AMCS
ACTIVITIES NEWSLETTER

Number 37 May 2014

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

The *Activities Newsletter* seeks articles and news items on all significant exploration and research activities in the caves of Mexico. The editor may be contacted at the address below or at editor@mexicancaves.org. Exceptional color photographs for the covers or other full-page applications 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 Yazmin Avila, Oscar Berrones, Yvonne Droms, Jim Kennedy, and Mark Minton.

All previous issues of the *Activities Newsletter* are available in print, as PDF files, or both, as are various other publications on the caves of Mexico. Contact sales@mexicancaves.org, see http://www.mexicancaves.org, or write the address below.

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Front cover

Guillermo Contreras at La Reprisa de la Esperenza (The Ledge of Hope) in Joya Jonda, San Luis Potosí. Photo by Roberto Legaspi.

Back cover

Kamila Svobodová in the Cenote K'oox Baal section of Sistema K'oox Baal, Quintana Roo. Photo by Radoslav Husák with lighting by Daniel Hutňan and Jan Sirotek.

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NEWS

Mikołaj Harasimowicz in Sistema J2–Last Bash during the 2013 expedition. Photo by Kasia Biernacka.

MEXICO NEWS

Compiled by Bill Mixon

CAMPECHE

Archaeologist María Elena Barba Meinecke announced the June 27, 2013, the discovery of a new tunnel a kilometer long in the caves of **X'Tacumbilxuna'An**, near Hopelchén, that contains hundreds of rock paintings up to perhaps six thousand years old and numerous Maya pottery fragments. It is called the **Gruta de Miramar**, and the site can only be visited with the aid of ropes. It might be opened to tourists eventually, but that would require considerable infrastructure. *Source*: http://www.yancuic.com/yancuic/noticia/26785.

CHIAPAS

Abstract: Cave and Karst Managment on the Reserva de la Biosfera Selva El Ocote, Chiapas, Mexico: U.S. Forest Service International Programs Exchange 2010–2013, by Johanna Kovarik and Miriam Toro-Rosario.

The U.S. Forest Service and the **Reserva de la Biosfera Selva El Ocote** have been working collaboratively, primarily through interchanges, since 1993. Recent work on the el Ocote (since 2005) has centered on issues relating to aquatic ecosystem conservation and water-quality monitoring. Focus on these themes stemmed from the need to balance potentially conflicting demands for clean water, recreation, and biodiversity conservation in the Río La Venta and Río Negro watersheds. In 2010, the reserve requested assistance through the Forest Service from a karst hydrogeologist, which resulted in an initial assessment of cave and karst resources on the reserve and management recommendations. This initial assessment was completed in 2012 with a subsequent trip, and the reserve identified further goals including community outreach, assistance with collaboration, and coordination with caver user groups on the reserve; karst ecotourism assessments; and karst groundwater vulnerability and disturbance mapping. In April of 2013, a water-quality monitoring program was initiated on the reserve, and ecotourism assessments were developed and begun in the field. In August of 2013, water-quality sampling was continued during the first two weeks of the exchange. In the final week of the exchange, educational materials developed for the reserve in collaboration with Project Underground were presented to the local teachers and reserve personnel during three workshops.

Source: *20th National Cave and Karst Management Symposium, November 4–8, 2013, Carlsbad, New Mexico, USA., Program with Abstracts*, page 30.

Abstract: Un posible caso de sacrificio de niños del Clásico Tardío en el área Zoque: la Cueva del Lazo (Chiapas) [A Possible Case of Child Sacrifice in the Late Classic Zoque Area: Cueva del Lazo (Chiapas)], by Davide Domenici.

The excavation of the **Cueva del Lazo** (Ocozocoautla, Chiapas), in the Zoque region of Western Chiapas, brought to light a Late Classic context composed by eleven child burials, associated with a huge amount of perishable materials, including textiles. Despite the fact that the bioanthropological analysis didn't detected any evidence of violent death, the interpretation of the archaeological context suggest that the children could have been the object of a sequence of sacrificial acts.

Source: *Estudios de Cultura Maya*, v. 41, pp. 61–91, 2013.

The Centro de Estudios Kársticos La Venta (CEKLAV) was formally established in Mexico on November 21, 2012. Its goals are to provide more continuity to exploration and conservation efforts than can be provided by the twice-yearly efforts of the La Venta Esplorazioni Geografiche group from Italy, to take over adminstration of the reserve at Ranch El Arco from the La Venta group and hopefully build there a center for documentation and education about the caves of Chiapas and the rest of Mexico, and to help influence public policies on cave and karst management and advanture tourism. They do not seek to substitute for or compete with existing speleological organizations. *Sources*: www.ceklav.org and *Kur* magazine number 20, 2013, page 13.

All of the issues of *Kur*, published by the La Venta Esplorazioni Geografiche group in Italy, are now available as PDF files at www.laventa.it, under Publications. Almost every issue contains interesting or important information about projects in Mexico, some of which has been reprinted in *AMCS Activities Newsletters*. Previous issues have been bilingual Italian/English, but in number 20, for 2013, it is announced that henceforth the printed version will be in Italian and a free English-language version will be on their web site. Mysteriously, however, the AMCS has received a nicely printed paper copy of the

English version.

Kur number 20 contains an article on the La Venta group's Chiapas 2013 expedition by Carla Corongiu (see "Mexico News" in AMCS Activities Newsletter 36) and an article on their Selva 2013 expedition by Francesco Lo Mastro. In the latter, they succeeded in reaching **Sótano Chiccivà**, hidden in forest near Veinte Casas; I light-weight team reached it in three days and determined its exact position. Another promising lead in the area is a sink in which one can hear the roar of a waterfall that feeds a large underground river. During the second half of the expedition, ten days in the jungle, they located a huge feature seen from the air, **Sótano de las Huellas**.

According to the blog at laventa .it, the Chiapas 2014 expedition of the Italian group La Venta got underway in April. Divers immediately headed to **Cueva del Chute Redondo** near Veinte Casas to explore the sump in that cave. Others were given a helicopter ride over the Río La Venta canyon, courtesy of Chiapas Protección Civil. Other goals of the expedition are to reach and explore the huge **Sótano Chiccivà** (Who Goes There, due to its difficult access) and continue mapping in **Cueva Los Bordos**.

The **Grutas de Mamut** are part of a 12-hectare ecotourism center that is an exercise in sustainable development by the Ejido Agua Pajarito, some 4 kilometers east of San Cristobal on the road to Tenejapa. It is part of a larger plan for a Ruta de Los Molinos prepared by the tourism department of Chiapas and the Asociación Cultural "Na Bolom" to develop other scenic and historical attractions in the area. The cave may also be known as **K'in Vo'**, or connected to a cave with that name. *Sources*: two web pages that seem to have disappeared.

CHIHUAHUA

Abstract: Preliminary U/Th Dating and the Evolution of Gypsum Crystals in Naica Caves (Mexico), by Laura Sanna, Paolo Forti, and Stein-Erik Lauritzen.

The origin and the evolution of giant selenite crystals in **Naica** caves, together with the understanding of their growth mechanisms, is one of the aims of the international multidisciplinary research called the Naica Project. In this context, the exact timing of when the gypsum nucleation started and whether its growth has been constant over time have been investigated. The preliminary data obtained with the U–Th disequilibrium method show significant differences in ages for gypsum (between 191 ± 13 kyr for one of the **Ojo de la Reina** cave crystals and 57 ± 1.7 kyr for the base of Espadas cave's spar) and have produced a coarse chronological interval of growth. The crystal depositional rates vary from 0.56 to 1.22 mm/kyr, in excellent agreement with the laboratory tests for gypsum deposition under present conditions performed in the deepest part of the mine. These results are also consistent with a multistage precipitation started at different times in the Naica caves (first in caves at the upper level, where gypsum was subsequently dissolved, and only later in the deeper part of the aquifer under stable conditions), and they allow us to improve the knowledge on the speleogenetic evolution of these caves.

Source: *Acta Carsologica* 40(1)17–28, 2011. The full paper is free at http://ojs.zrc-sazu.si/carsologica/article/view/25/22.

Abstract: Gypsum-Carbonate Speleothems from Cueva de las Espadas (Naica Mine, Mexico): Mineralogy and Palaeohydrogeological Implications, by Gázquez Fernando, Calaforra José María, Forti Paolo, Rull Fernando, and Martínezfrías Jesús .

Some of the most outstanding hypogenic gypsum speleothems worldwide have been recently discovered in the Naica mines. The **Cueva de las Espadas** (Cave of the Swords), which lies at 120 meters depth, hosts a rare type of speleothem called *espada*. This study contributes to the understanding of the mineralogical composition of these singular speleothems by means of their examination using micro-Raman spectroscopy, FT-IR spectroscopy, and EDX microprobe. Our data revealed a complex mineralogy comprising a high-purity selenite core covered by several layers of calcite, aragonite, and gypsum. Solid inclusions of polymetallic oxides (Mn-Pb-Zn) and graphite were also detected. The position of the water table during the genesis of the "espada" speleothems over the past 60 kyr was deduced from their mineralogy. Water-level fluctuations at around 120 meters depth led to environmental changes within the Cueva de las Espadas. The selenite core and gypsum layers were precipitated under biphasic (water-rock) conditions when the cave was submerged under hydrothermal water. The aragonite precipitation required triphasic (air-water-rock) conditions and occurred when the water table intercepted the cave, allowing the CO_2 exchange necessary for carbonate precipitation. Solid inclusions were trapped in an aerobic environment when the gypsum-aragonite boundary condition occurred. A thin calcite layer was precipitated under vadose conditions after the water table definitively moved out of the cave.

Source: *International Journal of Speleology* 41(2)211–220, 2012. Full paper available at www.ijs.speleo.it/pdf/78.648.41(2)_Gazquez.et.al.pdf.

Abstract: Isotopes of Gypsum Hydration Water in Selentie Crystals from the Caves of the Naica Mine (Chihuahua, Mexico), by Fernando Gázquez, José-María Calaforra, David Hodell, Laura Sanna, and Paolo Forti.

We examined the isotopic composition of gypsum hydration water ($\delta^{18}O$ and δD) in several selenite speleothems from the caves of the Naica Mine (Chihuahua, Mexico). The gypsum samples were collected from depths of 120 meters (**Cave of the Swords**) and 290 meters below the surface (**Cave of the Crystals** and **Cueva Ojo de la Reina**). $\delta^{18}O$ ranged between –4.66 and –3.26‰, while δD varied between –81.78 and –71.43‰, relative to V-SMOW. The isotopic composition of the Naica aquifer was calculated using known isotopic fractionation factors for δD and $\delta^{18}O$ during gypsum precipitation

($\alpha D_{gyp-H2O}$ = 0.980 and $\alpha^{18}O_{gyp-H2O}$ = 1.004), which are independent of temperature (at low values). Our results reveal that $\delta^{18}O$ of the Naica aquifer water ranged between –8.62 and –7.23‰, while δD was between –63.04 and –52.48‰ during the period in which the gypsum crystals precipitated under subaqueous conditions from a hydrothermal solution. The data are described by a line $\delta D = 7.97\ \delta^{18}O + 5.81$, which is close to the current meteoric water line at the setting of Naica. Furthermore, the current water in the deep aquifer shows isotopic values that also fit with the inferred values of the aquifer palaeogroundwater. The differences observed between gypsum at –120 and –290 meters deep could be explained by the selenite crystals forming under different climatic conditions, as revealed by previous geochronological studies on these speleothems. Changes in the main moisture source of precipitation (Pacific Ocean/Gulf of Mexico) affected the isotopic composition of the meteoric water in this area during the Quaternary. Alternatively, $\delta^{18}O$ and δD of gypsum precipitated during the Holocene at –120 meters show that evaporation of the shallower aquifer affected the isotopic composition of the groundwater during that period. In conclusion, we confirm that the huge gypsum speleothems of the Naica caves precipitated from water of meteoric origin that infiltrated in the hydrothermal aquifer of Naica, with indication of evaporation during the Holocene. Our preliminary results suggest that phreatic gypsum speleothems constitute a potentially promising archive for palaeogroundwater and palaeoclimate reconstruction.

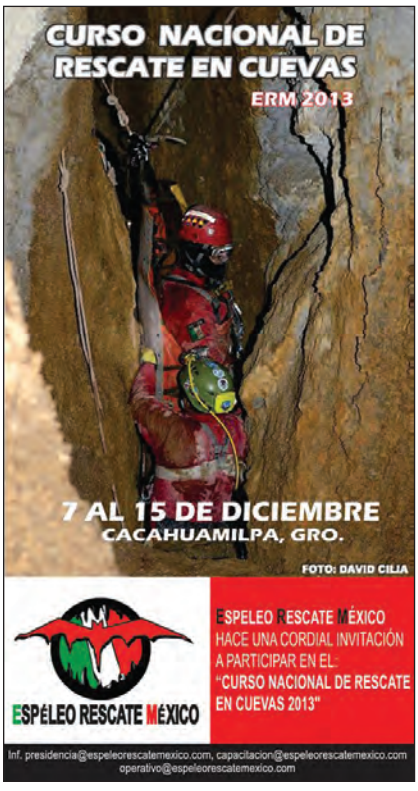
Source: *16th International Congress of Speleology Proceedings*, vol. 2, p. 388–393.

There are some short PowerPoint shows (.ppt files) on the **Cave of the Crystals** in the mine at Naica at http://xa.yimg.com/kq/groups/27864331/1640165493/name/NaicaCaverndeCristal%2Epps and http://xa.yimg.com/kq/groups/27864331/587372833/name/Naica_%2Epps. The text on the slides is in Spanish. The photos are from a variety of sources and not very nicely presented, for the most part. One of the shows also has a couple of shots from other caves in the mine. *Source*: tlamaqui e-mail list post by "Carlos" in Argentina.

Dr. Penny Boston, in collaboration with Dr. Diana Northup and Michael Spilde, both from the University of New Mexico in Albuquerque, and Cameron McMillan, Northern Arizona University, Flagstaff, continue to analyze materials collected during the 2008 and 2009 **Naica** expeditions to Chihuahua, Mexico.

Based on analyses of DNA, the nearest relatives to microorganisms found in this remarkable system include microbes from other caves elsewhere in the world, volcanic soils, heavy-metal environments, and other unique settings. The specific, unusual properties of the strains isolated from the system include extraordinary resistance to highly osmotic fluids, resistance to high temperatures, high salinity, and high metal contents. *Source*: *National Cave and Karst Research Institute 2012–2013 Annual Report*, page 3.

A National Speleological Society webinar by Penny Boston titled



"From Giant Crystals to Tiny Microbes: The Mineralogy and Microbiology of Naica," was presented on March 5, 2014. A video of the hour-and-a-half illustrated lecture can be viewed at http://www.caves.org/webinars/index.shtml or downloaded as a 160 MB .mp4 file from www.caves.org/webinars/Naica.mp4. "Enormous crystals, stifling heat, and a thriving microbial community of extremophiles make Mexico's **Naica** caves some of the most amazing and hostile in the world, and an extreme environment for both life and mineralogy. Dr. Boston will discuss her team's scientific findings, what it is like to cave in these conditions, and the approaches used to enable survival and safety in this challenging environment, which has great relevance to human extraterrestrial exploration."

COAHUILA

The web site TodoSaltillo.mx contains an article with numerous photographs on the "Cuello de Oca" (**El Hundido**), which was also the subject of an article in *AMCS Activities Newsletter* 32, pages 146–148. It is normally a 100-meter pit in a sinkhole, but in wet weather the pit and sinkhole fill with water, creating a large lake. The article is at todosaltillo.mx/article/un-cuello-de-oca-en-coahuila-por-monica-ponce/.

GUERRERO

The "centipede" pictured on page 6 in *Activities Newsletter* 36 is actually a polydesmid millipede, probably of the family Rachodesmidae. Centipedes have one pair of legs per body segment, but this animal clearly has two pairs except near the anterior end, which is common in millipedes. Millipedes and centipedes are as different as any two classes of animals, such as reptiles and amphibians or insects and arachnids. *Source*: Bill Elliott.

A national cave rescue course was hosted by Espeleo Rescate México in Cacahuamilpa December 7–14, 2013. The purposes were to convey to the participants the techniques, procedures, and criteria involved in the execution of a cave rescue and to assess qualified participants for

possibly joining the rescue group.

MICHOACÁN

Vigilantes are searching an extensive cave system in the hunt for the last fugitive boss of the Knights Templar drug cartel, a "self-defense" group leader in western Mexico said Thursday. Vigilante leader Estanislao Beltran said there are signs the cartel had used the caves near the town of **Arteaga** in Michoacán state. "I think they used it as a hideout," said Beltran, who had descended about 100 meters into the caves. "We found evidence." *Source*: AP dispatch April 24, 2014, called to our attention by Jerry Atkinson. The only URL I have for that is ridiculously long. Peter Sprouse points out a video at https://www.youtube.com/watch?feature=player_embedded&v=LO0VUOhT-3A. Doesn't anybody realize that sometimes URLs have to be typed, not just clicked?

MORELOS

INAH has approved a first research project in caves by archaeologists in Morelos. The project involves surveys of cavities in the **Nexpa area**, Mpo. Xoxutla. Anyone with useful information or who would like to participate in the project may contact Enrique Méndez Torres at vengati@hotmail.com. *Source*: Tlamaqui e-mail list post June 8, 2013.

NUEVO LEÓN

The Asociación Coahuilense de Espeleología is starting a project of documentation and re-exploration of **Grutas de Bustamante**. Contact them at espeleocoahuila@gmail.com. *Source*: *Texas Caver*, December 2013, pp. 16–19; see also nice nine-minute video at youtube.com/watch?v=qWQ7LrC-63M.

There is a nice collection of digitized old maps of Nuevo León and Monterrey from the period 1894–1908 at http://cdigital.dgb.uanl.mx/la/1080048648/1080048648_14.html. *Source*: Roger Moore.

OAXACA

The newly named and launched Proyecto Espeleológico Sistema Huautla is off and running with the stated plan to conduct month-long expeditions annually for the next decade. The first one, in April 2014, was successful on several fronts. Diplomacy at the state, *municipio*, and *agencia* levels was for the most part fruitful, with permission granted to go caving in the area for three years. One area remains a challenge, and a plan has been formulated to deal with it.

The area to the east of the known passages of **Sistema Huautla**, in the Plan Carlota *agencia*, was an objective, and around twenty new pits and caves were explored and mapped, without anything going real well. Two caves in the San Agustín *agencia*, southeast of known cave in the system, show promise with strong airflow, and will be pushed in 2015.

Biologists from UNAM in Mexico City spent four days with the expedition and collected in caves three new species of tarantula, two new species of harvestmen spiders, and one new species of scorpion. A potentially important paleontological site was found in a cave as well.

About 3.5 kilometers of new passages were discovered and mapped in the **La Grieta** section of Sistema Huautla by Kasia Biernacka, Gilly Elor, Corey Hackley, John Harman, and Bill Stone, with three of them camping underground for seven days and two of them for nine. Their most significant discovery was a passage extending over 1.5 kilometers to the north, directly toward the highest topography in the area. The turned around in 20-by-20-meter borehole.

Twenty-nine cavers participated on the expedition, with eighteen from the USA, seven from Mexico, one from Tasmania, one from Canada, one from Switzerland, and one from Poland. *Source*: Bill Steele.

The article "In Deep: The Dark and Dangerous World of Extreme Cavers," by Burkhard Bilger, appeared in *The New Yorker* on April 21, 2014. It is about the 2013 **J2** expedition, mainly. For a *New Yorker* article, it is poorly written and poorly edited. The author confuses J2 with Sistema Cheve, which they don't even spell correctly, perhaps due to too much reliance on Bill Stone, who imagines that J2 is part of Cheve. The article is on the web at http://www.newyorker.com/reporting/2014/04/21/140421fa_fact_bilger?currentPage=all. (It would be easier to Google "Bilger 'In Deep'.") *Source*: Bill Mixon.

Abstract: Proyecto Sierra Mazateca 2013, Mexico, by Marion Akers and Tony Akers.

Proyecto Sierra Mazateca is dedicated to cave exploration, karst ecosystem conservation, and Mazatec culture preservation in the **Sierra Mazateca**, Oaxaca, Mexico. This area is home to indigenous people who still speak their native dialect, although many speak Spanish, and it is still a remote area of the state. Accessing the region's caves and gaining the trust of the locals requires patience, time, and a willingness to build long-term relationships. Over the past fifteen years, Tony and Marion Akers have developed a foothold in Cafetal Carlota, working and living with the people and exploring local caves. This year [2013] in January, our area of focus was in the *municipio* of Huautia de Jiménez, and we were again welcomed back. Offering to pay a day's wage for cave-guide services, plus extra for real caves found, proved to be a huge incentive. Along with work opportunities, the cavers brought added business and friendship to local merchants and families.

Following a brief history of the project, the groundwork to overcome differences in language and cultures will be presented that led to the discovery, exploration, and mapping of eight new pits and the completion of **Cueva de la Sorda**.

With the help of donations from the National Speleological Foundation and the Southern Colorado Mountain Grotto, educational presentations and supplies were given to several schools throughout the region. We were able to accomplish many of our goals and strengthened the foundation for future years of exploration and conservation.

Source: *Program Guide to the 70th Annual NSS Convention*, page 52.

Abstract: Deep Caving in Mexico: J2 2013, by Mark Minton.

After a three-year hiatus, a large international team returned to push the sumps at the bottom of **Sistema J2** in the southern Mexican state of Oaxaca. J2 is hydrologically connected to Sistema Cheve, which is part of the deepest proven karst system in the world, at 2550 meters. Cheve ends at –1484 meters in impenetrable breakdown beyond two sumps, but J2 offers a possibility to connect into the main drain beyond the end of Cheve and bridge the more than 10-kilometer gap to the resurgence, Cueva de la Mano. J2 had also been pushed through sumps to 1222 meters depth in 2009, and it continued underwater. The objective of the 2013 expedition was to push through the sumps and explore passages on the far side.

Logistics for such an endeavor are daunting. The bottom of J2 is many kilometers from the nearest entrance, and both known entrances are tight and involve significant vertical work. A new generation of lightweight rebreathers made by Poseidon was used for the dive. Nevertheless it took over a month to get all the gear in place via multiple cave camps and to begin active exploration. The final sump ended up being over 500 meters long but only 12 meters deep. It came up into large borehole, which unfortunately died in impenetrable breakdown. No way on could be found, but bolt climbing before the sumps revealed drafting passage that continues upward. Other entrances were also located that may provide more opportunities to push the system.

Source: *Program Guide to the 70th Annual NSS Convention*, page 52.

Abstract: Recent Explorations in Sistema Huautla, Mexico, by Ernie Garza and Jon Lillestolen.

Sistema Huautla in the southern Mexican state of Oaxaca has a long and rich history, having been first explored by modern cavers in 1966. In the forty-seven years since, Huautla had been pushed to over 62 kilometers in length and 1475 meters in depth, with twenty entrances spread across the Sierra Mazateca. In 2013, a team of cavers from the British Cave Diving Group led by Chris Jewell returned to the bottom of **Huautla** to push beyond the sumps and pursue leads only seen once before. A six-week expedition made it possible for a team to camp beyond the sump and return with over 2 kilometers of new cave survey and a new Western Hemisphere depth record of 1545 meters.

Source: *Program Guide to the 70th Annual NSS Convention*, page 51. This talk was not presented due to the absence of speaker Lillestolen. Bill Mixon filled in with a brief description of the expedition, without any visual aids.

Abstract: Resumed Exploration of Sistema Huautla, Oaxaca, Mexico, by Bill Steele.

The caves of the Huautla de Jiménez, Oaxaca, area were discovered by cavers in 1965. From 1966 through 1970 two caves, Sótano de San Agustín and Sótano del Río Iglesia, were explored and surveyed as the first and second deepest caves in the Western Hemisphere.

Caving resumed in 1976, and through 1994 expeditions were held most years as a major NSS Project. In 1988 the project was awarded an NSS Certificate of Merit. Two books have been published about the caves, *Beyond the Deep* and *Huautla: Thirty Years in One **of** the World's Deepest Caves*. An article about Sistema Huautla is included in the *Encyclopedia of Caves* [and another is in the *Encyclopeida of Caves and Karst Science*].

Since 1994 only a handful of American expeditions have been conducted. In 2013 a British expedition pushed the sump at the bottom of **Sistema Huautla**, resulting in a depth of 1545 meters, again the deepest cave in the Western Hemisphere and the eighth deepest cave in the world and, at 64.3 kilometers (40 miles) in length, the longest of the world's sixteen deepest caves.

American cavers joined the British expedition and checked leads in the Camp I area at –250 meters. By bolting and digging, over half a kilometer of virgin cave passage was discovered and surveyed. American and Mexican cavers are planning to resume annual expeditions under a new name, Proyecto Espeleológico Sistema Huautla, with the objective of exploring Sistema Huautia to over 100 kilometers in length.

Source: *Program Guide to the 70th Annual NSS Convention*, page 51.

On June 4, 2013, Espeleo Rescate México was asked to help in the

The northbound borehole where cavers turned around in La Grieta during the 2014 Huautla Project expedition. *Kasia Biernacka*

search for one Sergio Morales, who had disappeared on May 30. His cap had been found on the edge of a pit, **Sótano Golondrinas**, about 450 meters north of the village of Las Ruinas on Cerro Rabón, Mpo. San José Tenango, Oaxaca. (The pit is located at 751218E and 2007615N, 14Q WGS 84.) After consultations with the authorities to confirm the need, members set out for the area on Friday, June 7. The cave was rigged and descended by three members of the team on Saturday, and the body was found at a depth of about 120 meters at 1:30 p.m. They returned to the surface and notified the family of the victim and the authorities. Two other cavers went down to package the body and prepare it for hauling to the surface, which it reached at 10:50. Derigging was completed at 1:00 a.m. Sunday. *Source*: xa.yimg.com/kq/groups/27864331/615661240/name/Reporte%20Tenango%202013%2Epdf; there is no information about how the man, presumably a local, came to be in the pit.

The November 2013 issue of the *NSS News* contains an article by Bill Steele about his spring 2013 caving in the old route down **Sótano de San Agustín**. It is the same article that appeared in *AMCS Activities Newsletter* 36, with a different selection of photographs. Both the front and back covers of that issue of the *News* display photographs from San Agustín by Elliot Stahl.

The web site of the *Daily Mail* newspaper in the UK contained an article on the 2013 British expedition to **Sistema Huautla** by Olivia Williams, posted June 20, 2013. The site contains a number of nice photos from the trip.

Source: http://www.dailymail.co.uk/news/article-2344927/British-explorer-leads-team-lowest-depths-recorded-cavers-venturing-mile-underground-pitch-black-tunnels-including-600m-underwater-swim.html.

There is a video on the 2013 British diving expedition to **Sistema Huautla** on YouTube at http://youtu.be/iajDjEX6jqY. *Source*: Terry Holsinger.

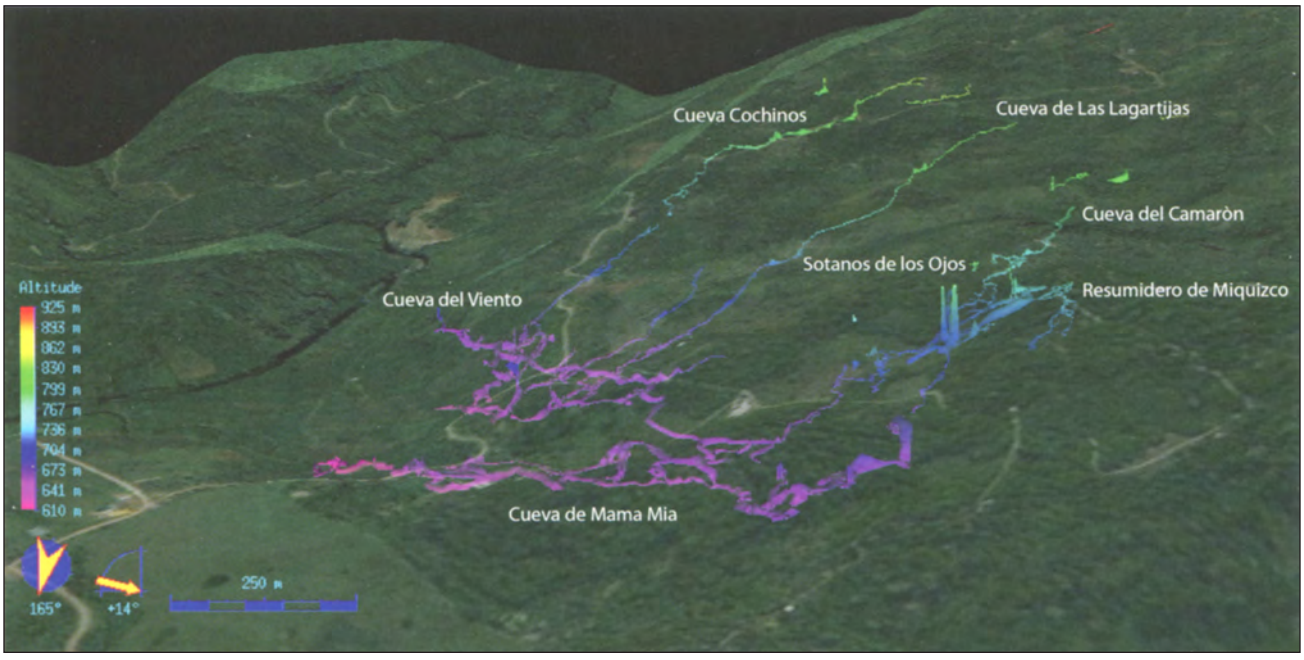
Inspired by new passsages found in **Sótano de San Agustín** during the British expedition there in 2013, Bill Steele and Tommy Shifflett have decided to resume exploration in the area. The Proyecto Espeleológico Sistema Huautla aims to increase the length and depth of the system by searching for higher entrances and exploring the known caves more thoroughly. They aim to have annual expeditions in April. *Source*: *Texas Caver*, December 2013, pp. 10–11.

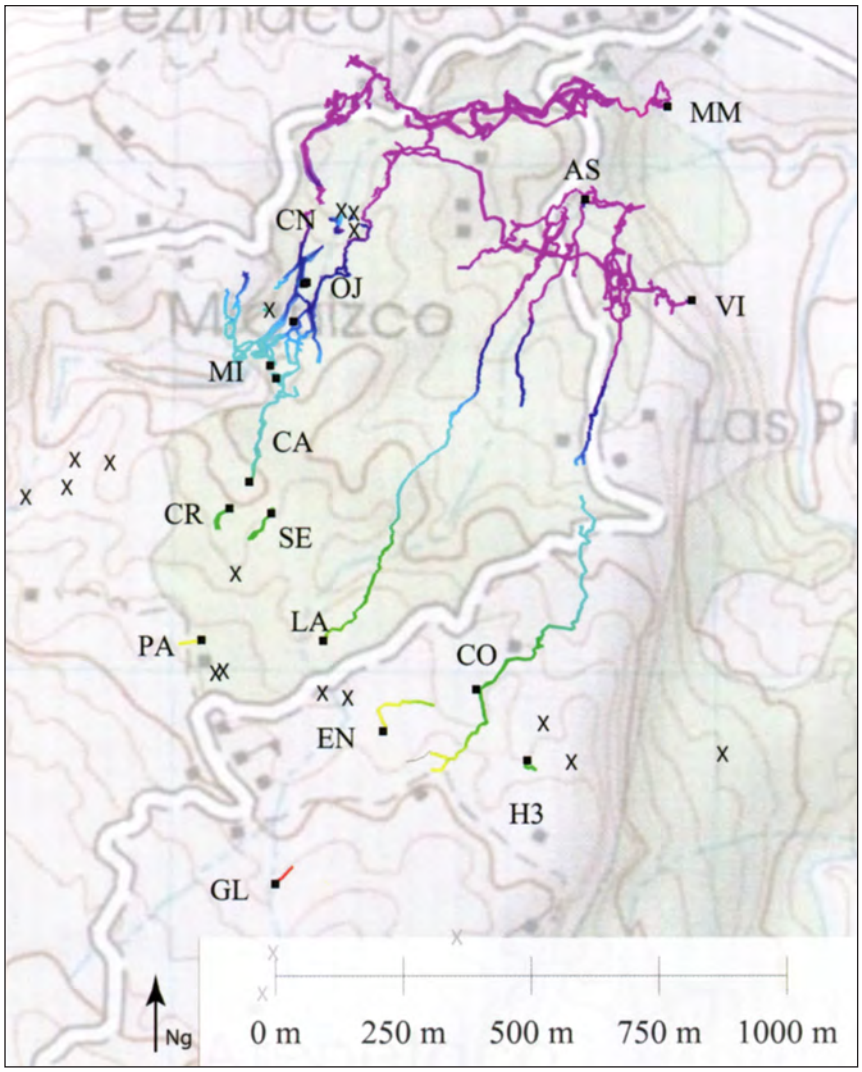
PUEBLA

Efraín Martínez Martíenez, nineteen, was swept away by the current of a rain-swollen river and washed into **Atlalaquia de Atikpak** (Sumidero Atalaquia) in Alcomunga, Ajalpan, Puebla, Mexico. A week later, a recovery team from Espeleo Rescate México still harbored hopes that he might be found alive, despite unsucessful recovery attempts by other groups.

Technical rigging was required to enter the cave due to the high water levels. About 600 feet into the cave, they found the lifeless body of Martínez, nine days after he disappeared. The river flowing into the cave continued rising even as the recovery operation took place, requiring additional rigging for safety and to extract the body. Local people helped carry the stretcher with the body away from the cave. *Source*: *NSS News*, August 2013, (American Caving Accidents) note by Mark Minton based on the same source as the similar note in "Mexico News" in *AMCS Activities Newsletter* 36.

We summarize the main results achieved during five speleological expeditions in the **Hueytamalco area**, Puebla, that occurred in 1998, 2002, 2008, 2010, and 2012, in the frame of a project called Tláloc.





Caves in the Atepetaco area, Mpo. Hueytamalco, Puebla. Asterisk indicates cave connected in the Atepetaco system. AS, Sótano Asunción; CA, Cueva del Camarón*; CN, Cueva del Cocinero; CO, Cueva de los Cochinos; CR, Cueva de las Cruces; EN, Enchonada; GL, Cueva Gloria; H3, Huertas Tri; LA, Cueva de las Lagaritijas*; MI, Resumidero de Miquizco*; MM, Cueva de Mama Mia*; OJ, Ojos de Miquizco*; PA, Pequeña Agonia; SE, Sótano del Sendero; VI, Cueva del Viento*; X, minor caves.

cave	length (m)	depth (m)	year of exploration
Cueva de las Lagartijas*	800	173	1998
Resumidero de Miquzco*	2109	120	1998
Cueva de las Cruces	48	13	2002
Cueva del Cocinero	190	67	2002
Cueva de Los Cochinos	983	125	2002
Cueva del Camarón*	672	59	2002
Cueva del Viento*	4192	111	2008
Cueva de Mama Mia*	4103	94	2008
Huertas Tri	62	33	2008
Cueva Gloria	53	13	2008
Enchonada	188	29	2008
Cueva de Victor			2008
Cueva de la Pequeña Agonia	57	6	2008
Sótano de Sendero	173	22	2008
Embudo de Rancho Viejo	32	101	2010
Pozo Ostia	62	42	2012
Cueva Don Alfredo	363	99	2012

* part of the Atepetaco system

During these expeditions, thanks to the joint efforts of cavers from Sicily, Lombardy, and Mexico, many cavities were discovered.

These cavities were initially explored as independent caves but subsequently extensively connected to each other, creating a single complex named Sistema Atepetaco. This system is 12,100 meters long and 222 meters deep. In 1998, Resumidero de Miquizco was explored, discovering three entrances and total length of 1.5 kilometers. In 2002, the Cueva de Los Cochinos, 500 meters in length, was explored. In 2008, the entrances of Cueva del Viento and Cueva de Mama Mia were discovered, and during the exploration the two caves were connected. The length of that system reached 5.5 kilometers, with four entrances.

In 2010 Cueva del Camarón (600 meters), partially explored in 2002, was connected to Resumidero de Miquizco, and that system then reached 2.3 kilometers, with five entrances. The Resumidero de Miquizco and Cuevas Viento–Mama Mia (then up to 6.9 kilometers) systems were only 25 meters apart. In 2012, the Cuevas Viento–Mama Mia was connected to the Miquizco system by overcoming a breakdown and a sump. A few days later, Cueva de Las Lagartijas, up to 800 meters long, was connected to the same system.

Source: Edited from the introduction to article Exploration and Documentation of the Atepetaco Karst System (Hueytamalco, Puebla, Mexico), by Alberto Buzio, et al., *16th International Congress of Speleology Proceedings*, vol. 2, p. 52–57. (Note that the lengths in the table printed here don't add up to quite

12.1 kilometers.)

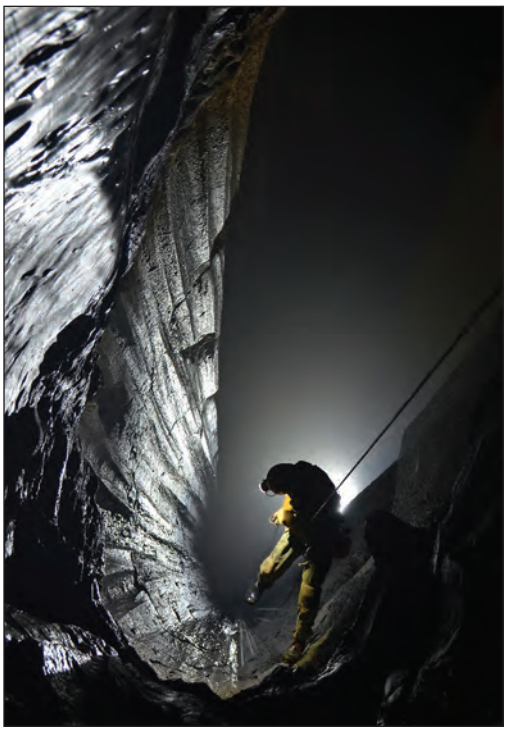
The Tlálok series of expeditions from 1998 to 2012 in the Atepetaco area, located in **Mpo. Hueytamalco** in northeastern Puebla, discovered and connected several caves that form a 12-kilometer-long and 200-meter-deep karst system. The explorations and documentation of the caves were carried out by the collaboration of Italian and Mexican caving groups. The first expeditions saw attention fucussed on only the most visible and accessible caves. A clearer picture of the potential of the system was obtained only in 2008, when Mama Mia and Viento caves were connnected. In 2010, Cueva del Camarón and Resumidero de Miquizco were connected. In 2012 new connections (Miquizco, the Viento–Mama Mia system, and Cueva de Las Lagartijas) enlarged the Atepetaco karst system. *Source*: revised from English abstract (p. 80) to the article "Tlálok 2012" in *Speleologia* 69, December 2013, pages 36–45. The color area map and perspective plot are from that article.

The 2013 Mexpé expedition of the Société Québécoise de Spéléologie took place from March 23 to April 9. The goal was to explore the high plateau on Cerro Tequixtepec, at an elevation of around 2200 meters. (See article on Mexpé 2012 and Gustavo Vela's photos of Mexpé 2014 in this issue.) The major discoveries were **Cueva Chupa Pierna**, pushed to a kilometer long and 235 meters deep, and Mosca Busca Pez, which has promise for the 2014 trip. *Source*: *Sous Terre*, volume 24, number 1, pages 5–11, spring 2014.

The 2013 Mexpé expedition of the Groupe Spéléo Alpin Belge (not to be confused with the 2013 Mexpé expedition of the Société Québécoise de Spéléologie) was briefly described in Mexico News in *AMCS Activities Newsletter* 36, page 13. Gustavo Vela participated and provided us with the photos on the facing page.

A progress report on the Grupo Espeleológico Chicomoztoc's 2014 expedition to the Sierra Negra says that two promising caves have been found in the area of Ojo de Agua. **Cueva Potero** has reached a depth of 250 meters and **Cueva Marisolita** has been pushed to –169 meters. Both caves continue. *Source*: Tlamaqui e-mail list post by José Luis Godoy Atala, April 20, 2014.

A pit explored during the GSAB Mexpé 2014 expedition. *Gustavo Vela*



The thirty-fourth expedition of the Groupe Spéléo Alpin Belge to the Sierra Negra took place from Febuary 18 to March 10, 2014. Besides twelve cavers from Belgium, there were three from France and one from Mexico. The mail goal was extending the **Tepetzala** system, which reached 20 kilometers in length. *Source*: Gustavo Vela.

QUERÉTARO

The article "Formación de Estalactitas . . . ¡Cuestión de Equilibrio Químico!," by Gilberto Ledesma Ledesma appeared in the *Revista Digital Tlaloc* of the Asociación Mexicana de Hidráulica number 60, July–September 2013. The ten-page paper can be read or downloaded at http://revistatlaloc.org.mx/anteriores/edicion_60/art_02_edi_60.htm. Note that downloading it produces a Windows .exe file of a Flash Reader e-book, not the most convenient or standard thing. But it can be printed to a PDF to get it out of Adobe's clutches. An edited version of the English abstract in the article follows.

This paper presents the chemistry of water dripping from a stalactite to try to understand from a chemical point of view the formation of a stalactite. How is a stalactite formed? The situation is not simple, requiring the study of a number of variables. However, with the knowledge of some key laws of chemical equilibrium, it is possible to reach some conclusions about the most important phenomena involved in its formation.

This work presents the chemistry of water trickling from a stalactite in **Cueva El Nuevo**, San Joaquín, Querétaro. Over a year from February 2011 to February 2012, fifty-four samples were collected and measured for conductivity, temperature, pH, HCO_3^-, Cl^-, SO_4^{2-}, Ca^{2+}, Mg^{2+}, Na^+, K^+, total dissolved solids, and total hardness.

Through the use of general laws of chemical equilibrium, my objective was to determine how these results allow these structures to form over the years.

Source: post to Tlamaqui e-mail list by Gilberto Lesdesma, December 9, 2012.

QUINTANA ROO

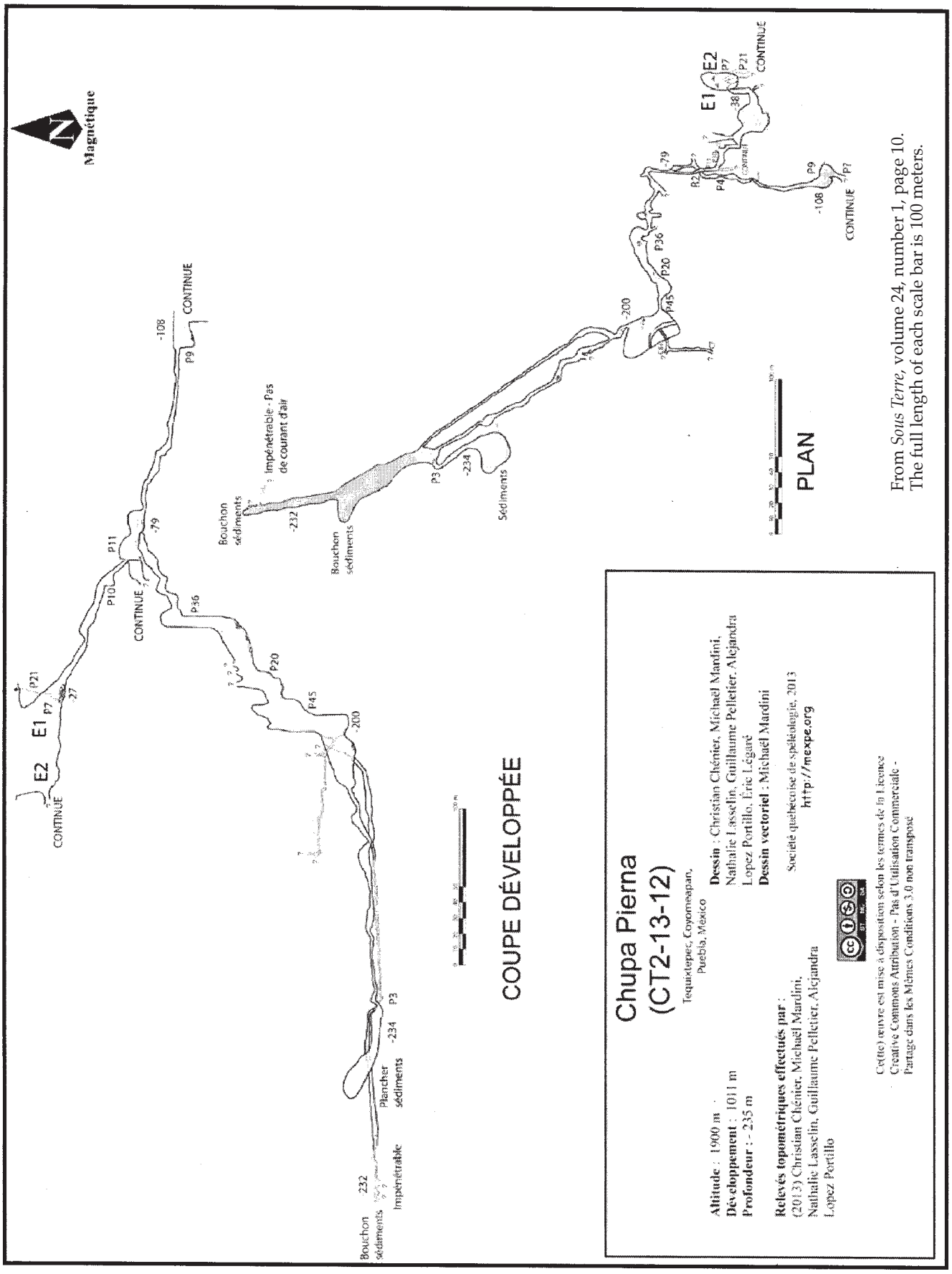
Abstract: Late Pleistocene Human Skeleton and mtDNA Link Modern Paleoamericans and Modern Native Americans, by James C. Chatters, et al.

Because of differences in craniofacial morphology and dentition between the earliest American skeletons and modern Native Americans, separate origins have been postulated for them, despite genetic evidence to the contrary. We describe a near-complete human skeleton with an intact cranium and preserved DNA found with extinct fauna in a submerged cave on Mexico's Yucatan Peninsula. This

Clockwise from upper left: Luis Álvarez observing drip pockets in the mud. Base camp. Richard Grebeude and a wall of unusual breccia in Cueva Clandestina; the fragments fill all the space [pressure solution?—ed]. Joseph Dewult and a drapery.

Photography by Gustavo Vela

Mexpé 2013 Groupe Spéléo Alpin Belge



From *Sous Terre*, volume 24, number 1, page 10.
The full length of each scale bar is 100 meters.

Divers Alberto Nava and Susan Bird transport the Hoyo Negro skull to an underwater turntable so that it can be photographed in order to create a 3-D model. *Paul Nicklen/National Geographic*

skeleton dates to between 13,000 and 12,000 calendar years ago and has Paleoamerican craniofacial characteristics and a Beringian-derived mitochondrial DNA (mtDNA) haplogroup (D1). Thus, the differences between Paleoamericans and Native Americans probably resulted from in situ evolution rather than separate ancestry.

Source: *Science*, volume 344, number 6185 (16 May 2014), pages 750–754. The abstract and a link to a summary of a news item in the magazine about the find can be found at www.sciencemag.org/content/344/6185/750.

Press reports about this discovery appeared promptly in many places, among them the web sites of the *New York Times*, the *Wall Street Journal*, and the *Daily Mail* (UK). The human skeleton, along with skeletons of various extinct animals, was found in **Hoyo Negro**, an underwater pit in the Aktun Hu part of **Sistema Sac Actun**. Articles on Aktun Hu and Hoyo Negro appear in *AMCS Activities Newsletters* 33, 34 (with cover photo), and 35.

Abstract: Ground-Penetrating Radar, Resistivity, and Spontaneous Potential Investigation of a Contaminated Aquifer near Cancún, Mexico, by Philip Carpenter, Ryan Adams, and Melissa Lenczewski.

Geophysical surveys were made over portions of the Cancún municipal well field in the Yucatan Peninsula of Mexico, approximately 20 kilometers southwest of the city of Cancún, in order to identify karst conduits that channel contaminated surface waters into the main aquifer. Specifically, ground-penetrating radar (GPR), vertical electrical soundings (VES) and spontaneous potential (SP) surveys were employed to identify these conduits and detect water movement through them.

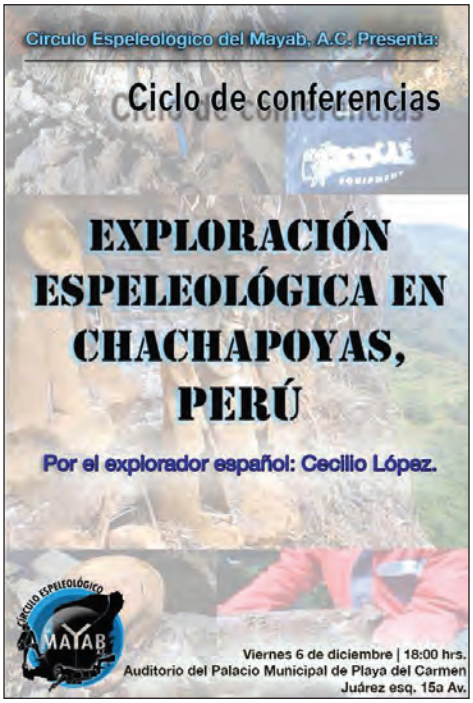
Cancún's municipal water supply has frequently been affected by fecal coliform bacteria and other contaminants. Water supplies are largely derived from highly permeable fractured karst limestone aquifers characterized by rapid transport of microbial and chemical contaminants from the surface to subsurface unconfined and confined aquifers. Quaternary and Tertiary limestone bedrock outcrops across this entire area, which exhibits less than 3 meters of local relief.

Schlumberger array VESs were made at two locations.. One sounding revealed a three-layered structure consisting of a 177-ohm-m layer 2.1 meters thick, (probably weathered limestone), overlying a high resistivity layer 8.2 meters thick (massive limestone with some small caves), overlying saturated limestone (45 ohm-m). The other sounding could not be successfully inverted due to lateral resistivity variations. Twenty-one GPR profiles were also made with 50- and 100-MHz antennas along roads passing through the well field. In the upper 5 meters these profiles reveal cut-and-fill structures and a myriad of diffractions that may represent collapsed and filled sinkholes or solution-enlarged fractures. A major interface delineated by GPR at about 6- to 8-meters depth probably represents the water table. An unusual transparent zone (absence of GPR reflections) was also visible in one GPR profile made near a surface conduit. This transparent zone was at least 1.5 meters wide and extended over several meters depth. SP measurements near this conduit during a rainstorm revealed a peak-to-peak variation of 16 mV, suggesting SP may also be a viable method for mapping subsurface water movement in this well field. The overall implication of this work is that geophysical methods are valuable in delineating recharge points and shallow contaminant pathways and should be used more extensively in this part of the Yucatan Peninsula to support groundwater investigations.

Source: *Proceedings of the 13th Multidiscipinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst*, page 231. A large PDF file of the book is at http://www.karstportal.org/sites/karstportal.org/files/KIP-0011735-25.pdf.

The American Caving Accidents issue of the *NSS News*, August 2013, contains a shorter version of the accident report about **Sistema Cocodrilo** that appeared in "Mexico News" in *AMCS Activities Newsletter* 35.

As part of the overall Festival Internacional de la Cultura Maya 2013, which ran from October 17 to November 3, there was a session on diving in cenotes, the IX Encuentro Internacional de Espeleobuceo, on October 18–21. There were daily trips to cenotes in the vicinity of Mérida, Yucatán. Evening lectures included "Paisajes subacuáticos in película,"


Circulo Espeleológico del Mayab, A.C. Presenta:
Ciclo de conferencias
EXPLORACIÓN ESPELEOLÓGICA EN CHACHAPOYAS, PERÚ
Por el explorador español: Cecilio López.
Viernes 6 de diciembre | 18:00 hrs.
Auditorio del Palacio Municipal de Playa del Carmen
Juárez esq. 15a Av.


Circulo Espeleológico del Mayab, A.C. Presenta:
Ciclo de conferencias
M en C. Olmo Torres Talamante
De la Pangea, meteoritos y cuevas gigantes a extraterrestres y otros bichos.
Viernes 27 de septiembre | 18:00 hrs.
Casa de la Cultura. Cruz de los Servicios con Av. 115 Col. Ejidal
En contraesquina de "Plaza de Las Américas"


Circulo Espeleológico del Mayab, A.C. Presenta:
Ciclo de conferencias
Proyecto Cueva Quebrada, Isla Cozumel
Explorador Steve Ormeroid
Viernes 31 de enero | 18:00 hrs.
Auditorio del Palacio Municipal de Playa del Carmen
Juárez esq. 15 Av.


CIRCULO ESPELEOLOGICO DEL MAYAB, AC
PRESENTA :
TECNICAS VERTICALES
DÍA DE ENTRENAMIENTO
SÁBADO 1 DE MARZO. 9 AM
PARQUE DE QUINTAS DEL CARMEN
PLAYA DEL CARMEN


CIRCULO ESPELEOLOGICO DEL MAYAB, AC PRESENTA:
TESOROS BIOLOGICOS EN LOS CENOTES
— REMIPEDIAS —
POR
JILL YAGER, PH.D
AUDITORIO DEL PALACIO MUNICIPAL
AV. 20 ENTRE CALLES 8 Y 10 PLAYA DEL CARMEN
VIERNES 28 DE FEBRERO, 6 PM ENTRADA LIBRE


El Circulo Espeleológico del Mayab y el Centro INAH
Quintana Roo tienen el agrado invitarle a la conferencia:
10,000 AÑOS DE HISTORIA EN LAS CUEVAS DE QUINTANA ROO
Impartida por la Mtra. Carmen Rojas Sandoval
El viernes 25 de octubre del 2013, a las 6:00 pm
en el Auditorio del Palacio Municipal
Playa del Carmen
ENTRADA LIBRE

by Joaquín Rodríguez, Alajandro Vázquez, and Sergio Grosjean; "1980–2013: Treinta y tres años de exploracieon en los cenotes de Quintana Roo, un approximamiento humano y ambiental," by Mario Zabaleta; and "Exploración subacuática en Isla Cozumel," by Germán Yáñez. *Source*: www.seduma.yucatan.gob.mx/encuentro-espeleobuceo/.

