bat survival. The body temperature and the metabolic rate of the bats are dependent on the ambient temperature except when it is modified by gregarious social behavior. There are some species that have developed a microclimatic selection very close to their shelter and show physiological adaptations and behavior unique to them.

The most important microclimatic factors that intervene in the selection of a bat shelter are temperature and relative humidity. Some authors have found that the selection of a fresh shelter during active periods help facilitate bat digestion, pregnancy, growth, and development of the young. Nevertheless, there are studies recording shelters with very high temperatures and humidity (heat caves) that are selected by the bats. Previous studies have speculated that Mexico has this kind of shelters, but none have been identified.

This kind of hyperthermal caves are know as "hot caves," "hot grottos," or "hot caverns." Their most distinctive feature is that biological conditions modify the interior climate, enhanced by the speleomorphologic accident of a single entrance access. Animal populations are established, radically changing the physical conditions of the cave and, thus, modifying the exanten ecology. This activity makes for a unique population composition, density, and dynamics. No other faunal community is known to support a similar biomass with these characteristics in a confined space. The populations of bats vary depending on the type of cave and the zone where they are located.

The Cueva de los Cristales Micrometeorology

Giovanni Badino. Pages 1407–1412.

Cueva de los Cristales, Naica, is one of the most interesting caves ever explored. During the Proyecto Naica, led by SpeleoResearch & Film, we undertook a complex series of measurements with the goal of understanding its current physical state. This was mostly carried out by the Department of General Physics of the University of Turin. Its natural state is at a depth of 170 m immersed in 54°C mineralized water. Now it is filled with air, partially surrounded by ventilated galleries at 35–38° C.

All kinds of micrometeorological processes are happening and unfortunately we are rather unprepared to follow the details because it is what in physics is called a "transitional state." It is, in other words, experiencing a "fall" towards a new state of equilibrium that we still have not determined, but that we hope to be able to influence in some way in the future. In the meantime, all the environmental parameters vary far more than expected and in an irreversible way, so the techniques usually used to study caves aren't applicable here.

The climate of a normal cave is in fact substantially static, with minimal oscillations, whether daily or seasonal, around a point of equilibrium. They are oscillations related to the shape of the cave, but which also partly determine it, because they are able to start air currents and condensation processes which, over millennia, can significantly alter the rock. But we are still speaking about systems near equilibrium and which are therefore relatively easy to study. The climate of Cristales is evolving in an irreversible way, as well as quickly.

Our measurements have shown various phenomena. The cave continues cooling by approximately half a degree per year, because it loses heat by conduction towards the nearby mine galleries to the North-West, as well as by irradiation along the access corridor. We have also noticed that in the upper areas the air is stably warmer and more humid than the lower zones and those close to the exit. An unexpected find has been that, while the temperature is very stable, even if in slow decline, the humidity shows strong variations, on both the short and seasonal time scales. This is probably due to meteoric water infiltrations along the fractures created by the mining activity. Finally, there is an air current of about 50 L/s which starts when the access door is opened.

Recent Observations in a Remarkably Dynamic, Sulfide-Rich, Hypogenic Cave in Sourthern Mexico

Louise Hose. Pages 1525–1530.

Observations over the last decade in a two-kilometer long cave in southern Mexico have revealed a remarkably dynamic hypogenic karst system. During this time, both mineral and microbial wall coverings markedly changed and, at two test sites where material had been completely removed, areas have repopulated to the point that the previous damage is no longer identifiable. These observations suggest tantalizing opportunities to directly observe, test, and quantify some forms of speleothem deposition, passage development, microbial participation in both processes, and hydrologic system dynamics. These

observations also document compelling evidence that unique sulfur folia form subaerially, a finding that contrasts with the hypothesized origins of more common calcite folia or mud folia.

[There is an article on Cueva de Villa Luz in AMCS Activities Newsletter 24, pages 48–54.]

Karst and Groundwater in Northeastern Coahuila: An Edwards Aquifer Mirror

Peter Sprouse. Pages 1690–1692.

The northeastern corner of the Mexican state of Coahuila contains some of the most extensive limestone outcrops in the country, yet the karst and groundwater have seen relatively little investigation. The western (recharge) portion of the area contains ridge tops of Lower Cretaceous rocks over 1500 m in elevation, which slope down to the east and south to plunge underneath less karstic Upper Cretaceous outcrops. This represents a confined aquifer zone where wells can flow under artesian pressure. In this respect it resembles the Edwards Aquifer across the Rio Grande in Texas, with similar carbonate lithologies and karst components.