The Circulo Eseleológico Mayab has presented a large number of public lectures in support of its goal of conservation through scientific eductation. And in the summer of 2013, they fostered a unique example of cooperation between *municipio* officials, the Department of the Environment, and land owners in preserving **Cenote la Cruz**, which was discovered within walking distance of Plaza Las Americas when land was being cleared to build a church. CEM members Germán Yáñez, Michel Vasquez, and Mario Zabaleta and Paamul Grotto member Liliana Viola quickly surveyed the cave, putting in twenty-five stations and finding an additional entrance. Plans for the church property were changed to preserve the cenote. *Source*: Mario Zabaleta.

Abstract: Air-Filled Treasures of Quintana Roo, Mexico, by Patricia Kambesis and Dave Bunnell.

Since the 1980s, the Caribbean coast of Quintana Roo, Mexico has been the focus of intense underwater cave exploration. Cave divers have documented an extensive series (1100 kilometers to date) of linear, phreatic, interlinked, and anastomosing cave systems within an 80-kilometer block of coastline that extends from Puerto Morelos south to Muyil. Almost parallel with underwater cave exploration have been efforts in the areas between Akumal and Puerto Aventuras to explore and map caves currently located within the vadose zone, i.e., air-filled. Those efforts have stepped up since 2010, and currently 105 kilometers of "dry" cave has been documented. What started out as segments of dry-cave passages have now been linked up into longer cave systems, the longest being **Pool Tunich** with over 30 kilometers of surveyed passage and with greater length potential, as satellite caves adjacent to it are likely to be connected. Many sections of the "dry" caves are portals into underwater passage, so cave divers and "dry" cavers work together in extending the known limits of the caves. Cuts into the thick jungles of the region, made in the name of touristic and local development, provide cave explorers with access routes and reveal more cave entrances to be explored and mapped. Whether or not the "dry" caves of Quintana Roo have the potential to exceed in length the underwater caves is not know, but it is certain that the dry caves are as significant as their underwater counterparts.

Source: *Program Guide to the 70th Annual NSS Convention*, page 52.

Abstract: K'oox Baal: 4th Longest Underwater Cave System, by Zdeněk Motyčka**.**

In February 2006, members of the Czech Speleological Society started with the exploration of **K'oox Baal**, a 3.5-kilometer-long underwater cave system in the Chemuyil area on the Riviera Maya, part of the eastern coast of the Yucatan Peninsula, Mexico. These expeditions discovered, explored and surveyed 17 kilometers of new passages by the end of 2008, as reported in the proceedings of 15th ICS in Kerrville, Texas. Since 2009 they have discovered another 40 kilometers of new passages and connected this cave system with the Tux Kupaxa underwater cave system, so the total length of K'oox Baal is now 75,140 meters. It is the fourth longest underwater cave system in the world, but thanks to the fact that all discovered parts were immediately mapped, it is the longest completely surveyed and mapped underwater cave system in the world.

Source: *16th International Congress of Speleology Proceedings*, vol. 2, p. 130–133. The same article, without the abstract, appears in *Czech Speleological Society 2009–2013*, published for the 2013 International Congress, pp. 36–39. It is reprinted, with different illustrations, in this issue.

Another article on the exploration of the **K'oox Baal** system appears in a special bulletin of the Slovak Speleological Society published for the 2013 International Congress. It is "Cave Diving in Mexico," by Karol Kýška and Dan Hutňan, pages 84–87. It contains color maps of the system and details of two of its parts.

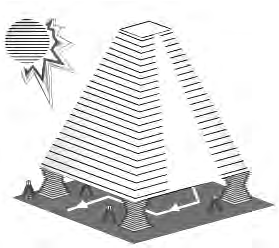
At the Sixteenth International Congress of Speleology in Brno in 2013, the **K'oox Baal** project of the Czech Speleological Society was cited as one of the most important cave exploration projects in the preceeding four years. *Source*: Steve Peerman.

A shorter report on the triple drowning in **Sistema Chac Mool** that was reported in Mexico News in *AMCS Activities Newsletter* 36 is in the American Caving Accidents issue of the *NSS News*, August 2013.

Underwater Speleology, the magazine of the NSS Cave Diving Section, for July–September 2013 (volume 40, number 3, pages 7–11) contains an article on the **Sac Actun** system by Luis Sánchez, Ricardo Castillo, and Alfonso Caballero. It is mainly a guide to the route from the Pet Cemetary entrance to the Blue Abyss, one of the few sites in the underwater caves of Quintana Roo that have significant water depths.

Dr. [George] Veni traveled to Cancún, Mexico, to teach the workshop "Environmental Impacts and Managment of Karst Systems." The

Underwater Caves in Quintana Roo Longer than 3 KM



Quintana Roo Speleological Survey
April 20, 2014
Compiled by Jim Coke

Underwater Cave System	Length (ft)	Length (m)	Depth (ft)	Depth (m)	Cenotes
Sistema Ox Bel Ha	842878.5	256909.4	-114	-34.7	140
Sistema Sac Actun	757136	230775.1	-332	-101.2	170
Sistema Dos Ojos	270578	82472.2	-391	-119.2	28
Sistema K'oox Baal	243867	74330.7	-86	-26.2	44
Sistema Xunaan Ha	171305	52213.8	-89	-27.1	32
Sistema Toh Ha	105909	32281.1	-42	-12.8	18
Sistema Sand Crack	87751	26746.5	-58	-17.7	8?
Sistema Nohoch Pek	78429.5	23905.3	-61	-18.6	8
Sistema Ponderosa	49274	15018.7	-67	-20.4	19
Sistema Murena - Aak Kimin (Yal Ku)	46813	14268.6	-225	-68.6	19?
Sistema Dos Pisos (Ka'p'el Nah)	46509	14175.9	-80	-24.4	5
Sistema Camilo	43951	13396.3	-82	-25.0	7
Sistema Caterpillar	43901	13381.0	-89	-27.1	6
Sistema Doggi	39487.5	12035.8	-48	-14.6	6?
Sistema Cupul Ha	36178.5	11027.2	-46	-14.0	13
Sistema Ek Be	32497.5	9905.2	-60	-18.3	8
Sistema Muul 3	31593	9629.5	-63	-19.2	13
Sistema UchBen	30883	9413.1	-63	-19.2	11
Sistema Chac-Mol	30160	9192.8	-93	-28.3	9
Cueva Quebrada	29268	8920.9	-31	-9.4	10
Sistema Minotauro	28673	8739.5	-55	-16.8	5
Sistema Zapote	25816	7868.7	-90	-27.4	3
Sistema El Puente	25479	7766.0	-296	-90.2	6(?)
Entrada Boca Paila	22606	6890.3	-88	-26.8	1
Sistema Xel-Ha Norte	21825	6652.3	-44	-13.4	4
Cueva Aerolito	20014	6100.3	-90	-27.4	3
Entrada Caapechen (Manatee)	19480	5937.5	-92	-28.0	1
Sistema Joolis	19385	5908.5	-80	-24.4	6
Sistema Regina	19244	5865.6	-117	-35.7	3
Sistema Taj Mahal	17924	5463.2	-80	-24.4	8
Sistema Actun Chen	17831	5434.9	-82	-25.0	9
Sistema Ah Kax Ha (Chicken Ranch 2)	17142	5224.9	-87	-26.5	4
Sistema Actun Koh	16917	5156.3	-54	-16.5	5
Sistema Cangrejo	16835	5131.3	-70	-21.3	3
Sistema Chi Keen	16377	4991.7	-57	-17.4	2
Sistema Tortuga	16178	4931.1	-90	-27.4	2
Sistema Crustacea	16008	4879.2	-84	-25.6	5
Sistema Dzonot Took	16004	4878.0	-54	-16.5	5
Sistema Mosquito Factory	14093.5	4295.7	-34	-10.4	3?
Cenote Chan Ayim	13824	4213.6	-97	-29.6	1
Sistema Tatich (Nuhuch Actun)	13634	4155.6	-24	-7.3	2
Ka-Lag Dzonot	13402	4084.9	-48	-14.6	1
Sistema Burrodromo	13000	3962.4	-47	-14.3	2
Sistema Ich Tunich	12026	3665.5	-54	-16.5	8
Sistema Dos Pies	11536	3516.2	-43	-13.1	5
Sistema Choko Pek	10259	3126.9	-48	-14.6	6
Sistema Luna Azul	10182	3103.5	-71	-21.6	4

workshop was hosted by Los Amigos de Sian Ka'an and sponsored by multiple organizations. Over one hundred participants joined the two-day event, including governmental, private, and non-profit geologists, environmental scientists, and show-cave managers. The workshop also included ten papers by regional experts and a roundtable discussion on the karst hydrogeology and managment of the Yucatan aquifer. *Source*: *National Cave and Karst Research Institute 2012–2013 Annual Report*, page 7.

Club Espeleozots has been formed in Quintana Roo by students at the Universidad Intercultural Maya and the Universidad de Quintana Roo, inspired by the Espeleo Quintana Roo event held in 2012. They participate in exploration and scientific study of the caves of the Yucatan Peninsula, and particularly in the work of the Circulo Espeleológico Mayab, a multidisciplinary group promoting the conservation and preservation of the caves. *Source*: *Noti-FEALC*, volume 23 (issue 34), 2013, pages 14–16

SAN LUIS POTOSÍ

The American Caving Accidents issue of the *NSS News*, August 2013, contains the same report on the accident in **Hoya de las Guaguas** that appeared in "Mexico News" in *AMCS Activities Newsletter* 35.

An 85-year-old woman fell into a 45-foot-deep pit in the municipality of **Tamasopo**. The woman, locally known as Luca, spent sixteen hours in the pit before being rescued by local firefighters and the Mexican Red Cross. Reports say she was unhurt. *Source*: *NSS News*, August 2013 (American Caving Accidents). A longer report on the incident, which occurred on January 3, 2011, appeared in "Mexico News" in *AMCS Activities Newsletter* 34.

A group of teenagers was visiting the well-known **Grutas de la Puente** on March 11, 2010. They had no helmets and insufficient light. They entered the main entrance at about 8:00 a.m. and toured the front part of the cave. They were leaving via a back entrance called Las Escaleras when a metal bar used as a step on the steep climb fell and hit 15-year-old Francisco Nava Lomely on the head. Six of the group continued out and hiked back to their camp, where they called for help. The injured boy and four others turned around and went back out the main entrance, where there was a Jeep waiting to take them to camp. Espeleo Rescate México and Red Cross personnel arrived after midnight just as the injured boy arrived back at camp. He was examined and treated for a contusion and mild hypothermia. Another boy who had sprained his ankle on the hike back to camp was also treated for pain. *Source*: *NSS News*, August 2013, (American Caving Accidents) report by Mark Minton. This accident is also mentioned in Mexico News in *AMCS Activities Newsletter* 33.

Abstract: Cryptic Variation in Morphological Evolution: HSP90 as a Capacitor for Loss of Eyes in Cavefish, by Nicolas Rohner, et al.

In the process of morphological evolution, the extent to which cryptic, preexisting variation provides a substrate for natural selection has been controversial. We provide evidence that heat shock protein 90 (HSP90) phenotypically masks standing eye-size variation in surface populations of the cavefish ***Astyanax mexicanus***. This variation is exposed by HSP90 inhibition and can be selected for, ultimately yielding a reduced-eye phenotype even in the presence of full HSP90 activity. Raising surface fish under conditions found in caves taxes the HSP90 system, unmasking the same phenotypic variation as does direct inhibition of HSP90. These results suggest that cryptic variation played a role in the evolution of eye loss in cavefish and provide the first evidence for HSP90 as a capacitor for morphological evolution in a natural setting.

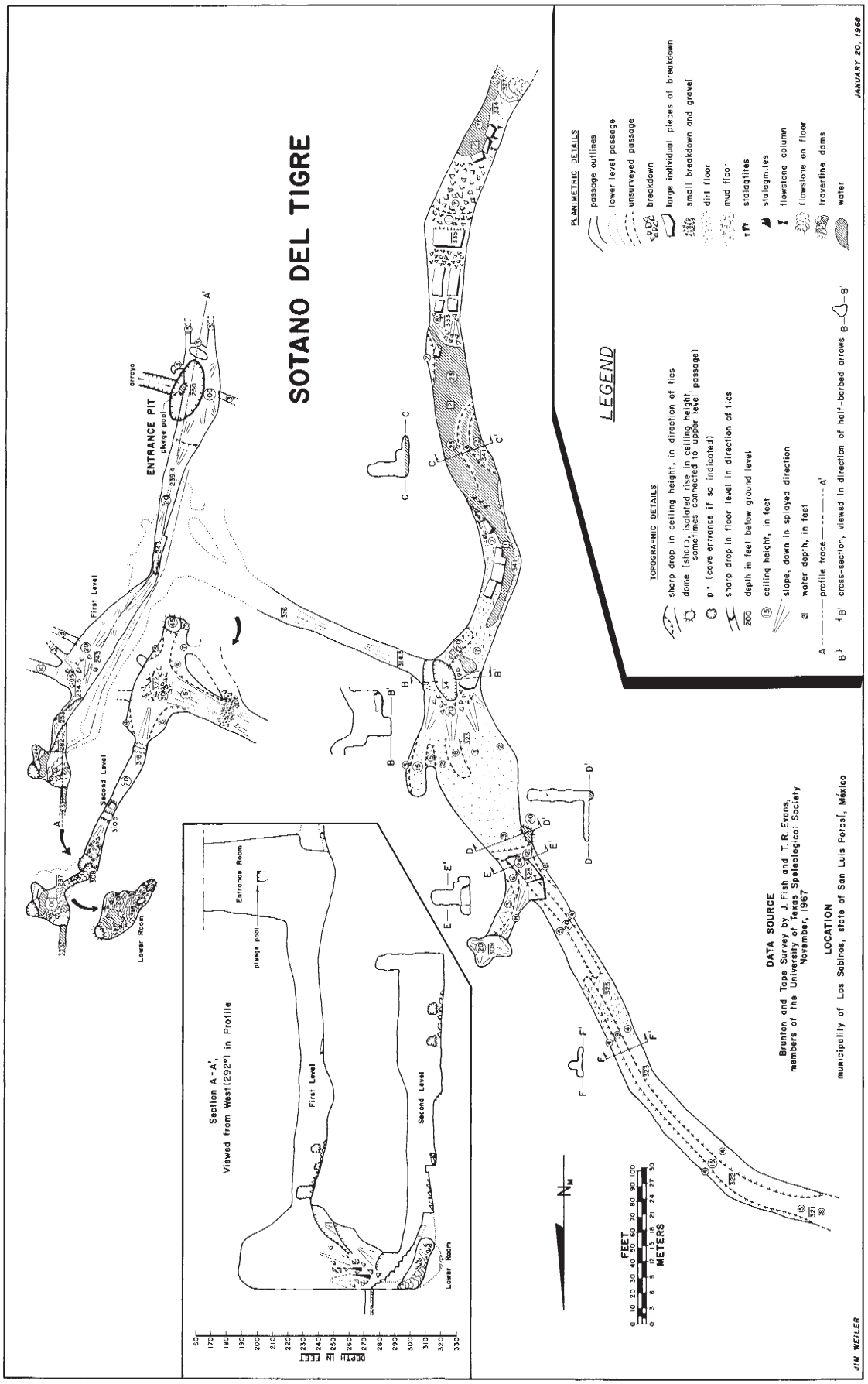
Source: *Science*, volume 132, pages 1372–1375 plus supplemental material, 13 December 2013. There is also a news note about the report on page 1304.

In the process of moving things from Bill Mixon's collection to the AMCS library and archives, an old map of **Sótano del Tigre**, on the Rancho de Los Sabinos, Mpo. Valles, was found. Evidently it was duplicated by the AMCS but never included in a publication. A reduced version of the map is included here; note that figures are in feet. The lowest level continues a long way beyond this map. We hear that someone is at long last drawing up a complete survey. From *Mexican Eyeless Characin Fishes, Genus* Astyanax*: Environment, Distribution, and Evolution*, by Robert Mitchell, William Russell, and William Elliott, 1977, pages 52–53:

"This deep pit is located at 22°07′N latitude and 98°58′W longitude, about 14.5 kilometers north-northeast of Ciudad Valles. It is located on the Rancho de Los Sabinos. The name *(tigre= jaguar)* is not purely imaginative, because Mike Collins and others of the Association for Mexican Cave Studies saw and photographed a jaguar in the arroyo near the cave entrance in 1969.

"It is not entirely certain when this cave was discovered by speleologists, but its first mention in the literature was by Bonet in 1953, who noted the existence of the cave but did not enter it. The cave was first entered on Christmas Day of 1963. Over the next three years, the cave was entered several times, but little explored beyond the impressive entrance drop. On 25 November 1967, Mike Collins, T. R. Evans, John Fish, Terry Plemmons, and Janie Evans returned to the cave, and Fish and T. R. Evans surveyed about 600 meters of passage on the first and second levels to a depth of 96 meters. On 27 November 1967, T. R. Evans, Janie Evans, Fish, and Plemmons reentered the cave and surveyed about 520 additional meters of passage. On this day, blind fishes were seen. This partial survey was drafted by Jim Weiler and distributed privately. On 1 February 1968, Robert Mitchell and James Reddell made the first fish collection in the cave, at a level of 96 meters beneath the entrance, or at an elevation of 149.5 meters.

"The entrance of the cave is one of the better examples of a classical stream-capture to be found in the Sierra de El Abra. The captured arroyo


SOTANO DEL TIGRE
ENTRANCE PIT
plunge pool
arroyo
First Level
Second Level
Lower Room
Entrance Room
Section A - A',
Viewed from West (292°) in Profile
DEPTH IN FEET
FEET
METERS
LEGEND
PLANIMETRIC DETAILS
passage outlines
lower level passage
unsurveyed passage
breakdown
large individual pieces of breakdown
small breakdown and gravel
dirt floor
mud floor
stalagtites
stalagmites
flowstone column
flowstone on floor
travertine dams
water
TOPOGRAPHIC DETAILS
sharp drop in ceiling height, in direction of tics
dome (sharp, isolated rise in ceiling height, sometimes connected to upper level passage)
pit (cave entrance if so indicated)
sharp drop in floor level in direction of tics
depth in feet below ground level
ceiling height, in feet
slope, down in splayed direction
water depth, in feet
profile trace
cross-section, viewed in direction of half-barbed arrows
DATA SOURCE
Brunton and Tape Survey by J. Fish and T. R. Evans, members of the University of Texas Speleological Society November, 1967
LOCATION
municipality of Los Sabinos, state of San Luis Potosí, México
JANUARY 20, 1968
JIM WEILER

drains an area of about 2.5 square kilometers, and as it approaches the cave entrance it becomes narrow and sheer-sided, being about 15.5 meters deep at the point of capture. It no doubt carries a formidable torrent of water into the cave during heavy rains. No surface fishes inhabit the surface drainage.

"The entrance lies at an elevation of 245.5 meters and is 76.5 deep. Because of the existence of several levels of complexly developed passages, the cave is difficult enough to illustrate, much less to describe verbally. Basically, though, the cave may be said to be developed on three levels. On the first level (bottom of the entrance drop), the main cave passage trends north for about 75 meters to a sloping drop of some 21 meters. Six side passages exit from this tunnel. After the 21-meter drop, the main passage turns and strikes south to lie beneath the first level, and it slopes to reach a depth of 96 meters. The passage then strikes west for about 60 meters to the top of a 9-meter drop from the bottom of which the passage then trends south containing a shallow pool about 60 meters long, which supports a large number of blind fishes. Water temperature here in June 1969 was 24°C. The passage continues on for hundreds of meters. Also from the bottom of the 9-meter drop, another passage trends northwest. It harbors a remarkable population of the ricinuleid *Cryptocellus osorioi.*

"More recently, John Fish and members of the Association for Mexican Cave Studies have continued the survey of this cave. It is known now to consist of over 3000 meters of passageway and to reach a depth of 161.5 meters where long, horizontal, muddy passages suggest that base level is being approached."

Abstract: Complex Craniofacial Changes in Blind Cave-Dwelling Fish are Mediated by Genetically Symmetric and Asymmetric Loci, by Joshua B. Gross, Amanda J. Krutzler, and Brian M. Carlson.

The genetic regulators of regressive craniofacial morphologies are poorly understood. To shed light on this problem, we examined the freshwater fish ***Astyanax mexicanus***, a species with surface-dwelling and multiple independent eyeless cave-dwelling forms. Changes affecting the skull in cavefish include morphological alterations to the intramembranous circumorbital bones encircling the eye. Many of these modifications, however, have evolved separately from eye loss, such as fragmentation of the third suborbital bone. To understand the genetic architecture of these eye-independent craniofacial alterations, we developed and scored 33 phenotypes in the context of an F2 hybrid mapping pedigree bred from Pachón cavefish and surface fish. We discovered several individuals exhibiting dramatic left-right differences in bone formation, such as extensive fragmentation on the right side only. This observation, along with well-known eye size asymmetry in natural cave-dwelling animals, led us to further evaluate left-right genetic differences for the craniofacial complex. We discovered three phenotypes, inclusive of bone fragmentation and fusion, which demonstrated a directional heritable basis only on one side. Interestingly, the overall areas of affected bones were genetically symmetric. Phenotypic effect plots of these novel craniofacial QTL revealed that cave alleles are associated with abnormal conditions such as bony fusion and fragmentation. Moreover, many linked loci overlapped with other cave-associated traits, suggesting regressive craniofacial changes may evolve through linkage or as antagonistic pleiotropic consequences of cave-associated adaptations. These novel findings illuminate significant craniofacial changes accompanying evolution in complete darkness and reveal complex changes to the skull differentially influenced by genetic changes affecting the left and right sides.

Source: *Genetics*, volume 196, pages 1313–1319, April 2014.

TABASCO

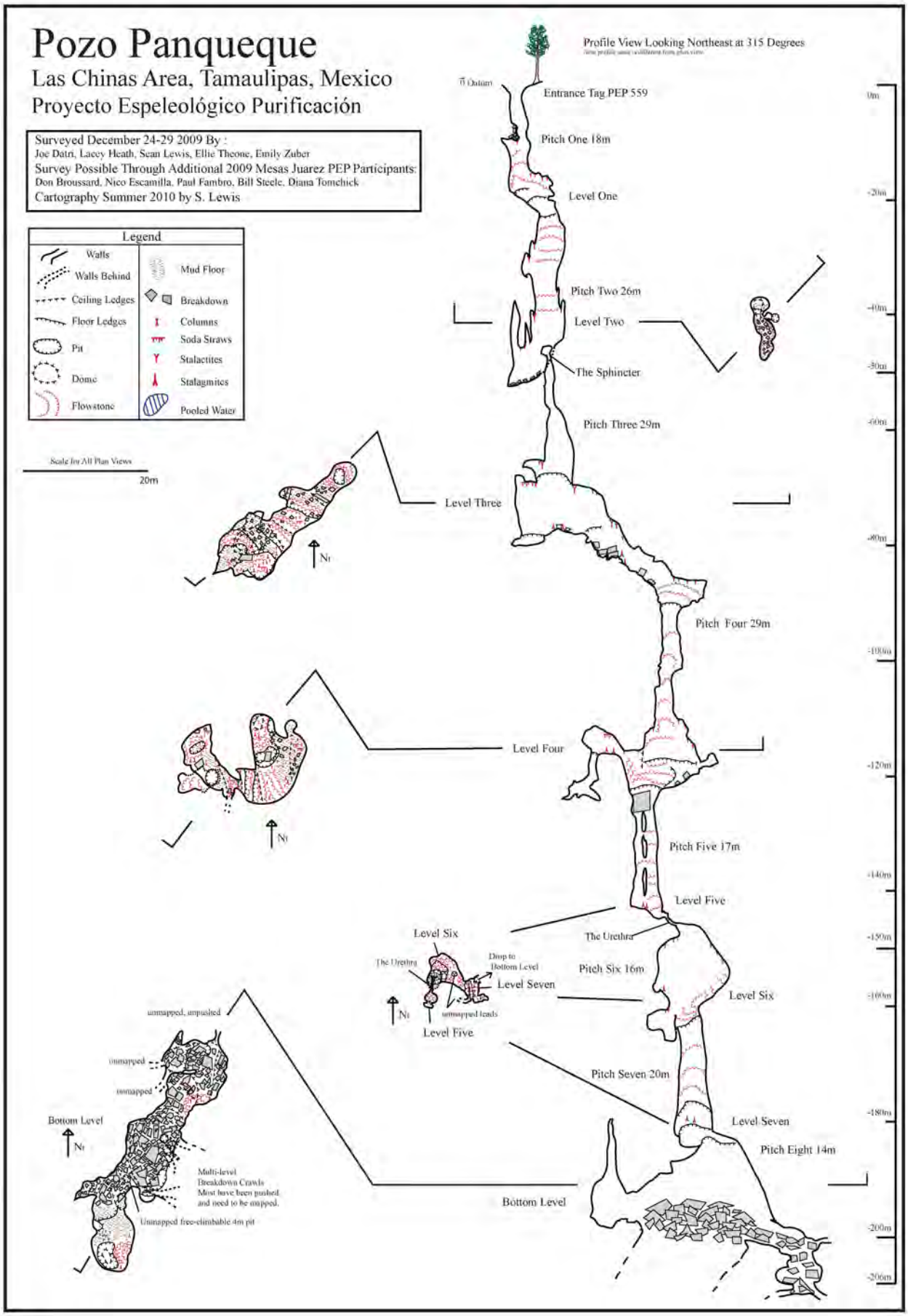
Abstract: Evolution in Extreme Environments: Replicated Phenotypic Differentiation in Livebearing Fish Inhabiting Sulfidic Springs, by Michael Tobler, et al.

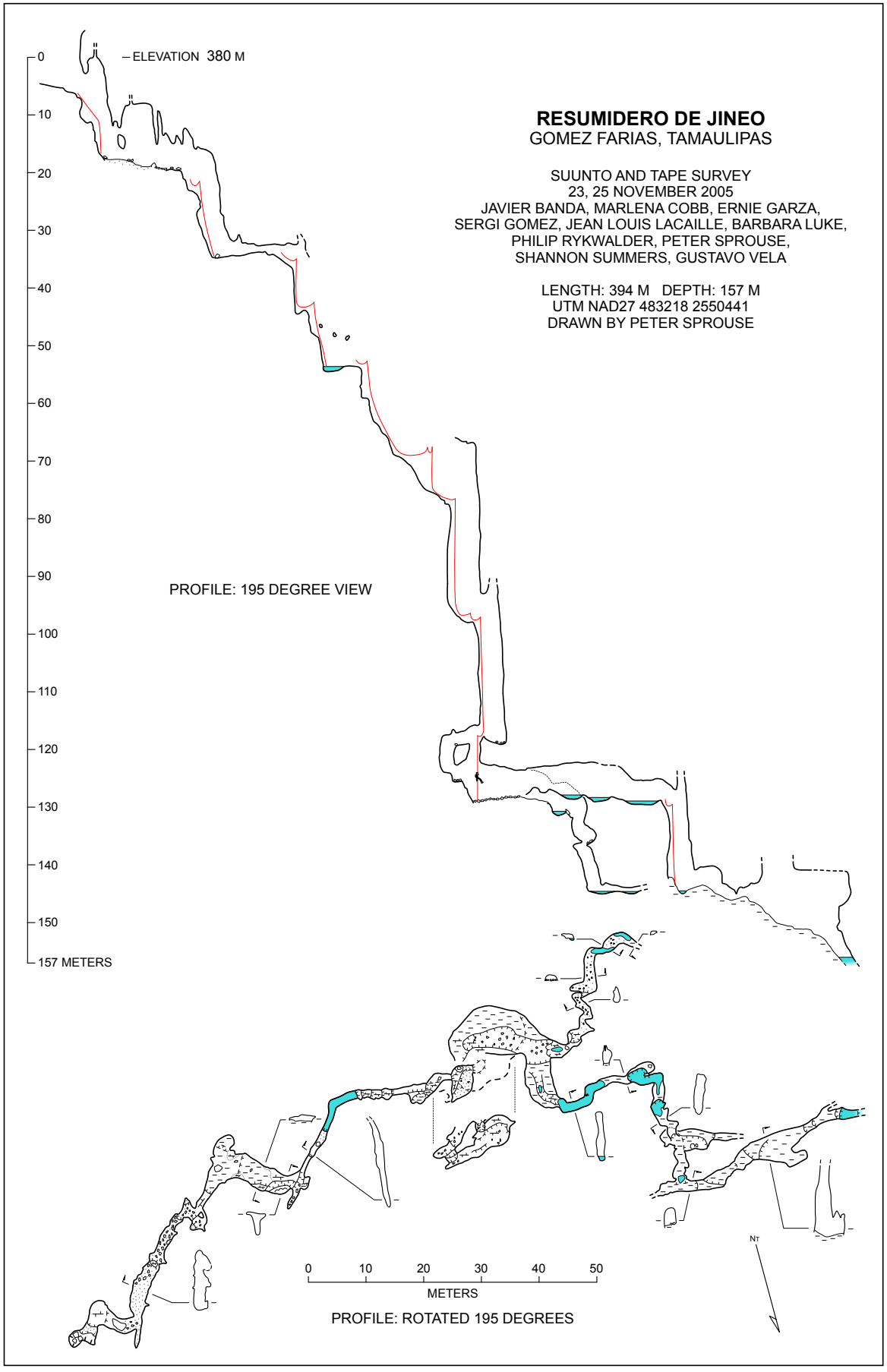
We investigated replicated ecological speciation in the livebearing fish ***Poecilia mexicana*** and *P. sulphuraria* (Poeciliidae), which inhabit freshwater habitats and have also colonized multiple sulfidic springs in southern Mexico. These springs exhibit extreme hypoxia and high concentrations of hydrogen sulfide, which is lethal to most metazoans. We used phylogenetic analyses to test whether springs were independently colonized, performed phenotypic assessments of body and gill morphology variation to identify convergent patterns of trait differentiation, and conducted an eco-toxicological experiment to detect differences in sulfide tolerances among ecotypes. Our results indicate that sulfidic springs were colonized by three different lineages, two within *P. mexicana* and one representing *P. sulphuraria*. Colonization occurred earlier in *P. sulphuraria*, whereas invasion of sulfidic springs in *P. mexicana* was more recent, such that each population is more closely related to neighboring populations from adjacent nonsulfidic habitats. Sulfide spring fish also show divergence from nonsulfidic phenotypes and a phenotypic convergence toward larger heads, larger gills, and increased tolerance to H_2S. Together with previous studies that indicated significant reproductive isolation between fish from sulfidic and nonsulfidic habitats, this study provides evidence for repeated ecological speciation in the independent sulfide spring populations of *P. mexicana* and *P. sulphuraria*.

Source: *Evolution* 65(8)2213–2228 plus on-line supporting material, 2011.

Abstract: Genetic Differentiation and Selection against Migrants in Evolutionarily Replicated Extreme Environments, by Martin Plath, et al.

We investigated mechanisms of reproductive isolation in livebearing fishes (genus ***Poecilia***) inhabiting sulfidic and nonsulfidic habitats in three replicate river drainages. Although sulfide spring fish convergently evolved divergent phenotypes, it was unclear if mechanisms of reproductive isolation also evolved convergently. Using microsatellites,


Pozo Panqueque
Las Chinas Area, Tamaulipas, Mexico
Proyecto Espeleológico Purificación
Surveyed December 24-29 2009 By :
Joe Datri, Lacey Heath, Sean Lewis, Ellie Theone, Emily Zuber
Survey Possible Through Additional 2009 Mesas Juarez PEP Participants:
Don Broussard, Nico Escamilla, Paul Fambro, Bill Steele, Diana Tomchick
Cartography Summer 2010 by S. Lewis
Legend
Walls
Walls Behind
Ceiling Ledges
Floor Ledges
Pit
Dome
Flowstone
Mud Floor
Breakdown
Columns
Soda Straws
Stalactites
Stalagmites
Pooled Water
Scale for All Plan Views
20m
Profile View Looking Northeast at 315 Degrees
0 Datum
Entrance Tag PEP 559
Pitch One 18m
Level One
Pitch Two 26m
Level Two
The Sphincter
Pitch Three 29m
Level Three
Pitch Four 29m
Level Four
Pitch Five 17m
Level Five
Level Six
The Urethra
Drop to Bottom Level
Pitch Six 16m
Level Seven
Level Six
Level Five
Pitch Seven 20m
Level Seven
Pitch Eight 14m
Bottom Level
unmapped, unpushed
unmapped
unmapped
Bottom Level
Multi-level Breakdown Crawls Most have been pushed and need to be mapped.
Unmapped free-climbable 4m pit
0m
-20m
-40m
-80m
-60m
-80m
-100m
-120m
-140m
-150m
-160m
-180m
-200m
-206m


0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
157 METERS
ELEVATION 380 M
RESUMIDERO DE JINEO
GOMEZ FARIAS, TAMAULIPAS
SUUNTO AND TAPE SURVEY
23, 25 NOVEMBER 2005
JAVIER BANDA, MARLENA COBB, ERNIE GARZA,
SERGI GOMEZ, JEAN LOUIS LACAILLE, BARBARA LUKE,
PHILIP RYKWALDER, PETER SPROUSE,
SHANNON SUMMERS, GUSTAVO VELA
LENGTH: 394 M DEPTH: 157 M
UTM NAD27 483218 2550441
DRAWN BY PETER SPROUSE
PROFILE: 195 DEGREE VIEW
0 10 20 30 40 50
METERS
PROFILE: ROTATED 195 DEGREES
NT

we found strongly reduced gene flow between adjacent populations from different habitat types, suggesting that local adaptation to sulfidic habitats repeatedly caused the emergence of reproductive isolation. Reciprocal translocation experiments indicate strong selection against immigrants into sulfidic waters, but also variation among drainages in the strength of selection against immigrants into nonsulfidic waters. Mate choice experiments revealed the evolution of assortative mating preferences in females from nonsulfidic but not from sulfidic habitats. The inferred strength of sexual selection against immigrants (RIs) was negatively correlated with the strength of natural selection (RIm), a pattern that could be attributed to reinforcement, whereby natural selection strengthens behavioral isolation due to reduced hybrid fitness. Overall, reproductive isolation and genetic differentiation appear to be replicated and direct consequences of local adaptation to sulfide spring environments, but the relative contributions of different mechanisms of reproductive isolation vary across these evolutionarily independent replicates, highlighting both convergent and nonconvergent evolutionary trajectories of populations in each drainage.

Source: *Evolution*, vol. 67?, on-line in advance to print, accessed July 2013, 15 pages plus on-line supporting information.

Abstract: Challenges and Opportunities for the Management of Cueva de Villa Luz, Tabasco, Mexico, by Laura Rosales-Lagarde, et al.

Management of **Cueva de Villa Luz** has the challenges of changing authorities, an atmosphere with high and variable concentrations of toxic hydrogen sulfide, and a rich-biodiversity. Hydrogen sulfide is discharged by springs inside the cave, nourishing chemosynthetic microorganisms. These microorganisms sustain a rich ecosystem, including insects, fish, and bats. Additionally, some microbial communities also require local water percolation to thrive. Thus, changes in climate could directly affect their development.

To decrease the exposure to the toxic atmosphere, most tourist routes concentrate in a section with a higher number of skylights and typically lower hydrogen sulfide concentrations. Otherwise, they do a short visit to areas with higher hydrogen sulfide concentrations. Additionally, the local habitants collect the fish inside the cave, once or sometimes twice a year, as part of a traditional ceremony, which is also a tourist attraction.

Cueva de Villa Luz is located at a local park, which is losing area due to an increase in population and its living and farming space. The cave is managed by the Tourist and Economic Development Department of the local authorities. These authorities change every four years, complicating a long-term management program and the availability of a local repository for research results. The local libraries have been used as an alternate depository. In addition, the growth of local universities focused on community development and the increased interest of local biologists may result in a more stable management and research program for Villa Luz and other caves in the area.

Source: *20th National Cave and Karst Management Symposium, November 4–8, 2013, Carlsbad, New Mexico, USA. Program with Abstracts*, page 57.

The Karst Waters Institute's special publication 18, *Hypogene Cave Morphologies: Selected Papers and Abstracts of the Symposium Held February 2 through 7, 2014, San Salvador Island, Bahamas*, contains an extended abstract of a paper "Speleogenesis by the Sulfidic Springs at **Northern Sierra de Chiapas**, Mexico, Based on Their Water Chemistry" by Laura Rosales-Lagarde and Penelope J. Boston. The abstract is too long to include here, but is based on the research reported in AMC Bulletin 24, Rosales's PhD dissertation. The proceedings volume is at http://karstwaters.org/publications/SP18_Hypogene_Cave_Morphologies.pdf, and the abstract is on page 101.

TAMAULIPAS

An NSS webinar presentation by Marcus Gary on **Sistema Zacatón** and the DEPTHX project is on the NSS web site at caves.org/webinars/Caving_Robot-1.mp4. It is a 50-minute .mp4 file of the May 2012 talk.

Pozo Panqueque was surveyed during a trip to Mesas Juárez in the Proyecto Purificación area in December 2009. There is a note about the trip in Mexico News in *AMCS Activities Newsletter* 33, starting on page 27. This cave is one of the deeper ones in the region and still has leads at the bottom. *Source*: Sean Lewis.

Resumidero de Jineo was surveyed in 2005. See the article on the Gómez Farías area in *AMCS Activities Newsletter* 29, pages 75–81.

VERACRUZ

On March 28, 2010, group of young tourists were on a commercially guided trip to **Sótano del Popoca**. They were lowered down a 70-meter-deep pit with a pulley system at about 3:00 p.m. When it was time to leave, the distracted tourists failed to grab a pack being lowered to them that contained the equipment they would need for the ascent, and it was lost in an underground river, leaving them stranded. One of the guides called for help and Espeleo Rescate México responded along with public safety officers, volunteer firefighters, and the Red Cross. The group waited nearly twelve hours until help arrived. The tourists were cold and hungry but not injured, and it was determined that they could climb out of the pit under their own power. Food and hot drinks were taken down, along with vertical gear. The tourists climbed out on their own, with assistance at a rebelay and at the lip. Everyone was out safely by 6:00 a.m. the following morning. *Source*: *NSS News*, August 2013, (American Caving Accidents) report by Mark Minton. This accident is also mentioned in Mexico News in *AMCS Activities Newsletter* 33.

On October 23, 2009, three children were chasing a rabbit at night in

the village of **Cimarrontia**, Veracruz. While in pursuit, one of them fell into a pit. Espeleo Rescate México, public safety officers, and the Red Cross were called to the scene. The pit was especially dangerous because of the mud and rocks that fell readily from the lip while rescue personnel were inside. This was partially due to local people approaching the edge, trying to watch the rescuers in action. After the bystanders were kept back, the body of 12-year-old Eloy Panzo was located at a depth of 120 meters. The body was placed in a Sked stretcher and hauled to the surface with a block-and-tackle system, assisted by rescue personnel at various rebelays. The body was turned over to local authorities before being returned to the family for burial. *Source*: *NSS News*, August 2013, (American Caving Accidents) report by Mark Minton. This accident is also mentioned in Mexico News in *AMCS Activities Newsletter* 33.

Guillermo Gassos's blog contains a March 2014 entry about the traditional Nahuatl ceremony called Xochilalas that takes place every first Friday in March at **Cueva del Sol**, on the slopes of the Sierra de Zongolica overlooking Coetzala. *Source*: http://espeleojarocho.blogspot.mx/.

A band plays Beatles songs in Cenote Maya. *Gustavo Vela*

YUCATÁN

On October 19, during an international symposium "El manejo del acuífero de Yucatán: retos actuales y futuros ante el cambio climático" held in connection with the Festival Internacional de la Cultura Maya 2013, the governor of Yucatán and the mayors of Mérida and the *municipios* of Seyé, Acanceh, Timucuy, Homún, Cuzamá, Tecoh, Tekit, Tahmek Hoctún , Xocchel, Hocabá, Sanahcat, signed a document establishing a **Reserva Estatal Geohidrológica** in the area of the "ring of cenotes." The area of the reserve is 2,192 square kilometers, which increases the part of the area of the state under conservation protection from 12 to 17 percent. The reserve aims to protect the quality and sustainability of the aquifer that carries 180 million cubic meters of water every year. *Source:* http://sipse .com/noticias/firman-decreto-para-crear-una-reserva-geohidrologica-en-yucatan-57317.html, called to our attention by Mario Zabaleta.

The August 2013 issue of *National Geographic* contains the article "Secrets of the Maya Otherworld" by Alma Guillermoprieto. It includes material on a visit to **Cenote Holtún** (mexicancaves.org/maps/1790 .pdf) with Guillermo de Anda. An article of underwater archaeology at this cenote appears in *AMCS Activities Newsletter* 35, pages 43–50.

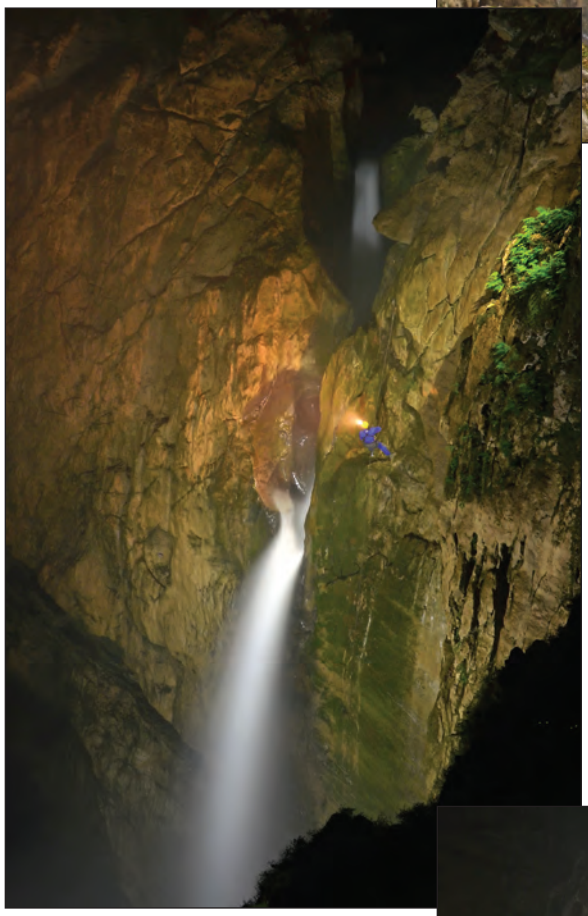
A report in Spanish on the visit to **Aktun Kaua** that was reported in "Mexico News" in *Activities Newsletter* 36 (page 30) is on the web at app.box.com/s/8dnyl5eqwlx5m4f88v00.

Gustavo Vela attended the second anniversary of **Cenote Maya**, near Valladolid, as a tourist attraction. *Source*: Tlamaqui e-mail list, July 14, 2013.

See also the note about the IX Encuentro Internacional de Espeleobuceo in Mérida under Quintana Roo.

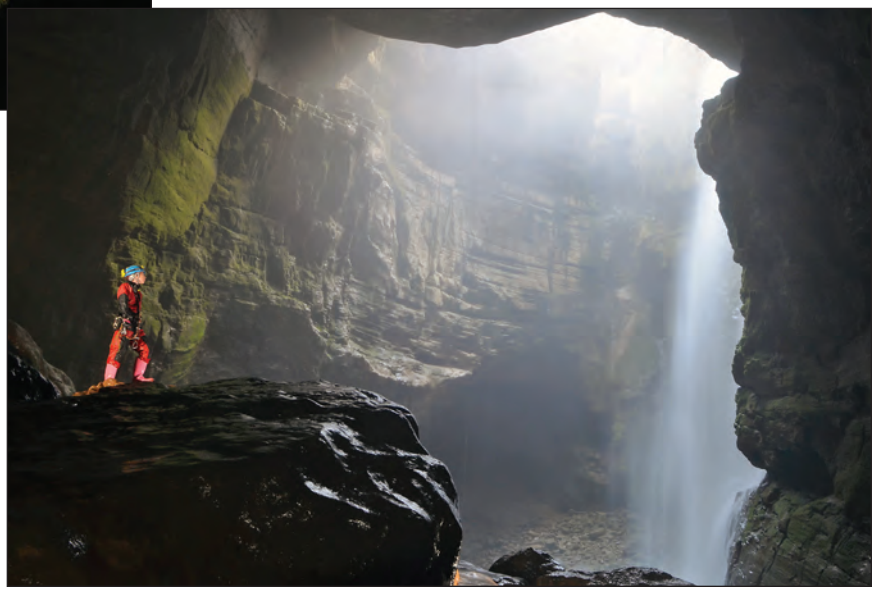
MISCELLANEOUS

Speleologia number 68, from the Societá Speleologica Italiana, was published in June 2013 as a special English-language issue for the International Congress of Speleology. Among the material about caves and caving in Italy, it includes an interview (pages 96–98) with Tullio Bernabei about the history of the La Venta Association, which readers of articles and Mexico News in recent *AMCS Activities Newsletters* will know has been active in Chiapas, Oaxaca, and Coahuila in Mexico. Bernabei was one of the



Sótano del Popoca
Veracruz
Photographs by Gustavo Vela

Above, Daniel Castro descends the second drop. Left: Roberto Rojo descending next to the waterfall at night; lighting assistance from David Tirado and Lorenzo Ortiz. Below, Vitza Cabrera enjoys the view at the bottom of the pit.



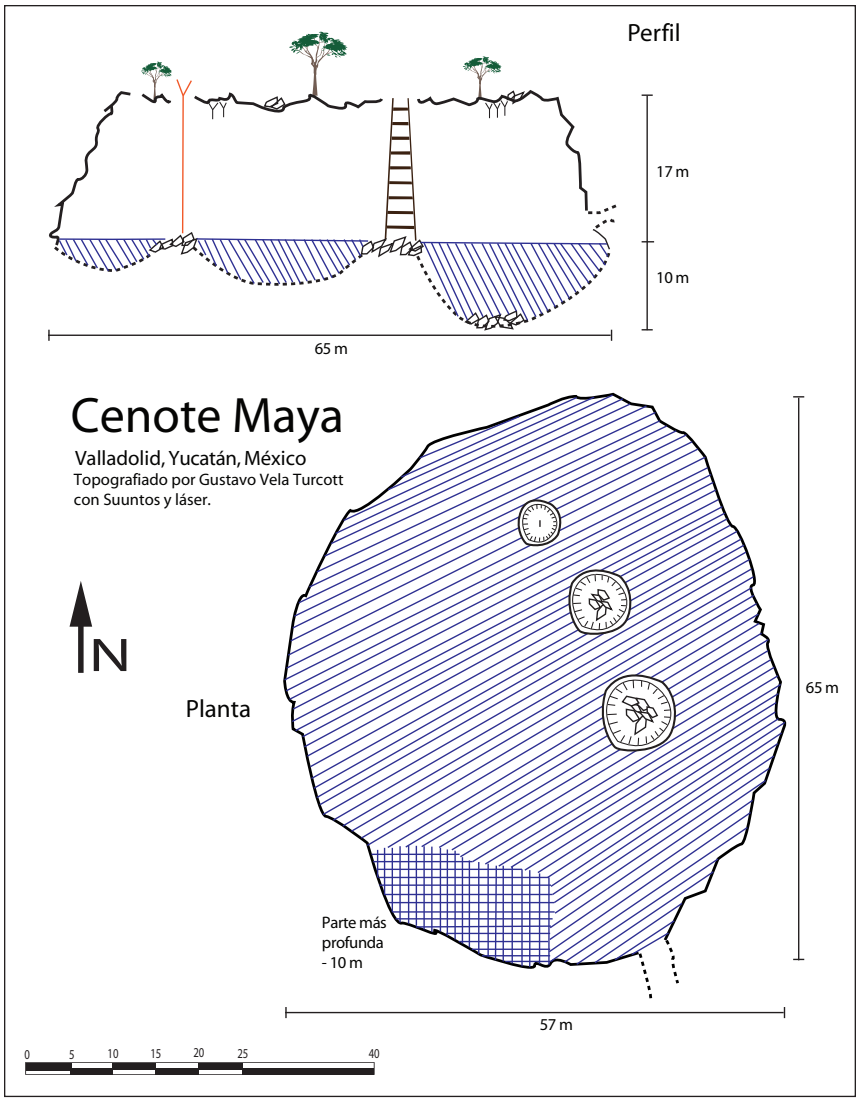
In December 2013, members of the Sociedad Mexicana Exploraciones Subterráneas visited and surveyed the lava tube Cenzontle, near Xalapa, Veracruz. Photographs by Gustavo Vela.

From left, Roberto Rojo, Arturo Robles, Ramón Espinasa, Denise Vera, and Sofia Espinasa in one of the entrances.

Lava Tube Photographs by Gustavo Vela

Denise Vera, Ramón Espinasa, Vicente Loreto, and Sofia Espinasa begin the survey.

Denise Vera in a large tunnel.



original members when La Venta was founded in 1991.

The thirteenth Semana de Cuevas, organized by the Taller de Bioespeleología and the Facultad de Ciencias at the Universidad Nacional Autónoma de México campus in Juriquilla, Querétaro, was held at the university's Centro Académico Cultural from 19 to 22 November 2013. The cave week is organized each year in order to bring together researchers who specialize in the study of caves and the organisms the inhabit them. The talks are meant to update specialists and the general public on the work being undertaken in the caves of Mexico, interesting but unfortunately little studied. *Source*: http://xa.yimg.com/kq/groups/27864331/1088873225/name/programa_final.pdf. This program also contains abstracts of most of the talks.

Tuesday, Nobember 19

Fernando Álvarez Padilla, Juan B.Morales Malacara, and José G. Palacios-Vargas. *Introductory remarks.*

Juan B. Morales-Malacara. *Murciélagos vampiros.*

Fernando Álvarez-Padilla. *Sistemática filogenética: un repaso y aplicaciones en cuevas.*

José G. Palacios-Vargas. *La Bioespeleología En Los Congresos Nacionales e Internacionales.*

Ignacio M. Vázquez Rojas and Laura L. Del Castillo Martínez. *Ácaros de vida libre en la cueva de los riscos.*

Dulce Flor Piedra Jiménez and Mariana Servín Pastor. *Procesos evolutivos en la fauna cavernícola.*

Film released 2008, directed by Eric Brevig. *Vieja al Centro de la Tierra.*

María del Pilar Aliaga Campuzano. *Las cuevas, fieles testigos de las variaciones ambientales.*

Wednesday, November 20

Brenda Ameneyro Angeles and Alejandro Guerra. *Buceo de Cavernas Dentro de Cenotes de Tulum, Q.Roo.*

Mariana Gamboa Vargas. Proteus anguinus el anfibio de las profundidades.

Maira S. Montejo Cruz. *Biología de Murciélagos de las Cuevas de Yucatán.*

Violeta Jiménez Parejas. *Revisión preliminar de la colección MacSwiney de la fauna de ectoparásitos asociados a los murciélagos de la Península de Yucatán, México.*

Film released in 2012, directed by Christophen Nolan. *Batman; el caballero de la noche asciende.*

Thursday, November 21

Cenia Almazán Marín. *Evolución de la hematofagia: una revisión de las principales moléculas.*

Liliana Trujillo Pahua. *Ectoparásitos del murciélago frugívoro Sturnira hondurensis del bosque de Veracruz, México.*

Maira S. Montejo Cruz. *Relatos De Cuevas En Yucatán.*

Gustavo Ramírez Hernández and Claudia Marcela Chávez Ramírez. *Salinas y murciélagos: una relación en beneficio de la diversidad vegetal de Zapotitlán.*

Mariana Gamboa Vargas and Mariana Servín Pastor. Alimentación en Murciélagos.

Documentary film. *Planeta Tierra, Cuevas.*

Uriel Garcilazo Cruz. *La ceguera de Darwin: pérdida de ojos en arañas cavernícolas.*

Francisco Andrés Rivera Quiroz. *Arácnidos en Cuevas.*

Dulce Flor Piedra Jiménez. *Bioluminiscencia en Cuevas.*

Juan Pablo Bernal. El clima de la Tierra visto desde abajo de la tierra.

Friday, November 22

Gabriela Rodríguez Arellanes and Maria Lucia Taylor. *Histoplasmosis y su relación con las cuevas.*

Adriana Espino del Castillo

Rodrí–guez. *Diversidad bacteriana en la Mina de Naica y su potencial participación en la precipitación mineral.*

Mario Gómez Ramírez and Pablo Sandoval Rivera. *La caverna de "Coamila" como un espacio didáctico en la enseñanza de la espeleología en la licenciatura de Geografía de la Universidad Veracruzana.*

Griselda Montiel Parra. *Aportaciones a la aracnofauna de la Cueva La Barca, Península de Guanacabibes, Pinar del Río, Cuba.*

Ricardo Paredes León. *Ácaros parásitos de lagartijas trogloxenas en cuevas de México.*

Bruno Espinosa. *Exploración en las venas de los gigantes.*

Linda Yazmín Martínez Aldana. *Rabia en Murciélagos.*

Gustavo Vela Turcott. *Resultados de las exploraciones en la Sierra Negra 2013.*

The magzine *México Desconocido* has a collection of eight cave photos, from Quintana Roo to Nuevo León, in the "photos of the week" section on its web site. The URL is www.mexicodesconocido.com.mx/fotos-semana-cuevas-abismos-mexico.html. *Source*: Guillermo Gassos post to Tlamaqui e-mail list, December 17, 2013.

DEEP CAVES OF MEXICO

Mark Minton
May 2014
Depth in meters

1	Sistema Huautla	Oaxaca	1545
2	Sistema Cheve	Oaxaca	1484
3	Cueva Charco	Oaxaca	1278
4	Sistema J2 (Ozto J2 (Faustino, Barbie) + Last Bash (Hija Puta))	Oaxaca	1229
5	Akemati - Akemasup	Puebla	1226
6	Kijahe Xontjoa	Oaxaca	1223
7	Sistema Nogochl (Olbastl Akemabis - El Santito)	Puebla	1182
8	Sistema Ocotempa (OC3 + OC11)	Puebla	1070
9	Soncongá	Oaxaca	1014
10	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli+Pozo 4)	Puebla	968
11	Sistema Purificación	Tamaulipas	957
12	Guixani N'dia Kijao (Guinjao)	Oaxaca	955
13	Sistema Perrito (Nia Quien Nita + Nia Nga'co Nita)	Oaxaca	906
14	Resumidero de la Joya Jonda (Hoya Honda)	San Luis Potosí	895
15	Nita Chó	Oaxaca	894
16	Sótano de Agua de Carrizo	Oaxaca	843
17	Sótano de El Berro	Veracruz	838
18	Sótano de Trinidad	San Luis Potosí	834
19	Hard Rock Cave	Oaxaca	830
20	Resumidero El Borbollón	San Luis Potosí	821
21	Las Tres Quimeras	Puebla	815
22	X'oy Tixa Nita	Oaxaca	813
23	Nita Ka	Oaxaca	760
24	Sistema H31-H32-H35	Puebla	753
25	Sonyance	Oaxaca	740
26	Nita Xongá	Oaxaca	739
27	Yuá Nita	Oaxaca	705
28	Aztotempa	Puebla	700
29	Sótano de los Planos	Puebla	694
30	Sótano de Alfredo	Querétaro	673
31	Cueva Santo Cavernario+Totoztzil Chichiltic	Puebla	667
32	Sistema de los Tres Amigos (Te Chan Xki)	Oaxaca	659
33	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	658
34	Cueva Tipitcli (Tipitli)	Puebla	653
35	Sótano de Tilaco	Querétaro	649
36	Nita Nashi	Oaxaca	641
37	Cuaubtempa Superior	Puebla	640
38	Oztotl Altepetlacac (Cueva Paisano)	Puebla	638
39	Sistema Soconusco - Aire Fresco	Chiapas	633
40	Sistema Atlalaquía	Veracruz	623
41	Cueva de Diamante	Tamaulipas	621
42	Sistema Coyolatl-Esperanza	Puebla	620
43	R'ja Man Kijao (Nita)	Oaxaca	611
44	Nita He	Oaxaca	594
45	Meandro Que Cruce (Meandre Qui Traverse, H54)	Puebla	588
46	Olbastl Koltik (Sótano Chueco)	Puebla	587
47	Yometa	Puebla	582
48	Sótano de las Coyotas	Guanajuato	581
49	Sistema Los Toros	Nuevo León	576
50	Arriba Suyo Sótano	San Luis Potosí	563

Mark Minton
May 2014
Length in meters

LONG CAVES OF MEXICO

1	Sistema Sac Actun (+Dos Ojos)	Quintana Roo	332452
2	Sistema Ox Bel Há	Quintana Roo	256909
3	Sistema Purificación	Tamaulipas	94889
4	Sistema K'oox Baal (+Tux Kupaxa)	Quintana Roo	75870
5	Sistema Huautla	Oaxaca	66858
6	Sistema Xunaan-Há (María Isabella, 3B) - Tixik K'una - Templo	Quintana Roo	60445
7	Cueva del Tecolote	Tamaulipas	40475
8	Sistema Yok Ha' Hanil (Río Cristal, Pool Tunich, Río Secreto)	Quintana Roo	38212
9	Sistema Cuetzalan (Chichicasapan+San Miguel)	Puebla	37676
10	Sistema Toh Há	Quintana Roo	32281
11	Kijahe Xontjoa	Oaxaca	31373
12	Sistema Tepepa (Ehécatl+Niebla+Xalltégoxtli+Pozo 4)	Puebla	29401
13	Sistema Soconusco - Aire Fresco	Chiapas	27793
14	Sistema Sand Crack	Quintana Roo	26746
15	Sistema Cheve	Oaxaca	26194
16	Sistema Nohoch Pek	Quintana Roo	23905
17	Sistema Coyolatl-Esperanza	Puebla	22221
18	Sistema Tepetzala (TB84-TB1-CO2-CO4)	Puebla	20000
19	Chjine Xjo (Xine Xao, Chine Xao)	Oaxaca	19515
20	Sistema Aerolito	Quintana Roo	18288
21	Sistema PonDeRosa (Pondazul, Edén)	Quintana Roo	16619
21	Cueva de Alpazat	Puebla	15200
23	Sistema J2 (Ozto J2 (Faustino, Barbie) + Last Bash (Hija Puta))	Oaxaca	14840
24	Sistema Murena - Aak Kimin (Yal Ku Lagoon)	Quintana Roo	14269
25	Sistema Dos Pisos (Ka'p'el Nah)	Quintana Roo	14176
26	Sistema Camilo	Quintana Roo	13396
27	Sistema Caterpillar	Quintana Roo	13381
28	Sistema Sac Muul	Quintana Roo	13378
29	Sistema Doggi	Quintana Roo	12036
30	Sistema Atepetaco (Miquizco + Viento + Mama Mia)	Puebla	11876
31	Sistema Cupul Ha	Quintana Roo	11152
32	Atlixicaya	Puebla	11120
33	Sistema Río La Venta	Chiapas	11020
34	Sistema San Andrés	Puebla	10988
35	Cueva de la Mano	Oaxaca	10841
36	Actun Káua	Yucatán	10360
37	Grutas de Rancho Nuevo (San Cristóbal)	Chiapas	10218
38	Cueva del Arroyo Grande	Chiapas	10207
39	Sistema Ek Be	Quintana Roo	9905
40	El Chorro Grande	Chiapas	9650
41	Sistema Muul Three	Quintana Roo	9629
41	Sistema Tepetlaxtli	Puebla	9600
43	Sistema Brumas-Selváticas	Puebla	9324
44	Sistema Chac Mol - Mojarra	Quintana Roo	9193
45	Cueva Quebrada	Quintana Roo	9000
46	Sistema Minotauro	Quintana Roo	8739
47	Sótano de Las Calenturas	Tamaulipas	8308
48	Gruta del Tigre	Quintana Roo	8200
49	Sistema Dos Árboles	Quintana Roo	7920
50	Sumidero Santa Elena	Puebla	7884

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DEEP PITS OF MEXICO

Mark Minton
May 2014
Depth in meters

1	El Sótano (de El Barro)	Entrance drop	Querétaro	410
2	Sótano de las Golondrinas	Entrance drop	San Luis Potosí	376
3	Sótano de la Culebra	Entrance drop	Querétaro	336
4	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
8	Pozo Poseidon	Entrance drop	Coahuila	288
8	Sotanito de Ahuacatlán	2nd drop	Querétaro	288
10	Sótano del Arroyo Grande	Entrance drop	Chiapas	283
11	Sima Don Juan	Entrance drop	Chiapas	278
12	Hálito de Oztotl	Entrance drop	Oaxaca	250
12	Sima Dos Puentes	La Ventana	Chiapas	250
14	Cueva Santo Cavernario	El Santo Tiro (Pozo Fabian)	Puebla	245
15	Resumidero del Pozo Blanco	Entrance drop	Jalisco	233
15	Sótano del Aire	Entrance drop	San Luis Potosí	233
17	Sistema Ocotempa (OC3)	Pozo Verde	Puebla	221
18	Live in Busch	Entrance drop	Oaxaca	220
18	Sótano de los Planos	Puits Tannant	Puebla	220
18	Sótano de Eladio Martínez (S-CHIC 1)	Entrance drop	Veracruz	220
18	Sistema Soconusco	Sima de la Pedrada	Chiapas	220
22	Sótano de los Coatimundis	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	Sistema H3-H4 (HU3-HU4)		Puebla	210
27	Unnamed Pit	Entrance drop	Chiapas	210
29	Kijahe Xontjoa	So On Jan	Oaxaca	209
30	Nacimiento del Río Mante (underwater)	Macho Pit	Tamaulipas	206
31	Hoya de las Guaguas	Entrance drop	San Luis Potosí	202
32	La Hoyanca	Entrance drop	Tlaxcala	201
33	Akemati-Akemasup	Gran Salto Acuatico y Barbaro	Puebla	200
33	Hard Rock Cave		Oaxaca	200
33	Sistema de la Lucha	Entrance drop	Chiapas	200
33	Hueholvastempa	Entrance drop	Puebla	200
33	Nita Gatziguin	Entrance drop	Oaxaca	200
33	Fundillo de El Ocote	Entrance drop	Chiapas	200
39	Kijahe Xontjoa	Lajao Se	Oaxaca	199
40	Cueva de la Funda	Entrance drop	Chiapas	198
41	Sótano de Soyate	Entrance drop	San Luis Potosí	195
41	Sótano de Tepetlaxtli No. 1	Entrance drop	Puebla	190
41	Cueva de los Murmullos (Cueva del Tízar)	Tiro de los Murmullos	San Luis Potosí	190
44	Sótano de Alpupuluca	Entrance drop	Veracruz	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
46	Cuaubtempa	Pozo con Carne	Puebla	188
47	Sótano de Hermanos Peligrosos	Orgasmatron	Veracruz	186
48	Atlalaquía (Sótano) de Ahuihuitzcapa	Entrance drop	Veracruz	180
48	Sima de Veinte Casas	Entrance drop	Chiapas	180
48	Croz 2	Entrance drop	Puebla	180
48	Sótano Cirque Cuauxipetstli	Entrance drop	Puebla	180
48	Sistema Ocotempa (OC11)	Puits Analogue	Puebla	180

ESSAY

EL HUNDIDO

The next day we leave the group of paleontologists to their reconnaissance work and move a few dozen kilometers to the west, to the base of the Sierra El Diablo (how else could it be named?), in the rancho El Hundido belonging to Doctor Martínez. El Hundido is simply a pit that suddenly opens on a hillside, without other caves in the area to hint at its presence. It's huge, 185 meters deep, with a width at the entrance of over 30 meters, widening as it goes down, to reach a huge and very deep lake of about 100 meters diameter. Doctor Martínez knows it well, because he has built an incredible piece of machinery there: A metal tower and a motorized pulley allow one to descend in a basket (whose degree of safety remains undetermined). Then, he laid an iron pipe down all the 185 m and at the bottom installed a diesel truck engine for the purpose of pumping water to the surface. A very unlikely structure, but one that worked until a few years ago. It is now completely abandoned, but the owner hopes that, thanks to the speleological explorations, El Hundido could become famous and bring some tourists.

We peer down the enormous entrance, completely astonished by the situation, undecided whether or not to go take a look. We aren't the first explorers. A few months ago a group of U.S. speleologists, lead by the famous Peter Sprouse, descended and mapped the abyss.

The place, the drop, the enormous and rotten machinery hanging over the pit, and the strong smell of guano coming from below certainly don't encourage a descent, but we are here. Unfortunately there won't be any winch to pull us up, and our rope supply consists of a hundred meters of 9 millimeter and a hundred of 8 millimeter, not really ideal as far as elasticity and sense of security are concerned. But it is doable, and to give an example, I go down, along with a small dinghy brought along for the occasion.

After 40 meters, the pit becomes very, very wide. At –50, a large fossil gallery can be seen on the distant NW wall. It's probably from there that, at sunset, the masses of bats described by the locals exit. We only see a few, but it's cold and raining. At –100 the size increases even more; the side walls disappear into the darkness, and only the one in front of me remains visible. A few meters away from me runs the long, rusty tube that brought the precious water to the surface. Just touching it causes it to start vibrating with a fearsome sound that echoes everywhere in the dark.

At –150 I look down and still don't see the bottom, only the tube going down into the darkness. Then I realize that the bottom is there, but isn't visible. It's a black lake, absolutely black, immense and gloomy. I begin thinking that maybe it wasn't such a great idea to go down into this infernal place, especially if the Americans have already seen it. . . . blasted curiosity. With relief I see a rock emerging several meters from the lake, probably the top of a detrital cone. It's also the point where the rope and the tube arrive and where the doctor has placed a large truck engine. The place is really nightmarish, beyond any description.

As soon as my feet reach the rock, among trash of all kinds, I shout up "clear" and hurry to check the few square meters of dry land for snakes. Yes, because if the pit, the lake, and the absolutely godforsaken place weren't enough, the locals have warned me about the presence of poisonous snakes that fell in and survived. And in fact something is moving. I freeze, with my heart pounding and a rock in my hand, but fortunately it's only a large red-eyed toad.

As soon as Alfredo arrives, we embark on the dinghy and try to explore the lake. All we manage to do is follow the wall around in the dark, without seeing anything else. Now and again the black water is cloudy, having an indefinable layer of something on its surface, and makes some sinister gurgling sounds. We really ask ourselves whether some monstrous creature grown up here, far from the known world, is about to emerge. I've seen many caves, even many disquieting places, but this one tends to beat them all.

The ascent on 8 and then 9 millimeter rope gives me some bleeding blisters on my hands and feet from the friction against my ankles, exposed by the low-cut shoes (a beginner's mistake), but at least it gets me out of that awful place. I do manage to sense some air movement, which seems to confirm that the gallery at –50 could be an excellent exploration possibility, once it is reached by an aid traverse of at least 30 to 40 meters. My companions in adventure, especially Leonardo and Alfredo, have the some feeling, to the point that a new expedition is trying to reach that goal. Anyway, going back there is worth it. We received word of several other caves, some of them blowing air, in the area around El Hundido.—Tullio Bernabei, lightly edited from an article in *Kur Magazine* number 15, December 2010. The article includes a reduced version of the map of the pit that appeared in *AMCS Activities Newsletter* 32.

ARTICLES

Kamila Svobodová in the Balam Tsal part of Sistema K'oox Baal. Photo by Radoslav Husák with lighting assistance by Miloslav Davořáček and Daniel Hutňan.

RESUMIDERO DE LA JOYA JONDA THE DEEPEST CAVE IN SAN LUIS POTOSÍ

Roberto Legaspi

On April 20, 2013, after twenty-five years of exploring the Sierra de Álvarez, the Asociación Potosina de Montañismo y Espeleología (APME) reached a depth of 895.4 meters during its third caving season in Resumidero de la Joya Jonda (the local spelling of *olla honda*, deep bowl). This depth, at least for the time being, makes Resumidero de la Joya Jonda the deepest cave in San Luis Potosí, 61 meters deeper than Sótano de la Trinidad and 74 meters deeper than Resumidero El Borbollón. For thirty years the title had belonged to Sótano de la Trinidad, with a depth of 834 meters. Trinidad was initially explored in 1978 and 1981 by members of the McMaster University Caving and Climbing Club to –827 meters, and in 1982 an American group reached a depth of 834 meters. What follows is the story of the exploration of Joya Jonda, a fantastic and tough cave.

2006–2007 SEASON

First visit, October 15. We left early from San Luis Potosí. The group comprised Homero Resendiz Rivas, Luis Manuel López Romero, and I, Roberto Carlos Legaspi Balderas. Upon arrival at the community of Monte Caldera, in the Municipio of Cerro de San Pedro, we went to see Don Natividad (Don Tivis) to ask him to allow access to the ranch. We had decided to visit Joya Jonda after having visited Sótano de Jabali and Cueva de Diablo in the same area. According to Don Marcelo and Don Tivis, Joya Jonda "takes a lot of water and never fills," but based on our experience with other caves in the area, we were skeptical that this one would be very deep.

Upon arriving, we took a quick look at the entrance passage. It extended 7.5 meters before turning right for a short distance. Immediately there was a step followed by a pit of 7 meters. A bolt was set and I rappelled down. I crossed a dry pool and threw a stone into the next pit, which I estimated at around 50 meters. I turned to call the others and had a magnificent view up the first pit towards the cave entrance. Homero, Luis Manuel, and Alfredo Blanco, a friend of mine who had brought us to the area area and had just arrived at the cave, rappelled next. They started to rig the second pit with a bolt and a natural anchor. Luis Manuel descended to a steep ledge, followed by me, Alfredo, and Homero. Prior to getting on the ledge, Homero placed another bolt 9 meters down for a rebelay. The total depth of the second pit was 38 meters.

After pushing on down a steep slope called El Tobogan (the Slide) we came to a small ledge overlooking a 5-meter pit followed by a 4-meter pit. Beyond, we found another pit that was estimated at 30 meters. That ended our exploration, as we were not prepared for a deep cave. We started the ascent, but not before naming the final pit La Repiso de la Esperenza, the Ledge of Hope, because we hoped that the cave might be very deep after all.

Second visit, November 2. On Día de Muertos we got an early start to the cave and began to rig the pits that already had anchors, putting in additional bolts to make the descent safer. We finally reached the edge of the last pit we had seen. I was the first to descend that 20-meter pit, and then I realized it was followed by another pit, about 7 meters in depth. The problem was that the rock walls in that part of the cave were not solid enough for bolts, so I decided to put one on the floor. This placement made it difficult to start a rappel. This pit was baptized as Suuntos Difuntos, Dead Suuntos, since Homero dropped the Suuntos there on the Day of the Dead, making them useless. Finally the pit was descended, and we found ourselves looking into a medium-size chamber with large collapsed blocks. It was named the Salón de los Bloquesotes, the Large Blocks Room. We found our way through the blocks to the lower level of the chamber. In the wall facing the rope there was a bat colony, and close by we saw a 4-meter pit that took us to a small ledge. The drop continued for another 10

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Translated from Spanish by Yazmin Avila, Jim Kennedy, and Sergio Sánchez Armass.

Roberto Legaspi at the entrance to Joya Jonda. *Homero Resendiz*

Daylight at the top of the first pit. *Roberto Legaspi*

Guillermo Contreras and Gerardo Luga climbing in the second pit. *Roberto Legaspi*

Gullermo Contreras in La Repisa de la Esperenza. *Roberto Legaspi*

meters, but there were wedged fallen rocks that block the way, leaving only small spaces through which we have to squeeze to keep rappelling. Homero rappelled down and found a 6-meter pit that he did not descend. The cave continued! Later we would learn that we had reached a depth of 133 meters. Meanwhile, Alfredo and Luis Manuel had begun the climb out, while I waited for Homero.

Third visit, November 19. Homero and I decided to explore without mapping. We rappelled the 6-meter pit left from the previous outing. According to the time it took the rocks to hit the bottom, the drop beyond was approximately 30 meters deep. This pit proved extremely difficult to rig because none of the walls were adequate for bolts. The pit began with a sloping section 5 meters long, followed by a 6-meter section with a very steep slope where the rope was protected by a large plastic tarp and a series of ledges facilitates the descent to a small ledge. There I placed a bolt for a rebelay just above where the 21-meter freefall starts, for a total of 30 meters of depth in the Tiro de la Bruja, named for a rock formation. A few meters away from where we landed there was a 3.5-meter pit. At its base, at –173 meters, was another pit that contained ledges and was estimated at 40 meters. The pit was rigged with a 15-meter rope, that was the last one we had, to see if we could reach the first ledge. I was able to reach the ledge, but had to undo the knot at the end of the rope to do so. Homero followed and met me on the ledge, 13 meters below our last anchor. From there the next ledge appeared to be about 20 meters below. As we had no more ropes, we started back. We emerged at night, to heavy fog. It was a good thing that we already knew the way out of the ranch by heart.

Fourth visit, December 2–3. This time out, on a Saturday afternoon, Luis Manuel and I arrived at the cave to continue the survey from Suuntos Difuntos. Of course we would also continue the exploration if we had a chance. We completed mapping to the edge of the pit at –173 meters. This took until 3:00 a.m., so we bivouacked a while to recover. A couple of hours later we were awakened by cold, so we continued exploration. We went to the first ledge and rigged the next drop, 22 meters, and then another new one, 12 meters. After traveling a short passage, going up and down rocks, we came to a large chamber at –221 meters. After an initial recon, Luis Manuel had the impression that the cave had been completed. We could not believe that the cave was finished, and we looked more closely around the room. Luis finally found a track in the sand where the water flowed, so we followed it and came to a place where there was a small opening 10 centimeters high by 60 wide. We obviously could not pass through, but felt a very strong wind, a sure sign that there was more cave. So we started digging. After digging for two and a half hours, we had moved only 4 meters, so we decided that after eating we would leave the cave.

Sergio Sánchez-Armáss in the Salón de los Bloquesotes. *Robero Legaspi*

When we arrived back in San Luis Potosí on Sunday night, Luis Manuel had a big surprise. His daughter had been born on Sunday morning while he was in the cave! Luckily for him the baby was born fifteen days ahead of schedule, so it was not his fault that he had been away.

At the APME meeting the following Thursday, the situation in the cave was discussed. It seemed that for now the cave was finished at –221 meters. However, there was a still a chance to continue if we could dig out the narrow, sand-packed passage. Attendees were inspired and resolved to try to break through.

Fifth visit, December 10. Homero, Miguel Ángel Blanco Rodríguez, Cyntia Chinchilla Espinosa, and Eleazar González Ochiqui entered the cave, along with two cavers from Irapuato who got down to about –120 meters before heading out, and got to the dig. When I finally reached it, there was good news. I was told that the others had reached the other side of the restriction after another 4 meters of digging. The ceiling then rose gradually, and in less than 2 meters there was another pit, 15 meters deep. The cave continued! Eleazar and Cyntia began their ascent to the surface, while Miguel, Homero, and I continued digging to make it a little more comfortable. We also began rigging the pit for the next trip.

Sixth visit, December 17. Excited about what was after the crawlway, Homero, Hugo Rodríguez, and I decided to continue with the exploration. Homero and I rigged the pit while safely secured to a hand line, while Hugo worked on making more space in the belly crawl. The pit descended 16 meters, where we found a room approximately 11 by 13 meters, with big breakdown blocks and a beautiful formation 6 to 8 meters long. We named this room Salon de Bandera en Espiral. Eventually this room served as the first camp.

At the other side of the room we found a narrow passage that led to an 8-meter drop. A natural anchor was used at this point, and then we came to a second room with a 2-meter step that dropped into a pool where it was hard not to get wet. Immediately another pit was found. It was estimated at 20 meters, but not explored due to lack of rope. The cave was becoming very

The Bandera en Espiral formation.
Roberto Legaspi

interesting.

Seventh visit, January 7. With the New Year came renewed vigor. On this trip were Ricardo Peralta Artiga, Claudia Arriaga Rodríguez, Homero, me, and a caver friend of Ricardo's from Mexico City, Jean Carlo. Many meters of rope were taken to ensure we would have more than enough. Part of the team started surveying at the –170 meter level, until they got to the last pit found on the previous trip. We descended 16 meters and reached a very low space to a 1.2-meter step down, followed by a long, steep ramp 18 meters long. This led to a narrow slot 35 centimeters wide and about 8 meters in length that ended abruptly in an 8-meter drop. Going through all this was very uncomfortable because of its width, two difficult rebelays, and landing in a small pool. After two more downsloping sections, Homero went down a 10-meter pit and was happy to see that the cave continued. Since it was getting late, we decided to continue another day. When the survey caught up to that area, we learned that the depth at the 8-meter pit's rig point was 317 meters. The low place is now known as the Puerta a las Grietas de los Flacos Envidiables, suggested by Sótano de los Flacos Envidiables (Sótano of the Enviable Thin People) at El Chital Ranch in the Sierra de Álvarez, where everyone pushes their luck because of the closeness of the walls.

Eighth visit, January 14. Cyntia and Sergio Sánchez-Armass Acuña fixed some of the rigging and switched carabiners for links while Homero, Migel Ángel, and I continued with the exploration. We extended the exploration to a new 16-meter drop. After this, we decided that longer trips were necessary to make progress. The cave was now at 333 meter deep.

Ninth visit, January 27–28. This time Homero, Sergio, and I spent twenty-six hours in the cave. Sergio and I fixed the rigging at El Tiro de la Bruja, which needed more rebelays to prevent damage to the rope. I was the first to arrive at the Salon de la Bandera en Espiral, the best place to serve as a camp, at –235 meters. I started placing bolts for the hammocks, while Homero and Sergio were bringing all the camp gear and ropes. After we finished setting up the camp, we rested for a few hours and continued the trip. Forty-five new vertical meters were discovered and surveyed before we left the cave.

Tenth visit, February 17–18. After nine continuous hours of working at night, the new day found Homero and me tired, and the cave continued very narrow. We were able to survey to –415 meters. Exhausted, we spent some time resting at the camp. A few hours of sleep should have been great for us, but since I suffered from something like altitude sickness and could not sleep, we had to leave a few hours later. Homero just said his well-known phrase, *"No te pases de ranchero,"* meaning he wanted to sleep more.

Exploring and surveying had become very slow because of the very narrow passages, in which it was even difficult to place a bolt. Most of the time in the cave was lost just in travel, reducing the effective time for exploration and survey and consuming the time to rest.

Eleventh visit, February 24–25. Sergio and Homero arrived early at the cave carrying ropes and food to supply the first camp. They went in separately, each one at his own pace. Later in the day, Luis Manuel and I entered the cave and eventually caught up with Sergio at the Puerta a las Grietas de los Flacos Envidiables. I decided to continue on quickly to catch up with Homero. After passing very narrow passages, Sergio and Luis arrived at the first 40-centimeter constriction, continued through the meander, surmounted the rock that blocked the way, and finally arrived to the second constriction between the wall and a thick flowstone formation. They slid through, taking advantage of the steep downward slope. They dropped off the ropes on a nearby ledge, and Sergio returned to the second camp while Luis Manuel continued to meet the others. Luis and I were able to survey to –465, while Homero continued exploring to a very narrow vertical crack that was probably going to have to be enlarged. The next day, back in the first camp, Homero told us that at around –435 he had seen a ledge above a crack that maybe could be used as the second camp on the next trip.

Twelfth visit, April 5–8. We planned this visit to take advantage of the holidays. A longer trip was necessary to provide enough time to set the second camp and explore the crack where Homero had stopped last time. This time we would have a hammer and chisel.

Sergio, Homero, Luis Manuel, and I packed things that would be needed to set the second camp: hammocks, dry clothes, stove, and food. I started in with a pack of ropes and to start placing bolts for the next camp, while the others entered at a slower pace hauling the packs full of gear. Once at the site chosen for the second camp, I noticed a small pool of water that could be filtered well enough for cooking. I climbed the muddy slope to camp and began to choose sites for the bolts. This was not so easy, since the place was small and seemed drippy, plus it

was very muddy. But it was the best place possible for the camp. When the other arrived after a few hours, everything was ready for cooking and rest before we continued with our planned activities.

The next day Homero went ahead with hammer and chisel in hand. But when he came to the tight spot, he realized that it was only necessary to move a loose rock in order to pass, although it got very narrow soon after. The rest of the group arrived at the site to hear the good news. Homero continued while Luis Manuel, Sergio, and I started mapping. The passage was very difficult because of the narrow and tortuous vertical crack. In one place there was a very sharp turn, and Luis Manuel announced that his leg was stuck and he felt that it would break if he moved. Sergio and I got scared and told Luis Manuel to calm down before trying to move again, because we did not want to think about the implications of a fracture at –476 meters in this cave with many narrow meanders. Gradually Luis Manuel freed his leg, and we all breathed again.

Mapping was resumed and finally the crack became less narrow beyond 8 meters that were very, very narrow. From that point, it was possible to walk standing between narrow, meandering walls. The cave became more horizontal, which had not happened before. We found a downclimb, and in the following passage there were flowstone formations that narrowed the passage.

Shortly, at a depth of 485 meters, we reached a 5-meter pit that had to be passed between very narrow walls. Sergio decided that it would be a good idea for someone to remain there, instead of all of us going down. Luis Manuel and I descended and came to a spacious chamber, noting that this place was much better for the second camp. It was drier. The way on was almost horizontal, with some downward slopes, until we reached a small vertical crack that was completely blocked. But it looked like it was taking water. Our depth was now 495 meters. We went up 2 meters on a rocky slope and followed a passage above the blocked crack, and soon we saw a pit with overhanging walls that seemed impassable. The floor looked about 2 meters down. We wondered how Homero, whom we still hadn't caught up with, had passed it. That he had encouraged us, and with some contortions we got it. Almost immediately we found Homero coming back because he had run out of rope. Immediately there was a meeting to decide what should be done next.

Homero said that after a terrible sideways crawl, with one arm on the floor and the other up the vertical crack, which was much worse than all the previous tight cracks, he had climbed down 4 meters, through another sideways crawl passage, also 15 meters long, that led to a 15-meter pit with a very difficult entrance, but he had no more ropes. Later Ricardo named this pit El Tiro de la Carne Asada, since when you are struggling to slide into the pit with only the cowstail clipped to the rope, trying to reach the far-away rebelay, you wonder what am I doing here instead of being at home having roast beef. We would need to return to the second camp for more rope. On the other hand, we said , maybe it would be better to begin to derig the cave, because the rainy season approached. None of us would have the necessary free time soon for trips that involved more than a weekend, and progress was getting more complex and time-consuming. We chose to derig the cave and continue the exploration next season.

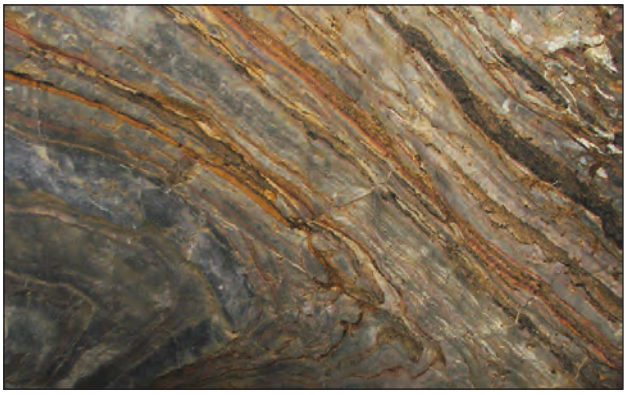
Luis Manuel and I continued mapping up to where had Homero turned around. We began to derigged up to the second camp, where we rested. By the third day in the cave, we had derigged from –435 to –295, and we slept at the first camp. Finally, on Sunday after seventy-eight hours inside the cave, we got to the surface. The final survey gave us a depth of 508 meters, with 894 meters in length. The Resumidero de la Joya Jonda was now the sixth deepest cave in the state of San Luis Potosí.

Thirteenth visit, April 28–29. That day, Homero, Sergio and I carried the ropes from –295 to –235. Homero and Sergio hauled the ropes to the top of the pit (-219m) that leads to the first camp from the Cámara del Arrastradero and then rappelled down to rest in Camp I. The next morning, while Sergio was climbing a rope, he found that it had moved out of position and was no longer protected by the pad. After nervously passing the frayed portion, he replaced the rope. Progress continued upward, and the ropes and equipment were left at –170 meters.

Fourteenth visit, May 20. On this trip Luis Manuel, Jorge Landeros, Homero, Sergio, and I almost completed the derigging. Shortly after Jorge, Homero, and I left the cave, it began to rain heavily. Luis Manuel, who had already left the second drop, was told by Jorge that water was running down the cave. He rapidly returned to inform Sergio, who was 8 meters from the Y anchor on the second drop. Sergio waited

Roberto Legaspi in the sand crawl.
Homero Resendiz

Colorful rock at –200 meters.
Sergio Sánchez-Armass



Folded rocks in the second pit. *Sergio Sánchez-Armáss*

on a ledge for running water, but it did not appear. He had time to climb the small ramp, and the water still hadn't come. He installed his ascending system, but thought it was better to stick to the wall and wait for the stream of water, likely carrying stones and debris, to arrive before climbing. Soon he saw the mighty stream of water falling and bouncing off the side of the pit, then rushing on down. Quite a show! After waiting a short time for any solid objects in the water to pass, he started up. Stone dams between the pits, which formed pools that filled before overflowing, had caused the delay in the falling water. Finally they got to the exit. Back at the cars it had stopped raining, but we decided to recover the ropes of the two pits in another occasion.

Fifteenth visit, May 27. On this occasion Yazmin Avila Flores, Omar Sánchez-Armáss Cappello, Sergio, Homero, and I went back to the cave. We all entered, and Yazmin and Omar enjoyed the first two pits with their fancifully folded rock layers. We derigged the pits and installed a numbered aluminum plate at the entrance corresponding with the cave entry in our database. We then did some surface ridge walking to see where the cave was heading and to look for other nearby entrances. This was the last trip of the year, but we were hoping to continue in 2008.

2008 SEASON

This year exploration continued, but for many reasons no great progress was made. We only extended the cave 31 meters, giving us a total of 539 meters of depth and 994 meters of surveyed length. This made the cave the fourth deepest in the state. But more importantly, we were left certain that the cave continued.

Sixteenth and seventeenth visits. March 1–2 and 8–9. Sergio, Homero, and I began to rig the cave. We changed the way we rigged Suuntos Difuntos pit and in the Salón de los Bloquesotes. Bad news came when we got to the Cámara del Arrastradero at –219 meters. We realized that the belly crawl was blocked again with sand. We continued carrying ropes and equipment needed to set up the first camp at –235 meters. Homero dug through the belly crawl and reached –310 meters.

Eighteenth visit, March 15–17. Taking advantage of the long Easter weekend, Luis Manuel, Omar, Sergio, and I planned to reach our goal of –495 meters, where the wide and dry chamber would be ideal to set up the second camp. After almost twenty-four hours, we arrived tired, hungry, and sleepy at the small chamber at the beginning of the 8-meter-long narrow vertical crack that had cost us so much effort the previous year. Sergio suggested the possibility of hanging the hammocks in that chamber because he was very tired, and it was going to take a lot of time dragging the packs and ropes through the infamous crack. But I insisted that we were already near the planned site, which was bigger and dry. Finally Sergio accepted this reluctantly. I went first, followed by Omar, then Sergio, and finally Luis Manuel. About halfway through, Sergio, who was going feet first, got stuck. While trying to free his legs, he got his chest stuck. He was hyperventilating and powerless after struggling for a while, and Luis Manuel could not get to him easily to help because of the ropes and packs blocking the passage. Fortunately, Omar was nearby and helped him unstick his body and move a little. Sergio told them he was going to return to the last room to set a temporary camp. Omar went with him, and Luis Manuel had to back up to allow them to leave the belly crawl.

Luis Manuel entered the crack again to meet with me and set up the second camp in the room beyond. Sergio and Omar placed the bolts to hang hammocks at their camp, thinking that soon they would taste hot soup and coffee. But they had the stove, and Luis Manuel and I

had the pot. Luis and I were in the same situation. Everyone went to bed without soup or hot coffee, having only cold food.

After a restful sleep, Luis Manuel and I returned to meet with Sergio and Omar to begin the long exit. We all were quite happy, because finally the stage was set up for a big exploration push the following week.

Nineteenth visit, March 21–22. Claudia, Cyntia, and Miguel Ángel entered the cave carrying ropes and equipment that they left at –270 meters to help the next exploration team.

Twentieth visit, March 27–28. It was Homero's and my turn in the cave and we got to the new second camp at –490 meters and continued rigging until we reached El Tiro de la Carne Asada, –508. With great excitement, we descended and surveyed the following 17-meter pit and another of 4 meters and walked up and down meanders until we came to an 8-meter drop. Tired but happy at reaching –539 meters, we returned to the new camp to rest before continuing exploration the next day. We had dinner, but before falling asleep Homero suffered a minor fall and hurt his knee. When we awoke, his knee still hurt, and we decided to head out early instead of spending three days in the cave. Now the two Easter-vacation weeks were over, and we doubted much could be accomplished on only weekend trips.

Twenty-first visit, April 19–20. Luis Manuel, Sergio, Eleazar, David Solís Barba, and I started the long descent to –539 meters to start derigging the cave. After several hours we reached the fearful 8-meter-long narrow, vertical crack. Sergio feared getting stuck again, so he took his turn between Luis Manuel and Eleazar in case he would need their help. However everybody went through the crack without problems, and soon we arrived at the new camp in the room to eat a snack. The group continued, and Sergio caught up with Eleazar, who hurt his shoulder down-climbing when a handhold broke. Together, they arrived at the horizontal crack that was the gate to the infamous sideways crawl at –503, just in time to see Luis Manuel disappearing into it. They waited there for the others, who after a while appeared with the equipment retrieved from the undescended 8-meter pit. We continued derigging up to the –400-meter level, where we finally dumped the load.

Twenty-second and twenty-third visits,April 26–27 and May 11. Once Gustavo Samperio, Ricardo, Sergio and I reached the equipment depot, we picked up all the gear and continue derigging to –250 meters, a little bit below the first camp. In the following visit, Ricardo, Claudia, Homero and I took the gear up to –150, just three pits below the Salón de los Bloquesotes. The job's end was very close.

Twenty-fourth visit, May 18. For the final push, a sizable group of Sergio, Miguel Ángel, Cyntia, Miguel Ángel Jones, Luis Manuel, Claudia, Ricardo, Homero, and I, assembled and took all the equipment out, and the second season was officially over. However, we all knew that the cave continued and that the lack of elevated CO_2 at that depth suggested that the end of the cave was still far away. To reach the end of this cave we would need to gather a good-sized team with plenty of spare time. When would we return?

2013 SEASON

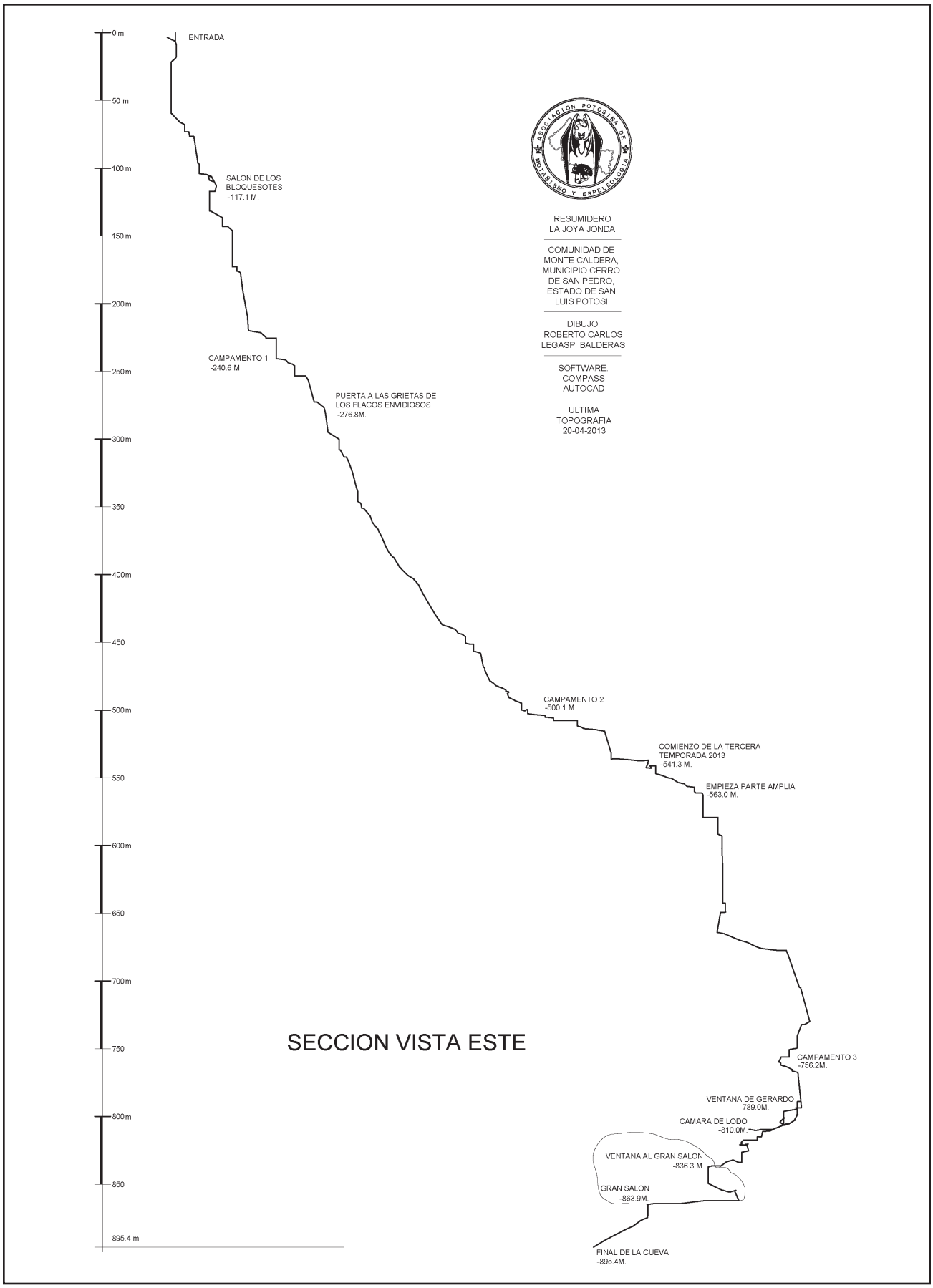
Although we kept thinking about Joya Jonda, our attention shifted to new areas and also to exploring long-known caves and pits. Once the memories of being squeezed in the many long and tight passages faded away, the impulse to know how deep Joya Jonda would go gathered strength. So, January 2013 was selected as a tentative date for rigging it once again.

Twenty-fifth to twenty-eighth visits, January 13 to February 9–10. It took four trips to rig the cave and set up the usual camp sites before we reached the 8-meter pit where exploration had ended four years earlier.

Twenty-ninth and thirtieth visits, February 16–17. At the bottom of the first pit below the first camp, at approximately –250 meters, Sergio saw a couple of beautiful dark brown salamanders with yellowish spots and warned the others to watch out for them. Later, on the way back, Gerardo Morrill Corona and Sergio counted nine salamanders. The place was called the Salón de la Salamandras. They not been seen by anyone in previous years. Thirty meters below there was another room with a lot or organic material and only five salamanders.

Gerardo, Sergio, Ricardo, and I gathered at the second camp for a quick meal and a short rest in order to face the very tight end-to-end sideways-crawl passages and proceed into unexplored ground. With great expectations Ricardo and I descended the 8-meter pit and kept following the medium-size route at the top of the long vertical crack that we have been following. Finally, a long-anticipated change in the cave happened. We were on top of a wide drop 18 meters in depth that had a flow of water. The bottom of this pit was in fact a ledge above a 12-meter pit. The walls of the cave kept quit apart. At last the cave had opened up. Gerardo and Sergio caught up with us, and Gerardo took the lead, while Ricardo, Sergio, and I mapped

In the Salón de las Salamandras.
Roberto Legaspi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ENTRADA
SALON DE LOS BLOQUESOTES -117.1 M.
CAMPAMENTO 1 -240.6 M
PUERTA A LAS GRIETAS DE LOS FLACOS ENVIDIOSOS -276.8M.
CAMPAMENTO 2 -500.1 M.
COMIENZO DE LA TERCERA TEMPORADA 2013 -541.3 M.
EMPIEZA PARTE AMPLIA -563.0 M.
CAMPAMENTO 3 -756.2M.
VENTANA DE GERARDO -789.0M.
CAMARA DE LODO -810.0M.
VENTANA AL GRAN SALON -836.3 M.
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FINAL DE LA CUEVA -895.4M.
ASOCIACION POTOSINA DE MONTAÑISMO Y ESPELEOLOGIA
RESUMIDERO LA JOYA JONDA
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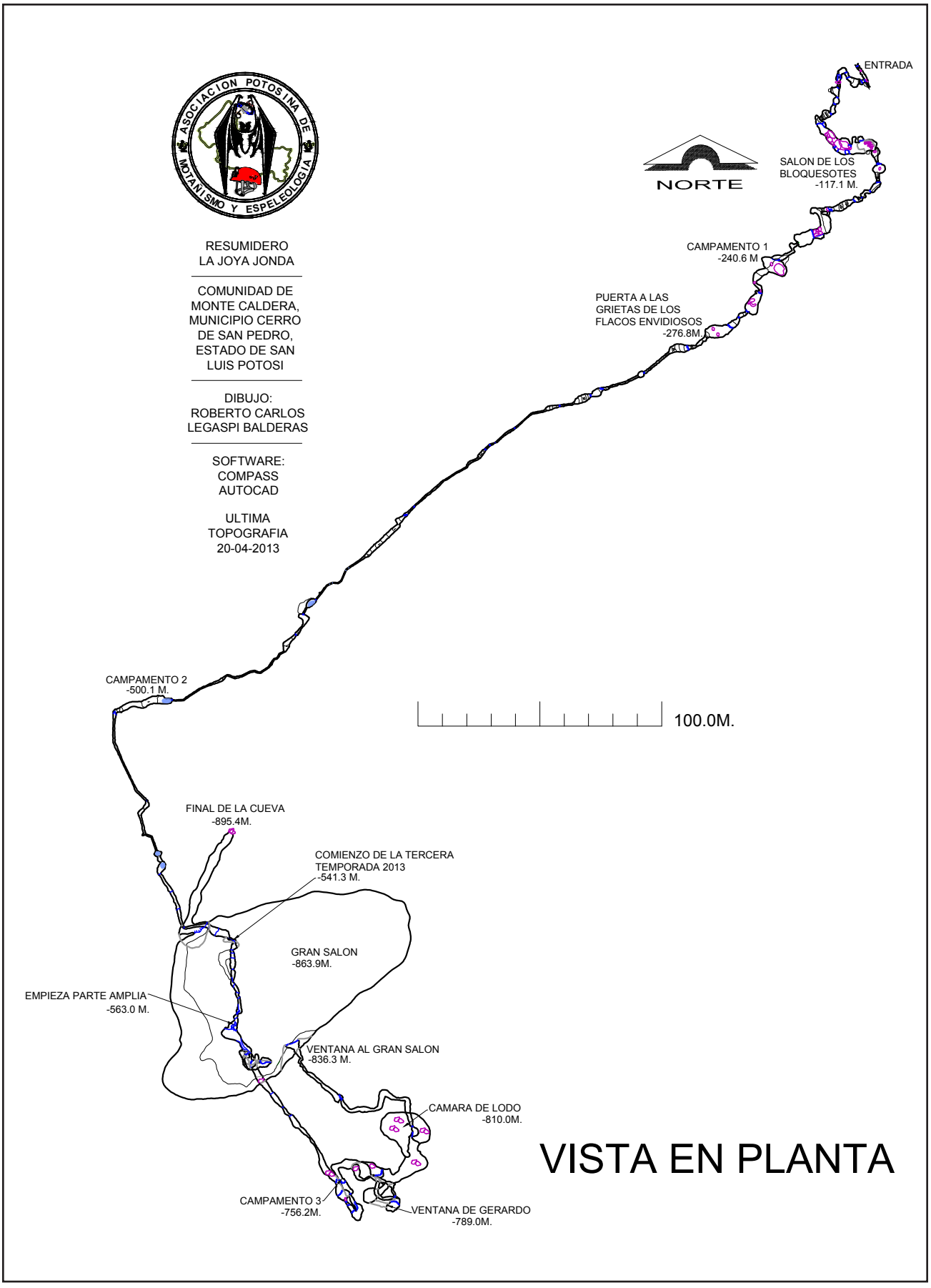
ASOCIACION POTOSINA DE MOTANISMO Y ESPELEOLOGIA
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LUIS POTOSI
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CAMPAMENTO 3
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VENTANA DE GERARDO
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VISTA EN PLANTA

the new ground. We all descended the pits and then another one, 8 meters. Suddenly we were looking into a beautiful, deep pit, 48 meters, that Gerardo rigged with four rebelays. At the bottom there was a 15-meter pit with a very narrow entrance that promised to give a hard time when coming up. Our last rope was too short, so reluctantly we had to stop the exploration. We were very happy, because the cave had reached the depth of 650 meters.

While having a snack we talked about the gear needed to tackle what we hoped would be the first –1,000-meter cave in San Luis Potosí. The obvious problem was that we had just about run out of long 11 mm or 9 mm ropes. Our stock contained only short 11 mm ropes, and we need more carabiners, bolts, and hangers. So the four of us decided to share the cost and place an urgent order for rope and other equipment with Gonzo Guano Gear. Then we went back to the second camp for some sleep before heading the long way up to the surface. When we broke the news of the depth reached and the good probability that the cave would continue, some other members of APME offered to help to pay for the ropes, and our AMCS friends in Austin helped us with ropes and bolts.

Thirty-first visit, March 28–31. Once we received the ordered and donated equipment, we were ready to find out what was beyond the 15-meter wet pit. Ricardo and I were to do the rigging and set up the third camp. Gerardo, Eleazar, and Sergio had to ferry gear and 300 meters of new rope. The narrow entrance to the pit proved to be tricky, but gravity helped. The cave continued in a long passage, but the walls were progressively narrowing down. We found a site with loose fallen rocks that made difficult the crawling to the entrance of a 28-meter pit the walls of which rapidly opened up. Close to the bottom there was a second 28-meter pit with a long but really narrow entrance. I tried to go through, but I got stuck. It was impossible to pass without widening the entrance. It was quite late and we were very tired; in addition there was no news from the other team, so we decided to go back and look for suitable place to set up the third camp while waiting for the others to arrive. Looking for a reasonably good place, we traced back our way to near the 15-meter pit where we began the exploration. The "best" spot was long and wide enough to hang two hammocks side by side. On one end there was a pond, and water trickled down the floor.

Since our friends had not arrived, we decided to go up and look for them. After a short walk we began to hear the muffled sound of dragging packs, and we waited for them at the bottom of the 15-meter pit. Only Gerardo and Sergio arrived, and they told us that Eleazar was okay and on his way to the surface. The delay had been caused by the struggle to pass the ropes and gear packs through the miserable, tight, end-to-end crawlways. They had to uncoil the ropes and tie them together. Eleazar fed rope at the entrance of the passage, with Sergio at the "wide spot" at the middle of the passage and Gerardo at the other end pulling the ropes. The packs were tied to an old, long rope and pulled through the same way; of course they continually snagged. They did the same procedure in the second passage. These maneuvers took a lot of time. When they reached El Tiro de la Carne Asada, Eleazar decided to return to the second camp and then back to the surface because he was not felling well. Without his help, the hauling of the ropes and packs or course took even more time. Ricardo and I told them about the progress and that it would probably be necessary to enlarge the entrance to very narrow entrance to a third pit, now called the Tiro de la Hernia.

We went to the selected spot for the third camp and faced a dilemma, as there were only two hammocks and four tired cavers. We changed into wonderfully dry and warm clothes, ate, and then Gerardo and I volunteered to continue the exploration for a few hours; in the meantime Ricardo and Sergio would get some sleep, but they would get up when we returned and start the trip for the surface.

Gerardo and I reached the Hernia Pit, and after some hammer blows and several attempts we got through, again with gravity to help us. The pit had a depth of 28 meters and was followed by two pits of 9 and 10 meters. Then we descended a pit of 6 meters and arrived at a wider and drier passage. Immediately we preferred it for the third camp over the spot 85 meters higher. Close by there was a perfect place to set up the kitchen and cache equipment. After some narrow meanders we arrived at a 26-meter pit with difficult access, but now we were used to pits with hard entrances. While rappelling Gerardo noticed a window in the opposite wall that may led to new passages. The bottom was almost circular, and the cave continued through a long, narrow belly crawl. Beyond we found a 10-meter pit that Gerardo descended to get a look at what was ahead. I decided to get some rest and waited for him. He found himself in a large chamber with several options to follow. To his back the wall was visible 10 meters away, right in from of him the meanders continued, and to his right there was a rock ramp with small water-filled pools. He decided to

Robero Legaspi

Hugo Rodriguez in a tight spot before the Tiro de la Carne Asada. *Homero Resendiz*

follow the meanders. After a considerable time, he returned and told me that the cave continued for a fairly long distance. He had followed the meanders at different heights above their floors, because at several places the way was blocked by unstable collapsed rocks or became too narrow. He found a 7- or 8-meter pit that was partially blocked by some rocks. He thought that the CO_2 concentration in the air was higher than normal. It was time to return to the third camp to get a well-deserved rest. We had been away from it for five hours, and when we arrived Ricardo and Sergio were getting ready to head out. We had a quick meal and some sleep before leaving camp. The known depth of the cave was now 830 meters, just 4 meters short of Sótano de Trinidad.

Thirty-second visit, April 18–22. Since the rainy season was again imminent, in an APME meeting we decided to have one more trip to try to go deeper, and if the cave continued, the idea was to leave the equipment in the cave, just derigging a few pits and leaving the ropes in a safe place, repeating the procedure has often as necessary, and then to return in late November or early December to continue the exploration. But if the cave ended, we would just start derigging. We thought it would be best to send two teams, one comprising Gerardo, Cuauhtémoc Sánchez Arellamo, and Sergio that would enter on Thursday, April 18, and the other, Luis Manuel, Homero, and I, would enter the cave early Saturday.

Carrying gear, the first team went non-stop to the new third camp, arriving Friday afternoon, where they set up three hammocks in line along the passage. After just five hours of sleep they headed for the big window in the 28-meter pit. Not far from camp, Cuauhtémoc noticed another window in a nearby wall, into a deep pit. They wondered if it would connect to the big window. Gerardo went to the 28-meter pit, while Cuauhtémoc and Sergio shined lights through the window and dropped small stones. Sure enough they connected, but there were no ropes left in the third camp, so they kept moving on the old route. When they arrived at the big window, Gerardo was already rigging the pit on the other side of the window. Cuauhtémoc placed a second bolt for a Y rig. At the bottom of the pit there were some large rocks and a small, sloping passage with loose rocks on the floor. Gerardo remembered that all the ropes and rigging gear were at the top of the 10-meter pit below the 28, where I waited for him, so he climbed back out and went there. In the meantime Sergio explored the passage, which took him to a place where the passage split in two. On the right there was a quite large passage, and to the left a ramp took him to a chamber where he saw a rope. He yelled and heard Gerardo's answer. He was below the 10-meter pit. The window had only bypassed the long, narrow passage. Gerardo lowered the ropes and equipment packs to Sergio, retrieved the rope and retraced his way to the other side of the window.

Gerardo followed the tight meanders toward the 7-meter pit that had been seen in March while Cuauhtémoc and Sergio began mapping the new area. The muddy floor of the large passage to the right was formed by big, unstable rock slabs from a major collapse. From time to time they could hear or see Gerardo struggling in the meanders below. The passage ended in a quite big room around 30 meters wide with large slopes of mud. They trace his footsteps, looking for a way to reach the meanders. Finally they saw a pile of rocks left by Gerardo and went in, not before removing some unstable slabs. They arrived at a small chamber with two 5- or 6-meter pits; neither of them had a rope. They where at around –810 meters.