Over 60 caves have been explored in the area, most since the year 2000. Upland portions of the recharge zone contain vertical caves that likely contribute to aquifer recharge, although numerous seep-spring caves in canyon walls disgorge some water prematurely. The canyons themselves are major zones of recharge, exemplified by El Abra, a horizontal stream cave that is the longest in Coahuila at 1841 m in length. In the lower part of the recharge zone close to the artesian zone, there are a number of caves which are estavelles. These have large funnel-shaped sinkhole entrances that slope down to pits, dropping up to 90 m to flowing streams. These normally take water, but during times of heavy rains in the recharge zone they can become springs.

[The full article appears elsewhere in this issue.]

The Naica Caves Survey

Giovanni Badino, Antonieta Ferreira, Paulo Forti, Giuseppe Giovine, Italo Giulivo, Gonzalo Infante, Franesco Lo Mastro, Laura Sanna, and Roberto Tedeschi. Pages 1764–1769.

The Naica caves survey is posing important technical and conceptual problems, in order to save the memory of these marvelous structures. A large effort was made to create a database of the main mega-crystals inside the Cueva de los Cristales.

Caves dimensions recorded to date are:

Cueva de los Cristales. Length (survey plots): Main chamber: 109 m, SE branch: 42 m, NE branch: 68 m. Surface: 1100 m^2. Volume: 5000–6000 m^3. Vertical Range: 12 m.

Cueva de las Espadas. Length: 105 m. Surface: 600 m^2 . Volume: 1400 m^3.

Cueva de las Velas. Length: 75 m. Surface: 400 m^2. Volume: 1500 m^3.

Cueva Ojo de la Reina. Length: 15 m. Surface: 50 m^2. Volume: 150 m^3.

Cueva del Tiburron. Length: 22 m. Surface: 50 m^2. Volume: 70 m^3.

We have measured each giant crystal in Cristales (position in space, position relative to the others, and dimensions). In total, we have mapped 149 crystals, which we estimate to be more than 90% of the total. The largest crystal is Crystal Cin, in the northeast part of the main chamber. Its length is 11.40 m, with a volume of 5.0 m^3.

[See the map of the giant crystals in "Mexico News," Chihuahua. An early map of the Cueve de los Cristales is on page 52 of *AMCS Activities Newsletter* 30.]

Mexpé: Sistema Tepepa and Area

Christian Chenier. Pages 1778–1783.

Mexico has always been a prolific area for cave exploration. The Mexpé project, headed by the Quebec Speleological Society, began in 1987 when a hard-to-access region of the Sierra Negra (at the extreme southeast of Puebla State) was seen for the first time by cavers. Important discoveries came quickly including the descent of Sótano de Alhuastle, with its 329 m in-cave free drop; then a world record. During 15 expeditions so far, tens of caves have been explored, surveyed, and connected to form various large cave systems, the most notable being Sistema Tepepa (28 km, −899 m). No less important, these expeditions have allowed friendships and collaboration to develop with our Nahuas and Mazateca hosts. For many, Mexpé has served as an "expedition school" where the friendly environment allowed quick integration. Exploration continues with several kilometers of new discoveries each years but the potential still appears endless in this region where karst is continuous for some 3000 vertical meters.

[This article appeared in *AMCS Activities Newsletter* 32, pages 129–132.]

Tláloc 2008 Esploración—México-Italia, Hueytamalco, Puebla, México

J. Domínguez-Navarro, S. Santana-Muñoz, M. Díaz-Ávila, E. Hernández-Vargas, C. Cruz-García, M. Garces-Trenado, J. Trujillo-López, M. Mangas-Moreno, J. Madrigal-Gómez, V. Cruz-García, G. Pérez-Montes, A. Rodríguez-López, R. Álvarez-Rangel, D. Brugali, A. Buzzio, F. Camillieri, A. Corna, F. Finali, R. Gaiti., A. Iemmolo, N. Manno, F. Merisio, G. Pannuzzo, S. Piccitto, S. Virgillito, F. Vitale, and G. Zaccaria. Pages 1793–1798.

The word Hueytamalco, comes from Náhuatl language: "huey" meaning huge, "temo" for descend, "ahco" for ascent, and together meaning "huge descends and ascents" or "slopest hills." This municipality is located in the northwest part of the state of Puebla in the northern hydrographic slope in 19°51′03″N and 20°12′42″N and 97°12′48″W and 97°22′42″W, being contiguous to the north with the state of Veracruz; to the east with San José Acateno and the state of Veracruz; to the

south with Teziutlán and the west with Tenampulco and Ayotoxco of Guerrero.

The complicated topography and warm and humid climate strongly influences the vegetation with high perennifolia forest and mesofilic forest in the mountain and varied fauna. An intricate network of cavities in the ubiquitous limestone were partially explored by speleologists in 2005. The karst topography influenced the Pre-Hispanic religion, which has coexisted with Catholicism since the conquest by Spaniards in 1522. This mixture has resulted in a cultural wealth.