After a while Gerardo arrived, free-climbed one of the pits, and told them that the 7-meter pit was far from where they were, that he had cleaned it and gone down, that this time the CO_2 level was fine, and that the cave continued as very narrow meanders. At last he had found a window about 8 meters above the floor, and he had seen a huge room at the other side, but he had no rope with him, so he returned looking for his companions. It was already 4 a.m. Saturday, and as they were confident that the cave continued, they decided to return to the third camp. Gerardo was sure than the cave had reached at least –850 meters at the window, already deeper than Sótano de Trinidad.

Homero, Luis Manuel, and I started into the cave early on Saturday morning. Homero and I were moving fast, but Luis was trailing behind. But he was an experienced and safe caver, so we kept on the move. Shortly before we arrived to the new third camp, Sergio and Gerardo were yelling to us to watch out because the camp was right under the pit. When we arrived they asked about Luis, and we told them that he must arrive son. Then they told us about the excellent lead where the mapping had stopped and some suggestions on how to reach the new window to the huge room. Surely this was a –1,000-meter cave.

Homero and I continued toward the window, and Gerardo said that he would catch up with us. In the narrow meander we deviated from Gerardo's directions and soon were swimming in mud until we reached another window, higher than the one described by Gerardo. We

contemplated the huge room, maybe 50 meters in height by 100 meters across. We were very, very happy. Eventually Gerardo caught up with us . He told us that Luis Manuel had never arrived at the camp and that Cuauhtémoc and Sergio were had been preparing to leave camp when he left them. Now we were worried about Luis.

We descended the 12-meter drop into the room, and Homero and I took a time for a little food, since we had not eaten since we entered the cave. We followed the stream that went around one side of the room, climbing down the rocks of the colossal collapse, until Gerardo found a 10-meter pit. Gerardo and Homero went down this pit while I took notes for the map. Suddenly, Gerardo and Homero came back, saying that the cave, unbelievably, ended. Below the pit, there was a passage with a floor sloping down. The roof was also going down. Suddenly, there was no place to go; the water just disappeared. Ironically, we had just used the last rope when the cave ended at –895 meters. Quite sad, deeply discouraged, and very tired we derigged the cave all the way to camp, where we slept for a while. Gerardo was very restless, having troubles with breathing, so he get up, took some ropes and gear, and headed for the upper camps. Homero and I went back to sleep a little more. After breakfast we continued derigging, but the load increased very quickly, and we dumped it at –650 meters.

Cuauhtémoc and Sergio's trip to the second camp was uneventful, except for the long struggle that Sergio had topping the Tiro de la Hernia and that there was no sign of Luis. Near the second camp they were yelling Luis's name without any answer. Suddenly he did answer; quite a relief! Soon, Sergio saw him at the other end of a tight meander. "What happened to you? We were quite worried." Luis answered, "I was worried about you guys, it is already Saturday midnight, and I will explain later what happened, hand me a pack." That is the type of caver that Luis Manuel is, always thinking to help others, in this case despite his having an injury to his shoulder. Once we were all in the second camp, he told us that a couple of pits below the El Tiro de la Carne Asada he slipped on a rock and broke the fall with his right arm, but the inertia sent his body forward, hurting his shoulder so that he was not able to raise his arm higher than shoulder level. He decided to go back to the second camp and wait there for us to return.

Sergio gave some medicines to Luis Manuel and told him about the good lead they had seen. Luis Manuel had to go back into the hammock because Cuauhtémoc and Sergio were very tired and needed some hours of sleep. After a couple of hours Ricardo and David Ochel arrived in the camp just to get some news. They carried Luis Manuel's pack and helped him along the entire way out , specially at the difficult pit tops. A couple of hours later Gerardo arrived with the terrible news that the end of the cave had been found. Nobody believed him; surely he was joking. Only when Cuauhtémoc and Sergio saw all the equipment that Gerardo had derigged and dumped at the camp did they accepted that he was telling them the truth. After a short rest, Gerardo left the camp with a couple of packs.

Sergio and Cuauhtémoc were almost ready to leave the second camp when I arrived. They told me the news about Luis Manuel, and I told them that I would wait for Homero, who was lagging behind. A couple of hours passed, and I became seriously worried. When I was prepared to go looking for him, he arrived, very tired but well. After resting and eating we started out. We arrived to the surface at 4 a.m. on Monday, tired but happy. Outside, Gerardo waited for Cuauhtémoc and Sergio, who had spent some time at the first camp and got out noon on Monday.

Thirty-third through thirty-sixth visits, May 5, 12, and 26 and June 2. It took four more trips and lots of good friends to get all the ropes and the many packs of gear out of the cave. In one of these trips, at about –400 meters Cuauhtémoc had a bad cramp in a back muscle, and almost simultaneously, just one pit below him, I became quite dizzy and nearly fell into a pit. Sergio and Guillermo Contreras were with us. After taking a strong painkiller, Cuauhtémoc left by himself to the surface, while I recovered at the first camp. Luckily, all ended well.

We wish to thank to Francisco and Pablo Alderete, owners of the ranch, and to Don Tivis, herdsman, for permission to visit and explore their land and for their friendliness. Also thanks to Yazmin Avila, Cyntia Chinchilla, Miguel Ángel Blanco, Victor Ruiz Pecina, Vico Jones, and Oscar Berrones of the APME for their sponsorship, to Becky Jones for taking

Roberto Legaspi kneeling in front of José Flores, Sandra Martínez, Alan González, Jackelline Acosta, Ricardo Peralta, and Diana Flores during the final rerigging trip. *Roberto Legaspi*

our order of equipment all the way to Austin, and to the members of the AMCS that donated ropes to the APME.

Cast, in order of appearance:

Homero Resendiz Rivas
Luis Manuel López Romero
Roberto Carlos Legaspi Balderas
Alfredo Blanco
Miguel Ángel Blanco Rodríguez
Cyntia Chinchilla Espinosa
Eleazar González Ochiqui
Hugo Rodríguez
Ricardo Peralta Artiga
Claudia Arriaga Rodríguez
Jean Carlo
Sergio Sánchez-Armáss Acuña
Jorge Landeros Medina
Yazmin Avila Flores
Omar Sánchez-Armáss Cappello
David Solís Barba
Gustavo Samperio Verástegui
Miguel Ángel Jones
Gerardo Morrill Corona
Cuauhtémoc Sánchez Arellano
David Ochel
Guillermo Contreras

Resumidero de la Joya Jonda
La Cueva mas Profunda de San Luis Potosí

Después de explorar durante 25 años las cuevas y sótanos de la Sierra de Alvarez, el 20 de abril del 2013 la Asociación Potosina de Montañismo y Espeleología (APME) alcanzó una profundidad de 895.4 m durante la tercera temporada de exploración del Resumidero de la Joya Jonda (Olla Honda). Esta profundidad sitúa, al menos por ahora, al Resumidero de la Joya Jonda como la cueva mas profunda en San Luis Potosí. Sobrepasa por 61 m al Sótano de la Trinidad y por 74 m al Resumidero El Borbollón. El Sótano de la Trinidad sostuvo por 30 años este título, con una profundidad de 834 m. Fué explorada durante dos temporadas (1978 y1981) por miembros del McMaster University Caving and Climbing Club hasta los 827 m de profundidad. En 1982, un grupo de espeleólogos norteamericanos lograron llegar a 834 m de fondo. En este artículo se presenta la historia de la exploración de la Joya Jonda, una cueva fantástica y muy demandante, física y mentalmente.

La cueva se localiza en terrenos de un rancho privado cercano a la comunidad de Monte Caldera, en el Municipio de Cerro de San Pedro, San Luis Potosí. Cabe señalar que la mayoría de las salidas se realizaron durante los fines de semana. Durante la primera temporada (octubre del 2006 a mayo del 2007) se alcanzaron los 508 m de profundidad y una longitud de 894 m, que situaba a la Joya Jonda como la sexta cueva mas profunda del Estado.

La segunda temporada fue corta y se efectuó de marzo a mayo del 2008, pero debido a un accidente sin consecuencias que acabó con la posibilidad de continuar la exploración 3 días más, sólo se ganaron 31 m de profundidad (539 m) y 100 m longitudinales.

A pesar de que siempre pensábamos en la Joya Jonda, nuestra atención se centró en explorar nuevas áreas y cuevas que habíamos localizado desde hacía mucho tiempo. Cuando los recuerdos en los muchos largo pasajes angostísimos se hicieron borrosos, creció la curiosidad por saber que tan profundo llegaría la cueva. Y así se planeo que la tercera temporada iniciara el 13 de enero del 2013.

Una vez que se llegó a los –560m, la cueva se abrió en una serie de amplios tiros que nos permitieron alcanzar rápidamente los –640 m. Entonces, los meandros se angostaron nuevamente y lo mismo sucedió con las entradas de los tiros hasta una profundidad de –750 m. A este nivel se montó el tercer campamento con 3 hamacas dispuestas a lo largo del pasaje. El 19 de abril la exploración se quedó en una ventana a –830 m, a través de la cual se veía una enorme cámara y el mapa en –810 m. El sábado 20 llegó al tercer campamento un equipo de relevo que descendió la ventana a –830 m para ingresar en la enorme cámara de 100 m de diámetro, parcialmente llena con una gran pila de rocas que media cerca de 50m de altura. ¿Sería ese el fin de la cueva?. El grupo de exploración rodeó la cámara siguiendo el curso de un arroyo que se vertía en un tiro poco profundo. Ah, la cueva continuaba! La esperanza de que la cueva llegara al umbral mágico de los 1000 m de profundidad, latía de nuevo. Una vez en el fondo del tiro, siguieron una rampa larga e inclinada que tristemente terminaba en un pasaje impasable a –895.4 m de profundidad. No se alcanzaron los –1,000 m, pero la Joya Jonda se ganó el título de la cueva más profunda de San Luis Potosí.

1000 HOURS UNDER THE EARTH

Phil Short

I had been invited by Bill Stone to be a full-time team member and lead diver on the 2013 project to extend Sistema J2 in Oaxaca, using the Last Bash entrance, beyond the point reached in Sump 4 during the 2009 expedition. I had now returned home, and many of my caving and cave-diving friends asked, "Wow! Three months in Mexico. How many times did you get to go caving?" And I smile inside at their reaction when I say, "Oh, five." Not many, but once for nineteen days, once for five days, once for twenty-one days, and two one-day trips, totaling over one thousand hours under the earth.

It all started on arrival at Mexico City's airport with Marcin Gala and the crew that would be filming the entire expedition for Discovery Channel as an episode of their *Curiosity* series. After clearing customs with their seventeen bags of film gear, we loaded two minibuses and set off for Faustino's ranch at the base of the mountain that would be home for the next three months and beneath which was the 15-kilometer labyrinth of passages that was J2/Last Bash. After a long drive, the last three hours on dirt roads, we arrived late, so I slept in the field behind the ranch, to be awakened by a friendly pig at 7:00 the next morning. After coffee, breakfast, and a team briefing, a group set off up the mountain to the site that would be our base camp. The walk from the ranch took us ever higher through fields of slash-and-burn, until we reached the tree line and entered the cool green gloom of the cloud forest that shrouds the mountain tops, where we continued to climb, and eventually the winding, muddy trail between the trees flattened out, and there was no more up, but no view, due to the density of the forest. Here will be home for the next three months.

We spent the day, initially, clearing personal spaces for our tents and covering them with tarps, then we worked as a team to clear a large area for the workshop and kitchen tarps, build and set up the kitchen, dig a latrine, and clear a fire pit, where we spent our first evening around the base-camp fire looking forward to the adventures ahead. I spent the next eight days hiking down to the ranch, rigging, testing, and packing dive gear, then hiking back up to base camp, the idea being to acclimatize day-by-day to the 2400-meter elevation of base camp and build my fitness by carrying increasing loads of gear up the hill on my back. This seemingly crazy idea really paid off when the cave trips started. The heaviest gear was delivered to base camp by donkeys and drivers from the ranch, who also daily delivered our water in 20-liter drums, as there are no water sources near base camp. The growing pile of diving-equipment bags was then moved by donkey directly to the cave entrance some 200 meters below. In camp we had a rebelay course rigged up on a giant pine tree, with a 2-meter-square "dive platform" rigged in the crown. The idea was to use this to assess each team member's rope skills on arrival and to allow practice, but it also gave us the opportunity to climb up through the oppressive green gloom of the cloud forest to the clear blue sky above to get some sun, watch the sun rise or set, or just chill out. This platform became our sanctuary between trips underground.

On day 9 I hiked down to the Last Bash entrance with Marcin for my first journey into the cave. The entrance is a small crack against a cliff wall at the head of a muddy gully, and, to be honest, very uninspiring. But after a traverse and several tight, vertical sections the passage gradually opens out, enters a small horizontal room, and then goes vertical again in very large passage in the form of a 170-meter vertical pitch with nineteen rebelays, getting larger and larger as you drop deeper and deeper into the earth. From here, after a brief respite from the rope on a large ledge, the drops continue, taking you eventually to a short, wet horizontal section that ends in another pitch at 300 meters below the entrance. At this point, the limit of the rigging teams' work so far, we tested the telephone wire by connecting to it and calling base camp, then turned to head out, arriving back on the surface after a seven-hour trip. This first foray into the cave had merely scratched the surface of the 1000-plus meters of descent and 8000 meters of horizontal cave to reach Sump 2, our first dive site. I was itching to go farther, but now realized the enormity of transporting the complete pile of fifteen bags of diving gear, at 20 kilograms or more each, to the end of the cave.

Several more days of packing and preparing equipment passed while the rigging team continued on to reach the bivouac site at –500 meters. Then a three-man team entered the cave to sleep at the bivi and enlarge the squeezes beyond

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Text from http://www.philshorttechnical.co.uk/blog/?p=26

Kasia Biernacka. *Marcin Gala*

by digging away rocks, gravel, and other flood detritus. The section of cave beyond the bivi consisted of small, wet stream passage with some short rope sections and three major squeezes, a fun, sporting section of cave for a normal weekend cave trip, but a nightmare for transporting three months' worth of equipment through the cave. John Harman, Elliot Stahl, and Corey Hackley did a fantastic job of enlarging the extremely unpleasant flat-out wet squeeze and the two very tight vertical squeezes before the main carry of gear began. On day 15 Marcin Gala and I headed into the cave for the phase-1 push. With a support team, we went from the Last Bash entrance to Camp 2A. (Camp 2 was in the old J2 section of cave, but had been moved to the 2A location after Sump 1 was drained.) We spent the night there before continuing on, in an exhausting eleven-hour trip the next day, to Camp 3 through gigantic borehole passage and a beautiful section of active steam where Marcin had to repair, rerig, or replace all ropes on the vertical sections.

The next morning we returned to Camp 2A to start hauling bags from there to Camp 3. Bag hauling is tough; the cave is like the worst obstacle course ever, and hauling is like an intense gym workout while cold and wet for eight to twelve hours at a time. Basically you pick up one or two 15- to 20-kilo bags and walk, climb, crawl, and struggle through the earth, then go back and get more. In some sections, like the boulder-choke breakdown of Donde Homek, a team spread out through very tight and constricted passage and passed bags man-to-man in a chain, which speeds things up.

The next eight days were spent moving between Camp 2A, Camp 3, and the Sump 2 base until all gear for the phase-1 push was at the sump. The dry cave ends at the base of a rope pitch on a rock bridge above the lake of Sump 2. Here the underwater passage is so large that there is no sound or visual indication that this is the flowing J2 river, and the sight is a crystal-clear, turquoise-blue lake 5 meters below the bridge, and I have to say it was *so* inviting. The 2009 dive platform that had been stored on the rock bridge was in good condition, and we initially rigged it on the bridge as a work table to assemble the two MkVI closed-circuit rebreathers and other dive equipment, then we lowered it to water level and rigged it as a platform for kitting up. So finally, on March 10, we had two assembled and checked-out rebreathers, four open-circuit bailout cylinders, food and camp equipment, survey and caving gear, and our personal gear ready and were able to lower it all to the platform, kit up, slip into the water and dive off into Sump 2. I've been privileged to dive many sumps in caves around the world and to also visit and dive some of the world's most beautiful spring sites, but this was a sump as beautiful as a spring. As I dropped down the dive line, descending below the dive platform and the flood of filming lights, the crystal-clear water revealed, disappearing into the distance in front of me, a 10-meter-wide, 4-meter-high borehole with grey limestone walls, stripes of calcite "lightning," and a white gravel floor reflecting our lights.

The sump had been dived and passed by US Deep Caving Team members on a previous expedition, and the thick handline and telephone cable were intact throughout the sump. The thick line had been laid to ease the hauling required to transport equipment and supplies through to the dry cave and Camp 4 beyond, and on this dive both Marcin and I each had a full sump tackle bag and a Santi dry bag clipped to our sides. Sump 2 is the first sump reached when entering J2 system by the Last Bash entrance, and at less than 150 meters in length and a maximum of 7 meters in depth was a straightforward dive. After passing the sump I unpacked and connected the telephone to the cable and called back to our support crew at the upstream dive base to inform them that we were through, safe, and staying. Then Marcin and I shut down and stowed our MkVI CCRs and climbed a huge hall of boulder breakdown, passing over the top to enter continuing dry, mud-floored borehole passage down to the site of Camp 4. At this point I dekitted and poured several liters of water out of my drysuit, wrung out my undersuit and base layer, and informed Marcin that the dive through Sump 2 had resulted in a total flood of my suit. Not a big deal for the 15-degree-C water temperature and the short dive through Sump 2, but it would be a big deal for the continued exploration of the cave if I could not find and fix the issue. As it turned

out, the silicone neck seal had been punctured twice, like a vampire bite, under the chin when the suit had been hung over a line, but touching the floor, at the Sump 2 dive base during the last few days of equipment preparation. We were saved! Thanks to the custom design of the J2 expedition's Santi caving drysuits, the neck and wrist seals were quick to remove and replace, among numerous cave-specific features.

Next morning I kitted up in Marcin's drysuit and undersuit and passed back through Sump 2, de-kitted, and climbed the ropes to the rock bridge to retrieve the seal-replacement kit and tools and a spare dry under-suit, along with another bag of gear for further work beyond the sump, before returning back through the sump to Camp 4 and Marcin to replace the neck seal and sleep in the wet undersuit to dry it. Back on schedule! We then had to strip down the MkVI CCRs and all other dive gear to loads of manageable size and weight for carrying between just the two of us—no support here on "The Dark Side of the Moon"—over the kilometer to Sump 4. (A dry passage bypasses Sump 3.) This led to five loads each, 10 kilometers of caving, followed by equipment rebuild and test on the next day, followed by a rest day. Being beyond a flooded section of cave that is 8 kilometers horizontally and 1 kilometer vertically from the entrance for several days with just one other human being for company is a humbling experience. It does feel seriously remote, and during the expedition Marcin and I spent a total of twelve days there, in five- and seven-day stretches.

Will haul for food. From left: Matic Di Batista, Gilly Elor, Bill Stone, Tim Bilezikian, Andreas Forsberg, Matija Perne. *Kasia Biernacka*

On the first day of our third week underground, Marcin and I set off into Sump 4, following José Morales's dive line from 2009 into the right-hand branch, and with only one line break to repair, soon arrived at 300 meters of penetration, the end of Jose's line and the 2009 explorations. The passage to this point was stunning, meandering left to right, large, clean-washed, with white gravel and sand floors undulating in waves and heavily rippled from water flow. Visibility, as in Sump 2, was crystal clear, and with our Light Monkey video lights we got a stunning view of the passage. At this point I tied on a new line reel and swam on into unexplored passage, each meter heading farther into a piece of the planet never before illuminated or seen by human eyes. As the line rolled off the reel and the passage continued to ascend and descend over gravel and sand dunes and meander to left and right, it became obvious that the sump was not about to surface into dry cave soon, as had been hoped, but was going deeper, and soon, at the crest of a large sand dune with three ways on ahead, the familiar tug on my wrist as the last of the line fed out signaled the end of 120 meters of new passage. I tied on a second reel and checked the right passage first, but found no obvious way on. The left passage started out curving to the left and ascending, but proved to be an oxbow looping back to re-enter the main passage above our own line 50 meters behind us, so I rewound this line and set off into the middle option, which immediately enlarged—the way on.

Beyond our deepest point yet, at 12 meters, with the second reel emptying rapidly, we arrived at a wall of flowstone steps blocking the passage from wall to wall. We ascended step by step to surface in a small chamber about 4 to 5 meters high, 4 meters wide, and 2 meters across, with much flowstone. We were through the fourth sump, but was there a way on? After removing our masks and hoods so we could talk, all we could hear was the roar of fast flowing water. A waterfall! Excitement rose. Marcin de-kitted, and while I held all his gear crawled carefully, to protect his drysuit, through a hole ahead at water level. He could soon be heard to my right.

A 2- to 3-centimeter airspace allowed us to talk and me to see his light, so dipping my head into the water, having replaced my mask, I saw a square hole through to Marcin's legs in a small chamber beyond. After I'd passed Marcin's gear through to him, the small hole turned out to be perfect Phil-in-a-MkVI-with-two-bailouts size, with a bit of shoving and scraping. We

Discovery Channel guys Doug Dunderdale and Zachary Fink record a planning session by Nicholaus Vieira, Tomek Fiedorowicz, Mike Frazier, and Artur Nowak. *Yvonne Droms*

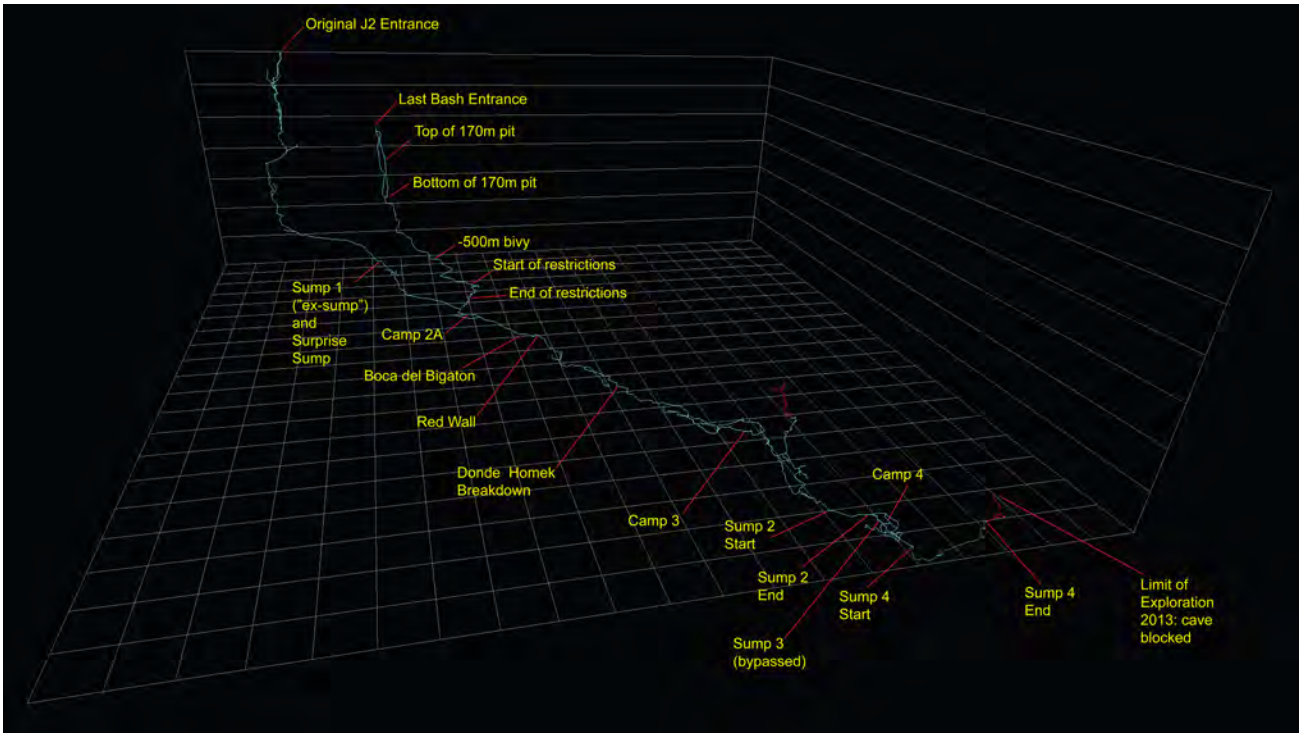
were able to de-kit and safely stow our gear to see what lay beyond. We first swam in a deep-water canal of crystal-clear, fast-flowing water between flowstone walls below a stalactite-decorated ceiling, then the water shallowed and we could walk downstream to a huge stalagmite and squeeze around it to the left, along with the water, into a huge borehole passage beyond. Here the water cascaded vertically down a fissure on the right wall, and ledges led up to the right to enter a large high-level ongoing passage.

On day 29 of the three-month expedition, we had passed the initial, primary target of the expedition, Sump 4, and found continuing dry cave beyond, dropping deeper into the earth. We were, to say the least, ecstatic. After filming all we had found, we returned to our dive gear, kitted up, and made a very enjoyable return dive along our own line, filming enroute, to the Sump 4 dive base. There we dekitted and returned to Camp 4, having been away for fourteen hours, for a double dinner and several coffees. When we telephoned base camp with our great news, there was now a lot to consider. The sump, hoped to be short and straightforward, had turned out to be 510 meters long, posing logistics challenges for continuing exploration, so we needed to head out and be debriefed to allow the whole team to decide the best way forward.

Of course heading out was not as simple as it sounds. The day after the push dive that passed Sump 4 we had to disassemble the MkVI rebreathers into three manageable loads and then carry all the gear back through the 1 kilometer of cave to the downstream side of Sump 2. This took a whole day, after which we spent a final night at Camp 4 and left early in the morning for the dive out, with empty food containers, flat batteries, and trash, to be met by our support team, who not only quickly hauled our gear from the dive platform to the rock bridge above, but also had a pot of fresh, hot coffee on the go for us—especially appreciated, as we had run out of stove fuel beyond the sump and been on water and food bars for the last two days—along with cheese, sausage, and salmon jerky. Then, after a night at Camp 3 and a night at Camp 2A, we reached the surface four days after the push in Sump 4.

The morning after our exit, Bill called a dive-team meeting to discuss a new plan in light of what we had found. Fortunately, as the meeting took a while, our support team continually delivered pancakes with maple syrup and coffee to me; they said that after nineteen days underground I looked like a POW. The end result was that we would revert to Florida-style diving tactics in dealing with this sump, using the dive line for reference only and swimming lighter, neutrally buoyant loads of essential equipment through to explore the cave beyond. We would now take just enough equipment to continue exploration, make hot food and drinks, and establish an emergency bivouac beyond the sump, rather than the original plan to run a thick haul-line and telephone cable through Sump 4 and establish a Camp 5. With those logistics-driven changes we were back in business.

Before a return trip beyond the sump could be mounted, however, we needed to all camps resupply with food and charged batteries, including Camp 4 beyond Sump 2. To facilitate this, we agreed that after a team had delivered the necessary supplies throughout the cave as far as Sump 2, Bill Stone and Dominic Graczyk, as support divers, would do a resupply trip through Sump 2 to Camp 4 and Sump 4 with all gear required for forward exploration.



Zachary Fink and Bill Stone under the gear tarp on a cold night. *Kasia Biernacka.*

Due to a shortage of manpower at this phase in the three months, I volunteered to go back in four days after getting out to carry gear to Sump 2 and help Bill kit up to dive Sump 2—no rest for the wicked. I entered the cave with the support team and arrived at Sump 2 via a night at Camp 2A and a night at Camp 3. There I helped Bill and Dominic by packing the haul bags with equipment required for the next push trip and weighting them as close to neutral as possible, lowering gear to the dive platform, and helping the divers kit up. Bill and Dominic set out with a bag each, dived through Sump 2, and emptied the bags, before returning to the dive platform for me to repack the bags so they could go back through the sump again to get four bags full of gear through it. They then spent the next two days hauling the camp supplies to Camp 4 and the exploration gear to Lake 41, the entrance to Sump 4 beyond. I and the rest of the support team returned to Camp 3 for one night and then decided to do a direct exit from Camp 3 in one long day, starting early the next morning. I arrived back in base camp exhausted after a four-day trip that had begun only four days after a nineteen-day push. I spent the next seven days in base camp eating, reading, eating, sleeping, and eating. We were now ready for the main push trip to survey Sump 4 and explore the high-level and river passages beyond it.

After my needed days of recovery, on April 1 I headed back into the cave with a bag of personal and resupply gear for a non-stop trip with Nick Vieira to Camp 3. Marcin Gala and a new support cave team joined us at Camp 3 the next day with more gear, and Marcin and I then started to prepare gear and pack loads at the Sump 2 base for our dive through on April 5. Our dive through Sump 2 was enjoyable, because Bill and Dominic's resupply trip to Camp 4 had left each of us with only a single manageable load and we could have a look around and shoot some video. Once through, we dekitted and moved to Camp 4 for the night. The next day we again stripped down our rebreathers and carried all diving gear in five loads each through the dry sections between Sumps 2 and 4 in order to rebuild it all at Sump 4 to dive on. We had learned our lesson on the previous push, and knew now, two months into the project, that rest days were important, so once set up to dive we spent the next day at Camp 4 reading and sleeping. On April 8, a week after entering the cave, we were ready to go. The dive through with the caving gear was tough due to the drag, but we had managed to make the two bags almost perfectly neutral, and at a carefully slow pace we passed the 510-meter sump in forty minutes. On reaching the far end we got out through the squeeze to the right and dekitted, shutting down the rebreathers and storing our dive kit on the flowstone ledge. Still in our drysuits, we swam down the canal and entered the large chamber we had found on the initial push, where we established our emergency bivouac, changed from diving suits to cave gear, made a hot drink, and prepared the survey and vertical gear. We first set off into the large borehole passage to the left that ran up above the water flow. I moved ahead to the farthest point of direct sight, tied on a tape survey-station marker, and labeled it while Marcin took distance with a laser and azimuth and inclination readings and made a sketch of the passage to construct a high-accuracy map. In this manner we continued in large tunnel with a sand or dry-mud floor for 150 meters, where the passage ended with a ceiling-to-floor flowstone formation.

We returned to our bivouac to kit up in our vertical gear and prepare the drill, hangers, and rope to explore the vertical drop taking the J2 river. Sadly, on plugging the battery into the drill and pushing the trigger we found the drill to be dead and unusable—one of many flood-related battery issues on the expedition. But thanks to Marcin's rigging skill we were able to rig and descend the 11-meter drop into the fissure to join J2's river in the passage

David Rickel

J2—LA RUTA ESMERALDA

The Last Bash entrance to J2 is tight. In fact it was so tight as to be impractical for hauling the large amounts of dive gear and other equipment needed for a major push at the bottom of the cave. Thus one of the early objectives of the 2013 J2 expedition was to widen the entrance area and first drop. During one of those widening trips I wandered up a side passage and dug open a blowing crawl that led to a drop. We later found this drop mentioned in the original survey notes, but it had never been descended and seemed to have been forgotten.

After our enlarging work was done, we checked out the new route. Yvonne Droms, Bill Stone and I surveyed down two drops through beautifully polished rock. Embedded in old flowstone and subsequently cut through by flowing water were some unusual green cobbles, which led to the name La Ruta Esmeralda. We stopped in a decorated room with two separate pits continuing down. Interestingly, the airflow in this new passage was opposite to that in the main cave.

Two days later a team of five returned: Kasia Biernacka, Yvonne Droms, Nico Escamilla, Bill Stone and me. We were loaded for bear with 200 meters of rope and 17 bolt sets (bolt, hanger and quick link). We chose the larger of the two leads. I went first, rigging pit after pit while the others surveyed and Kasia filmed our descent. The passage went almost straight down, including one 70-meter pitch. More or less simultaneously we ran out of rope, bolts, drill power and time. It was so vertical that I never had to cut the rope! This was one of those exquisite vertical push trips that you only get in deep vertical caves.

A few days later Kasia, Yvonne and I were back with another 130 m of rope and 15 bolt sets. Our previous rope had taken us to the only horizontal section of passage we would see, and that didn't last long. Again I rigged drop after drop without cutting the rope, and ran out partway down another pitch. This last pit had air moving down it instead of blowing out like the rest of Ruta Esmeralda. A couple of drops up, the air was blowing at us. The split seemed to happen at the base of an infeeding dome, which will make an intriguing lead for the future.

After Yvonne and I left the expedition, Matt Covington and Elliot Stahl returned to Ruta Esmeralda. On an epic trip they connected it back into the main route in Last Bash, surveyed, and derigged.

Although the primary focus of the 2013 J2 expedition was diving at the bottom of the cave, we nevertheless found time for some fun original exploration. Ruta Esmeralda provides an independent 330-meter-deep route into the cave, but it is no improvement over the original. Some leads remain for intrepid explorers in the future.—Mark Minton

below. This section of passage was beautiful, with the crystal-clear river cascading along from pool to pool through dark-grey to black limestone covered in "lightning bolts" of white calcite. After the first pitch we carefully, in light of the remoteness of our situation, scrambled our way down the river until our progress was halted by a lake that was the width of the passage and appeared to be 8 to 10 meters long with undercut walls and deep water. As Marcin and I were wearing only our thermal base layer and vertical gear, we looked at each other and wondered, "What now? Back for the drysuits or go for it?" Of course we grinned at each other like kids at Christmas and went for it, trying and failing to use handholds along the walls to hold our chests out of the water. Soon we reached the shallow water beyond. This led on to a second pitch, more like a series of cascades, and then a final drop into another lake. Marcin again rigged on natural belays and descended, with me following. Beyond another lake was a small chamber where all the water disappeared through finger-width slots in the floor. A climb over flowstone steps to the left led up to a squeeze so small it required removing our vertical gear. It opened into a small chamber beyond in the base of a loose mass of

Corey Hackley hauling supplies through a canyon on the way to Camp 3. *Elliot Stahl*

breakdown, impassable and in light of our extremely remote situation rather scary. After a thorough look around to confirm that there were no other ways on, we returned frozen to our bivouac base to make a hot drink and reflect.

We'd reached the end of J2, after 1000 meters of previously unexplored cave, including the new section of Sump 4, the high-level passage, and the streamway. Time to start the long journey out. We packed up and moved all gear to the downstream side of Sump 4, kitted up, dived through Sump 4, and returned to Camp 4 together. After that fourteen-hour day, we made a huge and much-needed meal and coffee before sleeping.

The next day was a rest day spent in Camp 4 eating, reading, and sleeping, and the following day we returned to Lake 41 at Sump 4 to empty and re-pack the MkVIs Sofnolime canisters, do our pre-dive checks, and head back into the sump for the survey dive. First we swam the 510-meter length of Sump 4 slowly side by side, with Marcin on the left wall and me on the right, using video lights to check the walls from floor to ceiling for any missed side passages. I had in mind two areas where I had noted potential passages, both on the right, on previous dives. The first was a parallel tunnel running for 20 meters in the original 2009-project section of passage, and the second was at the point where, on our first 2013 dive, the first reel had run out 420 meters into the sump. At this point I followed a side passage to the right that climbed a gravel and sand bank and then dropped into a rift that curved sharply to the left to re-enter the main passage after 30 meters of oxbow. This was the same area where a parallel passage on the left had been noted on our first dive of Sump 4, so this area had in fact three parallel passages, all interconnecting. Having reached the downstream end of Sump 4, we turned, and with two compasses, two depth gauges, and a measuring tape we recorded the data for a high-grade survey of the sump. This turned out to be a 150-minute dive and gave us a detailed knowledge of the sump.

Enough fun, time to work. The inevitable next step was to pack up and remove all gear from the cave. Marcin and I were joined at Camp 4 by two support divers, Yuri Schwartz and Nick Vieira, who had dived through Sump 2 on open circuit to help pack and carry gear across the 1 kilometer of cave from Sump 4 to Sump 2, where the four of us made eight dives hauling bags through that sump to where the cave support team met us to haul up onto the bridge all gear and finally the dive platform itself. We made an improvised bivouac for the night at the head of the pitch above Sump 2, and the next morning stripped and packed all dive gear into seventeen loads of 15 to 25 kilograms.

Marcin and I stayed in the cave after our push and survey dives to help the first support team haul all these bags back to Camp 3 and on to Camp 2A, before finally leaving the cave at the end of our twenty-one-day last trip into J2. Over the next week the remaining support teams cleared the rest of the cave of all equipment, breaking down the camps. In all more than forty bags were removed from the cave. Having spent forty-two nights underground, twelve of them camped beyond sumps, and forty-five out of seventy days on the mountain underground, it was time to head home, tired, 8 kilograms lighter, and very happy with what had been achieved during my one thousand hours under the earth.

1.000 horas en la Tierra

Phil Short fue uno de los principales buzos en la expedición al Sistema J2 en Oaxaca en la primavera del 2013. Para esta expedición se utilizó la entrada Last Bash. Phil y Marcin Gala permanecieron dos períodos en el Campamento 4, más allá del sifón 2, con el apoyo de otros cuatro buzos quienes trasladaron equipo y suministros a través de éste. Lograron avanzar más allá del límite de la exploración anterior al sifón 4, utilizando respiradores MkVI, y encontraron pasajes secos después del sifón de 510 m. Desafortunadamente, a partir de ahí toda el agua desaparece por pequeñas grietas en el suelo, por lo que J2 se terminó después de 1,000 metros de pasajes inexplorados previamente. La profundidad del sistema es ahora de 1,229 metros.

J2

Nicholaus Vieira

J2 was found by Polish cavers on a recce in 2004 during one of the many United States Deep Caving Team expeditions to the area. It was quickly discovered that the cave was going deep, and it was left going. The USDCT returned to it in 2005, finding a sump at –752 meters. Diving equipment was brought in from the U.S., and Al Warild successfully passed Sump 1. During the next week, while a team explored farther down J2, others began work on a boulder dam below Sump 1 and were successful in lowering the sump 5 meters, turning it into a swim. The cave was left going again, this time in borehole at –1000 meters.

The USDCT returned in 2006, and a few survey shots beyond their last station of the year before they discovered Sump 2, the Sifón de los Piratas. Members of the expedition spent the next three weeks looking for a bypass to the sump. Nothing. Then, in an amazing feat, Spanish cavers brought dive gear in from the surface in a single push to –1200 meters through 10 kilometers of passage. James Brown dove the sump and succeeded in passing it to discover large passage on the other side and a third sump. The Spanish cavers then removed the dive gear, again in a single push.

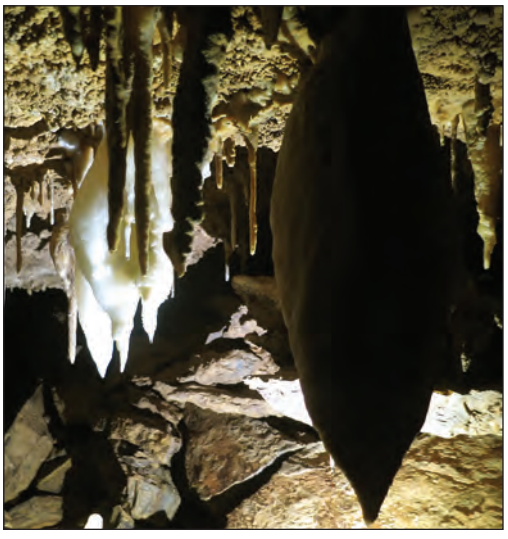
The cave was not visited again until 2009, when the focus was on diving at the bottom of the cave, Sump 3. A bypass to Sump 3 was discovered, and the large and small passages were surveyed, Sump 3 was dove and surveyed, and the newly discovered Sump 4 was dove for over 200 meters. The 2009 expedition ended with two going leads, the first Sump 4 continuing underwater and the second a bolt climb on the upstream side of Sump 2, From Russia with Love. There were some issues with water levels on the way out, as a new sump had formed, trapping some cavers for a few days without much food. All got out safely when water levels waned.

A smaller and lighter expedition to the area was organized for 2010, with the objective of exploring a cave that had shown some potential in 2009, Last Bash. The hope was to join this cave to J2 to bypass the old Sump 1 and the intermittent Surprise Sump. After some miserable squeezes in water, the trip was a success, connecting to J2 near Camp 2A. The team then spent the remaining time pushing the few remaining leads around Camp 3, including From Russia with Love. The cave stood at 13.5 kilometers long and just over 1200 meters deep, and plans were made for another large-scale expedition. [Articles on these J2 expeditions appear in *AMCS Activities Newsletters* 29, 31, and 33.]

I began caving with very few books on the subject, four to be exact. The first two were stories that involved Bill Stone, the third was *Caves of the Canadian Rockies and Columbia Mountains* by Jon Rollins, and the fourth was the Rat's Nest Cave book, *Under Grotto Mountain* by Chas Yonge. Bill had a bit of a reputation I had heard about on an expedition or two, as well as from other cavers. I figured I should try to cave with him on one of his expeditions one day, and I might be able to learn something after all, or just be highly entertained. I first caught wind of this J2 expedition in the spring of 2011, and after exchanging e-mails with Bill Stone and Vickie Siegel I was on board. Fall came, and the 2012 expedition date was pushed back to spring 2013.

On February 6, 2013, I flew to Austin, Texas, to help drive the equipment to Mexico. (I thought it would be a good laugh.) The project was delayed for a week, while I enjoyed amazing hospitality from Texan and Mexican-Texan cavers,

Nicholaus Vieira



nick@crazycaver.com
http://www.crazycaver.com/content/j2-mexico-2013
Canadian Caver 78, spring 2013, pp. 20–23

Hauling gear through the borehole beyond Camp 2A. *Nicholaus Vieira*

notably Vico Jones. This included touring Austin, some 'possum trapping, and assisting with rebreather assembly and having a 6000 PSI cylinder extrude its O-ring. Finally I was off to the border with two vehicles to participate in a Bill Stone expedition. The drive down was not without a few entertaining moments, including being pulled over at gunpoint twice, border officials trying to extort us, and getting lost in the Sierra Juárez.

Eventually I arrived at base camp in the clouds and rain, after toiling with my eighty-plus-pound bag for two and a half hours through what was described as the jungle from the 1987 film *Predator*. I settled in and helped with the finishing touches of setting up base camp. Then something weird happened: I was asked to lead the sherpa teams. We began by meeting the mules in the cloud forest, then carrying the equipment into the cave to –250 meters or so for a warm up, then repeat. A pair of Russians, Dmitry (Dima) Kraev and Alexandr (Sasha) Deryuga, showed up and decided that I would be a good person to cave with. Tough bastards, I almost broke them. After a few days the rigging and enlarging teams had progressed enough that American caver Kristen Anderson, the Russians, and I could make the journey to Camp 2A, with me rigging the last few pitches. We settled in, working from there to rig the phone line to Camp 2A and haul camp supplies and dive gear from the bivi at –500 meters to 2A. Phil Short from the UK and Marcin Gala and Mikołaj (Miko) Harasimowicz from Poland arrived a couple of days later to rig to Camp 3. Once that was completed, Kristen and I joined them in carrying equipment to Sump 2. Kristen, Miko, and I were then replaced by two other Americans and headed out. I surfaced nine days after going to Camp 2A. My surface time of four days was spent doing reconnaissance and searching for a missing caver who had gone on recon but not come back. We found her at 3 a.m. with a possible broken arm from falling from a 10-meter cliff. She'd had a memorable night, but it turned out the arm was not broken.

Phil Short and Marcin Gala were prepared at Camp 4 to push Sump 4 when I entered again, with Sasha, Dima, and Miko, toiling eight heavy bags between us. (I told you I almost broke them.) We had arrived at Camp 2A with the equipment for a third rebreather diver when the divers arrived back at Camp 4 after a long, sixteen-hour day and phoned their report to the surface. They were going to have a rest day, then shuttle the dive gear from Sump 4 to Sump 2 the next day, then dive out. As for what was found, it was "complicated," according to Phil Short. They had emptied one and two-thirds dive reels beyond the line laid by José Morales in 2009, making the sump estimated to be nearly 600 meters long. (They had been asked to recon only, not survey.) They had found their way through complex underwater passages and surfaced through a narrow, half water-filled passage into borehole with the J2 river dropping down a pitch. They had returned excited, but very aware that very few people in the nine-person dive team were qualified to repeat the dive, or even get to the sump. The surface was a little shocked at the news, having expected them to surface 20 or so meters beyond the 2009 limit. I immediately congratulated the guys on the job well done and told them we would meet them at Sump 2 when they surfaced in two days. The surface told us to drop all of our loads to make the journey easier, and told the dive team to remove all of the camera equipment. (We were filming the expedition for a Discovery Channel documentary to be aired in November of 2013. We have been recording our progress in diary entries, filming the exploration as it happened, and adding a few staged shots—get the lighting right then walk down the passage. (No

A floor to not fall on. *Nicholaus Vieira*

Phil Short and Marcin Gala prepare to dive through Sump 2. *Nicholaus Vieira*

regular film crew was ever going to be able to come with us.)

We continued forward with the majority of our loads. We left Camp 3 without breakfast on the arranged rendezvous day, taking all the food for Camp 4, including food for Phil and Marcin. We moved to Sump 2 quickly to set up for filming, but also to get some food and of course fresh real coffee prepared before Marcin and Phil arrived. They had been without the means to cook food for a day and a half, surviving on beef jerky and protein bars. We waited in darkness. Slowly the sump's crystal water began to glow, the green gaining in intensity until you could see the silhouette of the first diver. We met them with grins and hoots of encouragement and the aroma of freshly brewed coffee. After they dekitted, we ate, organized the gear, and had a story-telling and bitch session, then left like a swarm of locusts for the surface, devouring all the food in the camps. When we were blinded by the dazzling greenery of the surface, Phil and Marcin had been underground for nineteen days, with only one day taken as a rest day. My team had been underground only a meager six days.

I attended the dive meeting the following day that discussed the issues the length of the sump imposed and strategies to be used. I had some very tantalizing invitations to stay, but I was overdue on the Huautla expedition, so needed to leave. I would try, though, to see if I could change my flight to help support my good friends at J2. I left that afternoon, March 20, for Huautla, hoping I could come back. [See Vieira's article on the Huautla expedition elsewhere in this issue.]

On March 30 I trudged back up the mountain to warm greetings, smiles, and hugs from the friends I had made there. It felt good to be back to help out the project. I found out that Phil and Marcin would be heading in on April 1 to explore the passages beyond Sump 4. Bill Stone and Dominik (Honzo) Graczyk had finished a resupply run through Sump 2 to prepare for what was to come, a possible thirty-day stint below. I shaved my head in preparation.

Phil and I paired up for the trip in and opted to travel directly to Camp 3 so we could enjoy the cave at our own pace. I woke during the night with fluids spraying from both ends (expedition beards and vomit unfortunately do mix). After resting for a day in Camp 3, I felt better, but a little sad for missing a day of gear-hauling. A few days later, after helping Phil and Marcin, who jokingly urged me to come with them to Camp 4, kit up on the dive platform and slip away underwater, I made my way to the surface with the most musical cavers ever, the Polish.

Two days after surfacing, I was sitting next to the cave telephone waiting for the call from Camp 4. It cracked to life, and Phil began the story of their first push trip beyond Sump 4. They had surfaced and rigged the upper passage above the fissure that took all the water, surveying this passage to its conclusion. They then began with the fissure. After Marcin worked his magic with the ropes—the drill they took through the sumps did not work due to flooding—they rappelled down, adding depth to J2 the farther they went. Being just in their Fourth Element long underwear made swimming the lakes they came to very brisk. Alas, all good things come to an end; all the water sank into an impenetrable boulder collapse, ending all leads beyond Sump 4. Phil then went on to relate their next plan of action. They would complete a detailed survey and check of Sump 4, making certain that no leads were left unchecked. Then the sweetest thing I had heard in a long time, a request that Russian caver Yuri Schwartz and I come down and dive through Sump 2 and assist transporting equipment from the entrance to Sump 4 to Sump 2 and through Sump 2 to the dive platform at its entrance. I was exuberant! I left with Yuri's drysuit and other kit that afternoon, going to Camp 3 solo. My plan was to build and prep all of the dive kit except Yuri's dive harness, which needed to be sized, to speed up the process at Sump 2 so we could dive a day earlier. Five and a half hours later I phoned from Camp 3 after dropping more than 900 meters through 8 kilometers of

Kristen Anderson, Nicholaus Vieira, Mikolaj Harasimowicz, Phil Short, and, in front, Marcin Gala. *Nicholaus Vieira*

passage—I was focused. Yuri arrived the next day with the team that was to work on the climb in From Russia with Love. The next day we kitted up and dove the 220 meters of very large, beautiful passage that is Sump 2. Phil and Marcin were on the far shore to greet us. After dekitting, we went on a tour of the cave, all the way to Sump 4, where we grabbed gear and shuttled it back to Camp 4, where we would spend the night. On April 12 we broke camp and carried all of the equipment to the downstream end of Sump 2.

There was a mountain of equipment. After preparing bags and kitting up we were prepared to start doing laps of Sump 2 with the gear. Yuri and I were diving open-circuit and would do two shuttle trips, then Phil and Marcin would do the rest. Bill Stone and his team met us on the upstream end of Sump 2 to take the gear from the dive platform. Yuri and I spent one hour moving through the sump the super-negative or super-buoyant bags, which made for some entertaining moments. Then the rebreather divers, Phil and Marcin, spent close to two hours underwater moving gear through. When we finished, the staging area was waist-deep in gear. We spent the next eight days transporting the equipment through the cave with Bill Stone's team. We surfaced in clouds. Phil and Marcin were wiped after spending a grueling twenty-one days underground.

In an effort to remove all of the kit out of the cave I decided to give the project a bit of a boost, so I went back in the next day to move the twelve bags from the bivi at –500 meters to the base of the shaft series at something like –360 meters. I gave up after four hours. Alone and tired, I reflected on my last night in J2, my thirty-fourth night spent camped underground in the past few months. There have been many highs and lows along the way, new friendships forged, and a truly epic expedition beard grown. The next day I left the bivi with two bags and began the trip to the surface, then up to Base Camp to pack. It was nice lying in the hammock reflecting on the expedition, but it was time to start to focus on projects back in Canada.

J2

Nick Vieira fue miembro de la expedición 2013 para explorar los sifones al fondo del Sistema J2 en Oaxaca. En apoyo a los buzos, ayudó a transportar grandes cantidades de equipo y suministros desde la entrada de Last Basch hacia el Campamento 2A y desde allí al Campamento 3 y Sifón 2, donde iniciarían las exploraciones de buceo. Este artículo contiene información acerca de los resultados de las exploraciones, pero el buzo Phil Short cuenta más sobre ésto en otro artículo de esta misma edición.

AKUMAL AREA CAVING, MAY 2012

Joel Despain

Time to head to Mexico! We were to join a mini-expedition surveying caves along the coast of Quintana Roo. Peter Sprouse and Aaron Addison have led teams working in this area for several years, leading to kilometers of cave mapping and some completed maps. Heather Veerkamp and I boarded a flight in Los Angeles and had a fine non-stop trip to Cancún. On the night of May 25 Brad Hacker and Pat Kambesis joined us at the Centro Ecológico Akumal, our home away from home. There we were joined by Germán Yañez and his friend Robert Romero. They both are experienced cave divers. Germán has been along on several caving trips to the area with us. Perhaps we have been slowly converting him to a dry caver?

On Saturday, May 26, we went to a pit cave behind Akumal that had been found by Germán, Brad, and Devra Heyer in February by following the calls of motmots living in the entrance. The cave started as a small room with an overhung pit at the bottom. Unfortunately, the drop was short, and Cueva Nido de Avispa did not go. There were small lakes, speleothems of course, plenty of roots, and perhaps 75 meters of survey.

The team also went on a long hike across the property to an area reported to have a large cave that had seen tours many years ago. We used a trail across the land that appears on Google Earth, but no cave was found in the dense "hurricane" jungle. Lots of nice butterflies, flowers, plants, and Maya walls were seen, however. On the way back the clouds were closing in. We just made it to the owner's back porch when the rain dumped down.

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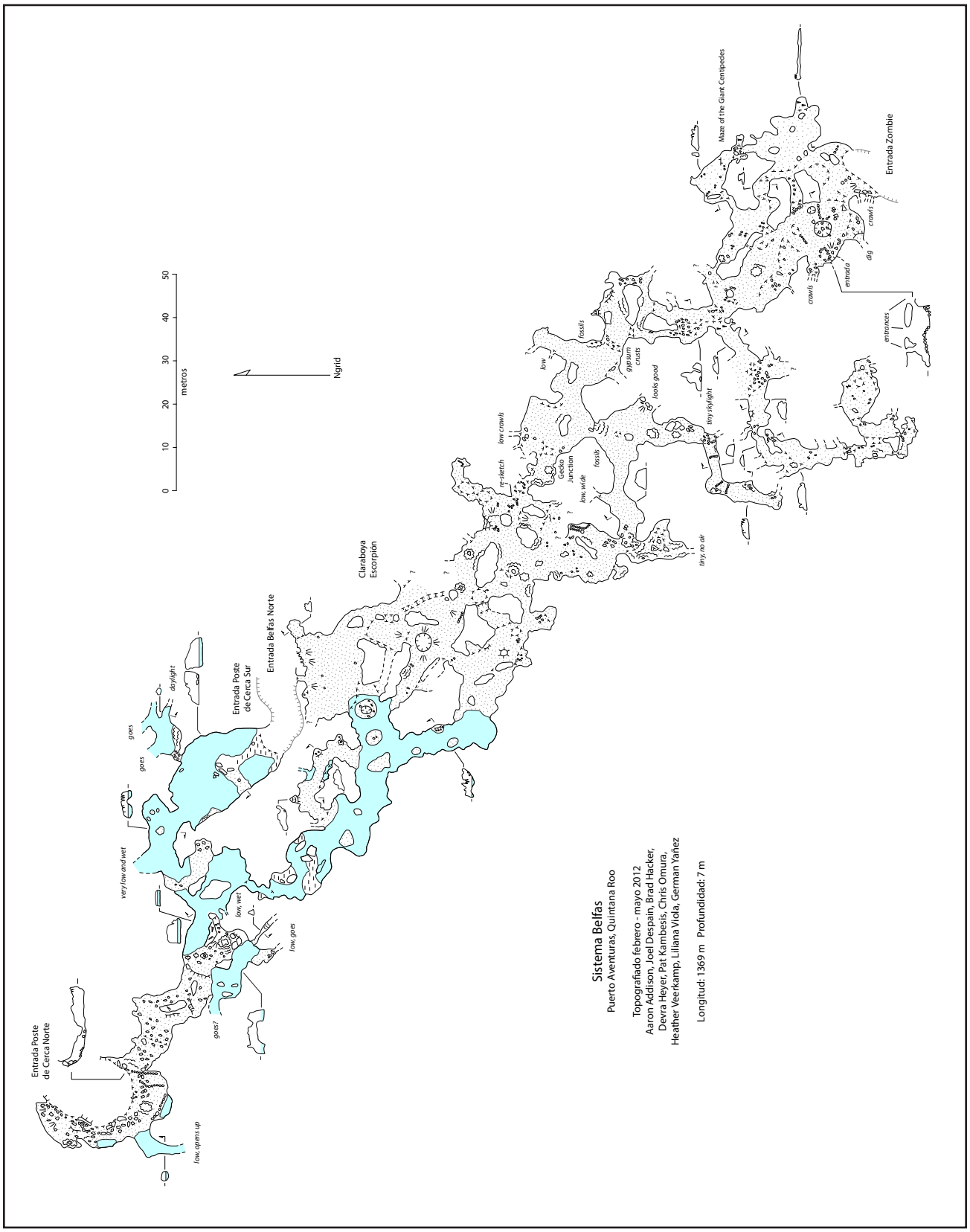
On Sunday we drove north, and two teams went to survey in Sistema Dos Árboles. It is just south of Playa del Carmen, and after a drive we parked near the highway and headed out into the bush. We hunted around and fairly quickly found the small entrance we had used to reach the Circle Entrance area of the cave on earlier trips. We headed for a series of leads left behind in February, and they were found to be mostly loops or deadends. Pat and Germán and I probably mapped about 200 meters. [The February 2012 trip is reported in *AMCS Activities Newsletter* 35, pages 111–115.]

Germán has a heavy-duty pickup with lots of room in the bed, perfect for heading inland on the rough roads that lead into the jungle away from the coast. On Monday we all piled into his truck and headed out to Rancho Tigre, perhaps 12 kilometers west of Akumal. The rancho is a small clearing in the jungle with a house amid numerous cave entrances. Germán escorted us down a trail past one set of entrances and into a prominent collapse perhaps 10 meters deep and 50 meters across. To the right was an enormous entrance more than 100 meters wide. We split into two teams and got to surveying. Pat and German headed off to work their way around the collapse, mapping into whatever entrances they could find. They found several small caves this way and quickly had them surveyed. They also spent a lot of time with the numerous motmots living in the cave entrances and saw a small troop of monkeys.

Brad, Heather, I, and our friend Liliana Viola, who had joined us for the day, headed into the big cave, Cueva de las Lagunitas Azules. First we mapped across the entrance for several shots and then into the maw of the giant entrance. To the relief of the sketcher, the passage size rapidly shrank, and it went up to a higher level. Large formations and lakes were everywhere. We mapped the main upper level and also some steeply descending side passages to water. Heather and I ran short of water and food, and Brad finished up the survey where the cave finally terminated in a formation room.

After lunch we headed back to the other entrances along the trail, and on the way passed Pat and Germán surveying in some small hole in a doline. This entrance along the trail was perhaps 20 meters wide and 5 meters high—very inviting. However the cave almost immediately sloped downward into sump pools. We surveyed left into adjacent rooms and more sumps. We surveyed right into a low, swimming passage that Germán thought had bad air. Soon he and Pat joined us, and part of the team split off to retrieve scuba tanks from the truck to push the passage. The rest of the group headed behind the house. Here were several more small caves, some with big entrances and some with small ones; in a few quick shots we had these done. The bad-air diving team returned; the passage didn't continue. With that we said goodbye to Rancho Tigre and our motmot friends and headed off


Sistema Belfas
Puerto Aventuras, Quintana Roo
Topografiado febrero - mayo 2012
Aaron Addison, Joel Despain, Brad Hacker,
Devra Heyer, Pat Kambesis, Chris Omura,
Heather Veerkamp, Liliana Viola, German Yañez
Longitud: 1369 m Profundidad: 7 m
Ngrid
metros
0 10 20 30 40 50
Entrada Poste de Cerca Norte
Entrada Poste de Cerca Sur
Entrada Belfas Norte
Claraboya Escorpión
Gecko Junction
Maze of the Giant Centipedes
Entrada Zombie
low, opens up
goes?
very low and wet
goes
goes
daylight
low, wet
low, goes
fossils
low crawls
try-sketch
low, wide
tiny, no air
low
fossils
gypsum crusts
tools good
tiny skylight
crawls
entrada
dig
crawls
entrances

for a bumpy ride back to Akumal.

The next day we had three teams in the Belfas area caves on the outskirts of Puerto Aventuras. Upon ending our drive we encountered a caretaker for the property. Luckily we had a few locals along. Soon Lili and the owner were having a long conversation on the caretaker's phone. Pat, German, Lili, and Brad went to meet with the owner of Belfas, and the rest of us went caving. Two small adjacent caves were mapped, and Cueva Poste de Cerca was connected into Sistema Belfas. The cave was very warm, with passages that were generally wide and occasionally low. There are many Maya walls in this cave, and plenty of geckos. We left leads in the southern part of the cave, but the northern area was largely finished. The owner-relations crew spent an interesting afternoon at a large ranch northeast of Playa del Carmen called Guadalupana, which has several beautiful caves and an enormous cenote lake.

On Wednesday the thirtieth, Pat and Germán went back to the Guadalupana property and mapped Cueva de la Guadalupana. It was spacious and well decorated, and they mapped 247 meters in this one. They left several more caves unsurveyed.

Brad, Aida Ferreira, and I went out to Sistema Dos Árboles and worked on more leads around the Circle Entrance. It was easy to find cave to survey, and we made several connections between large loops in the middle of the cave system. Several of the connections were fun short squeezes that joined other passages in unlikely locations. We got to see plenty of entrances and lots of Maya walls.

The next day Heather took a day off for snorkeling, and Pat went to meet with Jim Coke to talk cave genesis in the Yucatan. Brad, Aida, and I went to the northwest part of Cueva Dos Árboles via the Clownfoot Entrance. We had plenty of leads, but all about a foot high. Very quickly I was a sweaty mess, and we were all getting our butts kicked in low and grim crawls that went largely west, or nowhere. We found a few entrances and finally had had it. So we left the cave and got out the GPS data from Gil Harmon, the intrepid caver and winter resident of the area who had originally explored Dos Árboles. Soon we were off through the woods looking for entrances that had either been found by Gil or were new. There were plenty, but most were tiny and not appealing. Finally one looked good, with comfortable passages heading off in two directions. That night German and Robert headed for home.

Jed Mosenfelder on the 8-meter pitch in Cueva Nido de Avispa. *Pat Kambesis*

Friday was a day for dealling with things from home as both Brad and Pat worked, Heather helped Pat, and I started writing this story.

On June 2, Pat, Brad, Joel, and Heather headed for the best of the new entrances Brad, Aida, and I had found two days before.

Brad Hacker keeping the book dry in Sistema Belfast. *Pat Kambesis*

It was named Cueva del Higo Caído (Fallen Fig) for a prominent horizontal tree at the entrance. Heather and I shot our Disto to the left, and Brad and Pat went right. They ended up with the larger cave passage, but it was all roomy compared to the day in Dos Árboles. We wound our way west and northwest through rooms and tunnels, eventually encountering Brad and Pat again. Near here was a grand and glowing entrance with numerous Maya walls that looked almost untouched. We finished up some side leads and had 500 meters in the books. Not bad!

Sunday dawned rainy and gray. Soon a pitter-patter upon the roof was heard. But it was our last day, so damn a light rain. Brad and I headed out into the woods. We continued northwest through the thick forest from Fallen Fig. There are roads and power-line corridors heading inland, so we could not get too lost. We found a few small and low entrances in small collapses. Farther on, the ground sloped slowly downward to an obviously shallow little lake. We scrambled up the far side for a few meters onto higher ground. But there was only a bit more jungle before we were standing beneath giant power lines. We looked left and right, wondering if there was a cut track or road headed back toward the coast in this area. To the south we encountered another lake. Here, with much of the forest cleared for the power lines, it was easy to see that the lakes were groundwater in

very broad and wide collapse valleys. There would be no dry cave in this area. With no paths found, we got out the GPS and headed straight into the woods back toward Fallen Fig Cave. Within an hour we were back at the car and relieved to be out of the thick jungle. But the rain, the jungle flowers and plants, crazy bird calls, wasps, and cool flowers had kept us entertained.

The next morning we were up and headed for the airport. It had been a great trip. So much cave, so little time!

May 2012 Quintana Roo Expedition Survey Totals

name	May 2012 survey (m)	total length (m)	depth (m)
Sistema Dos Arboles	1349	6790	17
Sistema Belfas (now connected to Cueva Poste de Cerca)	416	1369	7
Cueva de las Lagunitas Azules	337		11
Cueva del Higo Caído	926		6
Cueva Guadalupana	247		6
Cueva Claraboya	232		16
Cueva del Mono Enojado	135		10
Cueva Raíces Venenosas	119		6
Cueva Nido de Avispa	85		11
Cueva Representativa	67		3
Cueva Dos Ojos Verdes	59		3
Cueva Resbalosa	50		8
Cueva Tarantula	49		5
Cueva Lubélula	31		4
Expedition total	*4102*		

Explorando el área de Akumal, Mayo de 2012

Cuevas secas en las inmediaciones de Playa del Carmen, Quintana Roo, fueron topografiadas durante este viaje, logrando grandes adiciones al Sistema Dos Arboles, una cueva con 51 entradas sólo al sur de Playa del Carmen. La cueva Poste de Cerca fue conectada al Sistema Belfas.

CAVING ON THE SLOPES OF ZIZINTÉPETL

Jesse Martin

The karst of the Sierra Negra appears as a wonderland to the uninitiated. The 45-degree corn fields perched some 1500 to 2000 meters above the valley floors are mind-boggling, even to someone who has hiked the Rocky Mountains his entire life, and they are surrounded by dense jungle floating above 20-meter-deep lapies. Nearby is the 3260-meter limestone peak of Zizintépetl, appearing as a vertical wall dotted with pine trees and cacti. Amid this visual splendor are the mountain villages and the people who make a living here in the clouds—quite a contrast to the smoggy, overcrowded streets of Mexico City whence we had just come.

In late February, cavers from Quebec, France, and Alberta began to assemble in Mexico for Mexpé 2012, twenty-five years since the first expedition of 1987, initiated by Marc Tremblay. Mexpé is primarily organized by cavers from the Société Québécoise de Spéléologie, in strong collaboration with cavers from all over France. The expedition takes place annually in southern Puebla among the mountains of the Sierra Negra. These mountains and those nearby in Oaxaca hold some of the world's deepest cave systems, drawing many international teams of explorers. From Zizintépetl's 3250 meters to the valleys far below at about 350 meters there is speleogenic limestone.

An advance team traveled from Mexico City by coach to the city of Tehuacán to obtain supplies and arrange transport. Among their acquired booty was a delicacy from Spain, air-dried pork, normally quite expensive, but seeing as not many locals could afford such quality the expedition received an additional forty percent free. The French know how to feed an expedition. Once supplies had been obtained and additional expedition members had arrived in Tehuacán, introductions were made and a run for delicious street tacos was conducted. (Beware of the effects of street tacos if you expect to go caving within forty-eight hours.)

Public transport and a local truck were used to move people and expedition supplies over the Sierra Negra to Tlacotepec de Díaz, the end of the main highway. We left Tehuacán around 5 a.m. February 26, which treated us to a jaw-dropping sunrise at the highest point on the highway, at approximately 2500 meters. From the ridge, however, we descended into a sea of fog, and all detail was obscured for the remainder of the day. From Tlacotepec another truck was hired to haul personnel towards our final destination of Tequixtepec. Near there all of the expedition supplies were dropped off at a storage shack on the side of the road; the rugged mountain road has been built only partway to the village, leaving the last 3 kilometers to be covered on foot. A team of surly mules had been hired to haul expedition supplies over the mountain. Vague trail markers of dried-up ferns were to guide us in the fog through the network of dirt paths along the flanks of the mountain.

Machetes were taken out of storage, and we set to the task of clearing the patch of jungle lent to us. Over the course of two or three days camp was constructed using tarps and parts of the plants we had cleared. Some very sturdy shelving, tables, and work benches were made from branches, twine, and a few donated boards. We even

Catherine Tardy Laporte in the entrance to Sótano Cañón "S". *Jesse Martin*

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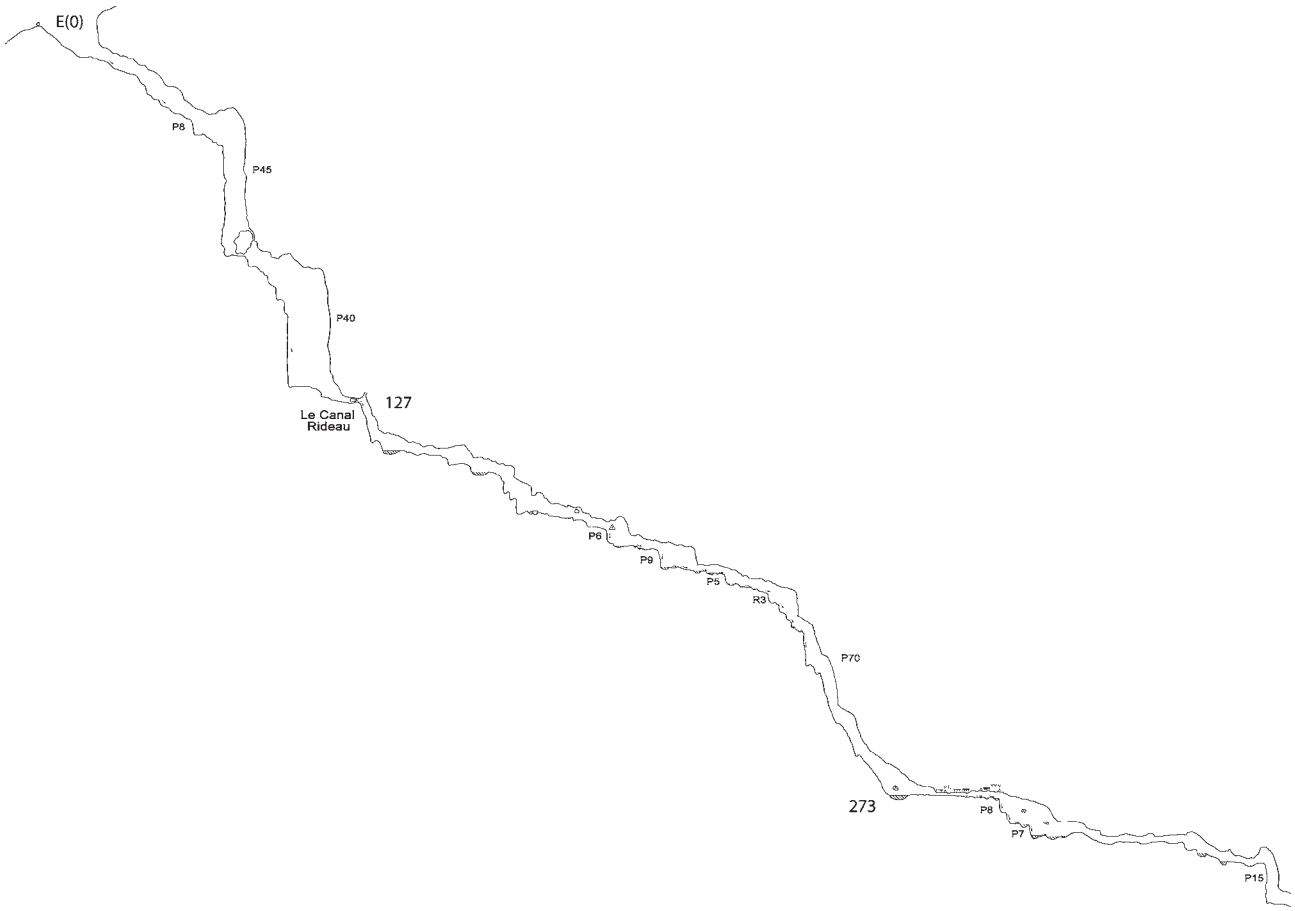
Canadian Caver 77, December 2012, pages 18–25.



COUPE DÉVELOPPÉE

0 400 m

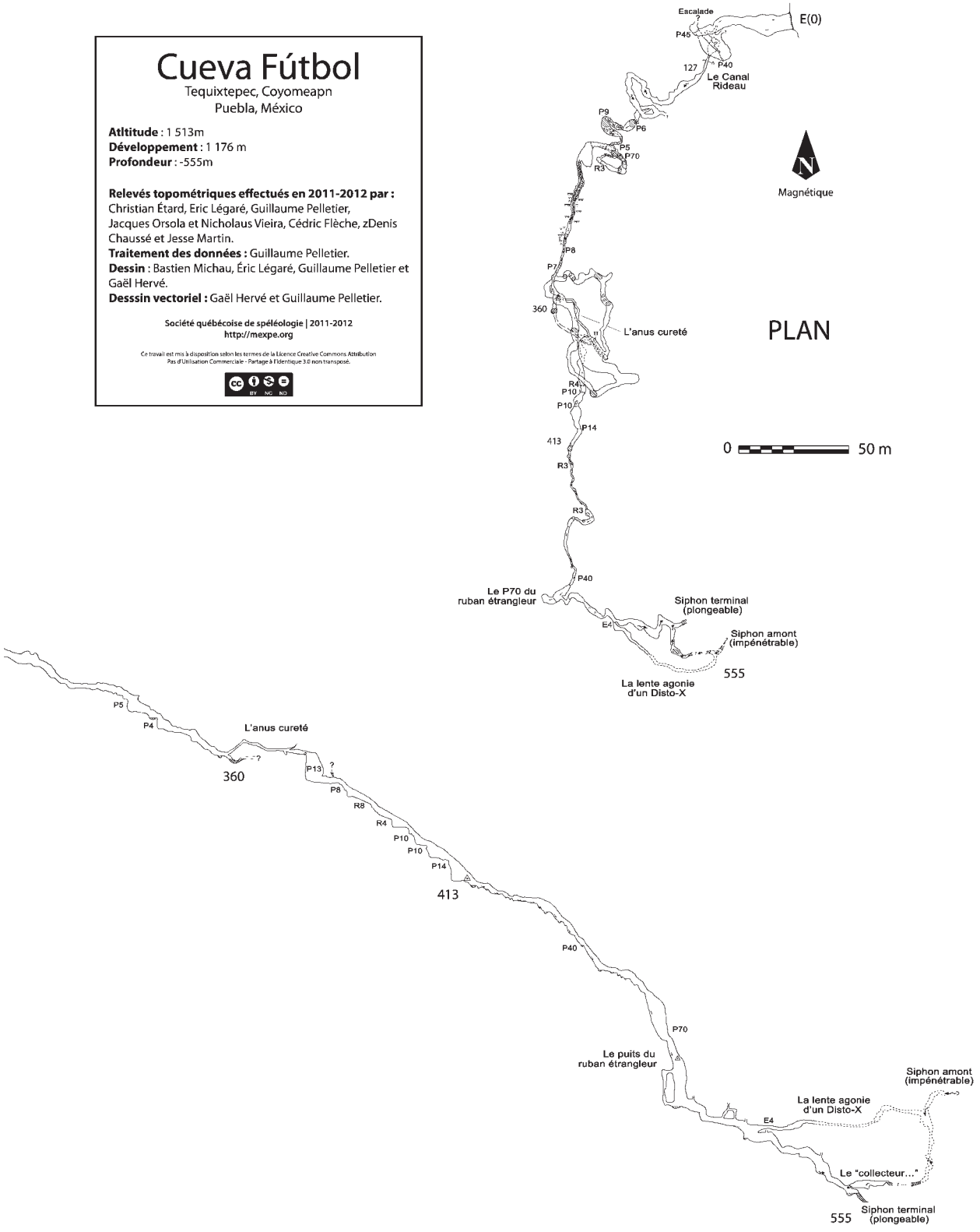
Cueva Fútbol

Tequixtepec, Coyomeapn
Puebla, México

Atltitude : 1 513m
Développement : 1 176 m
Profondeur : -555m

Relevés topométriques effectués en 2011-2012 par :
Christian Étard, Eric Légaré, Guillaume Pelletier, Jacques Orsola et Nicholaus Vieira, Cédric Flèche, zDenis Chaussé et Jesse Martin.
Traitement des données : Guillaume Pelletier.
Dessin : Bastien Michau, Éric Légaré, Guillaume Pelletier et Gaël Hervé.
Desssin vectoriel : Gaël Hervé et Guillaume Pelletier.

Société québécoise de spéléologie | 2011-2012
http://mexpe.org



Pico de Orizaba at dawn. *Gael Hervé*

had a proper latrine built under a rock overhang to protect us from rain, and a natural waterfall fed by a cave resurgence was our shower. Occupancy of these facilities was indicated by closing bamboo gates on the edge of the forest. All in all, I think our jungle camp deserved a five-star rating.

The 2011 and 2012 Mexpé trips were based directly out of the village of Tequixtepec. Obtaining permission to place base camp there and explore the surrounding karst took four years of negotiation with the local Mazatecs. The aim of this expedition was to push leads in caves explored during Mexpé 2011 and do some scouting for new caves in promising areas that had not been reached, for lack of time, during the previous expedition. One of the caves from the previous expedition that still needed to be pushed was Cueva Fútbol. This cave was of interest not only because it was going deep, but also because its entrance was close to the soccer field in the village center. The soccer field was inside a doline next to Tequixtepec's school, which was itself built on the edge of another doline sloping into the entrance of Cueva Fútbol. The entrance pitch contains miscellaneous human debris, including the occasional soccer ball. Caves in the area are commonly used as garbage dumps, something that is unfortunately common in many karst-rich areas of the world. Mexpé participants did make an effort to encourage locals to find alternative ways to dispose of their garbage. During my stay, there was always a strong emphasis on keeping up good relations with the locals. This is quite a logical and healthy attitude, seeing as we *locos* were marching through their crops and courtyards to reach cave entrances.

Exploration of Cueva Fútbol had been blocked 127 meters down, where the way was choked with gravel that required digging during the 2011 expedition. This effort earned the passage the name Le Canal Rideau. Efforts had also been thwarted by a sump at –360 meters, but a bypass had been found through a terrible, muddy crawl, l'Anus Cureté. Exploration in 2011 had stopped shortly beyond the bypass when time ran out. After the cave was re-rigged in 2012, it was quickly pushed to a junction with another streamway. Unfortunately, the cave sumped not only immediately downstream, but also upstream of the junction. An attempt to free-dive the lower sump proved it was impassable without dive gear. The upstream sump led to a series of sumps that could be bypassed via another passage. The second stream was pushed upwards to the top of a 10-meter waterfall, where it became too tight to pass without risk of drowning. The cave was ultimately pushed to –555 meters.

Surveying of the caves during Mexpé 2012 was accomplished mainly with a Disto X and the ability to sketch directly on a Palm Pilot. Distance, compass, and inclination were all digitally measured. With the line plot and passage dimensions displayed on the screen, sketching becomes very straightforward. The efficiency of this system is amazing.

Zizintépetl with coffee plant in the foreground. *Jesse Martin*

Mexpé 2012 Caves Pushed in 2012

	Length	Depth
Cueva Fútbol	1176 m	555 m (includes 2011)
Sótano Cañón "S"	989 m	256 m (includes 2011)
Chicharon Vegetariano	631 m	299 m
Cueva Pancho Villa	355 m	50 m
Cueva de Retro	221 m	67 m
Pulparindo Carnivoro	189 m	65 m
Cueva Elisa	188 m	60 m
Porche	140 m	32 m
Cueva Drenaje	134 m	34 m
La Luette Resurgence	85 m	11 m
Cueva Shelob	68 m	6 m (survey interrupted by spiders)

However, the Disto X can be quite sensitive to water droplets interfering with the laser, and low battery power can cause the device to give incorrect measurements. Checking the calibration of the instruments, just as with analog devices, should be performed daily prior to surveying. Some quite dramatic errors can go unnoticed, causing a major headache trying to CSI where the errors started. As with all electronics, water is the enemy, and devices must be ruggedized or cautiously handled in the harsh environment of a cave (or a five-star jungle camp).

As a sub-project of Mexpé 2012, a comic-drama short film, *Claustrofobia!*, starring Martin Archambault was produced. The film of course was about caving, and it was shot all around Tequixtepec and involved locals; one scene features a shaman.

Flying Mazatec child. *Guillaume Pelletier*

Our five-star jungle camp would not have been possible without the permission and help of the Mazatec community. They also have extensive local knowledge of the terrain and its accessibility and provide a fountain of knowledge on cave-entrance locations. Mexpé members continuously make an effort to ensure that relations stay positive, in order to avoid some of the negative and sometimes hostile situations other international teams have had to deal with in Mexico over the years. A zip-line was set up across the doline that forms the soccer field, and our personal caving gear was used to provide rides to the villagers. While the men were mowing the grass with machetes in preparation for a festival, the children and the school teacher, who went first, rode the zip-line. Even some other adults, after finishing their work for the day, took part. Toward the end of the expedition, a presentation was given in the school about the Mexpé project and the nearby caves that had been explored. The slideshow featured not only the exploits of the cavers, but also people from the community and how they have interacted with the expeditions.

Together, the 2011 and 2012 Mexpé expeditions surveyed 4068 meters of cave, 2364 of them during 2012. The longest caves are Cueva Fúbol and Sótano de Cañón "S" [see map of Cañón "S" in *AMCS Activities Newsletter* 36, pages 14–15]. While there are many caves yet to be explored near the village, it seems most of the easy passage has been pushed. Further expeditions are likely to head higher up the mountain to a plateau that has not yet been visited by cavers. This area has evaded much human activity due to the challenge of reaching it. One of the primary concerns for any sustained exploration there is obtaining water. The karst at that altitude drains all surface water. Previous expeditions to the upper reaches of Zizintépetl found water only 80 meters underground, and that after several days of searching. Those interested in a trip to determine the plateau's potential should be skilled in swinging a machete.

Espeleología en las Laderas de Zizintépetl

En Febrero de 2012, espeleólogos canadienses de la Société Québécoise de Spéléologie, junto con espeleólogos de Francia y México, celebraron una más de las expediciones de la serie Mexpé a la Sierra Negra en el Estado de Puebla. El principal objetivo era completar la exploración de la Cueva Fútbol, cuya entrada se encuentra justo al lado del campo de fútbol en el pueblo de Tequixtepec, del Municipio de Coyomeapan. Esta cueva y Cueva Cañón "S" (ver *Boletín de Actividades AMCS* No. 36, páginas 14-15) parecen ser las principales cuevas cerca de la zona, aunque hay muchas más en los alrededores. Las futuras exploraciones en el área probablemente se centrarán en las zonas karsticas de mayor altura en las montañas

HISTORICAL REPRINT

THE BLIND FISH OF LA CUEVA CHICA

William Bridges

This entertaining account of a biological expedition to Cueva Chica, San Luis Potosí, is reprinted from the Bulletin of the New York Zoological Society, *volume 43, pages 74–97, 1940. Only a selection of the photographs in that article, all by Sam Dunton, are reprinted here; the available copy of the original article is a poor inter-library loan scan. The blind fish is now generally considered a variety of the surface species* Astyanax mexicanus, *or at least certainly in the same genus. The scientific paper resulting from this 1940 expedition is "Descriptive Ecology of La Cueva Chica, with Especial Reference to the Blind Fish, Anoptichthys," by C. M. Breder, Jr.*, Zoologica: New York Zoological Society, *volume 27, number 3, pages 7–15 plus map plate, 1942. A more recent description of Cueva Chica is on pages 37–42 in* Mexican Eyeless Characin Fishes, Genus Astyanax: Environment, Distribution, and Evolution, *by Mitchell, Russell, and Elliott, 1977. A PDF of the book is at amcs-pubs.org/other/astyanax1977.pdf.*

On most scientific expeditions there is a time of crisis. There is a day, or maybe a minute, when you know how your luck is running. Things jell—or they don't. The luck of the Aquarium Cave Expedition jelled at 3 o'clock on the afternoon of March 13.

A thousand feet from daylight, deep in a Mexican cave, two men dragged a net out of the black water and the rest of us hugged a limestone ledge, watching. The seiners lifted a dozen little flopping white fish and dropped them into a picking jar.

Nobody said much, because there wasn't anything you could say that would do justice to the occasion. For some of these fish were totally blind and some had tiny, rudimentary eyes and some had big, perfect eyes. They all came up together in the same net, and it was the first time anybody had found a complete series of fish ranging back from blind, cave-dwelling specimens to the normally eyed.

The Aquarium Cave Expedition to Mexico this spring will bear important scientific fruits in *Zoologica*, but it may be months or even years before the studies are completed. I can't even foreshadow them here because the laboratory study of specimens and data has not begun. As I write this, six weeks after the return from Mexico, two members of the party are still in hospitals, and one other is merely creeping around, barely recovered from prolonged high fever that has puzzled the best tropical disease specialists in New York.

But I can tell the general story of the expedition, and I think it is worth telling at some length. Out of that visit to north central Mexico, Director Breder of the Aquarium developed two interesting sidelines—a cave habitat group embodying new ideas in aquarium display and an exciting motion picture for next January's annual meeting of the Zoological Society. Moreover, it happens that the operations of this expedition were so unified that one article can present almost all phases of them and thus give a fairly complete picture of one of the Zoological Society's activities.

The eyes of fishes are a curious study in themselves. Fishes with eyes divided horizontally, like *Anableps*, or vertically like the Four-eyed Blenny, attract every ichthyologist's attention. And, of course, the eyes—or lack of eyes—in the blind *Amblyopsis* of Mammoth Cave and the blind catfishes of South American caverns and elsewhere are of prime interest to every wide-ranging biologist. How did they get that way? Which came first—the blindness or cave life? Did seeing fish (and other cave-dwelling creatures that are not blind) lose not only their sight but even much of the physical structure of their eyes through millions of years of life in darkness? In other words, is this a perfect example of adaptation to environment? Or did fish with mutated or defective genes, so that they were incapable of developing normal sight, seek out or accidentally find refuge in an environment where their lack of vision was no handicap and predators were excluded?

Blind cave fish raise plenty of questions, and big ones. Dr. Breder's generalized interest in the subject became more pointed three or four years ago when Dr. E. B. Gresser of the Department of Ophthalmology of New York University began using the laboratories of the Aquarium as a base for some of this studies. It was whetted still more in 1936 when Dr. Carl L. Hubbs and Mr. William T. Innes published, in the *Occasional Papers of the Museum of Zoology* of the University of Michigan, a brief report: "The First Known Blind Fish of the Family Characidae: A New Genus from Mexico." [Reprinted in *AMCS Activities Newsletter* 33, pages 79–81, 2010.]

Here, it seemed, was "a blind, subterranean fish belonging to the family Characidae, of which no blind representative has ever been seen before." Furthermore it was "the first blind fish of any group to be named from Middle America." Hubbs and Innes gave a technical description of the fish and bestowed upon it a scientific name *Anoptichthys jordani*, a new genus and new species. "Anoptichthys" means "fish without eyes," and "jordani" was a tribute to the dealer in tropical fish who supplied the type specimens.

The New York Aquarium was among the first institutions to obtain living specimens of the newly-discovered blind fish and they have been on continuous exhibition since 1936. Apart from their eyelessness they are undistinguished; little white fish scarcely two inches long. They swim about their small tank in the tropical fresh-water section of the Aquarium with the utmost ease and freedom. Like a blind man entering a strange room for the first time, they bump into the sides of the tank during the first half-hour of occupancy, and then they apparently sense its size and contours and adroitly skirt its walls for the rest of their lives. They find and devour food dropped into the water and they thrive and multiply. And they have no eyes, not even vestigial eyes, only an opaque pulp and the traces of optical tissue.

Whether it was Breder or Gresser who first said, speculatively, "That's an interesting fish, that *Anoptichthys*; maybe we ought to go down and have a look at it," I don't know. In any event, the idea of an investigation of *Anoptichthys* in its native habitat was implanted, and it grew until it reached the stage of serious discussion last January.

Five of the tentative members of the investigating party met at the Aquarium late in January to examine the known facts and make up their minds whether it was worthwhile spending time and money on a trip to Mexico. Around the table were Dr. Breder and Dr. Gresser, Ralph Friedman, a member of the Zoological Society who was interested in the archeology of the blind fish region, Dr. R. T. Cos of the Department of Physics of New York University, and myself. I sat in because it looked like a good story for the *Bulletin*.

Dr. Breder had previously placed a six-page "preliminary proposal for an expedition to the caves of San Luis Potosi" in our hands. It outlined, succinctly, the time schedule of a four-weeks' trip, the proposed activities in the field and anticipated results, the detailed list of equipment for general work and studies, and the major points to be covered in a fine-toothed combing of the blind fish cave. Here is what the expedition proposed to do, transcribed from that "preliminary proposal":

1st week: Visit cave, collect, explore, make extraction, photograph, study food chain, behavior of blind fish.
2nd week: Visit nearest surface waters, collect, make extractions, photographs.
3rd week: Explore other caves if any can be located, for comparison with that already studied. If not, return to original and study more intensively.
4th week: Collect fishes for shipment to New York alive. Arrange and build pool in cave for experimental set-up if desirable. Pack up and return

"I can tell you in a very few words what I know about the fish and the region it comes from," Breder said, "because I don't know much.

"*Anoptichthys* is certainly closely related to a characin from that same part of Mexico—*Astyanax fasciatus mexicanus.* It's a common fish in all the local surface streams. We have *Anoptichthys* and *Astyanax* both on exhibition, and we can't see any differences—except, of course, in color and the eyes.

"The interesting thing is that *Astyanax* is one of the 'eye-minded' fishes. Some fishes depend mostly on sense-organs in their skin to find food. You can put a drop of beef juice in the water near a catfish's tail, and he'll whirl around toward it instantly. Other fishes seem to use their eyes to find food. You can see why a catfish wouldn't be too badly handicapped in total darkness. His eyes are poor anyway, and he could 'taste' his food at some distance and find it that way. But *Astyanax* doesn't work that way, and this Mexican blind fish is very close to *Astyanax,* or derived from it. And yet it gets along perfectly well in a cave without eyes.

"Another interesting thing: It seems that the cave where this fish is found is a warm-water cave. All the other blind fishes we know anything about come from cold-water caves, with temperatures of 55 degrees or lower. From the general geology of the region, it is likely that the cave water is heated from below in this particular case."

Breder turned a blackboard to face us. "Here's what I've been able to piece together about the cave and its surroundings. Dr. Myron Gordon was in that part of Mexico last year on a collecting trip and he visited the cave. Most of this is based on what he told me.

"The cave is in or very near Pujal, a small village in the state of San Luis Potosi. It's about eighty miles west of Tampico and around four hundred and seventy-five miles south of the border. The nearest town of any size is Valles, and that's where we'd have to stay, because it has several hotels and Pujal is just a collection of huts.

"What we'll find in the cave, I don't know. The fish are there; Gordon saw several of them. He found two pools at least two hundred feet from the mouth of the cave, and he saw fish in one of them. He saw a lot of bats hanging from the roof over one of the pools. That may be where the fish get their food. We'll have to work that out—find out whether water runs into the cave and carries outside food. One of the items I have on the list for study is working out the food chain.

"We might want to set up an experimental pool or pools, and pen up blind fish with eyed ones, and then somebody ought to go back in a year or two and see what has happened. From what Gordon saw in the cave, that pool set-up won't be easy. His electric torch wasn't very strong, but it looked to him as if the wall of the cave came right down to the water's edge, or very close to it. So we might not be able to go more than a couple of hundred feet into

the cave."

That was all we knew in advance, and some of that information might be unsound. If the prospect looked good enough to take a chance, Breder proposed making a thorough job of it and taking all the equipment we would need for the most extensive inquiry. He submitted a long list of basic equipment, the chief item of which was a collapsible boat that could be used to navigate the pools—for Gordon had made a sounding and found no bottom at 20 feet.

One piece of luck we could count on in advance. In the course of looking up the background of the fish and their cave, Breder found that the actual discoverer of *Anoptichthys* was Salvador Coronado, a young Mexican fish culturist in charge of the Fish Culture Station at Almoloya del Rio, up in the mountains near Mexico City. The Mexican Department of Fisheries was most cooperative and voluntarily offered to attach Sr. Coronado to the Aquarium's expedition. So we would have with us a man who already knew something about the cave and the fish.

The investigating party, then, was to consist of the five of us then present, plus Sr. Coronado and two others—Sam Dunton, the Aquarium's photographer, who would take still pictures to help plan the construction of a habitat group in the Aquarium and motion pictures for the annual meeting, and Marshall Bishop, as assistant in zoology in the Peabody Museum of Yale University, whose services for general collecting were offered by Dr. Stanley C. Ball, the Curator of Zoology at the museum.

"Well, what do you say? Is it worth taking a chance on the little we know about the cave?" Breder asked the question, but he already knew the answer. We thought it was worth taking a chance.

New York was still dazed by the disastrous ice storm of March 4 when the expedition set out for Mexico, but spring was at the flood in San Luis Potosi. Not a lush, moist, dreamy spring as in the North, but a dry and hot prelude to the rainy season. It was good to see the almost-forgotten phenomenon of sunshine and good to be awakened by the harsh clatter of vultures on a chicken yard fence.

Valles and Pujal, when they ceased to be dots on the map and became the working bases of the investigation, offered unexpected comforts. Valles proved to be a town of 5,000 population, and because it is the usual second-night stop for tourists from the United States, it possesses several good hotels. Pujal in reality was but little larger than a dot on the map—a straggling collection of bamboo and adobe huts straddling the swift-flowing Rio Tampaon. Its usefulness to us centered in a well-stocked general store where ropes and candles and matches and other small supplies could be obtained.

The party was complete and settled in Valles on Monday, March 11. Coronado was to meet us there after we arrived and had been summoned by letter. He joined the expedition the next day. Only Dr. Cox, of the group that had planned the investigation in New York, failed to take the field. Unexpected complications cause him to drop out at the last moment. For a general guide and helper, we had the good fortune to turn up an English-speaking native of Pujal—the willing, tireless and omniscient Ramón Aguilar. Not only did he know the cave where we would find *Anoptichthys*, but he knew the location of Indian villages and ancient mounds that Friedman wanted to see, the sinkholes and stream beds that Breder and Gresser wanted to investigate—and the walls of his white-plastered house yielded a morning harvest of tarantulas and "banana" spiders to help fill the vials I had promised to bring back to the entomologists of the American Museum of Natural History!

Locally, said Aguilar, our cave was known as "La Cueva Chica"—"The Little Cave"—to distinguish it from another and larger cave in the region. But the large cave was permanently dry and consequently of no interest to us. In view of what we subsequently discovered of the size of "The Little Cave," it is probably just as well that we passed up "The Big Cave," for we might still be exploring it.

The major hardship of the expedition developed at the outset of our first visit to La Cueva Chica that Monday afternoon. Aguilar had promised that we could drive up to the very mouth of the cave, and we foresaw an expedition de luxe. But when, with Aguilar directing, we drove from Pujal back toward Valles for exactly one mile to the lane that turned off to the east between burnt-over fields and palmetto brush, there was a hitch. The lane was used only by lime burners from two kilns near the cave, and it was not safely passible in a heavily-laden automobile. Rocks and stumps in the center of the road might pull the bottom out of the car. The driver and one passenger might ride the half-mile to the cave; the rest of us had to walk. But, as hardships go, it was bearable.

So we bumped and trudged down the lane, dipped through the dry bed of a stream, and drew up in a hundred-foot clearing in front of one of the lime kilns. We were on a slight elevation, looking out over a rolling wilderness of gray-green bushes and drought-stunted tress with here and there a palmetto breaking the monotony. The clearing ended at the bank of a deep-cut and rocky gully. And the gully poured itself into the mouth of the cave.

It was the right cave. Dr. Gordon had brought back a tiny snapshot of the entrance; I remembered a round chunk of rock at the left, just about where the first bicuspid would be if cave mouths had teeth. There was a round rock.

All of us most have felt the same tension of excitement as we filed down the dusty path toward the cave. This was the goal of all those weeks of planning; this was going to be our daytime home for three or four weeks. In the next few minutes we would know whether we were chasing blind fish or wild geese.

The actual mouth of the cave was not very wide. Only about fifteen feet, perhaps, between the curtain of rock on the left and the squat ledge on the right, but a man could stand upright under the thick slab of limestone that formed the first layer of the roof. Above it fissured layers of rock were piled one on another until they merged with the crumbling brown earth and sun-blackened roots

twenty feet above. It all looked so massive and immovable—and yet so precarious, too, for the horizontal fissures between the great layers of rock were deep and wide, and just inside the mouth lay of block of stone the size of a truck. The square fracture of its break from the roof was an ominous warning to be gazed at thoughtfully each time we had to creep under its still-pendent twin. The big chunk had dropped since Coronado's visit in 1936.

The gully feeding into the mouth was actually the bed of a stream in the rainy season, Aguilar explained. In May and June a leaping torrent poured into the cave and blocked it.

"Well, that answers part of the one question," Breder commented. "The fish don't lack food from the outside during the rainy season, anyway."

The cave welcomed its visitors with what at first was a refreshing coolness. It was hot in the gully; the afternoon sun was blazing, and the trees and bushes cast almost to shade. But in the darkness of the cavern's mouth there was cool, if clammy, air. A breath of wind would swirl a wave of oven-like heat against the gray rocks, and then it would eddy out again and the damp air would steal out of the blackness and wrap around us. Still, it felt good to northerners not yet accustomed to the hot sunshine.

Half a dozen steps inside and the roof closed down. By bending double we could just scrape through. Then the light began to fade and with lowered flashlights we picked our way over the tumbled rocks. Without the contrast of solar heat, the air was not so comfortable now. It was warmly moist, as in a greenhouse, but the odor of damp earth was not flower-scented, but old and stale and sour. We must have made a ludicrous picture that first afternoon, creeping along with our heads at the level of our knees for fully fifty feet beyond the point where the roof lifted until we could stand erect. A few bumped heads later taught us where the standing room began and ended.

We took it slowly, stopping every few feet to pick out with the lights some curious formation. It was an interesting cave, but not spectacular in the way that Mammoth Cave or the various Virginia caves are. Glittering drops of water on the roof seemed to hang forever before they fell to add their minute content of calcium to the baby stalagmites on the floor. In a few places there were fantastic formations on the walls as if the filling had been squeezed out of an enormous cake.

As nearly as we could tell without a compass—for we had lost our sense of direction when the blackness closed in—we were penetrating along an almost straight line. Distance is another sense, like the feeling of elapsed time, that is apt to be impaired in underground exploration. That night we made estimates of the distance we had penetrated the cave, and they ranged all the way from 300 feet to 1,000 feet. Actually our survey showed we had gone 365 feet on that first trip.

But at the time we seemed to be walking on and on and on. At a ledge of pitted, creamy flowstone our guide swerved to the right and descended by narrow natural steps. A low shelf of rock flared from the wall beside him.

"Under there," Aguilar said casually, "I think you find what you want."

One and all, we dropped to our knees and began crawling. Under the shelf the roof lifted to form a low-domed room that was roughly circular, and before us the floor dropped down to a black pool.

"Well, there they are! That's *Anoptichthys*, all right."

Breder squatted on the very brink of the pool and trained his light on one fish after another. The rest of us squirmed out on the overhanging back, and even Aguilar was infected by the excitement and lay flat on his stomach and inched out beside us.

For a long time nobody said anything. All we wanted was to look at the blind fish we had come 2,500 miles to see. The water, so black where the lights did not fall directly on it, was crystal-clear, and the ghostly white of the fish could be picked out at almost any depth, although most of them seemed to stay only an inch or two below the surface. Over most of the pool there was a petal-like scum of grayish-white. It was thin and nearly transparent—probably free calcium forced out of the supersaturated solution in the water.

It seemed hours that we crouched there watching those fish. They were oblivious of our presence. Even the brightest lights had no effect on them. How could they, when their eye structure was a mere jumble

These tiny white fishes are *Anoptichthys,* summoned to the shore by the simple device of dropping a pebble into the water. Unable to sense even the brightest lights, they nevertheless responded quickly and accurately to the vibrations of objects falling into the water.

of ineffectual tissue? It was easy to test their unresponsiveness to light. Time and again we picked out an aimlessly-swimming fish and played the concentrated beam of an electric torch around it, ahead, behind, to the side, and on it. The random cruising of the fish never changed. Whatever the course it had set as it slowly circled a small region of the pool, the presence or absence of light caused no deviation in its movements.

Gresser's verdict was: "No tropism at all to light. Anyway, we knew that from those sections of the eyes we made in New York."

"But they do find food. Watch this." Breder kneaded a pellet of moist earth and tossed it into the center of an area where no fish were swimming. Every fish in the pool seemed to turn instantly. The ripples were scarcely a foot away from the disturbance center before the nearest blind fish were heading in. They came streaming toward the spot from all sides. There was nothing idle about their movements now.

"There's a tropism for you. They can't see, but they can sense vibrations in the water."

Time after time Breder tested their reactions to disturbances in the water, and they turned tirelessly and swam toward each new possible source of food.

"We can be pretty sure that's the way they find food," Breder decided, "but what do they eat? Something drops into the water. Gordon said there were bats all over the place. They would mean food. But I haven't seen any bats so far."

Neither had anybody else. The air of the cave was dead and stale, but it was not tainted with the characteristic acrid odor of bats. But there were certainly thousands of bats just a few yards deeper in the cave when Dr. Gordon visited it. Why they had deserted that particular roosting place we never knew.

If there were no bats to provide food, there were plenty of tiny flies. They swarmed around our electric lights and uncounted thousands were consumed in the flames of the candles we later used at points where we wanted general illumination. Flies and spiders could explain the food supply, and the cave abounded in both.

When we finally backed out from under the shelf, Aguilar motioned ahead with his light.

"Big pool ahead."

He threw the beam down the corridor, and the smooth floor ended in abrupt darkness. On the brink we looked out across another underground pond perhaps fifty feet across. More white fish glistened just beneath the surface. This seemed to be the second pool that Dr. Gordon had mentioned, the one where he thought the wall came down to the water's edge and we would have to swim and dive if we went deeper into the cave. Aguilar seemed familiar with this pool. He dropped over the four-foot ledge to a sloping bank that skirted to the right.

"Good water," he explained. "Indians come here every day to get water. They come down here on the bank."

That was surprising news, but it became understandable later when we visited the Indian village three-quarters of a mile away, back in the bush, and found that the first two pools in La Cueva Chica were their nearest source of water. Outside the village there was a hole some fifteen feet deep that represented a communal attempt to dig a well. A few lengths of pipe around the hole showed that they had made soundings and apparently had given up when they found no trace of water. Aguilar said they had been using the cave water for many years, the men and boys of the village carrying out buckets of it every day. It seemed a desperately weary business, to supply a whole village from a pool three-quarters of a mile away, but after we saw the water supply of other Indians and Mexicans in more remote areas, these Huastecas appeared fortunate by comparison. Some of the others drew their drinking and cooking water from fetid sinkholes.

Our fresh electric torches revealed far more of the pool than Gordon had seen. It was roughly crescentic and the wall did come down almost to the water's edge on the far side, but not quite to the water, and under the arch there was another large pool. Bishop was all for plunging in and swimming under the arch, but we had paid freight on a boat all the way from New York for just that kind of exploration, and we held him back.

That seems to be as far as we could go without the boat, and we climbed up the ledge and turned back. Friedman, poking in every crevice for mementos of occupation by the ancient Indians, stopped us with the discovery of a narrow tunnel that led straight upward through the wall. It was just large enough for a man to squeeze through and on top was a high, dry bank of clay that sloped steeply into another pool—the water we had seen but a few minutes before under the arch.

Breder slid down the clay to the water's edge. "Plenty of *Anoptichthys* here," he reported, "and here's a crayfish!"

A blind crayfish, maybe? Bishop jumped and slid, waded knee deep in the mud, and grabbed frantically. The crayfish backed into deeper water, Bishop backed with it, and before he realized what he was getting into, he went over backward with a splash.

He came up spluttering with his electric light still burning, but the crayfish was gone. I still don't known whether it was an accident or whether Bishop was determined to go exploring. At any rate, he was as wet as he was ever likely to be, and our lights had picked out the vague outline of a shore on the other side of the pool. With the torch help over his head and describing wild circles, Bishop struck out for the other side.

There was pandemonium for the next few minutes as Bishop's excited yelps echoed across the water. "This cave goes on forever! I can't see the end of it! Here's a long passage! Rocks and shallow water!"

We could see him haul himself out on a rocky shore. His light turned upward and the beam was lost in blackness far overhead. He was in a narrow passageway fifteen or twenty feet wide, with almost sheer walls rising on either side.

"The water's running out of this pool! There must be a waterfall—I can hear something roaring! I'm going down!"

"No, you're not! Come back!"

It was the only fixed rule of the expedition that nobody was to wander off by himself in the cave, for fear of getting lost or accidentally injured, and Bishop reluctantly turned back. We had learned enough, anyway, to satisfy us that the cave was not as shallow as we had feared, and that it would be practicable to use the boat for deeper explorations. It was enough for the first day. Crouching and stooping we stumbled out of the cool cave into the blinding sunlight.

Experimentally, on the following day, we set up the boat in the clearing outside the cave. It turned out to be a more complicated business than the book of instructions said, and when the canvas skin finally was stretched over the planking and ribs nobody felt like tearing it down and rebuilding it inside the cave. So we lugged it down to the mouth and somehow, progressing by inches, carried it safely over the boulders without a puncture. In half an hour it rode like a cork on the astonished surface of Pool II, as we designated the larger of the pools we had found the day before. The first little circular pool under the shelf was Pool I.

This time we were going in prepared for anything, and a small mountain of equipment had to be carried—Dunton's cameras for still and motion pictures, boxes of flashlight bulbs, a seine, dip nets, collecting jars, ropes, and miscellaneous small gear in knapsacks. The boat would carry one passenger and a heap of luggage at a trip. Breder took the oars and the Pool II Ferry went into business.

Pool II was broad and mysterious when only a portion of it could be picked out by the beams of our lights, but it was suddenly dwarfed when the boat gave us perspective. Half a dozen strokes of the oar shot the boat under the arch, half a dozen more shoved the bow up to the shore where Bishop had crawled out of the water after his bath. Breder landed me, the first passenger on the ferry, and waist deep in the warmish water I hauled out the luggage and piled it on the rocks. A few minutes later Bishop came across with more bags and nets. We couldn't wait for the rest of them; the lure of that immense corridor beyond us was too strong. We started ahead.

Tumbled rocks alternated with shallow, narrow puddles. The going was difficult, but in the second puddle we forgot all about that, for Bishop spotted another crayfish. This time there was no escape, for the pool was scarcely a yard wide and twice as long. A couple of grabs and he had the creature. It was not blind. Lighter in color than the normal crayfish of the outside waters, it was fully eyed and of the common local species. That was a disappointment, but it went into the pickling jar anyway.

Behind us we could see lights coming and going. The rest of the party was landing and starting down the corridor. Bishop and I pushed on, slipping and wading and scrambling over wet rocks. Still we came to no waterfall, and Bishop was sure he had heard one the afternoon before. "It's certainly queer," he said. "There was a low, loud roaring—a kind of rushing sound, like a lot of water coming down. But I don't hear it now."

We listened carefully. Now and then there was a gurgle and a trickle underfoot as the water from Pool II slipped along through the corridor, but nothing that imagination could translate into a vast waterfall. We gave it up as a mystery and went on.

Collecting was good. Bishop dipped a creamy crayfish out of almost every little pool, and I was finding spiders in every crevice in the wall. Gigantic tailless whip scorpions, some of them with legs that spread eight inches, scurried along the walls and could be picked off with ease—if you were fast enough to grab them before they ran too high. Shining pholcid spiders, glittering in the concentrated rays of my headlamp, tumbled into vials of alcohol or shot away and left wriggling legs in my clumsy fingers.

Around a turn in the corridor the whole picture of the cave changed suddenly. The corridor widened abruptly and the roof soared to a height of sixty feet or more. Against the right-hand wall there was a jumbled pile of yellow rock, apparently fallen from the roof since the last rainy season, for it bore no evidence of erosion by the water. The rest of the floor was a fantastic series of little cup-like pools, stair-stepping downward. The only thing I can compare them to is cup fungus, so commonly seen on dead wood in forests. They were all sizes—large ones ten feet across the lip, little ones only a foot or so wide. Their depth varied with size, and the big ones were perhaps three feet deep. Why they should have formed in that part of the cave and nowhere else, I am not geologist enough to know. But there they were, a magnificent series of little individual pools already formed by nature. And we had worried, back in New York, about the mechanics of constructing only a couple of experimental pools in the cave!

By stepping from the lip of one pool to the next, it was easy to cross the "fungus patch." Bishop was methodically searching each cup for crayfish. I went ahead and in the next few moments stumbled into two of the most exciting, paralyzing events of the whole trip.

A large boulder blocked the path; a log carried in by some torrent of an earlier rainy season was lodged against it, and I noted that a colony of ants had built a heaping nest on the end of the log. Just beyond was the circular rim of one of the largest calcium cups, above it a head-high arch, and then a sheer drop of fifteen feet to a broad ledge of stone cups. Below that ledge was a pool—and a big one. My headlamp was fresh and strong and the beam was concentrated. I threw it down on the water in the hope of seeing what lay beyond and how wide the pool might be. White fish were swimming in the dark water, but there was something else—the gleam of tiny eyes!