The objective of speleological explorations on Hueytamalco from March 10–28, 2008, was to continue exploration conducted in 1998 and 2003, and to evaluate its development, since the topography and the development of some cavities indicated a possible connection of systems. Exploration continued in grottos: Miquizco, Cochinos (Pigs), Cueva del Viento (Wind Cave), and Mama Mia Cave.

The objectives of the exploration were: (a) To cement a relationship between the two countries, México and Italy to develop team work; (b) To evaluate exploration techniques to both complement and improve each other; and, (c) To complete prior explorations which according to underground topography offer the possibility of connections between cave systems.

[Full paper is in Spanish.]

New Discoveries in Underwater Cave Systems in Riviera Maya, Mexico

Zdeněk Motyčka. Pages 1845–1847.

Between 2005–2008 several new cave systems and new underwater passages were discovered during a cave diving expedition, organized by the Czech Speleological Society, in the Chemuyil area on Riviera Maya—part of eastern coast of Yucatan Peninsula. These expeditions discovered, explored and surveyed 17 km of new passages in the Koo´x Baal cave system, 3 km in Sistema Joolis and a new cave system was created by connecting Cangrejo and Ich Kin cenotes. Several animal skeletons and bones were discovered including the surprising find of an entire skeleton of a new animal species, a type of giant sloth, found in the Koo´x Baal cave system. All caves were surveyed, mapped, and extensively photo documented.

[The full article appears elsewhere in this issue.]

Five Years of Speleological Investigation in the Karst of Sierra Mixteca-Zapoteca, South of Tehuacán, Oaxaca, Mexico

Frandesco Sauro, Leonardo Piccini, Marco Mecchia. Pages 1904–1910.

Since 2002, the Italian team "La Venta" is carrying on a research project that has the aim to investigate the karst systems in the area of Sierra Mixteca-Zapoteca, located south of Tehuacàn. The Sierra consists mainly of Cretaceous limestone, covered by Upper Cretacic marly limestones and Tertiary calcareous conglomerates. The most karstified area is the limestone plateau crossed by the Rio Juquila (or Xiquila) Canyon. Presently, five missions, performed in the years 2002, 2003, 2004, 2006 and 2007 have allowed discovering more than 70 caves. Despite the good karst potential of the area, large underground systems have not been yet discovered. The longest cave is located in the middle part of Juquila Canyon and consists of a large relict phreatic conduit more than one km long. The deepest caves, vadose in origin, are placed in the top area of Cerro Granudo and in the southeast area, between the canyon and the village of Santa Maria di Ixcatlàn. Some of these vertical caves have deep pits, which are clogged at bottom by debris and mud deposits carried in by runoff water. The Cueva de la Laguna Prieta, for instance, which opens as a wide collapse sinkhole at 2490 m of elevation, displays a first shaft of 210 m, whereas the cave is 280 m deep. In the area just northwest of S. Maria, some caves of thermal origin have been surveyed during the 2006 mission. These caves display morphologies due to underwater solution processes, which probably attained during the rise of ipogenic waters. The caves are remnants of old hydrothermal karst system, presently remoulded by seepage waters and filled by deposits.

During the last mission, in November 2007, the higher part of the Juquila Canyon, named Rio Matanzas, was explored. This area is characterized by a very deep gorge more than ten km long whose cliffs present some big caves that represent the relict of an ancient phreatic system. Those caves are filled by speleothemes and re-crystallized calcite deposits. Finally, many caves show ancient traces of human's frequentation, as graffiti, wall paintings and jars, usually close to ruins of pre-hispanic (Ñuiñe culture) settlements.

Xilitla: Locus of Mexican Caving

Peter Sprouse. Pages 1922–1923.

The birthplace of Mexican speleology can be considered to be Xilitla, located in the state of San Luis Potosí. The first scientific investigation of the Xilitla caves was led by biologist and Spanish immigrant Dr. Federico Bonet in 1945, and cavers arrived in the area in the summer of 1958. In September 1962 vertical pioneer Bill Cuddington and crew descended the 105 m entrance drop to Sótano de Huitzmolotitla using revolutionary single rope techniques, setting the stage for deep caving all across the country for decades to come. Exploration has continued in Xilitla at a steady pace, and with 292 recorded caves it ranks as the most cave-populated municipality in México.

Despite the density of known caves, new discoveries continue, and since 2004 have revealed some very interesting caves. Sistema Huatecán resulted from the connection of insurgence and resurgence entrances, creating a system 1000 m long and 155 m deep. Sótano de Plan de La Florida captures a large drainage and reaches a depth of 180 m. Other recent finds contain significant archeological remains. Unfortunately

the caves of Xilitla are threatened by rampant dumping of trash into pit entrances.

[Articles on this area appeared in *AMCS Activities Newsletter* number 28, pages 173–176, and number 31, pages 79–86.]