I shouted for Bishop. What the eyes represented I hadn't the faintest idea. Crayfish, maybe, for the crayfish Bishop found had glittering eyes. But crayfish oughtn't to be so near the surface, and everywhere I turned my light the water was sparkling with pinkish fire.

The Pool II Ferry did a certain amount of sightseeing and then buckled down to business, this being one of the sightseeing tours. It indicates well how large Pool II actually was, since this shows on part of half of it.

Bishop yelled back, and far up the corridor the others shouted to know what was the matter. And then I began to hear something else, the dull, low roar that Bishop had thought was a waterfall. A rushing, beating sound that pulsated through the arch and filled the mighty dome behind me.

Anybody who wants that moment to add to his thrills of a lifetime is welcome to it. I don't like to think about it even now. It simply paralyzed me. It came on suddenly, just after my shout reverberated through the arch. I had a wild flash of recollection that the human voice, at certain vibrations, is supposed to be able to break a window; I *knew* that my excited bellow had dislodged the roof somewhere and that the Rio Tampaon was pouring into La Cueva Chica! The Rio Tampaon was a mile away, but that didn't matter. We were trapped in the cave and in about ten seconds all of us were going to be drowned.

Then a couple of bats whizzed through the arch from below, a dozen sped after them, and bats poured through by the hundreds, thousands, and maybe millions. I don't remember any greater feeling of relief in many, many years. My stomach righted itself. The bats were making the roar. The beating of their wings as they fled from their roosting place below and beyond was being magnified by the succession of domes, and that was all.

It was a completely crazy five minutes. Everybody was yelling at once—I to make myself heard above the thunder of the bats and make the others understand what I had seen in the pool down below; Breder, Gresser, Dunton, and the rest to know what was going on; Bishop with the most reason of all because he came charging down the calcium cups, fell against the ant nest, and pulled his bare arm out with a black coating of stinging, biting, fiery ants. His gyrations were something really spectacular.

Somehow and eventually it all calmed down and everything was explained. The bats were still pouring out from under the arch in an unbroken stream, and almost as many—presumably those that had flown to the mouth of the cave and been repulsed by the afternoon sun, were streaming back. But nobody minded the bats. Most of the time, even in that narrow passageway, they were adroit enough to miss us. Bats are supposed always to miss obstructions, but they sometimes collide in congested traffic, and Breder was smacked in the face a couple of times.

When everybody reached the calcium lip under the arch I explained what I had seen, or thought I had seen, in the pool below. Aguilar went back for a seine and one after another we dropped over the ledge to the shelf above the water of Pool III. Bishop plunged in and swam as far out as the seine would permit, then slowly circled. Coronado held a brail against the bank. The rest of us squatted on the shelf.

The seine came up with a pocket of glittering little fish. Breder cupped his hands under them and lifted the seine into the circle of Gresser's flashlight. Two were paper-white and eyeless. Five were colorless creatures with tiny black spots where the normal large eye should have been. And four were pale fish with faint traces of the normal lateral color band—and perfect eyes!

Gresser, always impassive, dropped them into the pickling jar.

"I guess we can go home now," he said.

Scientifically, the work of the expedition was pretty nearly over at that moment. We knew the answers to a lot of questions without seeking any further. The food problem was settled; if there were no bats in the front part of the cave, there were plenty of flies that were equally acceptable as food, and certainly the bat parade we had just been treated to—and were still being treated to, for that matter—was plenty of evidence about the source of food for the fish deeper in the cave. As a matter of fact, while we were shooting a movie scene in the calcium cup area a few days later, an eviscerated bat plunked into the water almost under the lens of the camera. Probably some sort of vespertine warfare high up in the black roof was responsible, and no doubt that sort of thing happened fairly often. One dead bat would provide food for a lot of fishes the size of *Anoptichthys*.

We could be fairly certain now where the fish came from. They came from the outside, of course, but they came through the lower end of the cave, wherever it was, and not through the mouth by which we entered. The gully that led into the mouth was dry a good part of the year, and Aguilar had explored the stream bed a long way back

into the bush. There were not even any muddy pools that might tide a supply of fish over during the dry season. Only surface drainage came tumbling in during the rainy season. *Anoptichthys* and the eye-possessing *Astyanax*—for such our eyed fish patently were—came in from underground, from deeper down in the cave. We wanted to explore further, of course, and find the outlet to the Rio Tampaon or some other surface stream, if we could, but it was not really necessary. A surmise was as good as a demonstration in this case, and the fact that a single sweep of the net in Pool III had brought up more intermediate and eyed fish than blind ones was evidence supporting the theory of ingress lower down.

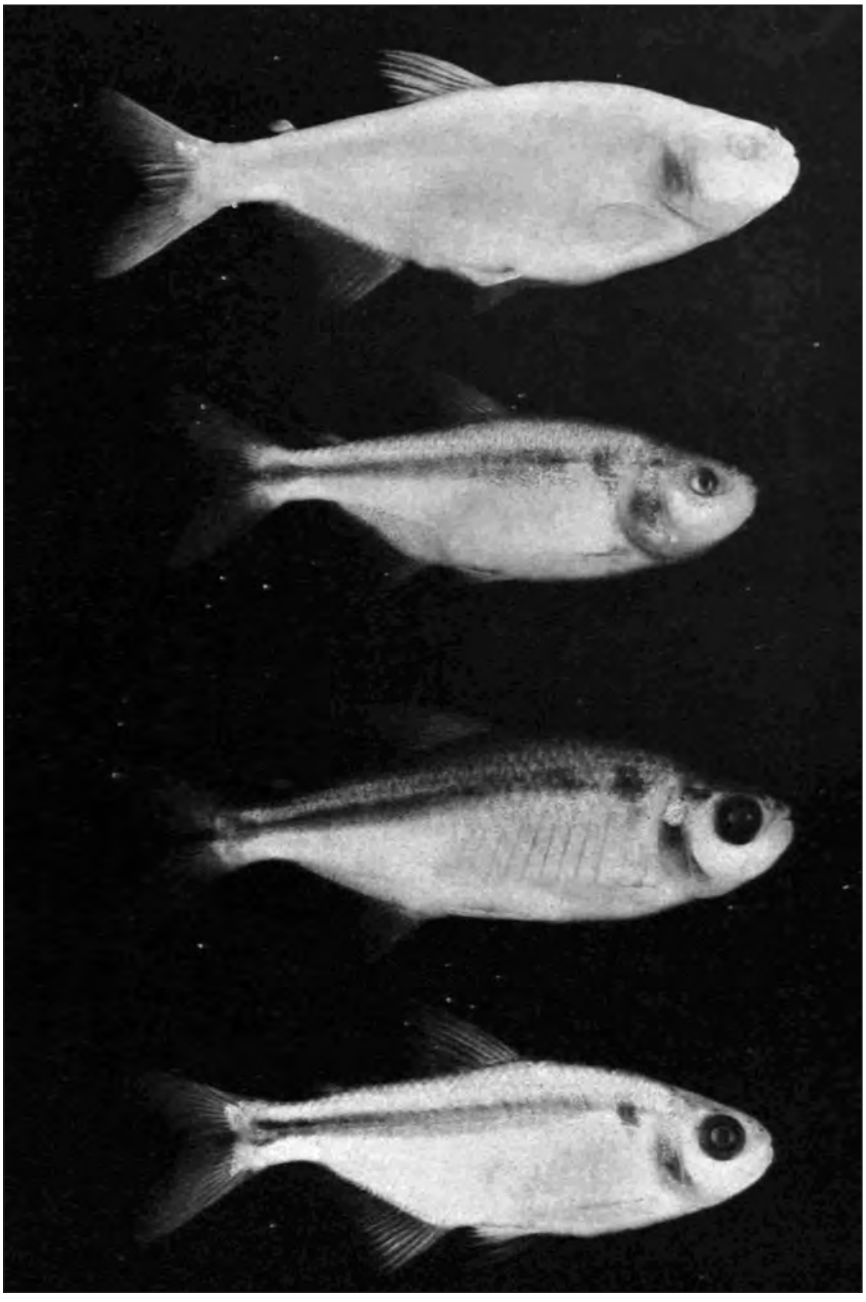
How did *Anoptichthys* get up the 25-foot shelf from Pool III to the lip of the calcium cups? Breder thought that was no insuperable obstacle. In the first place, a low arch constricted Pool III and in the rainy season it must cause the water to dam up and rise high against the bluff; and even if it did not flow level with the edge of the bluff, characins of this type could easily leap a low waterfall and swim upstream.

As Breder and Gresser argued the matter, it appeared plain that some underground exit of the waters beyond Pool III was the source by which *Anoptichthys-Astyanax* entered the cave. We were, at a guess, a quarter of a mile from the Rio Tampaon, the nearest presumed supply of *Astyanax* in open water. The cave waters might come to the surface between us and the river, or they might well out of the bed of the river as an undersurface spring. In either case, it would be perfectly logical and possible for *Astyanax* to find its way into the cave by such an underground route. Aguilar contributed the information that there were innumerable open sinkholes in the vicinity, one or two of them on a probable line between our location in the cave and the river. He promised to lead us to them.

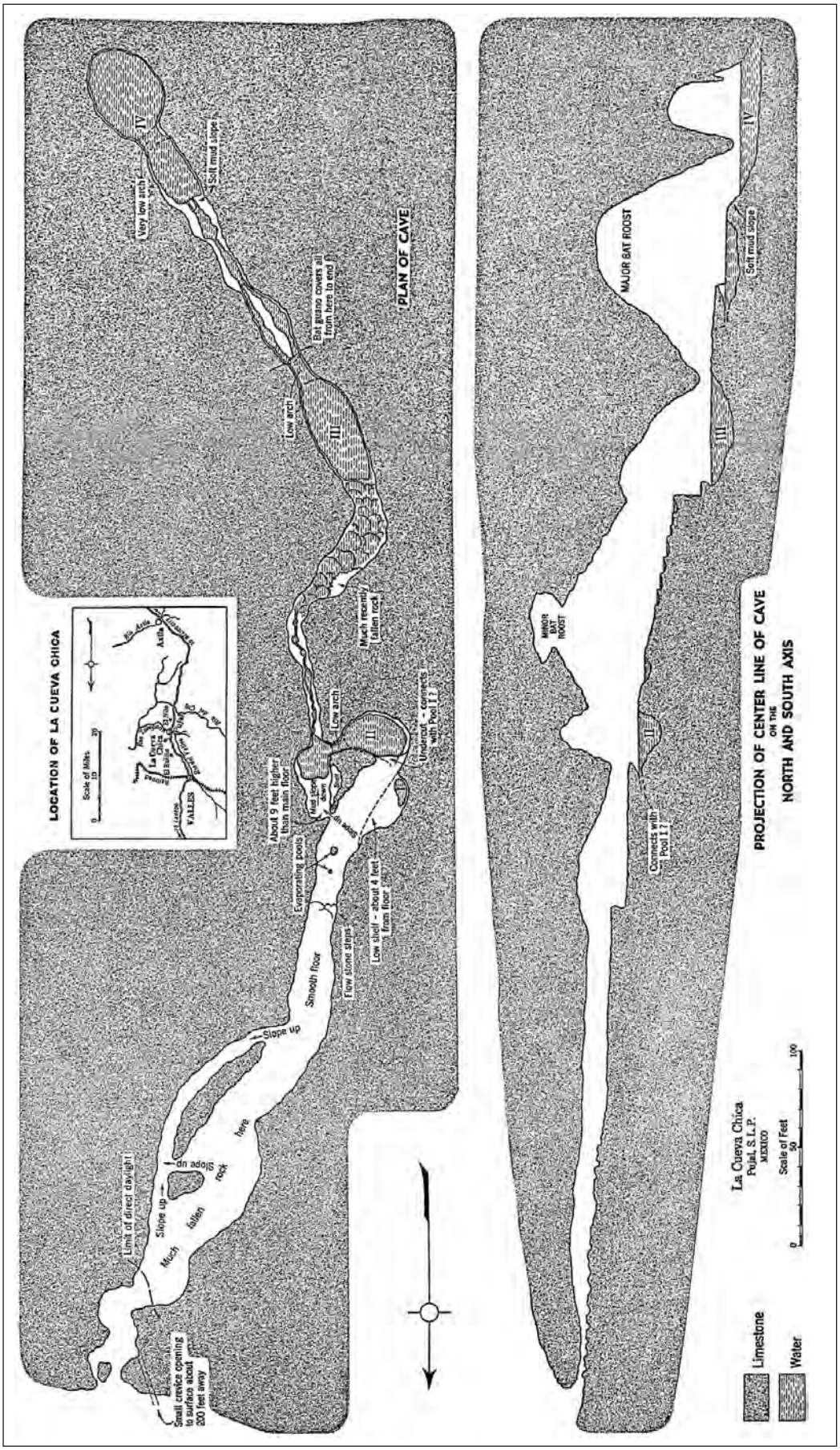
"Even if they don't connect directly with the Rio Tampaon, they can have *Astyanax* in them," Breder mused. "How fish get distributed the way they do is one of those questions nobody can answer. 'Rains of fishes' used to be one of the answers, like rains of toads and blood and so on. Darwin thought ducks carried fish eggs on their feet. Nowadays we often admit we don't know and don't try to put up a theory.

"So here we have *Astyanax* coming into the cave from the lower end, with perfect eyes, and we get intermediate forms with imperfect eyes and blind forms—all in the same net. That seems to knock out *Anoptichthys* as a new genus and new species. Or does it? Well, this was a good day's work, anyway."

It was, and a full one. There was more of La Cueva Chica to be explored, more tantalizing black water beyond the arch that hung over Pool III. But enough was enough for one day. We carried our trophies back to Valles and sat up late that night discussing the possible meaning and



A great deal of work will pass through the laboratory before the full implications of this photograph are recognized. At the top, the blind fish Anoptichthys; next, an intermediate form with imperfect eyes; then a fully eyed cave fish. At bottom, an "outside" *Astyanax*.


LOCATION OF LA CUEVA CHICA
Scale of Miles
Axtla
La Cueva Chica
El Salto
Tamazunchale
SIERRA
PLAN OF CAVE
Very low arch
Soft mud slope
Bat guano covers all from here in end
Low arch
Much recently fallen rock
Undercut - connects with Pool I I
About 9 feet higher than main floor
Mud slope down
Low arch
Evaporating pools
Low shelf - about 4 feet from floor
Flow stone steps
Smooth floor
Slope up
Much fallen rock here
Slope up
Limit of direct daylight
Small crevice opening to surface about 200 feet away
MAJOR BAT ROOST
MINOR BAT ROOST
Soft mud slope
Connects with Pool I I
PROJECTION OF CENTER LINE OF CAVE ON THE NORTH AND SOUTH AXIS
La Cueva Chica
Pujal, S. L. P.
MEXICO
Scale of Feet
Limestone
Water

With the aid of a small plane table, Dr. Breder made a survey of the entire cave. Incidentally, his survey may be the basis of well-drilling over one of the pools for the use of the Indians.

implications of these first intermediate forms of blind cave creatures.

Another day, and the investigators went at it again. Bishop swam under the arch in Pool III on a reconnaissance trip and reported that it was such a long pull that the boat would be useful, so it was carried down the corridor from Pool II, lowered over the calcium cup shelf, and into Pool III. Then, because we would be without the services of the boat to ferry cameras across Pool II when Dunton started taking his motion picture, Aguilar and Coronado fabricated a narrow raft of bamboo and launched it on Pool II. Where the mud bank slid down into the water we found an underwater ridge that permitted neck-deep walking. The equipment could be packed in gasoline tins, loaded on the raft, and the bamboo could be floated across in perfect safety. In that way cameras and flares and collecting bottles were transported to the corridor and down to the boat riding so easily on Pool III.

The exploration of the remainder of La Cueva Chica was a nightmare of slime and the stench of bats. Beyond Pool III was another narrow corridor with a roof that soared out of sight, and here, apparently, was the permanent roosting place of thousands of bats that called La Cueva Chica home. Their droppings coated the rocks on the far shore of Pool III, and layered the ledges on either side of the thick-scummed stream that trickled down the center. Where the stream widened to form shallow pools, the guano floated in layers two inches thick. You could take your choice; you could plunge in and wade through the fetid water, or you could creep along the foot-wide bank and chance a misstep that would plunge you head over heels into the water. Gresser elected the bank on our first exploration trip, and landed in the water. He went in up to his eyebrows. The rest of us decided to wade so that, if we had to swim, we could at least do it voluntarily.

A mere hundred feet beyond the far side of Pool III the corridor widened and deepened and Pool IV spread its guano-covered surface. None of us could have been wetter or filthier than we were at that moment after struggling through the slimy corridor, but nobody quite wanted to plunge into Pool IV. Not even Bishop. We went back and half-floated, half-carried the boat through the passageway and cast it out on the guano.

On this, as it turned out, ultimate exploration, we had a recruit in Carlos Moore, an Antiguan long resident in Valles and the manager of the Palma Court where Bishop and Dunton were staying. He, with Coronado, Bishop, and Dunton, paddled out on the semi-solid surface of Pool IV to see what they could see. There was very little to see. Pool IV was long and, as Pools II and III had been, constricted in the middle by an arch that came down so close to the water that it was necessary to duck when the boat slid under. In the further reaches of the pool the cave ended as far as we were concerned. The domed roof sloped steeply down to the water, a single stalactite hung over the guano, and then the wall closed in at the water's edge. That was the end of the cave; that was as far as we could go.

It might have been possible to dive under the floating guano, grope in the black water for an outlet which undoubtedly existed somewhere along that wall, and come up beyond in a still deeper recess of the cavern. But more likely it would have been suicide, and a most unpleasant way to die. The Aquarium Cave Expedition confessed itself foiled, and turned back.

We stayed on in Mexico for nearly three weeks after the scientific work of the expedition reached its climax in the discovery of the eyed, intermediate, and blind fish. The ecology of the cave was one of the important sidelines of the investigation, and Bishop hunted assiduously for specimens besides the fish, while I filled vial after vial with spiders and kept my eyes open for any other living creatures. There was nothing in the cave but what we had already seen. Bishop set traps all over the place, hoping to snare small rodents, and caught nothing. He baited Pool II with a chunk of meat and was able to seine up plenty of blind *Anoptichthys*, eyed crayfish, and minute copepods, but no unexpected prizes. Eventually the meat was trampled in the mud, decayed, and added a flavor to that whole section of the cave.

One archeological item came to

light. Crawling up the wall in the corridor directly beyond Pool II in search of spiders, I found myself face to face with the lip of a red earthenware pot buried in damp black earth. Freedman was the party's archeologist; I told him of the find, without disturbing it, and he dug out a perfect little pot nearly filled with mud. That night he washed out the mud and discovered two thin, flat, perforated disks of what appeared to be turquoise matrix. The pot was accidently smashed to bits before we left Mexico, but the fragments have been identified by archeologists of the American Museum of Natural History, I understand, as definitely pre-conquest. It was the only evidence we found in the cave of occupancy by an early race of people, although there were plenty of local stories of La Cueva Chica, as well as other caves in the neighborhood, being used as hideouts during the revolutions since the beginning of this century.

With the geography of the cave well in mind, Dunton began the making of a photographic record of the investigation, both with motion picture and still cameras. The motion picture work occupied nearly two weeks, and most of that time the whole party was needed in or around the cave for the various sequences. The tremendous handicap of working in a cave, where every bit of the equipment had to be carried long distances and pieced together by the light of candles or flashlights, and where the half-minute magnesium flares were apt to—and did—explode because of the dampness, can easily be imagined. I have seen the first print of the film, before editing, and it is an astonishing tribute to Dunton's technical skill and ingenuity.

On days when various members of the party were not needed for the cave pictures, and after a survey had been run from the mouth back to the final wall in Pool IV, we scoured the countryside in search of other caves and sinkholes that might give a clew to the geology and ecology of La Cueva Chica. Sinkholes abounded; one of them was said to be eruptive in the rainy season and to spew out foot-long red fish during the time when torrents of water boil out and inundate the lowlands around about. Other minor caves we investigated briefly, seining them and finding only the common, eyed fish that would normally be expected there.

From the water samples, the temperature readings, and the geological specimens that Breder collected, it appears that the whole region is one of limestone formations under which the molten magma of the earth's core lies relatively close to the surface. Such a hypothesis would explain the warm water of La Cueva Chica—an astonishing 80 degrees, as against the sun-warmed 77 degrees of the Rio Tampaon—as well as the sulphur springs within a radius of a score of miles. One sulphur spring we found with a temperature range of 90 to 111 degrees.

La Cueva Chica itself appears to be a typical limestone cave, chiefly exceptional for the temperature of its subterraneanly warmed pools. The eroding action of the surface waters explains the devious contours of its chambers and pools.

Sr. Coronado, lent to the expedition by the Mexican government probably in the expectation that our work would be finished within a week, stayed with us to the very end—three full weeks from the afternoon that we first visited La Cueva Chica. His assistance was invaluable, for he had collected widely in the neighborhood of Pujal, he worked tirelessly, and he smoothed the way for countless invasions of the privacy and riparian rights of Mexicans and Indians living back in the bush when we trudged into their dooryards and asked to seine and sample their water supply.

The final week of the investigation was hampered by sickness. First Aguilar came down with fever what was diagnosed as malaria and treated with quinine without showing any permanent improvement. Then Bishop fell prey apparently to the same illness, Dunton followed him, and finally Gresser took to his bed. Friedman had previously returned to New York, and became ill with the same symptoms soon after he arrived.

The strange illness of those five members of the party of eight is primarily of medical interest and need not be written here. Up to the present none of the specialists in New York and New Haven (Bishop has been in a hospital in the latter city), aided by research workers in tropical diseases

Looking up from the surface of Pool III toward the arch, this handsome series of limestone formations can be seen. This particular spot will be reproduced in the new cave habitat display to be built at the Aquarium.

elsewhere, have been able to pin a name on the disease. Aguilar was written that a physician in Mexico City cured him, and said that he did not have malaria—but failed to say what he did have. Friedman recovered within ten days; Dunton within three weeks; Gresser and Bishop are mending after more than six weeks of almost continuous high fever. Why Breder, Coronado, and I escaped scot free we do not know—because nobody knows what transmitted the disease.

Two-score living specimens of *Anoptichthys*, in all three stages of eye structure, as well as a quantity of *Astyanax* seined out of the Rio Tampaon by Sr. Coronado, are now in Albert Greenberg's hatchery in Tampa awaiting transport to New York when the weather is sufficiently warm. A miniature clay model of a cave habitat exhibit stands in Dr. Breder's office at the Aquarium, and any day now the workmen will begin constructing it on full scale. In the laboratory half a dozen jars of alcohol hold the specimens of *Anoptichthys* that were first dipped out of La Cueva Chica. They are going to be famous fish before the technicians and the ophthalmologists are through with them.

El Pez Ciego de la Cueva Chica

Biólogos de la Sociedad Zoológica de Nueva York visitaron Cueva Chica, cerca de Ciudad Valles, San Luis Potosí, para recolectar peces ciegos y estudiar su medio ambiente. En aquel momento el género de los peces era *Anoptichthys*; y ahora son llamados *Astyanax*. Una diversa variedad de formas de este pez, fue encontrada en la cueva, desde los que tienen ojos normales hasta especies totalmente ciegos.

THE GREAT PUSHUPS CONTEST

It was early February 1984, and the team was staying at Bill Stone's house while we assembled equipment and started packing for the 1984 expedition to the Peña Colorada. One evening Bill suggested that we have an expedition pushup contest to see who could do the most pushups. There was one rule: the winner had to win by at least five pushups. Most of us expected Bill to win easily, but we all gave our best. Finally it was Bill's turn, and he managed to do 75 pushups before tiring. Rob Parker was the only one left, and with a heroic effort he managed to barely do 80 before collapsing. Round 1 to Rob.

Eight or ten days later we were at John Zumrick's house in Florida finishing preparations, and Bill announced that it was time for round two. Bill had been practicing, and this time he managed to do 85. Rob took his turn, and with a lot of strain at the end, managed to get to 90. Round 2 to Rob.

We went to Mexico, where most of us forgot about the contest, but Bill didn't. Occasionally we would hear him doing pushups in his tent. After several weeks, we had a quiet afternoon in camp and Bill suggested holding another round. Most of us had dropped out of what was clearly a battle between Bill and Rob. Bill went first, and his exercises paid off. He managed to do 105 pushups. We could see that Rob knew he was in for a challenge. Rob was going strong for about 75 pushups, then visibly started to tire. By 90 he was going slowly and starting to struggle. When he hit 100, Bill reminded him, "Remember, you have to win by 5." Rob responded, "my left arm is getting tired." He placed his left arm on his back, then proceeded to do 25 rapid-fire one-arm pushups with his right arm, then switched to do 25 more with his left, then another switch . . . .

At 235, still knocking off one-arm pushups at high speed, Rob said, "I'm bored, I think I'm gonna quit now," and so he did. He'd been setting Bill up from the start.—Gary Storrick

PHOTOGRAPHY BY RADOSLAV HUSÁK

Cave diving in Quintana Roo

Lighting assistance by Miroslav Dvořáček, Daniel Hutňan, Martin Hutňan, Kamila Svobodová, Jan Sirotek, and Jan Žilina. radek@dtd-dive.cz

Clockwise from upper left:
Kamila Svobodová in Balam Tsal section of Sistema K'oox Baal
Daniel Hutňan in Coop One section of K'oox Baal
Kamila Svobodová in Balam Tsal section of K'oox Baal,
Daniel utňan in K'oox Baal section of K'oox Baal,
Daniel Hutňan in K'oox Baal section of K'oox Baal
Zdeněk Motyčka in Cenote Zebra

CANADIANS IN SAN AGUSTÍN

Christian Stenner

It was hard to hear over the roar of the rushing water all around me, but somehow my ears perked up at the voices from behind. I had just threaded my Stop and clipped my cowstail onto a sloping tension traverse and was waiting for the others to catch up in order to show them how to negotiate the rigging. There was some commotion in the voices, and I thought that it sounded like more than the usual cries of "rope free" and "OK." Then, though I thought maybe the sound of the water was playing tricks on me, I swore I heard "Christian" and "help!" I unthreaded my Stop from the traverse and started to jug my way back up a couple of short pitches until I met up with one of our team. "We lost a bag," said one of the Americans, who then described what happened to his partner. "He went through that swim with the bag on his back, and he just sank. He struggled with it under the water, got free of the bag, and was able to save himself, but the bag sank. He is OK now." I suppose a pack full of diving lead and Sofnolime wasn't the most buoyant of loads to swim though the Lower Gorge at –800 meters in Sistema Huautla. We were close to the San Agustín sump in one of the deepest caves in the world, and it was not a place to have an accident. The bag was found and we continued on, deeper and deeper.

After completing that run and safely back at Camp 3, I reflected. I had spent a good bit of the trip thinking that, chances are, there would be some kind of drama on an expedition of this nature. My hope was that a near-drowning was it, that maybe that was our drama, and if so, good. I had read too many stories about what was called the world's most treacherous cave. That it may or may not be, but for sure it was and is a most amazing cave. And now the deepest in the Western Hemisphere.

It was almost a year prior to this 2013 expedition when I heard from Nick Vieira of big expeditions in Mexico that were looking for support. One of them was to Sistema Huautla, and although I knew a little bit about the cave from the book *Blind Descent*, there wasn't a lot of information on the plans at the time. Finally the call came out, and in the end six Canadians formed part of the team: Adam Walker, Jared Habiak, Katie Graham, Nick Vieira, Tammera Kostya, and I, from the Alberta Speleological Society or the British Columbia Speleological Federation. Since the discovery by cavers of the Sótano de San Agustín, forty years of explorations had mapped the cave and connected it to various other caves on the Huautla plateau, creating Sistema Huautla, 62 kilometers long and 1475 meters deep. The low point in the system, until the famous 1994 expedition, was the San Agustín Sump, 840 meters below the San Agustín entrance.

The plan for all of us, as support-team members, was to assist in the main goal of getting five divers and their equipment to the San Agustín sump, now Sump 1, where they would dive through Sumps 1 and 2, beyond which Camp 6 would be established and two divers would travel to Sump 9 to conduct exploration dives. [All of Sumps 3 through 8 are easily avoided, but Sump 9 sounds impressive.—ed.] Additional goals of the expedition included climbing the Río Iglesia waterfall near Sump 9 and re-bolting the route up to Anthodite Hall, one of the largest chambers in any cave. The trip would involve hauling heavy loads of gear and quite a bit of vertical work. The San Agustín Sump is at

Adam Walker rigging in the Fools' Day Extension. *Christian Stenner*

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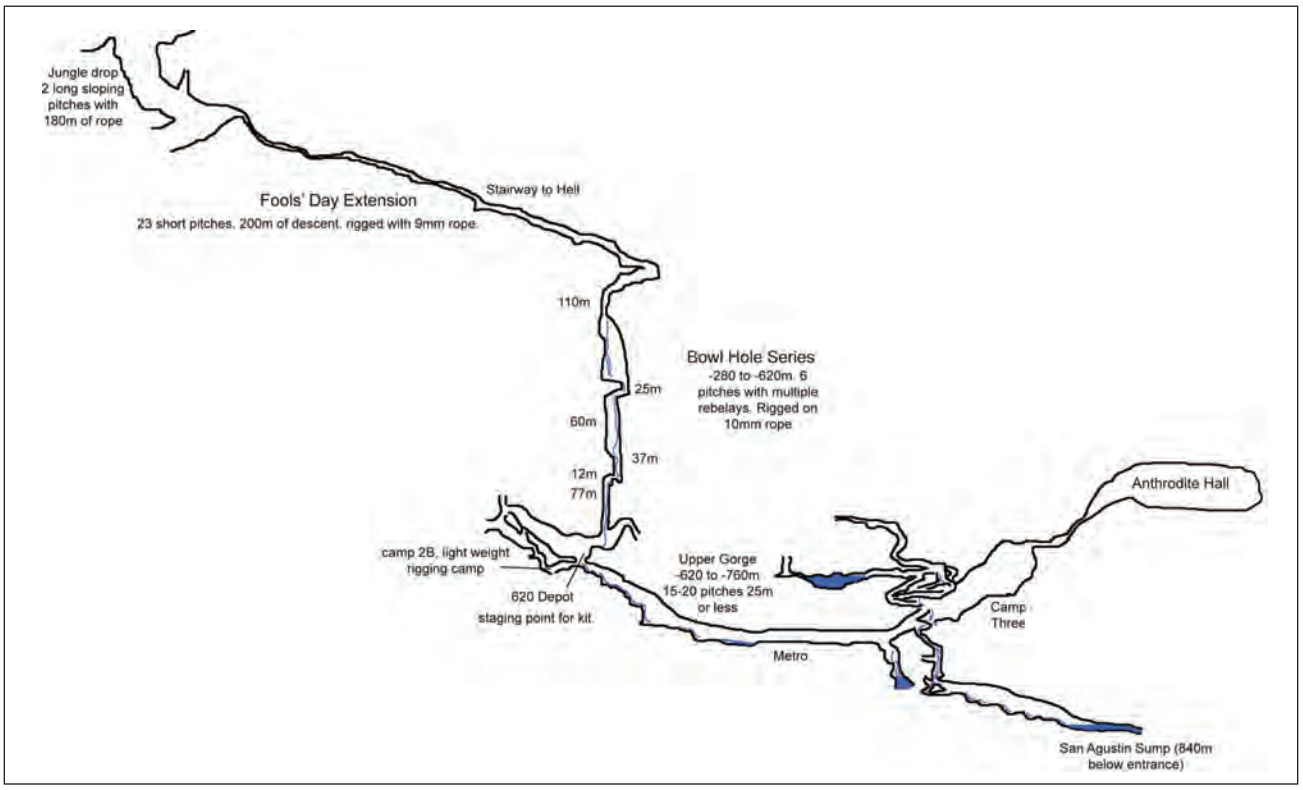
An evening in Camp 3. *Jarvist Frost Moore*

–840 meters from the San Agustín entrance. Approximately ninety pitches and traverses would have to be negotiated to get from the entrance to the sump. Preparations ramped up in the months before departure, and members of the team practiced vertical work and fine-tuned their gear during a number of trips to Rat's Nest Cave, where a ropes course with rebelays, knots, and deviations was rigged, along with a short free-hanging pitch, which was rigged with a pulley and 100 meters of rope, allowing members to practice hundred-meter climbs on what we affectionately referred to as the hamster wheel. Of course our preparation also involved reading the book *Beyond The Deep*, the troubling story of the last expedition to the sump, in 1994. Imaginations ran wild and excitement built until departure, when Adam, Tammera, Jared, and I left for Huautla for three weeks to be part of the first teams into the cave.

Our crude Spanish was enough to arrange tickets from Mexico City to Huautla on an overnight bus. We arrived in Huautla in the early morning, missing much of the winding mountain road to town due to an awkward sleep. I was curious what things I would recognize from reading about this place, and I was reminded of one within one minute of getting off the bus, when a local offered to sell us mushrooms.

It took a little effort to get a taxi to San Agustín Zaragoza, the Mazatec town that would be our base camp and home outside the cave. The driver seemed to want to take us to a trail to the cave; our pleas to be transported to the *casa de los gringos* didn't seem to translate. We ended up at the end of the road, which also happened to be at one of our expedition's houses, rented from Jaime Escudero. More bits of recognition from my reading: Jaime had assisted in the previous expeditions and, on a grim note, had conducted the Mazatec funeral service for Ian Rolland after he perished during the 1994 expedition.

We arranged our sleeping spaces in a separate house slightly down the hill from the main house and settled in. Chris Jewell, the expedition



leader, had a briefing for us. The official letters of permission for the expedition had yet to be obtained from the state officials in Oaxaca City, which caused a slight delay. However, a team had begun rigging anyway in anticipation that the permission would arrive. In 2012 Chris and a small team had come to San Agustín, re-bolted and re-rigged the cave down to the –620-meter level. This allowed the rigging phase of the expedition to go much more quickly, and it meant that we could get to work fairly soon moving the expedition kit into the cave.

Our first familiarization trip was with Chris, hauling gear bags through the Fools' Day Extension to the first gear depot at the top of the 110-meter pitch. The entrance drop, named the Jungle Drop for good reason, is a massive sinkhole covered with mud and vegetation. "It looks as spectacular as the entrance to one of the world's deepest caves ought to look", in the words of Bill Steele. There are 60-meter and 20-meter pitches to the bottom, and then a 20-meter climb up to the start of the Fools' Day. Then beyond some sandy crawls we start the Stairway to Hell, a series of twenty-three short pitches of 3 to 20 meters, many landing in pools of water. One of them was later given the moniker insanity pitch. The insanity pitch was a roughly 20-meter pitch rigged with six re-belays widely spaced horizontally, placed there in 2012 to avoid a deep pool of water. The problem was that this year there was no water, and the rigging made for a slow ascent or descent of this section. Would the water return, was the question, and so for a while this pitch remained in this configuration, just in case.

The trip to the 110 was uneventful and a great introduction to the cave and hauling 16- to18-kilogram gear bags and dry tubes. At the top of the 110 some of the others were washing some new rope that had been bought for the expedition. The rope was found to have a major problem with the sheath slipping and bunching, and it was hoped that it would shrink a bit if washed. It would be a major concern if we had to use the rope deeper in the cave and the problem remained. I made one mistake that haunted me. Having underestimated the temperature in the cave, I found myself out of water. I collected and purified some from the top of the 110 for the climb back out, but not well enough, it seems. Stomach problems that no Imodium would suppress plagued me after this day.

After the orientation trip, we had a number of bounce trips to the –620-meter depot to haul gear. Below the Fools' Day Extension, the Bowl Hole series would get us to the depot, which was on top of a house-size boulder in a massive borehole passage. The Bowl Hole series dropped from –230 meters to –620 meters by way of a series of six large shafts, the first being the 110-meter and the last the 77-meter Space Drop, an amazing pitch that started down a relatively small shaft and then broke into a free-hanging drop through blackness that justified the name. Even with a Scurion on full power, lighting up the walls of the room while on rope was a struggle.

When the advance team had rigged to the bottom of the cave at the sump, the time came for our teams to do deep trips with underground camping. Tammera and Adam had the honor of being the first Canadians on such a trip, spots at Camp 3 being limited by the number of communal sleeping bags and pads. With communal camping gear, we could focus on just hauling food, personal gear, and bags of expedition gear. I was jealous as I watched them pack and leave. I had hopes for a "Canadian camp" with the four of us, and perhaps even all six Canadians later in the expedition when the others had arrived.

Jared and I continued with bounce trips until the opportunity for a deep trip came. We entered the cave with Mexican cavers who had brought their own camping supplies, as well as British, American, and Polish cavers. It promised to be a busy day. I had started myself on a round of Ciprofloxacin to combat my intestinal ailment and had fingers crossed that the antibiotic would solve my problems. We had an uneventful trip through the cave and met up with Adam and Tammera as they were coming out of the Upper Gorge. Tammera was feeling ill, and so they had decided to return to the surface. Tales were traded about the route onward, and we learned that Adam had been the first Canadian to reach the sump, on the previous day. By this time Jason Mallinson had dived Sumps 1 and 2 and re-lined both.

The start of the gorges marked a great change in the character of the cave. It was wet. The deep shafts were replaced by a marble canyon with a raging river and numerous waterfalls, plunge pools, and swims. We said goodbye to Adam and Tammera and continued on through multiple wet pitches and swims.

Tom Clayton in the Lower Gorge.
Elliot Stahl

Anthodite Hall. *Adam Walker*

Upon reaching Camp 3 we found it deserted. A note perched on about ten sheets of toilet paper welcomed us to camp. The note read, "Welcome to Camp 3. Toilet paper shortage: use sparingly."

After a comfortable 18 degrees C overnight, the next day saw fifteen cavers in Camp 3. This would be a big day, with thirteen of us delivering gear to the sump. The trip through the Lower Gorge was trickier, tighter, and wetter. We were advised that, though the rigging was designed to keep you out of the water, we might want to skip some of it and swim instead. It was here that the sinking incident occurred and the kit bag was lost and then found. The rest of our trip to the sump was uneventful. We deposited all the kit into nooks and crannies on the walls as Chris began to assemble his rebreather on the dive platform. As others came and went with their loads, I accompanied the Americans on the trip back to Camp 3. This time, avoiding the swims, we made use of all of the various traverse lines and kept out of the water, even though it was more strenuous and the going was slow. Eventually we reached the Washing Machine, a waterfall that sprays mist all through its chamber. Here I elected to stay at the bottom until the rest were at the top. The thought of having to wait at a rebelay in the water spray was not appealing. I quickly made my way to the top once the route was clear.

Adam Walker in Anthodite Hall. *Christian Stenner*

Most of those in Camp 3 left for the surface the next day, leaving only Jon Lillestolen, Rich Hudson, Jared, and me to shuttle more loads. We expected a few Brits to arrive at Camp 3 later in the day, and we elected to move the last of the –620 depot loads so they wouldn't have to deal with them in addition to their personal kit bags on their way in. We calculated that there were only a few loads left to go to the sump, few enough that the newly arrived Brits could get it all done the next day. So Jared and I left for the surface the next morning as a team of two. The climb out was uneventful, and we emerged at the top of the Jungle drop after eighty-eight hours underground.

By this time the expedition was ahead of schedule, with the diving kit in place and Sumps 1 and 2 relined, and ready to start the push to establish Camp 6 and dive Sump 9. Adam and Tammera were getting stir-crazy on the surface, with no work needing to be done. When Jared and I arrived on the surface covered in filth, Adam asked if we would like to go to Oaxaca for a few days. The question of good food and a hot shower required no thinking, and we went for some R and R.

When we arrived back at base camp we prepared for our last trip into the cave. The Canadians would go for a multiple-night stay at Camp 3 to man the Nicola radios and, hopefully, get a chance to see Anthodite Hall. The Nicola radios were installed at Camp 3, Camp 6, and the surface, but only worked between Camp 3 and Camp 6. We would be the only link to the world for those in Camp 6 and would be prepared to assist if they needed anything. On the way in we re-rigged a nasty rub point in the Fools' Day Extension that had been handily marked "death rope" on a note. We felt pretty good on the trip into the cave, but found that due to recent rains the water level underground was quite a bit different and some of the sections were much more exciting.

The rains were a concern for Camp 6 as well, as there were some swims in that area that could become sumps, depending on water level. Fortunately when we entered the cave the sun had come out, and we were able to pass on the news. The next day we were able to rouse ourselves for meals, but illness swept the camp, and we made the trip to Anthodite Hall late in the day. The climb starts with an SRT ascent of the old rope left by previous expeditions. Once there, the massive chamber allowed amazing photo opportunities. With the rest of us light-painting and working the flashes, Adam created some of the best images of the chamber ever seen. The anthodite crystals were superb and a highlight

Anthodite Hall. *Adam Walker*

of the expedition. We had to make our way back to Camp 3 and the radio for the next scheduled communication, but left happy for having experienced the hall.

News came from Camp 6 that they had completed the dives and would return late the next day. We got no news on the result of the dives, but everyone was safe. With that, we left Sistema Huautla the next day. On the way out we met Katie as she was coming to Camp 3 with some new blood in tow. Our time at Huautla was done, and we left the next day, leaving to Katie, Nick, and a number of others yet to arrive the grueling task of hauling out all the expedition gear and de-rigging the cave.

The final result is that Sump 9 was extended 440 meters in length and to a depth of 81 meters underwater. This put the total surveyed depth to 1545 meters. In addition, newly surveyed dry passage extended the known length of the system by 2.7 kilometers. The new depth of Sistema Huautla made it the eighth-deepest in the world and the deepest in the Western Hemisphere. Back in 1967 Canadians established nearby Sótano del Río Iglesia as the deepest in the West at that time. The Canadian contingent was extremely proud to be part of such a well-executed expedition to do the same for Sistema Huautla in 2013.

Equipo Canadiense en San Agustín

Seis espeleólogos del oeste de Canadá, fueron parte del equipo de apoyo para la expedición de buceo 2012 al Sistema Huautla. Las provisiones para los buzos tuvieron que ser trasladodos por el apsaje llamado Fools' Day Extension y despues por una serie de tiros mas largos hasta llegar al almacen de equipo a los -620 metros; despues sequir hacia el Campamento 3 , cerca del Anthodite Hall. A partir de ahí, el recorrido continua sobre agua a través del pasaje Lower Gorge que lleva a los sifones localizados a -840 metros. Algunos buzos pasaron varios días en el Campamento 3, y fueron capaces de mantener comunicación con los buzos al otro lado de los sifones utilizando radios marca Nicola.

DIVING IN SISTEMA HUAUTLA

Jason Mallinson and Chris Jewell

Sistema Huautla is one of the most complex of the world's deep caves, with twenty entrances and numerous independent deep routes. The last extension at the bottom of the cave was made in 1994, when an expedition led by Bill Stone used the Cis-Lunar MK4 closed-circuit rebreathers he had developed to pass the terminal sump 840 meters below the Sótano de San Agustín entrance. That effort, marked by both tragedy and success, led to the discovery of 3.3 kilometers of new dry passage and Sump 9. [See the book *Beyond the Deep* or *AMCS Activities Newsletter* 21, pages 44–64.]

In 2013, a multinational team of cavers and divers visited Sistema Huautla to carry on the exploration. Since 1994, rebreathers have developed significantly both in terms of technology and knowledge. In contrast to the approach taken in 1994, the rebreather dives in 2013 all used manually controlled rebreathers with KISS valves. Caves are one of the harshest environments, and mud, sand, grit, and constant damp do not mix well with complex electronics. When you are at the bottom of a deep cave you can't phone tech support if your electronic rebreather doesn't calibrate. The most important feature of any rebreather used at the bottom of a remote and deep cave is reliability and simplicity.

It had taken over a year of planning to get the expedition off the ground, but just one week to rig the cave with ropes from the San Agustín entrance to the sump, with the final stretch, the Lower Gorge, rigged by Tim Allen, Martyn Holroyd, Pete Ward, and Mark Wright. Jason Mallinson was following behind with a rebreather that had been stripped down to the basics for the trip through the cave, with oxygen-delivery system, display unit, and all the hoses removed and packed in separate waterproof containers.

There is no dry land at Sump 1, so while a dive platform was being installed over the sump, Mallinson balanced his rebreather on a rock inches above the swirling water at the top of the last waterfall and began reconstructing it. The blanking kidney on the head was removed and replaced with another holding the oxygen-display cables. The oxygen-delivery system was plumbed back in, and the breathing hoses were replaced. For cave-diving use, he never uses an onboard diluent tank, as large volumes of bailout gas are needed, so diluent is taken from the off-board cylinders. The most precarious part of the assembly process was filling the stack with Sofnolime while trying to balance it on the rocks. Once this was done, the oxygen cells were calibrated and the unit was trimmed with lead. Unfortunately one vital part had been left back in Camp 3, and Mallinson returned there to fetch it.

Later that March 4, after a meal at Camp 3, Mallinson returned to complete the assembly of the rebreather, and he used the suspended platform to change into his drysuit. There is a long lake beneath the last cascade, and after swimming around a corner to where the roof went below water level, Mallinson tied off his dive line and began the dive. In the shallow tunnel, the water was murky, with 4- to 5-meter visibility, probably due to the traffic higher in the cave. This wasn't a problem initially, but after 90 meters, where the depth has increased to 15 meters, route finding was not easy. Odd remnants of line from the previous expedition were found along the floor of the large passage, and using these as a guide and poles from the previous expedition's platform that had been washing into the sump as belays for his line, Mallinson managed to negotiate the correct route through the deeper part of the sump, at around –25 meters. After 250 meters the passage rises and the walls could both be seen, which made progress easier, and the continuously rising tunnel eventually led, after 400 meters, to the Rolland Airbell. The sandbar described by the previous explorers had disappeared, and there was no dry land at all, just a long, deep lake. At the far side, the old line from 1994 was found, and Mallinson installed a new line along it into Sump 2. After around 100 meters an old line reel was seen and left in place. Continuing in the large, shallow tunnel, Mallinson surfaced after some ten minutes, beyond a total of around 600 meters in both sumps, into the large borehole found by the 1994 explorers. The rebreather had been performing flawlessly, and he did not hesitate to turn off the oxygen

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Compiled from article at www.underwaterjournal.com/cave-depth-record-achieved-using-kiss-rebreather and dive reports in *Cave Diving Group Newsletter* number 188, July 2013.

Laura Trowbridge and Mirek Kopertowski prepare equipment on the dive platform above Sump 1 as Connor Roe looks on. *Jarvist Moore Frost*

Jason Mallinson with gear ready to be taken out through Sumps 1 and 2. *Chris Jewell*

system, deposit the rebreather on a convenient rock, and head off for a short recce. An old Acurex cylinder was found wedged between boulders some 20 meters away. Mallinson got as far as Sump 3, which does not need to be dived, before overheating, and after forty-five minutes returned to Sump 2, where another old Acurex cylinder was noticed almost completely buried in the gravel. The dive back through Sumps 1 and 2 was completed in about thirty minutes, Mallinson checking along the way that the new dive line was properly installed and suitable for use by other divers when the main push came. Then about an hour was spent stashing all his dive kit on ledges and tying it down, as it would be in place for over a week. A long day was concluded by the ascent back to Camp 3.

A further week of hard work was required to transport all the dive equipment for the four other divers down to Sump 1 and ready the specially made dry tubes for equipment so that five divers could camp beyond the sumps for seven days. The tubes, needed to transport material that needed to be kept dry such as food and sleeping bags, had to be filled, weighted, and balanced to be neutral in the water for ease of maneuvering, and much time was needed for this. The team had determined that six tube-loads of equipment were required, and this meant two trips through Sumps 1 and 2 by each of the three divers who were using rebreathers. On March 11, Jason Mallinson set off into Sump 1 with one tube that he had prepared the night before. After about forty minutes, diver and tube had reached the 1994 extension, and he deposited the tube and headed back for another. Mike Bottomley,

Four Corners Lake. *Chris Jewell*

Jon Lillestolen prepares for an open-circuit dive through Sumps 1 and 2. *Chris Jewell*

Cavers on rope at the Río Iglesia waterfall after Jason Mallinson had found the route to the top. *Chris Jewell*

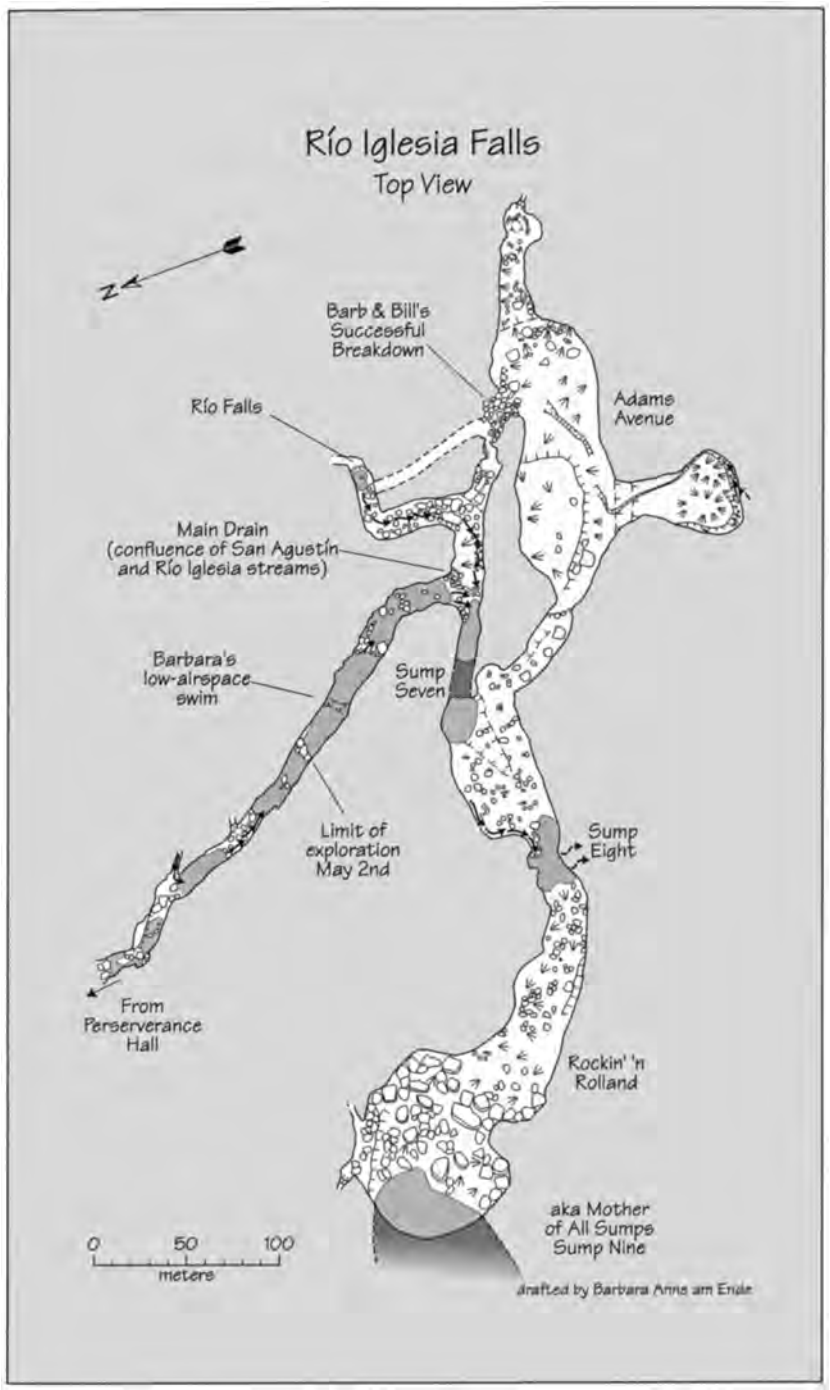
Sump 9. *Chris Jewell*

Tom Baker, and Andy Kuszyk helped him get the heavy kit down to sump level, and final preparations were made to ensure that everything had been packed that was needed for the initial twenty-four hours beyond the sumps. The second dry tube, grown to gigantic proportions with wellies and wetsuits hanging off, was slowly towed through the sumps. Once on the far side of the sumps, Mallinson dekitted and emptied both dry tubes, preparing one for collection by divers the next day, which involved filling it with large rocks and then trimming it by attaching similar rocks to the outside for balance. The old Camp 6 was found a few minutes down the large passage, and this seemed ideal for at least the first night. A very warm and pleasant night was spent there, after Mallinson transported some of the gear required for diving in Sump 9 as far as Four Corners Lake. Some of the old 1994 ropes were still in place on a couple of the climbs along the way.

The next morning Mallinson rose early, and with at least four hours to wait until the other divers would be coming through, decided to recce the cave as far as Sump 9 if possible. A rapid descent of the cave was made using the survey notes of the original explorers, and the sump was reached in around two hours. He was suitably impressed by the size of the sump pool. On the return a side passage at a boulder choke that had been noted on the old survey was looked at to see if it might be an easier route for moving equipment. This emerged at the top of the Río Iglesia waterfall, rather than at the bottom, and the need to bolt up the waterfall, one of the major objectives of the expedition, was eliminated.

When Mallinson arrived back at the camp and Sump 2, he found that Chris Jewell had left a note that he and the three other divers would all be diving through that night. He had kitted up on the dive platform, assisted by Conner Roe, and taken one tube through the sumps and taken the empty one back. Shortly after he arrived back at dive base, Mirek Kopertowski, Jon Lillestolen, and Rich Hudson appeared, and the three remaining tubes were packed and weighted. Jewell and Kopertowski took one tube each through Sumps 1 and 2, and Kopertowski returned for the final tube of camping gear. Both of them were using KISS rebreathers. Lillestolen and Hudson dived through the sumps using open-circuit gear with two 10-liter steel bottles and one 9-liter composite stage tank each. All five divers would sleep in Camp 6 for the following six nights.

With all the divers in the passage beyond the sumps, the next project was to transport enough dive kit to Sump 9 for Jason Mallinson and Chris Jewell to make a series of exploratory dives. The first day was



Vicinity of the Río Iglesia waterfall and Sumps 7, 8, and 9. Map from 1994 expedition by Barbara am Ende, *Beyond the Deep*, page 284.

Connor Roe looking toward the entrance to Sump 1. *Jarvist Moore Frost*

devoted to transporting Mallinson's kit, and following about three hours of portering, with some new rigging along the way, the team arrived at Sump 7. Although Sump 7 had never been dived and there was a bypass, it was decided that an easy underwater route would be much preferable to an awkward carry through a boulder choke to Adams Avenue, especially with delicate rebreathers. Some time was spent preparing the cylinders, getting the rebreather ready, and donning a drysuit. The dive itself was a relatively easy swim of 40 meters through a large and shallow sump, surfacing exactly where it was expected to, some 100 meters upstream of Sump 8. While the four porters traveled around via the boulder choke, Mallinson began carrying the rebreather down to Sump 8, where a short swim across this sump pool led to a massive boulder pile beyond which is the enormous chamber with Sump 9 at its base. Once all the dive kit had arrived, Mallinson made a descent into the vast black lake in terrible visibility. The visibility did not improve, and despite some searching around, he managed only to fumble a sloping descent of 30 meters, gaining no real impression of passage size or shape.

On the fourteenth, Chris Jewell's dive kit was transported to Sump 9. Along the way he kitted up at Sump 7, dived through, and then walked on down to Sump 8. Here a brief examination of the sump pool determined that there was no way on there; the water simply ran down through boulders. Jewell was then helped on down the cave to Sump 9 for a dive. Rather than follow Mallinson's line, he laid a new line from the surface following the right wall steeply down. At –48 meters the elbow of the sump was passed and a gradual ascent began. At –35 meters the left-hand wall came into view, and the floor of the sump was very silty. After completing decompression, Jewell surfaced in a static sump pool where a steeply sloping muddy tunnel led upward. The mud-cracked floor was difficult to climb, but by kicking steps the diver was able to follow the tunnel for around 50 meters up several steep climbs. The cave passage appeared to open out above, so he returned to the sump. On the return, he checked the sump to see where the main route had been missed, but poor visibility made this very difficult.

The next day, Mallinson took two ropes and caving gear through Sump 9 to the dry lead to enable him to ascend the slippery slopes and rig ropes for a more controlled descent. The intention was to remove the drysuit at some suitable point to allow for more comfortable exploration of the passage that had been found by Jewell. Getting out of the water with the rebreather on and ascending the mud slope to the point where Jewell had stashed his rebreather was a big effort, and a pair of ice axes would have been perfect for this. Once the rebreather had been removed, progress was not too much easier, due to wet and slippery drysuit boots on the hard-packed mud. After a couple of climbs and just beyond the point reached by Jewell, a suitable boulder was deemed the best spot to remove the drysuit. Continuing on in shorts and wellies, Mallinson emerged from the rift passage into a larger tunnel running from left to right. The right-hand passage was followed first, for some 100 meters down small steps to a pool that was judged to be at the same level as the sump pool. The left-hand passage was followed for only 20 meters before mud blocked the entire tunnel. No other leads were discovered, and the diver realized that this was not the main route and that the continuation of the cave lay underwater, probably somewhere around the elbow in the sump at –48 meters. Mallinson returned to base after three hours away.

For the dives on March 16, a new strategy was devised to get the best of the poor visibility in the large Sump 9. Jason Mallinson was to dive along the left-hand wall, searching all the alcoves and rifts, while Chris Jewell was to do the same along the right wall. Setting off into the sump together, they split up at –20 meters and kept within sight of each other, just barely, as they progressed along their respective walls. Nor far from the elbow, Mallinson noted some

Jason Mallison, looking, we are assured, cheerful, poses for a sponsor photo after a dive. *Chris Jewell*

Jason Mallison during return through Sump 1. *Chris Jewell*

unusual erosion features on a flat part of the wall and floor, and sure enough the wall turned down a large passage. Jewell, seeing what was happening, then crossed over to follow down the newly discovered main route. The large passage stayed at around 45 meters depth for a while, but then the depth began to increase, and at 200 meters into the sump the depth was 60 meters at the roof. Jewell turned to begin surveying out, while Mallinson found a suitable tie-off on a roof flake. Both divers then surveyed back to the decompression point and spent thirty to forty-five minutes decompressing. Their dive times were around two hours.

Mallinson made the first dive the following day, and if the sump still continued at a reasonable depth Jewell was to make a follow-up dive, using a second rebreather for more redundancy. Mallinson towed an extra trimix cylinder to 200 meters into the sump and left it clipped to the line, then swam on to the previous limit. Beyond, the tunnel continued to descend at a steady rate. A wide, perfectly flat roof was followed along a tunnel some 5 meters or more wide and 6 to 8 meters high. A good impression of the passage was not possible due to the bad visibility, and it was not possible to tell if there were any side tunnels. Soon 75 meters was showing on his dive computer, and the roof was still heading down. He decided that 80 meters would be his limit, as that was the limit of the gas mix he carried and he had already accumulated a significant decompression obligation. At 440 meters into the sump, the depth reached was 81 meters, and the diver tied off the line and began surveying back. The tunnel continues large beyond this limit, and Mallinson believes, based on the slope of the roof, that the sump will reach –100 meters quite soon. The three-hour dive included ninety minutes of chilly decompression, and Mallinson surfaced with a niggling shoulder pain. The pain persisted but did not increase, and he had no intention of getting back in the water when already cold to try to relieve it. Some time on the surface breathing O_2 and a bit of rest resolved the problem. Since there was no possibility of pushing the sump deeper with the available supplies of trimix, Jewell did not make a follow-up dive.

On March 18, Rich Hudson, Jon Lillestolen, and Mirek Kopertowski headed out through Sumps 1 and 2 first so that they could dekit and clear the dive platform before Jason Mallinson and Chris Jewell returned. Kopertowski took one of the dry tubes containing camping gear. The last two divers followed several hours later after packing up camp in the remaining three dry tubes. On the way through Sump 1 they took some photos, although the visibility was only about 3 to 4 meters. Some fun was had when a ballast rock fell off the load that Mallinson was towing, making a difficult time of the rest of the journey. After depositing his load at the start of Sump 1, Jewell returned for the last dry tube, and when he arrived with it was assisted out of the water by Mallinson. Kit was dismantled and packed for transportation away from the sump the following day.

Buceo en Sistema Huautla

Durante la expedición 2013 al Sistema Huautla, cinco espeleobuzos acamparon durante una semana más allá de los sifones 1 y 2 al fondo del Sótano de San Agustín. El objetivo principal era bucear el Sifón 9, descubierto en 1994. En una sola inmersión, se instalaron nuevas líneas de buceo en los Sifones 1 y 2, y al otro lado se intaló el Campamento 6, en un área seca. Los buzos británicos Jason Mallinson y Chris Jewell hicieron varias inmersiones en el Sifón 9 usando recicladores de aire de la marca KISS. En cierto punto del sifón, se encontró un pasaje seco y lodoso, pero de corta distancia. El trayecto seguido era una continuación más profunda del pasaje principal inundado, el cual fue explorado hasta una profundidad de 81 metros y una longitud de 440 metros, al límite del gas de respiración disponible.

Mallinson descubrió un pasaje que condujo al inicio de la cascada ubicada cerca del Campamento 9, la cual anteriormente se creía era parte del agua que desaparece justo en la entrada Sótano del Río Iglesia, por lo que no fue necesario intentar la escalada a la parte superior.

HUAUTLA 2013

Nicholaus Vieira

Around November of 2011 I received an e-mail from Chris Jewell asking if I was interested in going to Huautla in the spring of 2012 to recce and help rig Sótano de San Agustín down the Fools' Day Extension to the –620 Depot. That trip was in preparation for a 2013 trip during which Jason Mallinson and Chris Jewell would dive Sump 9, the "Mother of all Sumps." Nursing an injured back and in the process of preparing for my push on Raspberry Rising in British Columbia, I declined the recce trip but committed to the 2013 trip, and said I would also recruit willing sherpas from western Canada to help with the endeavor.

Each of the Canadians would have his own separate reason for going, but this was a pilgrimage of sorts for me. San Agustín and the Huautla area have played in my mind from the beginnings of my caving career. The Huautla area was a place I had to visit, having heard tall tales from Mike Boon and others during pub nights in Calgary and having read *Beyond the Deep* and other publications. Canadian caving has old ties to the area and its caves; after all, it was the early McMaster trips that made Río Iglesia the deepest cave in North America at the time. I advertised the expedition to Alberta Speleological Society and British Columbia Speleological Federation members. My goal was to introduce other western cavers to the international caving scene. After the e-mails came back, Jared Habiak, Katie Graham, Adam Walker, Christian Stenner, and Tammera Kostya had signed up for the adventure. With J2 and Huautla happening at the same time, I chose to dedicate the majority of my time to the J2 project, as there was anyway going to be a sizable Canadian presence at Huautla. I would commit to two weeks at the end of March. [See Vieira's article on the J2 trip elsewhere in this issue.]

I left Chapulapa, near J2, in the early morning of March 20 and began hopping the people trucks passing through Jalapa de Díaz and Carlota and finally arriving in Huautla. I wasted no time catching a truck to San Agustín, as I was already a few days late. I did not check my e-mail, so when I arrived I had no idea which house the expedition was renting. With no gringos in sight, I stopped and talked to some locals, who pointed me to the San Agustín doline, "all in the cave." Well, I wandered down, had a look at the impressive entrance, then walked back up to the town and found the rented house with a combination lock on it. Crap. It also meant I missed meeting Adam, Christian, Tammera, and Jared, as they would be heading to catch their flights home. Katie should be underground somewhere, though.

I spent the night outside. No one surfaced by morning, so I bought some eggs and wandered down to the doline, where I started a small fire and had breakfast. The plan would be simple: go down, find the cavers, and see what is going on. I organized my kit, changed, then began my rappel of the Jungle Drop. I left my large haul bag hanging off of a rebelay, safe from anyone poking around (not a bloody chance anyone was going to be able to lift it), then continued down with my cave bag full of overnight gear. The San Agustín entrance is massive, one of the largest I have seen. The stories I have read and heard went through my head as I moved down-rope farther and farther into its grand entrance. The stories became my map on how to find the way on. Once off of the ropes, I began looking for the climb to the Fool's Day Extension, and then I scrambled up the mud slope, worked my way through the howling crawls—great draft—into the stomping passage there. I quickly moved through this, laughing occasionally. I arrived at the Bowl Hole Series much sooner than I thought I would, and soon I met up with the first of the divers, Mirek Koportowski, at the 60. I chatted with him for a bit as he related the story about Jason Mallinson's 81-meter-deep, 410-meter-long dive in Sump 9, including the live scorpion on the ceiling at –6 meters in the sump. Soon up came others, joining in as I began sharing what was happening at J2. After a while they began climbing, while Rich Hudson, whom I had not seen since 2009 at Castleguard Cave, and I began catching up on our news. I told them to leave my bag on the Jungle Drop and that I would bounce to Camp 3, grab an expedition bag, and then head out and join them on the surface. I stored my cave bag on the ledge, then bombed down to

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http://www.crazycaver.com/content/huautla-mexico-2013, *Canadian Caver* 78, spring 2013, pp. 33–36

the –620 Depot and followed Chris Jewell's directions to Camp 3. The Upper Gorge was fun. I arrived to find Connor Roe (Ian Rolland's son) and Katie Graham cooking a late lunch. I chatted, ate some food, and then grabbed a bag and started out. I collected my own bag from the ledge it was stored on and then continued to the surface, retrieving my haul bag from the rebelay. Working my way up the doline with my three-bag burden sucked, but when I arrived supper was on, and beer.

The next day the group of us went into Huautla, and I finally checked my e-mail and withdrew money to pay for my food. Then I tried to call home and arrange to have my flights changed. After stopping by the candy shop, then Waldo's for beer, we were feeling good for the journey back to San Agustín.

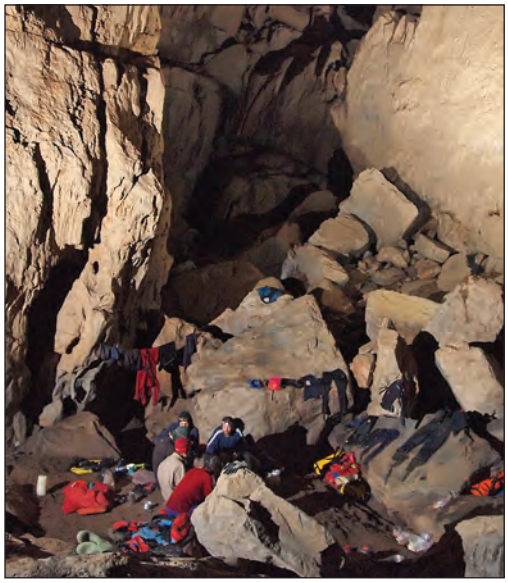
The next day everyone came out of the cave, having left twelve bags at the –620 Depot and a few bags at the sump. I was trying to confirm that my flight was changed, as I was scheduled to fly out in five days' time. Chris Jewell and Jon Lillestolen began the number crunching of the survey data. They had surveyed 1774 meters of dry passage beyond the initial sumps, and combined with the dive survey, this made the system's total over 64 kilometers long and 1545 meters deep, again the deepest cave in the Western Hemisphere.

On March 23 Rich Hudson, Jason Mallinson, and I headed in to haul all twelve bags of dive gear up the Bowl Hole series. We worked hard hauling two or three bags at a time up the pitches. Having gotten everything to the top or bottom of the 110, we headed to the surface with a bag each, finishing before dinner.

I took the next day off to rest and check that my flights were changed. They were; I would be staying until the end of April. Being very happy, I decided to bounce to the sump the next day. No one was interested in coming down with me, so I went alone. I checked my watch at the top of the Jungle Drop and began the trip. I moved quickly and efficiently down, down, and down. Two and a half hours later I was talking to Connor in Camp 3, getting directions to the sump. He said that he had left some gear I could bring up and that I should derig the dive platform. I arrived at the sump forty minutes later; the directions were good. I derigged the platform and packed the bags, then took photos of the sump and other places on my way out of the cave. At the –620 Depot I grabbed another bag and began racing up the ropes, which involved passing a few people on their way out when possible. Seven and a half hours later I was standing at the top of the Jungle Drop after the 840-meter bounce trip—what a fun, easy cave.

March 27 saw my last trip into the cave. My personal goal was to see and photograph Anthodite Hall. Seeing as there was no gear I needed to carry in for the project, I packed a tackle sack full of beer for Camp 3. I went in late with the others and started laughing enthusiastically when we arrived at the Upper Gorge. It had been raining hard for a few days, causing the water levels to come up, and it was wall-to-wall white water. So much fun! Rich Hudson, Elliot Stahl, and I arrived

Tom Clayton views the signature formations of Anthodite Hall. *Nicholaus Vieira*



A temporary camp was set at the –620 depot during the derig. *Elliot Stahl*

at Camp 3, then waited for the others to arrive. After an hour or so, we climbed up into Anthodite Hall for some photos and amazement. What a beautiful and BIG place. After a few hours we went back to camp and drank all of the beer I carried in. Then I slipped into a 1994 sleeping bag and went to sleep. I left the cave in the morning, again enjoying the high water, while the others prepared to derig the Lower Gorge.

Packed up, I said goodbye to the others and began my return trip to J2. The planning and organization by Chris Jewell made this a very fun and leisurely expedition. You had both hard tasks and free time. Great job, Chris!

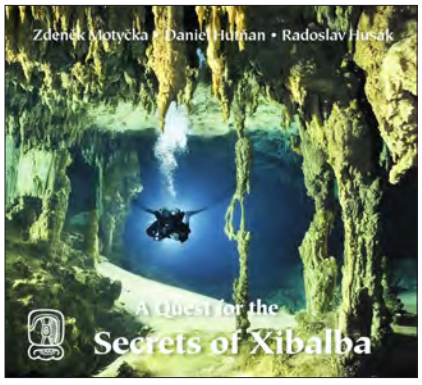
Huautla 2013

El autor tomó un tiempo libre de su participación en la Expedición J2 2013, para visitar la expedición de buceo en el Sótano de San Agustín. Ayudó a transportar las mochilas de equipo fuera de la cueva y disfrutó de una visita al Campamento 3 y Anthodite Hall.

BOOK REVIEW

A Quest for the Secrets of Xibalba. Zdeněk Motyčka, Daniel Hutňan, and Radoslav Husák. ZM Production, 2013. Hardbound 113 pages, 9.25 by 8 inches, with oversize map. $30 plus postage charge from mexicancaves.org. ISBN 978-80-903378-4-8.

This is an excellent account of ten years of exploration in Mexico by members of the Czech Speleological Society. Arriving in Mexico City in 2003, the group drove through Chiapas looking for cave-diving opportunities before heading on to Quintana Roo to see the famous land of cenotes. Arriving full of enthusiasm, they were greeted by the local cave divers with some caution before some good leads were given to them. They were directed to an underwater cave far out into the jungle named Cangrejo, where they quickly reached the end of known cave and laid 750 meters of new dive line. On the spot, they decided that this was to be their caving project, a project that ultimately produced Sistema K'oox Baal (Wild Thing in the Mayan tongue), now one of the longest caves in the country.



Over the next several years Cangrejo was extended to over 5 kilometers in length, and other nearby systems were being explored. Not far away was K'oox Baal, previously mapped by Bil Phillips to nearly 4 kilometers. One by one these caves were extended and connected, and the Czech team did an excellent job of keeping a detailed cave map up to date as they went. The book is richly illustrated with 104 color photographs, many of them displaying the spectacular nature of the Quintana Roo caves to great effect.

The text in this book was written by various members of the team, and conveys the sense of discovery and excitement as the divers ventured out from their jungle camp for new adventures each day. The English text is well edited, but leaves just enough of a foreign sentence structure to remind you who has written it. The map of Sistema K'oox Baal, now with 74 kilomters of passage, filled up a wall at the 2013 International Congress of Speleology, which was hosted in the Czech Republic by many of the same cavers. There is a folded copy of the map in a pocket in the back of this book, and sections of it are also included at relevant points in the text. This map is an impressive work of cartography, particularly since most underwater surveys from the area produce nothing more than a line plot. What the map doesn't show you is how close this cave is to a several other large systems, including Sistema Sac Actun, the second longest cave in the world at 318 km. Inevitably these will grow and connect, likely becoming the world's longest by the end of the decade. This book is the best account I've read of exploring these vast underwater systems, giving the reader a ringside seat in one of the most fruitful exploration zones on the planet.—Peter Sprouse

CAVING AT THE END OF THE WORLD

Juan Laden

December 14, 2012, found me flying over the Gulf of Mexico and the Caribbean to Quintana Roo once again. I was heading to the center of the world and also the end of the world, at least in the Maya sense. For a second time I was joining the biannual cave surveying trips organized by Peter Sprouse and friends to survey the "dry" caves of the Riviera Maya. [See the author's report on the March 2011 trip in *AMCS Activities Newsletter* 34, pages 91–97.] The caves on the east coast of the Yucatan Peninsula have the potential to be the longest cave system in the world. The caves are so extensive it sometimes seems that the area is like a layer-cake with the frosting between the layers replaced by caves with frequent columns supporting the upper layer. Presently the largest underwater caves in the world have been mapped here. The last decade has seen greatly increased surveying of the non-flooded caves, with much of the survey done in the longest show cave, Río Secreto, by Gustavo Vela and friends.

The earliest explorations of dry caves around Playa del Carmen were done by Gil Harmon and friends of the local Paamul Grotto. They were doing baseline surveys without sketching, and they found a lot of entrances, which are numerous due to the thin upper layer of the cake. Beginning in 2007, other caving groups began to make more detailed surveys in some of these caves. The Alberta Speleological Society, led by Colin and Vince Massey, surveyed in Sistema Sac Muul. At about the same time, Gustavo Vela began mapping in Sistema Pool Tunich, parts of which were being developed to become the Río Secreto show cave, and he also surveyed in Sistema Río Escondido (Cueva Dino). Trish Beddows had been doing aquifer research in the Akumal area since the early 1990s, and around 2008 she invited Aaron Addison to come down and map caves. Aaron in turn urged Peter Sprouse to come down and do the same, which he decided to do in 2010, when his caving area in Coahuila became too insecure.

On this December 2012 trip we had a large group, destined to be at the epicenter of the end of the world, according to the doomsayers. [Another report on this trip appears in *AMCS Activities Newsletter* 36, pages 102–110.] Where else to be, but where lived and still live the ones who some think foretold this in their calendar?

I flew in to one of the terminals in Cancún, and after some asking around, found that Peter Sprouse was coming in at the other terminal, where we would join up and be collected like school kids by our car-rental company. A short ride from the airport took us into a fenced yard that reminds one more of a chop-shop than a car rental place. We then drove back to the airport to pick up Aaron Addison and Gary Resch from their later flight and then took off down the sporting Highway 307 that runs the length of the Riviera Maya. A mandatory stop is at the Soriana supermarket, where we shopped for cave food and personal items before heading out to the jungle retreat where we were going to be staying for the next couple of weeks. Our Maya host, Cleofas, is the owner of some of the land that the caves are on, including an entrance to the Río Secreto tour.

When we got to the turn-off, we stopped at the Río Secreto ticket office entrance to speak with the managers, since mapping in this cave was the primary objective of the expedition. Río Secreto features "wild" tours with no lighting and few walkways. Tourists are outfitted with headlamps, helmets, wetsuits, and floatation devices for the tours. There was some concern that we would be a disturbance to the tours, but it turned out that we actually became another feature of the cave. The guides who were tasked with assisting us early in the trip considered themselves lucky, as there was a real attraction to working with the "professionals," a change of pace from the routine. We would also be seeking access to other caves. There is a lot of public-relations work involved in getting permission from all the different landowners in the area, and Peter is masterful at this due to his demeanor and language skills.

Leaving the Río Secreto office, we went through the guarded gate that protects the road into the jungle and all of the private land that the *ejido* guards from land grabbers. This gate closes at 7:00 p.m., and once we go in for the night it takes something special (and maybe some beers) to get in or out through that gate. We are basically locked in for the night, but since the caves are mostly where

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Peter Sprouse and Chris Lloyd helped prepare this article.

we are staying, there is little need to use the car. At Cleofas's we have breakfast and dinner every night, a constant supply of cold beer, and use of all the camping facilities. As for the caving, it is just two or three hundred meters to any entrance. There are a couple of large *palapas* with concrete floors, one of which we eat in and another that people could camp in. Late that night we had another addition to the expedition when Germán Yáñez arrived from Cozumel, where he is a diving guide. Peter had to go out to the gate to let him in.

In the morning of December 15, after a fine breakfast made for us by Cleofas and his staff, we started getting gear together. Alberta Speleological Society cavers Katie Graham and Andrea Corlett (Andrea the First, because Andrea Croskrey was also on the trip) arrived after getting a ride in from the Río Secreto entrance. They had been in the area working on their cavern-diving certification for a number of days. Our plan was to start at the entrance called Tuch, Mayan for belly button or the center of the body; if you look at the cave's layout, it does look like a mass of passage that forms the torso of a body with two outstretched arms and two legs. The Tuch Entrance is one of many natural entrances to the system. Joining us were Tania and other guides, so each survey team had someone from Río Secreto. The plan was to head down the legs of the cave and start surveying back from the ends. As a result, we ended up with some hanging surveys that took till later in the expedition to tie in. Of course the first day saw everyone forgetting some gear, and so we had some false starts after a little orientation by Tania about where we were supposed to be going. Since we were starting at the deeper end of the cave, a lot of it was swimming passage or really deep wading. Though the caves are warm enough to raise a sweat if you move too quickly and the water is comfortable, after about two hours one can get pretty cold, and a light wetsuit is advisable for any caving where you have to go more than waist deep.

After a slow start that first day, we all convened back at the Cleoxxo, where we would be taking our meals, and also where we would do the data entry into Peter's computer. The routine was cold beers and a wonderful meal, and then sitting down and reading out each team's data for the day. Of course there were all the stories and jokes and occasional raucous play among the enlarging group while the end of the world crept closer.

On December 16, Peter and I took off before breakfast to drive over to Dino's to see if we could access his Maravillas tour cave, which is the northwestern portion of Sistema

Sandi Calhoun in a forest of totems on the way to the Chac Mol entrance. *Peter Sprouse*

Río Escondido. Dino wasn't there, and as the week went on it became clear that he wouldn't be there very often. We would make it a morning ritual to drive over and talk with his manager, but never with Dino. Some things just take a lot of time, and in the end we got the "whole story" and also limited permission to use the entrance.

At the Pool Tunich entrance to Río Secreto, teams were formed that included local cavers from the area. On this day Paamul Grotto cavers Gil Harmon, Rick Nelson, Alan Formstone, and Liliana Viola showed up. Gil and Rick were going to look for some other entrances in the jungle, and the rest of us, including some tour guides who were going to assist in surveying, headed to the Tuch Entrance. With lots of cavers and only three sketchers, we had large teams and spent most of the time right in the entrance area. By the end of the day it became clear that there was a lot more cave than on the earlier survey, and most of what we had surveyed so far wasn't even on the map. It was looking like the plan of surveying Río Secreto the first week and going on to other areas wasn't going to happen. It was also looking like we were going to double the amount of surveyed passage without much difficulty.

More cavers arrived that night: Sean Lewis, Sandi Calhoun, Heather Túček, and Chris Lloyd. Chris rented another car, so we had the beginning of a fleet of Tsurus, the no-frills Mexican Nissans.

After breakfast on December 17, Cleofas showed us a nearby vertical entrance that had been used as a well. He told us that a diver had been in this entrance and that it connected to Río Secreto and to another entrance farther to the northeast that he would also take us to.

After the morning ritual of making up teams, we headed down to the various entrances to start our surveys. This morning there were some groups that were off to the Entrada Botella as well as Tuch. We had plenty of sketchers now and slimmed down to two-person teams, so we were really starting to rack up the meters. Still, we hardly got out of the main entrance areas, because the passage was a massive maze of loops.

By December 18 the teams were getting into the swing of things, and everyone was getting in good surveys with lots of meters. We were finally starting to range out of the center part of the cave, and we also worked on connecting in some of the hanging surveys so the Walls program could put them on the map. Chris's team ended up in the Auditorium area, one of the largest open areas in the tourist cave and mostly dry. Peter went with Liliana to the Forbidden Lake, so called because of the many fragile speleothems in the water. Sean and Sandi were off in the Ant Detour area. I ended up going with Aaron and Andrea the First to tie in Aaron's survey from the first day. In doing so we also put flagging tape on his first-day stations, since he lacked it on his first day out. We did a lot of swimming, and I was glad that I had borrowed Peter's wetsuit, as otherwise I would have been hypothermic. We were twelve hours in the cave, but we also got the team record for total meters surveyed for the expedition. The competition wasn't a big deal, but it was fun to see what was getting accumulated, and all the teams were getting a lot. The average for the whole expedition would be about 300 meters a day per team.

Andrea (the Second) Croskrey and Peter Sprouse enter survey data. *David Ochel*

It was often the case that a team would go into an area to check one wall, follow a lead off of it, and end up in a massive new area. The whole day would be spent there, and they would have to come back to the same wall and move up a little farther into the cave the next day. The complexity and maze-like character of the system prompted Sean to say, "I want to go back to somewhere like Kentucky where there are walls." It was definitely a challenge to the sketcher and the whole team. I found that as a station setter I did a lot of running around and scouting in order to get some idea of where to set stations.

There was a little scattering of the tribes as far as survey teams went on December 19, as Peter had to pick up folks from the airport, Katie and Andrea the First were off to complete their cavern-diving certification, and Gary was having some pain issues with his back. So we had only three survey teams go into the cave. The teams concentrated on the Auditorium area, as there was a lot of survey to do there. There is a new tour entrance

Deysi Uc Puc exploring in the Fried Egg Northwest area. *Chris Lloyd*

Chris "Batgirl" Omura and Roberto "Chibebo" Rojo at the Tuch Entrance. *Chris Omura*

under development that has ramps, ostensibly for handicap access, but steep enough that they would be better suited for extreme skateboard competitions. I visited with Chris, Heather, and Gil during their lunch break, and it was nice to see to that Gil was fully prepared with his machete and beer. Gil used to not cave with a helmet, but these days he has one, so one could say he is now fully equipped.

This was the night the final Canadian arrived, Chris "Batgirl" Omura, and more Texans, Saj and Matt Zappitello, Paul Bryant, and Terri Sprouse.

Now we had plenty of sketchers, so on December 20 we bumped our number of teams up to five. This was also going to be the last day for Aaron, as he had to get to the airport for an early flight out the next day. We were also joined by more local cavers, with Aida Ferreira and Antonio Alanis joining the teams. By now we seemed to have pretty much carte blanche access to the cave, and Tania and most of the Río Secreto guides were back to doing their regular tours. We only got to see them when we were on a tour route or at the start or end of the day. Sometimes it became a test of our patience around the areas where the tours were photographed, as we had to stop and put out our lights so that they could take their photos. The tourists weren't allowed to take their own cameras, as the company would take photos and then sell them to the visitors. A few of the places on the tour route were also "quiet" areas, where not only would the tours turn off all of their lights, but the guides would have everyone be quiet so that they could "hear the cave." It just didn't fit into their program to be hearing "on station" or "fifty-two point five." But it was nice that they were giving the tourists something like a real caving experience, and we worked around it, though it was nice to play through and get to an area where we could survey unimpeded. The guides did use us at times for a little fun, like telling the tourists that we were Alux (pronounced something like *aloosh*), the little mythical creatures in a cave that tend to do mischief. There were lots of different stories the guides would make up about us as they saw us, and they would also just explain what we were doing. Sometimes we were asked to explain things about our work or about the cave, as well.

We were beginning to realize some of the challenges of the cave, besides the lack of real walls to sketch. The calcite-raft debris that floored the water passages tended to get into everything and wear on the skin. It was getting especially hard on some folks' feet. The slightly brackish water in the lower part of the cave would short out lights. If you dropped a survey marker light in the water, it wouldn't turn off after that. There were a lot of marker lights that had to be dismantled in the evening and dried out in hopes of getting them to work when asked, at least some of the time. There were also some fatalities in the Disto department. Distos don't swim, and they don't live long if forced to do so. There were also issues with flora and fauna attacks. Heather got up one morning with "scabs" that turned out to be about 180 little ticks around her waist. It took me about an hour to pick them off with tweezers and drown them in alcohol. The entrances were a popular place for the local wasps to concentrate and greet interlopers with lights on their heads. Sean seemed to be a wasp magnet. And then there was the *chechen* tree, which causes a rash that I managed to get all over one leg while crawling up onto a root mass to set a station. Much like poison oak or ivy, it seems to be pretty virulent, and my leg swelled up like a sausage. Fortunately I was able to alleviate some of the effects with the bark from the *chaca* tree.

Sean's comment about his cave for December 21 was, "It was short and I am bummed, and I don't want to talk about it." All day there were quips about the end of the world, and at the end of the day we had a celebration. Of course, through all of our drinking we ended up saving the world, and so we got to pat ourselves on our collective backs for that. Sean, Sandi, and Batgirl borrowed one of the cars and went to a beach party at Tulum. They came in really late, having bribed Fernando with beer so that he would fake-lock the gate for their late return.

On December 22, Peter finally got permission to use the Maravillas entrance to Sistema Río Escondido, but since it was used for tours, we couldn't go in until after 5:00 p.m.

Sofia Cassini had showed up the night before. So even with Sean, Sandi, and Bat Girl going back to the party in Tulum for a day off, we were still fielding seven survey

crews and racking up the meters. Gary was back for a second day that would be his last, and of course Gil and Alan were helping make up the survey teams. Peter and Paul took Terri to the airport, then did some scouting along the power line near the highway. A recent mass invasion of squatters along the power-line cut had radically changed the area. There were lots of people building shacks and trying to claim the land, which made things rather chaotic, but the power-line cut was now cleared and many new caves exposed. The squatters were generally friendly and showed them many new entrances. This is an important area in the 500-meter gap between Sistema Río Escondido and Sistema Dos Árboles. Peter and Paul mapped into one wet cave called Cueva de los Venados, which quickly led to an exit named Cueva Lagunillas. The last cave of the day, Cueva de Lucia, was a very nice walk-in entrance on the northwest side of the power lines, and they decided to go ahead and survey that. A high school kid from the squatter camp tagged along and helped with the survey. They mapped 151 meters in this and it kept going. But mostly they just logged entrances for future exploration.

We fielded our maximum number of survey teams, nine, on December 23, if you count Peter and Andrea the First caving again after 5:00 in Maravillas. Pat Kambesis had also arrived and was leading a crew. This was the third-biggest day for meters surveyed, 2430. All the teams were really getting into the swing of things, and from then on we consistently surveyed a couple of kilometers a day. I have always been impressed, and, funny as it might seem, I get a warm fuzzy feeling working with such accomplished surveyors.

Due to a mix-up in communications, I ended up without a team and alone on December 24. I took a long walk up the road past the limestone quarry to the south of us. It has been the destruction of a lot of cave, including some that we had surveyed in previous years. Peter noted that, "the quarry hasn't destroyed the cave, they just took the rock around it." During our days in the caves, you know when it is past lunch time, because the quarry would blast at 1:00 in the afternoon. Depending on where you are in the cave, it can be quite a shocking sound.

Christmas Eve is a big day in Mexico, when families take the day off and stay up late. There was a lot of eating and partying, and at Cleoxxo, Cleofas and Francisco had been drinking a fair bit by the time that I got back from my walk of a few hours. Most of the crews were coming out of the cave early for the holiday, and they found me down in the kitchen area with Cleofas and Francisco making sure the beer didn't get too warm. Despite the early exit of many of the survey teams, we had still managed to get 2228 meters mapped on Christmas eve. There was also another after-hours trip to Dino's at Río Escondido to get in some more surveying while we still had permission. This was another trip led by Peter, with Chris and Paul. Agustín managed to keep cooking our evening meal while the rest of us got more and more incapable of anything more than pidgin English and Spanish and lots of hugs and bonding. Francisco really started to show an attraction to the ladies, and Cleofas was good enough to assign him to other duties by the time dinner was served.

After dinner there was an expedition to the other side of the compound to pick enough *cocos* to go with a gallon bottle of rum that had been in the bodega when we had arrived. It was apparently a gift to the expedition from Cleofas, and we felt that it was time to celebrate with it. The fifteen coconuts and vigorous machete work got us all fresh mixer and a vessel for our rum. We had fun and games, with Katie showing Matt how leg wrestling really goes. Seems that there was even some late-night swimming in the pool, which went mostly underused, perhaps because we often did a lot of swimming in the cave.

There was speculation as to whether Cleofas and crew would show up to cook us breakfast on Christmas, and some of us early risers were prepared to cook for the rest of the crew, but like a well-oiled machine, lubricated in some sense, our cooks were on the job and making another wonderful breakfast for us. We ate well the whole time, and we all looked forward to the giant tub of fresh guacamole with each meal. Often there was the "nuclear salsa," made with fresh *habañeros*, and fresh fruit, cantaloupe, watermelon, and papaya. They even made accommodations for the vegetarians

Heather Tuček

in the group. Despite the weak condition many of the crew were in after the night of celebration, we still managed to get in 2224 meters of survey.

On the twenty-sixth, there were arrivals and departures, and Peter and Paul surveyed in a couple of other caves, Cueva de Lucia and Cueva de los Venados, on the way back from dropping off Terri at the airport. Those caves were near the power-line road and the squatters' village. Some of the "residents" were a little touchy about who goes into the jungle, so Peter's Spanish and social graces were especially useful for access. Jacinto Vela and Deysi Rubi Uc Puc, two cavers up from Chetumal, had arrived the previous evening and went out with Chris. Chris was able to use his swimming-cave equipment, a child's float ring, and some pedaling with his feet to get around the swimming part of the cave with his hands and survey book dry. Jacinto had to do a little diving to retrieve a station marker that had been dropped in a deep pool. Many people took the day off to tour local attractions.

On the twenty-seventh we had the assistance of some novice cave-surveyors, Mario Zabaleta, a Spanish diver, and some divers that he worked with. It was the second time we had nine survey teams out, and we got the most meters, 2659, of the entire expedition. But for some reason we had a lot of difficulties with the surveys this day. Walls kept saying that there were problems with most of the surveys. Perhaps the stars were unhappy that the world hadn't ended after all? Who knows, but there were some resurveys the next day, and a lot of time spent on the computer sorting out data that evening.

Besides new surveying and resurveying on December 28, that night Roberto showed us a video that he and others had made of the cave using mirrors to light up the cave from the entrance. It really made for a special effect, with natural light well into the cave, and it created a mood that had a lasting effect on all of us.

We were coming to the end of the expedition, and though there was some relief after some of the challenges of caving and surveying for two weeks, there was also a sense of regret that it couldn't last a little bit longer. These gatherings of cavers from all over, united in a common goal, create an exceptional group experience. Like Peter said in response to those who questioned why we do this without pay, "Do you get paid to live?"

The next day was the day to do mop up, a time to tie in the last little bits. It wasn't the end of the world, but it was the end of the expedition. Most of the crews got out earlier than normal and got back to camp to start packing and sorting gear. The final total of our survey came to 27.7 kilometers. Most of that was in Río Secreto. We had doubled the size of the cave from the previous survey and had the data and sketches to create a truly complete map. We still can't rule out a dry connection to Cueva Río Escondido, and there are also possibilities of other connections through sumps.

Explorando en el Fin del Mundo

Durante una expedición en Diciembre de 2012, espeleólogos topografiaron 27.7 kilometros de pasajes secos en el Estado de Quintana Roo, principalmente en el Sistema Pool Tunich. Se trató de encontrar una conexión con Cueva Río Escondido, pero sin éxito. Se topografiaron también varias cuevas pequeñas ubicadas a lo largo de una instalación eléctrica. Un segundo informe sobre este proyecto puede ser encontrado en el Boletín de Actividades No. 36 de la AMCS, páginas 102-110. A pesar del termino del calendario maya, el decimotercero Maya Batkun, el mundo no finalizó de acuerdo a las predicciones.

HISTORY

THE GREAT SAN AGUSTÍN CAVE RESCUE

J. Michael Boon

Having read about the Huautla Project in AMCS reports, a Polish expedition under the leadership of Maciej Kuczyński arrived at San Agustín, Oaxaca, a month ahead of the American 1980 Río Iglesia Expedition, with the goal of achieving the expected connection between Sótano de San Agustín and Sótano de Agua de Carrizo first. After visiting the sump at –840 meters, they retreated to begin work in Kinepak Kanyon at –600 meters. Jerzy Musioł broke his leg while traversing a canyon some 2 kilometers from Camp 2 while on the way to the collapse area. While Józef Cuber was going to assist in the rescue of Musiol, a rope broke at the 25-meter shaft at the end of Route '68, halfway to Musioł. The fall severed his spine, and an international rescue ensued. First to reach the scene was a Belgian and American team who had been exploring caves in Cuetzalan, Puebla, as well as nearly fifty Mexican Cruz Roja people. (Based on "History of Huautla Exploration," by Bill Stone, AMCS Activities Newsletter *21, 1995.) The first-person account of the rescue that follows was published in 1980 by the Stalactite Press in Edmonton as the booklet* The Great San Agustín Rescue *by J. M. Boon. We thank Mike Boon for permission to reprint the text here. The added photos are from the 1980 Huautla Project expedition slide show.*

I heard of the problem sitting in a plush auditorium in the Ministry of Foreign Commerce in Mexico City. I was at a gathering of cavers, an international symposium arranged by the Mexicans. A rather plump but quite elegant woman was holding forth in Spanish on some topic or another, then there were slides with the usual freaky rock music. During the proceedings Alejandro Villagómez, a Mexican caver of my acquaintance, turned to me and said "Oh, by the way, do you know there are two Poles down San Agustín? One with a broken leg and one with a broken back."

I was staggered by this news because San Agustín is an enormously deep cave; the idea of a double smash-up down there amazed me. I asked one of the American cavers there what he thought of it. He seemed rather casual, but the situation was covered to some extent; the Poles naturally had some people there, and some shit-hot Belgian cavers were also up there, along with the American cavers Bill Liebman, Doug Wilson, Blake Harrison, and a friend of Blake's whose first name was Steve. The Belgians I had met in Cuetzalan and had pointed in the direction of Chichicasapan, where they had succeeded in finding a lot more cave in a most interesting area. I was still rather shocked by these two serious accidents at the bottom of this very deep cave.

I pretty well decided on the spot I should go to San Agustín. I asked Alejandro if he would like to come; he said he would have to phone his boss in the morning. I thought about it a little more as the slide show and the freaky music continued and decided it was a situation of devastating proportions and even warranted collaring a car in Mexico City to take to Huautla. So I went and phoned a friend of mine, Valerie, and asked her if I could borrow her car. She said, of course, but then had doubts. Some of her doubts revolved around why there was no more concern among the caving fraternity in Mexico City, and she asked me to ask them for a car, which was pretty reasonable. Alejandro, who was not really clued in to the situation, wanted to see the rest of the slide show, talk to people and so on, but eventually I dragged him up and around to the projection rooms above the auditorium to see one Jorge Ibarra. Jorge is really the founding father of Mexican speleology, a man of remarkable intellect and achievement in caving. I asked him about the situation and he said he really thought there were enough people up at the cave to handle it but of course if I thought Alejandro and I should go that would be our decision. By this time there was no doubt in my mind that we should go; we picked up the Volkswagen, picked up Alejandro's gear, picked up my gear, and Marlita, the lass I was staying with said, "You're crazy!"

I was very excited but very concerned for this poor Pole lying in the dark two thousand feet underground in San Agustín. At this time I knew only that the accident had occurred on the Thursday, by now it was the Monday; it had taken a couple of days for people to find out the accident had occurred since it involved, as far as I knew, a bolt coming out of the wall, causing a fall. This cut off the party's retreat, because the rope was at the bottom of the pitch, along with the man with the broken leg and the man with the broken back, both of whom were said to have been tandeming, that is going up the same rope as a pair. Word had apparently got to the Belgians and

Americans at three on the Sunday afternoon, so here we were, nearly thirty hours behind the first notification of the accident, still probably twelve hours from the area.

Alejandro and I drove from Marlita's house towards Teotitlán del Camino and Huautla. Here, in the spirit of tape-recorded journalism I should list our drugs; a bottle of margarita mix with a considerable admixture of pure alcohol and a bottle of sleeping pills. This latter derived from an attempt on Popocatepetl on which I shall not digress. Alejandro is a rather sleepy, relaxed type, but I managed to keep him awake long enough for him to navigate us to the highway. We drove south on the toll road to Puebla; around Puebla we got lost, and, very tired, I let Alejandro drive to Teotitlán del Camino. We gassed up and I drove through Teotitlán in this rather well-groomed Volkswagen, up the winding road to Huautla. Here I should mention we had been told that the road to Huautla had been washed out, so if the road was washed out imagine the state of the cave! However, onwards up a rather dry road, and here the big trucks were grinding upwards because by now it was about two in the morning. On we drove up this endless winding ramp which takes many hours, then one drops over a ridge and winds round another huge sweep of the mountain. The dawn broke, a beautiful pink dawn with a sun that made driving almost impossible so low was the angle of the light. Then down into the Río Huautla, where we were in shade, and up into Huautla itself, the capital of the mushroom country, the sacred mushroom, that is.

In Huautla we thought we might get some food and bought some bread but failed to get anything else much: "¿Hay queso?" "¡No hay!" So we plugged on with our two loaves of bread to San Andrés, where we were on the rim of the great San Agustín dolina, the big blind valley of the cave. The road skirts the rim, then cuts off one side of the hill in the lower part of the dolina. Down we went, the road now very bumpy, pursuing a winding course to avoid bottoming out, a Volkswagen of course being an ideal vehicle for this country. We turned off this road onto the new road to San Agustín. Here I at once saw Bill Liebman, the bearded American who wears a pirate hat. He said "Boy, I'm glad to see you!" And I said yes I was glad to see him too. He had Doug with him and he said the situation was kind of under control. He introduced me to the Polish chief of operations (?), Nacho, a rather small, lithe, very pleasant man who spoke excellent English and seemed to have a very careful, calm, grasp of the situation. It appeared that the Belgians were already underground and one of the men was already out, the one with the broken leg. But the really seriously injured man, the man with the broken back, was still underground, and still in the place where he had fallen, from what I could gather. But the Belgians were there, underground, and Bill himself invited me to go underground at twelve midday.

There was an excellent telephone system down the cave and before we were due to go underground Nacho came across from the phone and said that the Belgians would not be ready to move the injured man for another twelve hours. It would take this long to prepare him medically for the trip. Since the cave was rigged and it would only take us a few hours to get to that point, we put back our trip to six in the evening. I was extremely tired and very short of sleep, having driven myself out getting there, combined with the tension of the situation to come. I said I was going to find a quiet place to sleep for a few hours and Bill said "Good luck." I said "Remember, I know this area intimately." So I took my sleeping bag down to Río Iglesia where I had a nice camping spot. I settled in with my knock-out drops and three bottles of beer and proceeded to enjoy a couple of hours sleep. These Mexican knock-out drops are of devastating proportions; they really work. I woke up in the late afternoon and lazed around and admired the beautiful colors in the entrance. Around six, the time I was due to go underground, I got up and wandered up to the camp in what was left of the daylight to find a change of plan. Liebman and company had gone underground at four, since it was not going to take twelve hours to prepare the patient after all. So I had a meal, and some equipment to take down to Camp Two was pressed on me. This consisted of a telephone, which I had to plug in at Camp One to report to Base, and some chocolate and cigarettes, plus my own gear. And here Nacho pressed on me a rappelling rack, since he wondered if I didn't have a little too much weight for my usual system, double brake bars. This was very thoughtful of him I considered. I accepted these gifts, rather like Ulysses, departing. I asked him if he wouldn't mind showing me how one got to the entrance of this cave. "Weren't you here before?" "Yes, but that was, like, twelve years ago." He did a very good job of taking me down to the entrance.

Here you must believe me; the entrance to the dolina is through a cave! To get down to the dolina you have to go through this very small cave which serves as a kind of portal. And here was Ziggy, a man of magnificent linguistic abilities who was in charge of the telephone. Ziggy gave me a small gift too, another carabiner with a gate on it. Virtually all the gear I had was borrowed, my

In 1980, the 66 kilometers of dirt road up the west flank of the Sierra Mazateca from Teotitlán to Huautla took about eight hours to traverse. *Bill Steele*

gear having failed to make it in the rush from Cuetzalan. Ziggy gave me the carabiner and something to drink and I went through the portal, onto the rope, all in the dark by now. Then down the rope on my own, into the river and into San Agustín. I followed the stream down and in no time at all I was at Camp One. Then further into this strange world, down, down, down all these ropes. At one point I picked up three very thin strange ropes. I looked at them very carefully and one of them was worn into a kind of barrel shape by the stress, a very thin rope, maybe seven or eight millimeters. I thought about it and decided yes, I would go down it. Then on down to the 318, a magnificent pitch, on down that, down, down, down. And here I began to notice that the cave was festooned with bolts, spits, as the Belgians call them. The Belgians had re-rigged after the Poles or some such. The Belgians would rig down seventy or eighty feet into a bolt, where the rope would loop upwards and one would have to stop and clip into the line below the bolt, so down another seventy feet, down, down, down the 318, then down another big pitch. I picked up some light and there I was at Camp Two.

At Camp Two most of the people were out picking up Józef, who will become one of the major characters of this story. Józef was the Pole who had fallen down the pitch and allegedly broken his back. I had been told that he had also lost a liter of blood from his anus, or arsehole. Quite how this had been collected and measured I don't know; perhaps it was an estimate. Józef had been got through the boulders at the end of Route 68 and was on his way back to camp. One of the bundles Nacho had pressed on me was a bunch of dry clothing. I had not brought any kind of sleeping gear down to Camp Two as my own sleeping bag was heavy and bulky and I couldn't see dragging it down there and dragging it out. There was the dry kit and here was I in a wet wetsuit, slowly cooling off, so I thought oh well, may as well borrow this dry clothing till the owner gets back, you know, and I put it on. Then I thought I would press on and look for the stretcher. But it seemed to me I was getting the dry clothing wet and a bit muddy and I came to a kind of drop. I felt sure the others would handle it and I went back to Camp Two where the Poles gave me something to eat. I found a spare hammock and some rather nice nylon overalls, crawled into the hammock and went to sleep.

The stretcher party came back and I got up and went to see the injured Pole. This I had been rather dreading because I thought there would be this rather smashed-up, sickly-looking individual. Well, there was this instant recognition of a very strange kind between he and I; I merely went to look at him but he immediately caught me, shall we say. I shook his hand and there was this rather strange immediate bond, a kind of animal bond between us. He looked in pretty good shape, a rather large featureless head, broad-skulled, a typical brick-built Slav, you might say. And almost immediately I was sucked into the situation because somebody gave him tea. A cry came from Etienne, one of the Belgians, who was a doctor, "Don't give him any tea!" The tea was taken away and some water was brought. "No water either!" Józef had this water which was in a plastic cup in a grip of iron and I decided he was not going to drink it since he had been told he was not to have any water. This Tantalus-like situation of the water being held over this dreadfully thirsty man continued and then Józef jerked his arm away and set the cup down away from himself. In retrospect this seems a remarkable achievement; he had decided he was going to be the one to decide he was not going to get the water, not I. Good for him. He wasn't going to get it anyway.

I thought I could hardly stay in the hammock with a party just returned from dragging a stretcher. There was a bit of static about the dry clothing, but nothing made very much sense except that by this time I had found large quantities of polythene tubing which would make an ideal tube tent. So I picked out a broad, flat area well away from everyone, grabbed some more knock-out drops and went to sleep. Before this we had arranged to start out with Józef at twelve midday and also that some six or seven hours later there would be another party who would leave camp to relieve us, a rather indeterminate arrangement. At twelve midday Doug woke me; I got up and within an hour we had fed and were on the way with Józef, having first wrapped him in the polythene tubing. And here the trip out starts and one must realize that there were almost surrealistic aspects of this expedition; hearing of the accident while sitting in an auditorium, one's distress at the thought of this poor man smashed up thousands of feet underground, without a hope in hell, then this short but incredibly extensive caving trip through these huge vertical caverns. And the air of surrealism deepened. Perhaps the Mexican knock-out drops contributed to this.

Something over half the party turned out, eleven or twelve people. I suggested to the Belgians, who were far and away the fittest and most competent people around, that I wouldn't mind going up the pitches with the stretcher. But one of the Belgians, Rob, was much more competent on rigging than I, so we arranged for Rob to ride the stretcher up the pitches and for Guy, who was something of a giant, a very sound and solid fellow, to go at the top of the pitches and organize the rigging. So off we set. There was a series of short pitches above Camp Two, and I was devastated by the speed and accuracy with which the Belgians rigged these for the stretcher. Rob, who took charge of this section, ran a Tyrolean or static rope above all the small pitches; the stretcher was then attached to this line with pulleys. So the haul began; the Sufi-like mastery with which it proceeded was intimidating. At one point I thought I might contribute. There was a shortage of rope so I climbed up a bank and unbelayed a rope top and bottom. I brought it down and there was almost a chorus, two or three voices at least, of "Shit! This is a shit rope!" Rob came back and said, well, maybe we could use that, or some such, but "No, no, it's a shit rope! Polish shit rope!" So I went back and re-belayed the rope,

somewhat chastened.

We got to the top of the 70-meter drop. Some of us went up the pitch, where we found Guy, who had arranged a hauling system from a pulley. Philippe found a hauling point nearer the head of the pitch. Clipped into a static line we hauled up the stretcher to Rob's whistle signals. The stretcher arrived with an exhausted Rob behind it. Etienne came up the pitch last. There followed one of the most amazing scenes I have witnessed underground, with Guy, Philippe, Etienne, and Rob ripping away at this enormously complex collection of metal and rope at the head of the pitch, while I hung over the edge of the pitch onto the stretcher, presumably as they were untying it. I have never seen such incredible competence in de-rigging this cat's cradle and I said to them, "Now take it easy boys." All of them came safely over the pitch and so did the stretcher.

At this point we were very close to the bottom of the 318. And here a fairly long delay occurred, with poor old Józef simply parked on a rock. Periodically people would go over and look at him, but mainly he was just left to his own devices. Then the 318 was rigged. And at the 318 this most incredible thing happened, because it was decided that following up behind the stretcher was a bit of a mug's game. Philippe volunteered to ride up on the hauling rope at the top of the stretcher. Finally things were ready and the stretcher went up, Józef looking pale and saintly in his long polythene shroud, which was ripped at the bottom and now trailed five or six feet below his body so there was possibly twelve feet of Józef in polythene. Riding on his shoulders was Philippe, the whole thing looking like the ascent to heaven of some saint with his guiding angel. This unbelievable apparition was borne upwards slowly on the ropes while Doug and I held tail ropes to the stretcher to guide it away from the wall. I really wondered whether it was all happening, because this was the most theatrical event I had ever seen anywhere on this earth, or under the earth. But on it went. Of the Belgians this left Guy, and Guy was coming up with some rather odd suggestions, I thought. But I finally worked out that since I had a wetsuit he wanted me to go under the waterfall to get his rope to go on up the pitch. So I did this for him and Guy disappeared. This left Doug and me, who were by this time rather in a state of shock at these brilliant and dramatic maneuvers that the Belgians were coming up with.

By now the ledge system between the 318 and the pitch below was a scene of utter chaos; mounds of carbide inches deep, shredded plastic, carabiners just lying around, hammers just lying around, bolt gear and garbage and the endless batteries that the Poles carried that they just threw away. Doug went up the pitch ahead of me while I came up last in my borrowed equipment, which made me even slower than when my equipment is not borrowed. But I was in no great hurry and I slowly worked my way up the pitch. Here the specific form the pervasive unreality took was as follows: Where the rock was a creamy color with brown banding I began to see every kind of domestic shape one could imagine. The best comparison I can give is the painted friezes one finds on Grecian vases. These were domestic scenes with all kinds of houses, people, and so on. The rock is arranged in layers; I would come on another layer riddled with solution holes giving rise to innumerable segments of relief amongst the holes. These would assume human faces, full-face, half-face, profile, and human-animal faces, half-bat or half-fox faces, every conceivable gargoyle, a mediaeval allegory of virtues and vices in sneaky pointed faces. Lack of sleep and the dreaded knock-out drops.