Proyecto Akemabis 2008

Gustavo Vela Turcott, Al Warild, and Franco Attolini Smithers. Pages 1927–1929.

In 1990, the Groupe Spéléo Alpin Belge (GSAB) found and explored Sótano de Akemabis in the Sierra Negra in the south of Puebla State, Mexico. Even though the cave continued past the −1015 m point that they reached, they were nearing the end of their expedition and went no further. The years passed, and as they were in the habit of exploring different parts of the sierra, the exploration of Akemabis remained on the "to do" list. Following discussions with our Belgian friends, in 2007 we decided to mount an expedition to the area. We only reached −700 m due to lack of time following the distraction of finding a new cave, "El Santo Cavernario," −593 m deep and 1616 m long.

Then in April 2008, and after four weeks in the Sierra Negra, we thoroughly explored Akemabis with a group of 19 cavers, from 15 clubs and six countries. As with the previous year, the organization and the most numerous group was Mexican.

We rigged and re-mapped the entire cave. In the end we found three "bottoms": the first at −1051 m "El Sifón de los Espeleo-políticos Ciegos" (Blind Speleo-politician Sump). The second deepest point reached was: −1092 m, "Las Tripas de Pinto" (Pinto's Guts – clearly a less than pleasant place). The third and deepest point is beyond a narrow section and four pitches down to where the water disappears between boulders at the base of a large ascending shaft: "Salón del Final Feliz" (Happy Ending Chamber) at 1101m.

After adding about 150 m of extra depth we extended the cave to 1101 m deep and 3219 m long. We also found another new cave "El Santito" (Little Saint), which we surveyed to −523 m with no end in sight.

[An article about this expedition appears in *AMCS Activities Newsletter* 32, pages 47–52.]

The Naica Caves and Human Physiology

Giuseppe Giovine, Giovanni Badino, Antonio De Vivo, Francesco Lomastro, Giuseppe Casagrande, Alicia Davila, German González Hidalgo. Pages 1980–1984.

Naica Crystal Cave is an extremely hostile environment for human beings. However, it is also the most beautiful place on the planet for cavers. Any speleologist would like to visit it at least once in his lifetime. The caver's body is accustomed to physical efforts and the hostile conditions of the environment he explores, but this is not sufficient for survival in the Naica caves. In this place the temperature exceeds 45° C and humidity is well over 90%. No human being can survive in these conditions for more than 1520 minutes. A group of speleologists has planned and realized a simple and intelligent strategy that has allowed the exploration of this cave.

In this project, the medical aspects have assumed an important role, involving: a program of progressive adaptation for the speleologist to high humidity and temperature; a program of prevention and treatment of possible accidents, and; survey and analysis of the cardio-vascular, neurological and metabolic physiological activities.

The Sierra Negra in a PDA: Expedition-Wide Electronic Cave Surveying

Luc Le Blanc. Pages 2095–2099.

In 2007, Mexpé, the Société Québécoise de Spéléologie's annual expedition to Mexico's Sierra Negra, celebrated the project's 20th anniversary with exploration results beyond expectations: over 10 km of new passages were discovered and mapped in less than a month. This feat also consecrated the definitive adoption of the Auriga cave survey freeware by the exploration teams for the underground input of survey data. Running on almost any PalmOS PDA, Auriga has since become part of our survey toolbox with the help of classic pocket-sized binders now fitted with a waterproof write-through pouch. The display features provided by the software help in avoiding survey blunders, locating the cause of closure errors, and sketching walls or passage features to scale. With all previous survey data of neighboring caves readily available in the PDA while surveying a new cave or passage, surveyors can see in real time their progress in relation to the rest of the known underground terrain and often anticipate connections. This data availability of the 6000+ survey shots composing the 40+ known caves of the Mexpé area becomes extremely convenient when searching for an old permanent station to connect with a newly discovered passage. Auriga is undergoing a rapid evolution, and the Mexpé test case presents some challenging survey situations that have helped bring about several field-use features like full GPS support, tools for resolving conflicting station names between teams or fixing input errors in bulk, and improved data handling capabilities (IR beaming, memory card securing, and export/merge of cave subsets). Carrying a computer in the cave even inspired features unrelated to surveying, such as a pit sounder where Auriga uses the PDA as a stopwatch to achieve quasi-metric depth precision by timing the fall of a rock. In 2009, the survey process will go electronic all the way, thanks to Bluetooth-connected measuring devices and the on-screen sketching of cave walls and features. Currently in use in several countries, Auriga is freeware, available online in three languages (French, English and Spanish), and comes with a comprehensive user manual, online help, and extensive support (*www.speleo.qc.ca/auriga*).

[An updated version of the article appeared in the *Canadian Caver*, number 71, fall 2009.]