I made my way upwards and near the top someone said, "Mike!" I did not respond, not caring for unmeaningful communication on pitches. Then again: "Mike! Are you alright?" I said, "Yes."

Another of the freaky aspects of this trip: I thought the chap who had said, "Mike, are you alright?" was Jean Claude, one of the Belgians. Now when I got to the top of the pitch I may or may not have seen Jean Claude. What was happening was that the Belgians were dropping in and dropping out of this rescue, appearing and disappearing, and not only this, they were doing it from two directions, from below and from above. This caused confusion in my mind; it was a general problem, how many Belgians were there, where were they? They appeared from nowhere and disappeared just as quickly.

So the foxy faces had had their fun with me. I emerged into the head of the 318, a very small, oval, muddy little chamber, a perfect chamber for psychological collapse; it doesn't really have much import, it's sort of stuck in the middle of the cave. And here was Józef, who you will remember was what this rescue was all about. He was lying in his plastic shroud. I should remark how I had thought earlier how easily this plastic sheet for protection against the water could become a shroud, merely by raising it over his head. And here was Etienne, the doctor, no, I shouldn't say doctor; he was one of the Belgians who happened to be a doctor, and three or four Slavs, Poles, and Douglas. And the Poles were passing out cans of meat and here I should comment on my level of personal organization on this trip; I had enough carbide but I had nothing to sleep in, which would be very unusual for me, and no food at all. And here were these endless cans of meat; they came through me and went up to Doug, perched a bit higher in the rift, then came back through me; we all had more and more. They must have had I guess seven or eight cans of this meat. I became aware through the various languages that were spoken that Józef wanted a piss. I digress: There was this incredible language difference with German, Polish, French, English, and Spanish spoken, and you would hear the most outlandish conversations, a Mexican and a Pole talking in English and so on. It had been agreed by the way that English would be the lingua franca on the trip, but this, as I shall have occasion to remark on later, broke down at certain points. I was very flattered by the choice of language, but it didn't quite hold true.

Preparing Josef Cuber for a hoist at approximately –240 meters in upper Sótano de San Agustín. *Henry Schneiker*

Anyway, I became aware of the fact that Józef wanted a piss. Józef had been equipped with a catheter system, that is a tube stuck up his penis into his bladder. This could only be worked by a forceps system and Etienne wasn't really getting onto it too well; he was a little bit sleepy. In fact a general somnolence had fallen on us in this little chamber; not to push the Ulysses comparison too far, it was like the little island where they all call in to see Circe. Well, most of us were all becalmed and overcome, because now I imagine it was about two in the morning, which is the hour the K.G.B. and the Nazis strike when they come to arrest you, also probably the R.C.M.P. for that matter.

A general numbness of sense had fallen on the company. I thought, well, poor old Józef needs a piss and he also needs moving on. By a drawing together of similar forces one of the Belgians came down from above and said, "Yes, Etienne, please let's get a move on." I'd asked Etienne a couple of times if he wouldn't mind seeing to Józef's catheter system, which he really should do since he'd arranged it. Because all this while there had been the tinkling of hammer on bolt, as in the Fairies Workshop. Tink, tink, tink, a point into which one could rig rope and cause a hauling system to come into action. So, on about the third call Etienne bestirred himself and we found the square bottle in which Józef I won't say pissed, but into which his urine would be allowed to drain, and this was done. The bottle was knocked over on this occasion; I didn't know whether it was meant to be kept as some kind of permanent monument to his demise or otherwise, but anyway it was knocked over. The urine was somewhat discolored, wine-colored, probably with blood.

Somnolence returned, and then I thought in a rather dazed way I should take a part in these activities, in which so far I had played a rather subsidiary or subordinate role. This came as a rather monumental or stoned thought, something not immediately obvious. But I did bestir myself and went to the head of this small chamber. I climbed up a rift system, then back out over the chamber again, the rift being continuous into the chamber although too narrow to get through at one point. Here I acted as a human bridge while Józef was hauled up the pitch. Because other things had been going on, one of the Belgians whose name I don't know had been working and had arranged a pulley system to pull Józef up. By dint of a few shouts from me, "Yes, let's get Józef going, tie him on to this rope," and so on, Józef was pulled up the drop and passed over my knees. Another Belgian appeared Jean Pierre, I think, and I think from below. Meanwhile I should add another Belgian had appeared and disappeared and this I think was Jean Claude who had brought up a wire basket from Camp Two, deposited it, and gone back to Camp Two. So, if you follow me the Belgians were more or less appearing and disappearing, rather like spirits or angels from here or there who would lay their largesse on you and then disappear, fly into the Empyreum.

To digress, this same chamber in which the psychological collapse or somnolence had occurred, Circe's island, was where Blake Harrison had fallen on his head three or four years previously, causing damage to his neck and to his finger. Fortunately he had just bought a pretty good helmet.

At the head of this rift was the hauling system, another quite dazzling array of shunts, jumars, pulleys, and ropes, something as baffling to me as, say, the workings of the internal combustion engine. It was sited on a boulder, essentially. Below the stretcher appeared a Belgian who I thought was Rob but who in fact turned out to be not Rob at all. One of these Belgians who was around turned out to be Jean Pierre, the other was the seventh Belgian; you see for a long time my problem with the Belgians was that I thought there were six of them whereas in fact there were seven, so I was trying to fit seven circumstances or appearances into six names or people, which probably accounts for some of my confusion about them. Not of course that all of them do not have very recognizable identities, it's just that I was trying to squeeze so many apparitions or appearances into fewer slots than were available for them. Anyway this Belgian was not Rob, who in fact is a Frenchman, I believe. And beyond the boulder—but if I may just finish with this matter of the Belgians, there is one of them who is the most elusive or the last to be recognized by me; I know now who he is but I have no clue as to his name; I know all the other six names apart from his. He is a remarkable

man, very calm, very steady, and he had perhaps arranged this system at the top of the rift above the 318, one of the definite haul points or demarcation points of the system. He was sitting with Józef in the stretcher on his knees.

And here there was another wait, and here Adamski, one of the Poles fell asleep in this remarkable frozen position; if you were to find a spider in the forest, dehydrated or frozen to stone, this would be Adamski's position. He was sitting, leaning forward, but his arms were resting on nothing; they were extended and stiff, very remarkable. There was some movement; he would fall forward, catch himself, refreeze, all without waking. Meanwhile the mystery Belgian was still jammed across the rift. There were a couple of Poles there, and Jean Claude had appeared or perhaps had never gone down the 318 after delivering the basket stretcher. Or perhaps he had gone down and had come back; well I don't know, Jean Claude was there somehow. There was a ledge running along one side of the rift. At the end of this Jean Claude, following another Belgian, launched himself into space, with great calm and determination, rather on the lines of a parachutist. I won't say he dived headfirst, but there was that impression; he just flopped off the end of the ledge.

The last of the Belgians asked me if I wouldn't mind sitting crosswise in the rift to hold the stretcher. Etienne had gone up the pitch already and this I couldn't quite fathom, because as the doctor he might have been expected to remain with the stretcher. Apparently there was some kind of problem at the head of the pitch and here language difficulties may have come into it, because it may have been too complex to explain to me what the problem was. I think Jean Pierre went up the pitch with Józef. Józef had been lying in his crack, rather somnolent. Adamski had been at his head; Józef calling for "Stepan! Stepan!" who was his friend on the trip, rather ignored. This is the odd thing about it, the patient is so locked into his basket that really he's regarded as so much meat to be carted up the pitch, semi-human, if that. Józef, so drugged, was rather an object or at any rate a low form of life. He was hauled up the pitch and Jean Pierre with him.

I said to Jean Pierre, "Yell down the pitch when you're at the top." Here I should mention my persistent feeling that all these activities were being conducted in the open air. I had had this feeling from the moment we started, a feeling that one was not underground at all but that one was out in some kind of misty night. I had no sense at all of being underground, a good thing in a way since it reveals a high level of confidence, but really rather odd since we were fifteen hundred feet underground at this point. I should also say that at the top of the 318 I thought we were out of the cave as far as difficulties went. I thought we were almost out and felt we were operating in some dark, misty night.

It was now at a critical point, since it was now my turn to parachute myself into space. I am not really very happy about highly athletic swinging around on ropes underground. I like to move slowly and carefully and either to be moving under my own steam or attached to a lifeline, or to be on a rope system. The idea of having slack on a rope and then swinging out into a gulf doesn't appeal to me. So my first reaction was to try to work out ways of slowly putting tension on the rope. Here I should say that when the stretcher rope had been payed out it seemed to me that it had gone too tight. There were of course two ropes, one for the stretcher and one for the man climbing with the stretcher. I had got the two ropes mixed up and had shouted back, "Untie that rope!" whereon one of the Poles had said, "Why? Why? No we don't need that rope untied; there's plenty of rope." This chap was quite a character. Having demonstrated on the ropes he went back to his station.

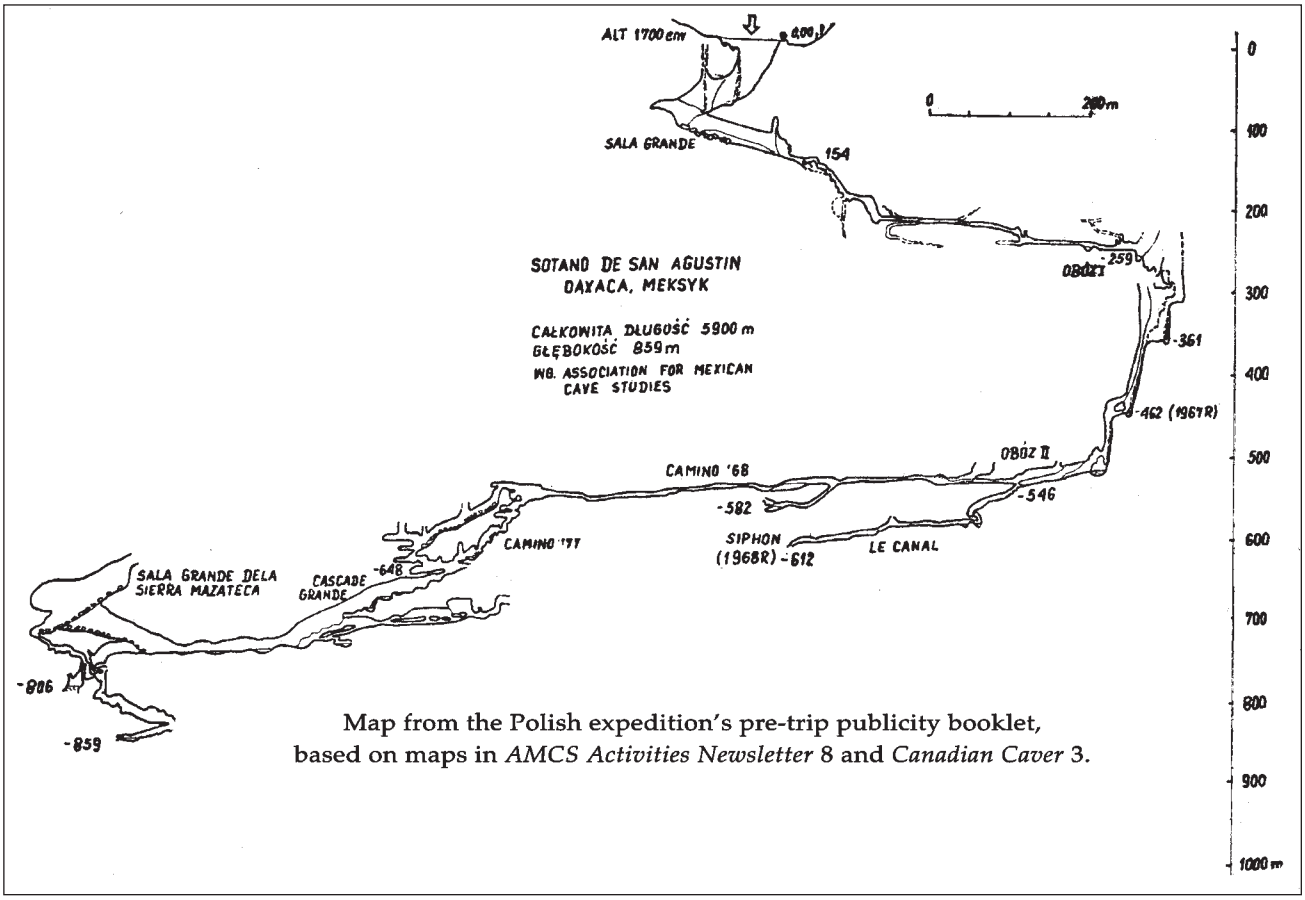
I was now more and more faced with a dilemma. I wanted to get up the pitch to help them out, but it was apparent to me that there were still people on the line, at least I thought so and I had not heard Jean Pierre shout down. I waited and waited and at a certain point I went back to the start of the ledge and free climbed down into the rift below. From here I could walk through a pond below the space launching and pick up three Polish clotheslines leading up the pitch. I had in mind using one of these to get up the pitch without stressing the rope in use. I had actually abseiled down one of these clotheslines when I came down the cave, and I remembered the knee-deep pool. I looked at them and then went back to the ledge system and considered it. I knew that these ropes had broken, because by now we'd become aware that the problem on this trip was that the Polish ropes were breaking; this was why Józef had had his fall. I thought, well, one should get to the top of the pitch, but one should not put weight on the climbing rope because here is Jean Pierre with Józef; we're talking about probably 350 pounds deadweight on the rope. And here comes, with the shock loading of the swing into space, about double my weight, say about 300 pounds, suddenly hitting at some critical point and totally jamming up the system and causing some very severe problem because the pitch was quite a wet pitch, splattering with water. So I considered whether I should climb up the Polish ropes. If I had used one jumar on each rope I might have been safer, on the other hand supposing one of the ropes had broken then I would have had all my weight hanging on one rope, and if that broke . . . I dismissed this idea, and I also knew that if I did this one of the Poles, who were less scrupulous or shall we say less cautious than I, would certainly swing his much greater weight into space and jam the whole system rigid anyway.

So I went back to my ledge and waited. There was remarkably little pressure from behind. Then Bill Liebman, the American, appeared. He said "Are you sure there's no one on that rope?" I could feel twitchings on it; I thought, well there is someone on the rope. Liebman asked again later; there was still something on the rope I thought. But eventually I thought, oh well, try it.

I should mention a flash of basic paranoia I had. One of the people behind had said would I mind

carrying a bag up the pitch? My natural instincts were to say yes, OK, but then I thought what the fuck, we're carrying bags out the cave when all our energies should be directed to carrying Józef out of the bleeding cave; I mean the gear could always come out later. I should mention I had had to find my way round a wire basket stretcher earlier. In my tired, dazed or stoned state I wondered what the hell they were doing carrying this wire basket out of the cave when we should have been carrying Józef, in other words all our energies should have been directed solely to carrying Józef. Of course the Poles had probably been told to bring it out because it might have been useful and also they probably thought the rescue was well in hand. I was less convinced of this. So when the comment came, which was in fact from a Mexican—would I mind carrying a bag up the pitch—I was more or less infuriated and either said to them or muttered why the hell didn't they concentrate on getting their own man up there, one of their own team up the pitch, rather than carrying junk out. Which was a misdirected comment because, as I say, it wasn't a Pole anyway, it was a Mexican.

Liebman said he was going to come up the pitch next. After much thought I threw myself out over the edge of the pitch and started up through the wet. I made it up to the Polish lines, one of which hadn't made it to the bottom of the pitch and was coiled up on a ledge; on up, wet, wet, it was like a typical wet English pitch. These pitches can be bad; it's cold, you can't see anything, you can't hear anything except water, you're totally isolated; it's worse than being in cold water because you have this moving mixture thrashing over you. At the top of the pitch I found Etienne. One knows when the situation is in disarray psychologically; there he was being thrashed around in the water. I'd picked up quite a load of climbing gear along the rift at the head of the pitch, carabiners and slings, and it's an indication of my state of mind that I took a piece of sling and just threw it away, possibly part of Etienne's gear. Józef was on his spine board, slumped down. The spine board needs to be leaning up against the wall so the man is facing upwards; when he's slumped down it seems that things are out of control. Etienne asked me if I would climb the pitch with Józef. I was really rather amazed because I had been somewhat dazzled by the Belgians' performance and had almost failed to recognize that they were human too. I was flattered to think I was being entrusted with getting the stretcher up the pitch in these quite testing circumstances. Etienne went up. And here was the crux of the situation in that Józef felt himself to be in an extremely bad way. He had been in the polythene tubing which we had replaced at the head of the 318, because by good luck there had been some more there. Józef seemed to be in extremely bad shape psychologically; he was slumped down and he was cold, cold, and he wanted me to hug him which I tried to do.



Map from the Polish expedition's pre-trip publicity booklet, based on maps in *AMCS Activities Newsletter* 8 and *Canadian Caver* 3.

He was saying, "Hug me" in Polish, and I'd immediately got his message and was trying to tilt him up into a slightly less dismaying position. And he said to me, "Józef is kaput." And I burst into a session of silent sobbing and then recovered and then had another bout of this sobbing at the extreme sadness that poor old Józef really was going to chop it in these dismal circumstances down this pitch.

Here I should say that Etienne had said as soon as I'd arrived, "The main problem now is cold." But I had put my hand down Józef's neck and felt him and he was like a furnace. And I'd said, "Oh, I'm not so sure about that." The other problem was that Etienne had taken his pulse earlier on and I'd asked, "A strong pulse?" and Etienne had said no, not strong at all. On this ledge I'd asked him about the pulse again and he'd said, "His pulse is not good." My feeling was that Józef was going to die of heart failure; his heart just wouldn't be able to take the strain of pumping this rather cool blood around his system and would just pack up. So "Józef is kaput." I said no, Józef is not kaput, and here the situation got kind of desperate and I was definitely being firm with him. His head would slump down and I would say, "Józef, put your head up into your helmet because it's warm there." Every time he would respond and make the effort, one of the few physical movements he could make, to push his head up into helmet where it would be warmed. Then his head would slump down. "Józef, get your head back into the helmet! That's because it's warm, it's good in there, see."

Józef's mate turned up, the same chap I'd shouted to when I'd misunderstood which rope was which on the pitch below. We tried to communicate, he and I. I was trying to get him to cuddle Józef, to put his arms round him and warm him up, which he caught onto and did. He was talking to Józef and generally cheering him up when, behold, the line tightened. This was the pull from above taking up the strain. The line tightened and slackened; it was so tenuous it was almost as if they couldn't do it, then it tightened again and Józef took his first tentative millimeter up the pitch. I was above him on my rather botched-up prusik system.

One might remark on the saintliness of Józef's aspect; perhaps that of the icon, the plaster face of the saint, drained of color and composed in holy resolution. Certainly Józef had a saintly calm about his features at times. One might also remark on his general responsiveness and desire to be touched; I think it was this rather child-like aspect of his humanity that drew one to him. He responded to any form of kindness or physical contact.

The haul up the pitch was rather slow and I managed to keep up with it. There was really not much difficulty; I kept Józef with his back to the wall away from the wall. I had arranged the signals with Etienne; one shout stop, two shouts up, three shouts down. A spare line crossed the two lines running up the pitch and the stretcher started to snarl up in it. I shouted up, "Cut the red rope! Cut the red rope!" They responded to this well, the rope came free, I pulled it clear of the stretcher and up we went.

At the top was Etienne, hanging in there as usual. There was a long traverse line, and we clipped the stretcher into this. A problem developed as the stretcher was being pulled along this line, so I clipped a lone carabiner into the line with the idea of following the stretcher. Etienne said to me, "Mike, don't you think you should have your jumar in there?" Since this wasn't an unreasonable suggestion I clipped my jumar onto the rope. A fairly strong pull came and Józef was pulled along the traverse line, which of course sagged under the strain. At stream level was a water rift and Józef was pulled into this.

I was struggling frantically to keep up with him, but by now I was completely entangled by virtue of this flaming jumar. There were panic-stricken exchanges in the stream trench above because by now Józef was down in the water there and it was impossible to pull him out. He wasn't actually under the water but the back of the stretcher was in the water. Eventually I managed to abandon my jumar again and sling myself along on the carabiner. By this time there were cries of "Mike!" Somehow I had become the local stretcher expert. A mass of panicky exchanges in French built up; everyone was yelling away at the tops of their voices and one chap was rushing around screaming at people to stop screaming. I got down into the slot almost lower than Józef because I too was sagging on the line and so was in a position to grab the tail of the stretcher. You may imagine this enormous weight of 200 pounds and the problem of getting it up and through this narrow rift. There was a fairly strong pull on the line but it seemed to me we weren't making any progress. Right at the tail of the stretcher, half jammed in the rift, half hanging on the line, I managed to shift him out half an inch or so when he seemed absolutely stuck solid. Once we had got the stretcher level with the rift we tilted it to one side and he went through the slot beautifully. Then we worked the board

Members of the Polish expedition after the rescue. Their truck had been shipped over from Poland. *Bill Stone*

onto its back again. It was quite a graceful maneuver; the stretcher goes through on its side then levels out, rather like a large aeroplane doing a half-roll.

Above this pitch was another pitch that was also a bit chaotic. I free-climbed this pitch to a scoop; we got a good pull from above and Józef went up again with me guiding him away from the far wall. In a rift leading up from the pitch was a big log, a vestige of the floods that roar through the cave. The head of the stretcher was lifted onto this and Józef went through. In pulling up the stretcher the climbing rope had got pulled up too and the query came up, "Can we climb the pitch without a line?" I said yes but I didn't recommend it. Jean Pierre free-climbed up, and I took one of the ratty old Polish lines and chucked it down the pitch, a rather larger diameter one than the small one that had broken, I should say.

There was more shouting from below and eventually I replaced this line. Liebman came up the pitch. He said to me, "The problem is we don't have enough people up the pitch to do the hauling." I said I knew that; we had all these people hanging around behind the stretcher who weren't doing anything. Shortly after this the bloody wire basket appeared, of course, the Poles triumphantly carrying out this flaming wire basket. Liebman said he would go up and organize the next pitch. Meanwhile here was Józef looking extraordinarily cheerful; the moment he got out of any of the horrible shit he was in he immediately recuperated and went back to being his normal cheerful self. Here he was, chatting away. Meanwhile Jean Pierre was having a really hard time because he had been awake for a very long time now. He was on the next pitch, which had two ropes down it, shouting to the people above and he was almost in tears, poor chap.

He came down and I said to him, look, let Liebman have a go at this Jean Pierre, or something like that. I had a little fun by igniting a pound and a half of half-spent carbide, causing a colossal bang, and Liebman set off up the pitch. He had been chafing at the bit somewhat. He was carrying an enormous bag, because wherever Americans go they always carry enormous bags; no one's ever been able to determine what's in 'em yet. There were two ropes down the pitch, and he chose the wrong one, one that went through an extremely narrow bit, which caused him to complain. Liebman got up and as we had agreed there weren't enough people at the tops of the pitches I suggested to a couple of Poles that they shoot up the pitch too. There was a great deal of shouting down the pitch about this, but in time Józef was tied onto the white rope and up he went. Rob, who was really sort of King of the Belgians, so at ease in the cave was he, appeared, where from I don't know, probably from below although I have no idea how he'd got below. Rob was seated comfortably on a ledge way above the Poles rather like a spectator at a play, looking quite stylish in a powder blue anorak. As I went up he made some comment, "Mike, don't you think . . ." something or other. Not being quite able to understand him I said, "Do you mean take one foot out of the jumar straps?" He said, "Yes, yes!" I thought, well, OK.

The stretcher went up with a nice pull. Once in a while the wall would curve away and one would have to stop the pull and ease the stretcher over a projection; it was quite simple really. Once they misinterpreted my signals and I bawled out, "Why don't you listen to the fucking signals?" at which all the Poles down below roared with laughter. They must have grasped the import of the message.

Up we went, up to another of the confounded spits, one of the spits that were put down three or four feet below the head of the pitch involving changing over to another loop. At the top was Jean Claude and Etienne too and a whole bunch of people. On these rescues the whole process is linear and one has no idea how many people there are round the corner. Suddenly the cave had been flooded with people who were coming down from above. Jean Claude grabbed the tail of the stretcher and pulled Józef up. There was some shouting from below that they wanted the rope back; we said, "Wait a minute, wait a minute, we haven't forgotten about you." There's always this feeling that things should happen slightly faster than they do. Józef and the stretcher were pulled through to the little round dry tunnel at the head of the fissure. Such a very obvious place, this fissure; it just takes off, a dark gap in dry rock.

At Camp One we were just flooded out with people, there were literally dozens. There was a big meal going and Józef was carried in triumph through some pools to a resting place. Józef was given some tea, all his wet clothes were taken off, and an old jacket of mine was put round him along with a dry sleeping bag. Józef took his tea, and Józef drinking tea was a sight to see. You would first of all ask him, "Would you like some tea?" and he'd say "Mya, mya, mya, mya!" and then he would lay his head back in his helmet and open his mouth in ecstasy. A few drops of liquid would be dropped under his tongue and he would "Mm, mm, mm, mm," savour them. Then "More?" "Uh!" his mouth would open again, his eyes close in delight at a few drops more under his tongue.

Józef was surrounded by dozens of carbide lamps and people, everyone talking at once. The Americans had come down. Bill Stone, Mark Minton, Jerry Atkinson, Dino Lowrey, Steve Zeman, and others. Stone said, "All right, we'll take over from now. It's only going to take six hours." At this point I felt I was redundant and had something to eat cooked by Danny. The whole thing was like a party or carnival. In fact the whole rescue had at times struck me as being like a party, or one room in a party, people would drop in, socialize for a while, in this case help with the rescue, and then drift off again. I've never been on such an unorganized proceeding; it did have a couple of moments when it looked close to breaking down, drop in, drop out. The Belgians had done magnificent work; they had put in dozens and dozens of man-hours on the pitches, although with the exception of Etienne I never could fathom where all of them were at any particular point.

So I decided to leave the cave; also wandering around was the Pole Adamski. I found the way I had entered Camp One and started crawling up it with Adamski behind. We found the telephone wire, but Adamski said no, he'd got a better way out. He led off to where there was some Polish string and I followed him up it until he seemed to be having trouble route-finding. He climbed into a high-level passage that only one person had ever been into, judging from the boot marks. He fell on my head coming out. Back to Camp One.

Jean Philippe said he would come out with me. I said, well, you know, Jean Philippe, if you want to go on ahead you just do, because I'm traveling pretty slowly. Yeah, he said, so am I. I thought to myself, your idea of traveling slowly is not mine, my friend. For a while I kept up with him because I could free-climb alongside the rope, then it got to prusiking and he obviously had to go on ahead. I hadn't remembered any verticals between Camp One and the entrance, but there is about 800 feet to be gained up sloping passages. The very bright Petzl lamps the Belgians use are like small fires. In the steep perspectives of these dark tunnels the distant but very bright flame would cause fantastic visual effects as it played on the different rock surfaces. It gave repeated visions of the surface; the light creating plays of shadow that looked just like trees. You could lose yourself in these beautiful visions, but they were not compelling to the point of danger. I was passed by Danny. The amount of vertical work to go was a continual surprise.

Then came the last pitch and the night. And one was out of the cave but somehow not out of the cave, because the gully on a dark night seemed just like the underground. Entering the main gully was a side gully in startling black and white rock, the white-streaked Huautla marble. This lead up as a steep gangway with a slot of sky above it. There were vague areas of light and darkness above. It seemed to be the sky with some kind of occlusion of cloud, the ramp below leading up at an incredibly steep angle. I trudged up this slope, occasionally using my jumars on the line, upwards, upwards. Once I was well up there came to be two lights below me. One was a carbide lamp, but the other was casting an incredible green glow. It was a chemical light which was casting a green glow on the vegetation below, a remarkable sight even if the effect was artificial.

The gully was awkward; it was too steep to climb unaided and not steep enough for jumars. There were lights above and a shout came down, "Who is that?" It was good old Ziggy. Then at the top rock, "We want to film you coming out." "Oh, yeah?" "Try and look tired." Try and look tired. I just looked natural and came out to the camera and lights. Through the dark little tunnel, Ziggy's little tunnel, a nice cold drink and then up towards the house. By now I was extremely weary, and although one feels one should never stop I sat down on the trail for a few minutes.

I walked round the rim of the San Agustín doline to the village. I met Blake and he told me something of what had been going on; there had been some discussion as to who was to take credit for the rescue. Also a representative from the Polish embassy had turned up. The Poles had left quite a lot of trash in the cave and Blake had presented him with a bagful, saying, "Basura! No es bueno." Blake dropped it at his feet whereupon the representative kicked it away in a gesture of defiance. Odd little things like this had been going on, nothing too serious, the whole operation seemed to be fairly harmonious. The kind lady Pole there gave me bowls of soup and any amount of food. I was too tired even to drink; I'd been promising myself a few belts of tequila but I couldn't even manage this and just crashed out by the schoolhouse.

Next morning people headed down into the shakehole for the final triumphant moment, the emergence of the stretcher. Etienne arrived at the school; he was absolutely exhausted. He raised his hand to me and said very weakly, "Hello, Mike." I went over to him and undid his belt for him, which was tied in a simple half-hitch; he was just too tired to handle it. I got the helicopter pilot and the chief of the Red Cross and brought them down to him, then brewed up some tea for him and the other Belgians. They were all really shattered. I was rather surprised because I'd thought the rescue was over with in view of the number of people down the cave.

I gave Etienne a flask of tea and some more food for the helicopter ride because he was ravenous. There was more eating and the whole thing slowly developed into a party, we cracked the margarita mix and people were drinking whatever they wanted, milk and coffee and tea and tequila. We had a little chat about spits and the party acquired a rather self-congratulatory glow. Then it was time to climb into the borrowed Volkswagen and head back to Mexico City, Józef meanwhile flying high above us in his great white bird.

El Gran Rescate en Cueva de San Agustin

Mike Book participó en el rescate de un espeleologo Polaco gravemente herido en Sótano de San Agustin en el año 1980. En dicho rescate participaron espeleólogos Estadounidenses y Belgas.

TLANEXILOTL 2014 EXPEDITION

Gustavo Vela Turcott

She stands on the horizon. I move two paces closer, she moves two paces away. I walk ten paces and the horizon runs ten paces farther away. As much as I walk, I can never reach her. What's the use of utopia? This is what it's for: to walk.—Eduardo Galeano.

Just how much can you desire something? How much are you willing to fight for it? How long can you wait for a cave? Like a star that awaits the night to shine, like a lover who waits for their loved one, like an explorer who asks what there is beyond. We've waited like this for 355 days to get our chance to see the bottom of the big pit in Olbastl Tlanexilotl (Sótano de las Ventanas). Last year's expedition stopped 285 meters down at the edge of what looked like a 100-meter drop. Tired, out of rope, and in the last days of the expedition, we went no farther, and so had to wait the whole year to find out what was below. [See article in *AMCS Activities Newsletter* 36, pages 118–123.]

After two days of shopping and packing in Tehuacán, seven of us started up into the Sierra Negra to deal with the usual. The guy we rented the pickup from wanted more money than we'd agreed to. The authorities in Ocotempa wanted "economic aid." (No sir, we are not the government.) The mule drivers wanted more than before or more than what we'd just agreed to, and when it came time to pay them, wanted even more; it seemed irrelevant that we were already offering nearly twice the local going rate. The landowner where we camped wanted money, but in the end was happy with used rope. It seemed like this year greed and avarice . . . er, sorry, the needs of the locals, were greater than usual. It's sad that many of them see us more as an easy money supply than as people.

After three hard days of shopping, travel, negotiations, and chasing permissions we found a little bit of calm, and on Friday we built our base camp in the same place as in past years, at 2300 meters in a forest that is slowly but surely being devoured by timber cutting. We installed the kitchen, eating area, toilet, and our solar plant—most important, with our need for electricity greater than ever, be it for charging caving lights, batteries for drills, the music player or the phone, or perhaps the radios, the Disto, or the Palm, in the end, all our toys, umm, equipment necessary for cave exploration.

With everything ready, on the Saturday five of us climbed to the Tlanexilotl entrance with loads of equipment to mount a simple bivouac. Sounds easy, only three or four hours in the blazing sun to cover 6 kilometers over lapies where all the rocks move or break, and if that's not enough, many of the plants have sharp spikes. Still, nobody said that exploring an interesting cave in this place was going to be easy. For this acclimatization walk we took about ten kilos each. We also built a water collection system, as there isn't a drop of this precious liquid on the surface up high, and before returning we checked the radios, which of course worked perfectly during the test. By Sunday we were ready to go, but the mountain had other ideas. Bad weather slipped in at dawn, and nobody went anywhere. At least we got a full load of water in the bivouac and another 150 liters in base camp, and it replenished the tiny soak that is our base-camp water supply.

On Monday we were back to sunshine, and six of us went to the bivvie. David Taberner and Al Warild rerigged last year's ropes, which we'd left out of the water for the year, while the rest did a gear carry and returned to base camp. The next day we tried to communicate with those in the bivouac, but couldn't make contact, so Andreas Klocker and I headed up anyway to continue the rerig. Along the way we met Al, and he told us that he and David

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Translated from Spanish by Al Warild.

Gustavo Vela

had rigged to –285 meters and had gotten out at three a.m., and the big pit was ready and waiting. A feeling of euphoria tinged with a little fear sneaked in. What cave-explorer wouldn't be excited by 100 meters of darkness and space?

After 355 days of waiting to see what was down there, at last the day had come. Andreas and I started down, a 40-meter pit to a window and the light diminished. A 10-meter pit, a traverse, and another window, and the perpetual darkness enveloped us. A 30-meter drop, a crawl, a 25-meter pit, another window, and we were at the narrow part. Two short drops to the first restriction, then some downclimbs, and we're at the first really tight spot—clip onto the rope and slide through the restriction. I tell Andreas to make sure he is clipped in really well, because the squeeze opens on the top of a 40-meter pitch. We get through with a bit of effort, hang from the rope on the other side, and continue on down.

A few more pitches and we're at the 50. At the bottom we wiggle through the second squeeze and are at the top of the big pit. We get ready to rig. With Andreas at the top, I begin to rig down. I drop 40 meters as I rig to the three anchors from last year to reach the end of the survey. I rig a double anchor and drop another 6 meters, put in another anchor, and get a 40-meter free drop. I slide down very carefully with a combination of fascination and excitement. Thirty meters down I see a large window, but as it's a long way off I keep descending to the bottom of the pit.

Once down, I call "rope free" to my companion. I begin to look for the way on, climbing down 3 meters or so where the water went, but it became too tight, so I look farther and find a meander and another 3-meter climb to a 6-meter drop that I have no rope for. After a while I realize that Andres hasn't arrived, so return to the bottom of the big pit and call him again. He answers, but due to poor acoustics and the distance I can't understand what he said, so I start back up. Once I am at the top, he tells me that he hadn't realized that the rope was free, so hadn't come down. Tired and cold, we decide that the surface would be a nicer place to be. Once in the bivouac with dry clothes and dinner, we are happy that we don't have to walk three hours to base camp.

The next morning we made radio connection with base camp to let everyone know how we'd done, and Irena Ermakova, David Tirado, and Jabi García prepared to ascend to continue exploration. We passed on the way and swapped information, and each group continued on its way. Thursday morning the group up top told us over the radio that they'd had a hard day. The survey showed the big pit to be 100 meters, and in total they had mapped 99 vertical meters, so that the cave was nearly 400 meters deep. They stopped at a tight meander and had no time to visit the window in the pit.

By 8 a.m. the next morning, Al, David Taberner, and Roberto Rojo were on their way to continue exploration. When they got to the bottom, they too couldn't get through the narrow meander, and it appeared way too long to consider widening, so they began to check everything on the way up. Fortunately, three pitches up Al found a window that went. The others arrived, and they installed a traverse and got to a pit about 40 meters deep. Al got halfway down, but ran out of rope. When they tried to adjust the rigging, the drill wouldn't run.

The next day, Friday, Andreas and I were once again ready to go, but a radio call saying that the drill was broken stalled our plans. Once the drill was back at base camp, we set to repairing it. We started up in the afternoon with a fixed drill and renewed enthusiasm that was quickly dampened by the storm that soaked us along the way. At least we got the minor compensation of a rainbow over the entire mountain and a beautiful sunset. That night I was tired and wanted to sleep, but couldn't because I didn't want to miss the show before me. We were in the bivouac cave beside Tlanexilotl, lying back in a rocky overhang in a doline, surrounded and covered by rock. The roof, some ten meters away, looked like the mouth of some giant animal, and the trees, some tall and others short, were the teeth with us safely inside. In the darkness, we had a strange two-dimensional view of the world. In the foreground the silhouettes of the trees, which all

Base camp. *Gustavo Vela*

The high camp at Tlanexilotl. *Gustavo Vela*

appeared to be the same distance away; in the background, the stars that filtered through the foliage and the immense blackness to the universe. Surrounded by silence, the night, occasionally shaken by the sound of the wind ruffling the trees above, devoured our tiredness. But I could stay awake no longer and drifted into the world of dreams.

In the morning I was awoken by the birds singing, some loud, others timid, some close to me, others farther off. I opened my eyes, and the normal three-dimensional view returned. Now trees did in fact appear close, and others not so close. All the colors of green filled my vision; I was surrounded by plants, bushes, and trees. The scene from a dream ended abruptly with the malodorous farts and snoring of my still-sleeping companion. We ate breakfast and prepared our gear, as it was our turn at the lead, and we had an undescended pitch at –380 to look at in Olbastl Tlanexilotl.

Once there, I took to rigging this beautiful 45-meter shaft, its strata cut cleanly through by the action of the water. The rope reached nicely, but once at the bottom we were disappointed to find a 30-centimeter-wide meander with a thin thread of water in the bottom. Andreas made short work of it a few sharp blows and slipped on in for some 5 meters until he hit an even narrower section. We both gave it a try, but without success. Fortunately we had the hammer and chisel, so could improve things a little. Even so, he still couldn't get through, but when I tried, I made it, only to hit another restriction. Excited by the emotion of new cave and without considering the consequences of being unable to return, I slipped through to the other side. Once there, I could look back and see the distant face of my companion; in the other direction, virgin passage. Without thinking further, I was off into the unknown. A not-so-tight meander 15 meters long and a couple of downclimbs took me to the next obstacle, a 10-meter drop. As I was no longer wearing a harness and had no rope, I had to return. Once at the restriction, I summed up courage and gave it a go. I failed three times, but got through on the fourth attempt, though not without plenty of grunting and scraping. Late and tired, we returned to the bivouac. In the morning we radioed in our findings so the next group could prepare.

Roberto Rojo and Lorenzo Ortiz on the trail up to the bivouac at Tlanexilotl. *Gustavo Vela*

Irina, David Tirado, and Jabi ascended and went straight into the cave. Jabi started to work on reaching the window in the big pit I had seen earlier. Meanwhile, Irina and David mapped the 45-meter pitch to the squeeze, which only Irina could fit through. By then, Jabi had put in a pendulum 80 meters up and started rigging down the wall, but he ran out of rope, so the three returned to camp. The same day five people did a water carry up to the bivouac. After a week of good weather we were running dry.

The next day Irinia, David Tirado, and Jabi descended, and between showers Al and David Taberner moved up to the bivouac just in time to catch a good downpour and collect more water in an hour than the five had carried up the day before. Back at base camp, the rain was finding imperfections in our roofing, but at least we collected a lot of water. The following day was really rainy, so nobody left base. The two in the bivvie, however, took advantage of a brief break in the weather to slip into the cave, only to find a torrent pouring down the big pit and the rest of the cave a little more "interesting" than normal. A day later, the sun was again shining, so five in base did some prospecting from base camp and found four *sótanos*, while Al and David went down Tlanexilotl.

That evening there was no radio call from the bivouac, and people in base started to become concerned. Had something gone wrong? Or was it a simple matter of radio failure?

Next morning those in base camp

Animal, vegetable, and mineral. *Gustavo Vela*

were thinking up contingency plans and Fernando Pinto and Miguel Pessoa were ready to start up to see what had happened, when at 8 a.m. Al called in. Nothing was amiss; the radios just hadn't made contact. The bad news was that they'd done the traverse into the big window and found that it only led to an 8-meter drop that connected via a meander to the base of the big pit.

Mierda! So much work and so much hope put into that window, and the best it could do was connect back. Even worse, the best hope was now a 10-meter pitch down a tight meander that so far only two people had fit through. So that same afternoon Pinto, Pessoa, and Andreas moved up to work on the squeezes and the 10-meter pitch. At the same time a group from base took a look at an area on the *meseta* off to the east. Irina descended three pits, the biggest being 20 meters and the last climbable, only to end in tight passage.

Late the next evening we heard that a lot of hammer-and-chisel work had managed to widen out three squeezes, and the three had gotten down the 10-meter drop, only to be stopped by a 6-meter pit.

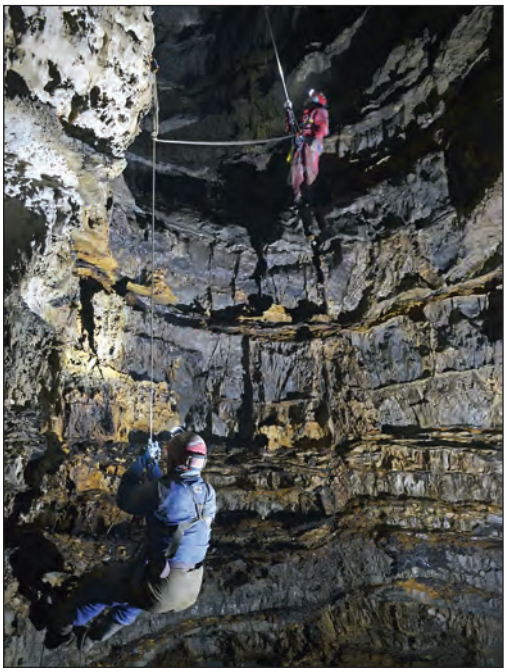
On this news the team of Irina, David Tirado, and Jabi once again went up to work on squeezes. By Saturday evening they were telling us at base that they'd gotten down the 6-meter drop and at its base found an longer, even tighter, and impassable meander, but below they could see a 30-meter pit. So near and yet so far. So near to the pit, so far from being able to explore it.

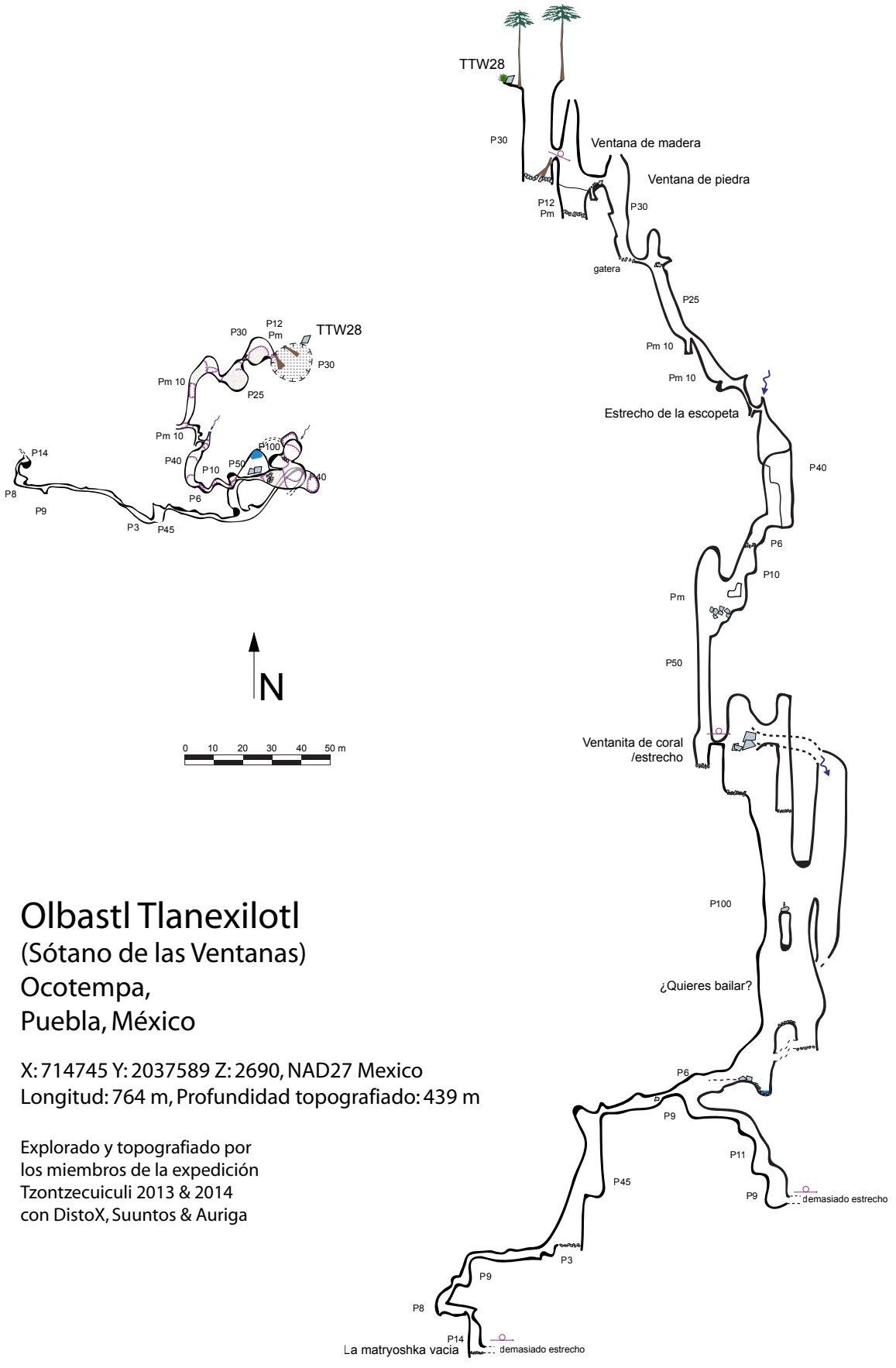
Sunday saw a team out east again prospecting shafts, but only got 10-meter and 17-meter holes. The same afternoon, David Taberner and Lorenzo Armas moved up to the bivvie planning to enter Tlanexilotl the next morning. Marta Candel, Roberto, and I decided to check out a small cave near camp that had a strong wind. Roberto dug out a lot of dirt until he believed that it might be possible to get through, so he shouted, "send in the assless." I slipped in, but my hips wouldn't fit. It's not that I have a big ass; the problem was with bones and rock, not flesh. Before pulling out, though, I noticed that it was also possible to widen out the other side, so I did, then called out, "send in the fat ass." Marta tried and successfully passed into this new route, which went 3 whole meters and turned into an impossible meander. We left disillusioned, collected our shovel, and went home. That evening Pinto, Pessoa, and Nacho Rafael moved up to the bivouac. David and Lorenzo tidied up some rigging, but with the drill once again sick, didn't get any farther in the meander. The next morning, the weekly rain came in and nobody went anywhere except those in the bivvie, who popped in to Tlanexilotl to try some photos.

On Wednesday a group of five from base camp took a look at some caves found some years ago and got a 50-meter pit and a scare from a very big boulder for their trouble. Pinto, Pessoa, and Nacho put a lot of work into the meander, but still couldn't get though. Later that day, Al, Marta, and Nacho went up to the bivouac, hoping to give the meander a good bash the next day.

In this third week of exploration we'd managed to push Tlanexilotl all of 800, well, centimeters and got it all the way from 417 to 425 meters deep. A lot of push trips, many hours of work, and a lot of scrapes to add 8 meters. So much work, but not a lot of results.

Roberto Rojo and Lorenzo Ortiz near the bottom of the big pit. *Gustavo Vela*





Olbastl Tlanexilotl

(Sótano de las Ventanas)
Ocotempa,
Puebla, México

X: 714745 Y: 2037589 Z: 2690, NAD27 Mexico
Longitud: 764 m, Profundidad topografiado: 439 m

Explorado y topografiado por
los miembros de la expedición
Tzontzecuiculi 2013 & 2014
con DistoX, Suuntos & Auriga

Friday now, and Marta, Nacho, and Al went in to try and enlarge the meander that was stopping us. Marta wiggled through a high part that nobody had really tried, but it still took a lot of effort to get the other two through, to where they rigged the "30-meter" pitch to find it to be 14 meters with no way on at the bottom—just a super-tight meander with air sucking into it. Was Tlanexilotl dead? The survey showed that they'd only gained 14 miserable meters. Disillusioned and tired, they returned to the surface, derigging, and hauling out the bottom ropes as they went.

On the 100-meter pitch, Lorenzo was hanging halfway up when a hum was heard. Little by little, the sound increased. Aiiii! A flood. When Roberto, Lorenzo, Jabi, and I had entered for a photo trip it was cloudy with occasional drizzle, but we hadn't thought much of it and went anyway. Besides, water makes for better photos. We couldn't look at that one last window with all this water around. Lorenzo was the last up, removing anchors as he went. We didn't expect any problem with water above the 100-meter pit, as most of Tlanexilotl was either dry or rigged well away from water, except perhaps for a few spots . . . .

Our concern increased, however, when a gush of water suddenly burst from a dry crevice. We realized that it was time for a cold bath. By the time Lorenzo had cleaned up the 100-meter pitch it was flowing well. There was a good sprinkle going down the 50 that soaked us pretty thoroughly. Not stupid, we got going as fast as we could, but it was inevitable that we'd be soaked. Sopping wet, we continued upwards. The 20 above also gave us a good drenching, but when we got to the 40, we were pleased that it was rigged so far from the water that we got up dry—or at least no wetter. The burst of adrenalin that had gotten us going was taking its toll, and now we felt tired and drained. Later, comfortable and warm in the bivouac, we joked about it all as we warmed ourselves by the fire.

Lorenzo Ortiz at the entrance to a narrow meander in Tlanexilotl. *Gustavo Vela*

Nacho and David Taberner were next up, to try that last window, at the top of the 100. Lorenzo, who had taken up residence in the bivvie, was there to join them. They managed the traverse across the blocks quite easily, but problems with the drill (again) restricted their ability. Still, they got across and found a pit that really needed bolts and, quite surprisingly for the top of such a pit, a series of meanders with an incoming stream. One hole failed the rock-drop test, as the rock reappeared in the main shaft, but there still remained one 15-meter shaft. On the basis of this Al and Enrique moved up from base camp for one last look. Lorenzo changed his mind about returning to base and went with them down the cave for the third day in a row. The undescended pit turned out to be 17 meters deep and completely blind, while the one in the meander connected to the main shaft. Only one last "last" window was left. Enrique had spotted it on his way up the 100-meter shaft. The only problem was that it was 40 meters down. Having come this far, we couldn't leave with one question haunting us, and after a quick evaluation Enrique was swinging about, whacking in fifteen anchors and penduluming under the water to reach what was indeed a parallel shaft about as far from the main route down as was possible. Unfortunately, once he reached it, it appeared to close down, and, just to make sure, he dropped rocks down it that bounced out into the main shaft.

By Monday, April 21, sad, a little disillusioned, and entirely frustrated we finally decided that Tlanexilotl was dead, at only 439 meters deep. It wasn't a quick or simple death. No simple pitch to nothing, derig, and leave. No, it played with us, almost closing several times, but offering a hope, offering a window or an alternative. How many dreams

Standing, from left, Lorenzo Orfiz, Gustavo Vela, Ignacio Rafael, Enrique Ogando, Fernando Pinto, Al Warild, David Taberner, Fabian Cuello,* Irina Ermakova. Sitting, from left, Roberto Rojo, Samuel Pessoa, Denise Vera,* Javier García, David Tirado, Marta Candel. *Guests who didn't participate in the expedition. *Gustavo Vela*

did we invest in this cave? Plenty. How much effort did we put in? Lots. Where does the air go? Where does the water go? No idea.

Over the next few days we removed the rope and anchors from the cave and prospected in the area some more, but nothing went. Al and I would like to thank everyone for coming and putting in such a strong effort. We should also mention Franco Attolini, one of the project leaders, who because of work couldn't come. This year we had cavers from more countries than ever, six in total.

Expedition members in alphabetical order:

Lorenzo Armas (México)
Marta Candel (Spain)
Irina Ermakova (Russia)
Javi García (País Vasco [Spain])
Andreas Klocker (Austria)
Lorenzo Ortiz (Mexico)
Miguel Pessoa (Portugal)
Fernando Pinto (Portugal)
Enrique Ogando (Spain)
Nacho Rafael (Spain)
Roberto Rojo (Mexico)
David Taberner (Australia)
David Tirado (Mexico)
Gustavo Vela (Mexico)
Alan Warild (Australia)

Roberto Rojo on the third pitch. *Gustavo Vela*

Expedición Tlanexilotl 2014

Del 27 de marzo al 27 de abril se reunieron 14 espeleólogos (4 de México, 4 de España, 2 de Australia, 2 de Portugal, 1 de Austria y una de Rusia) en la Sierra Negra, Puebla, con la finalidad de continuar la exploración de Olbastl Tlanexilotl (Sótano de las Ventanas) que habían dejado a 285 metros de profundidad desde el año pasado. Debido a la lejanía de la cueva que está a 6 km o 3 hrs caminando desde el campamento base se decidió montar un vivac para eficientar la exploración que no fue fácil ya que encontraron varias ventanas en algunos pozos pero todas cerraron, el camino que llegó mas profundo fue por donde se iba el agua pero encontraron varios meandros muy estrechos que tuvieron que abrir con maza y cincel. Después de tres semanas de arduo trabajo los deportistas llegaron a la profundidad de 439 metros, el aire y el agua se filtran por una grieta infranqueable. A la par de la exploración varios grupos se dedicaron a revisar entradas encontradas en otros años, ninguna siguió.

AUGUST IN THE JUNGLE

Peter Sprouse

In what seems to be the beginning of a tradition, cavers gathered for a few weeks of mid-August mapping on the coast of Quintana Roo. Summer along the coast is hot and sweaty, but not really all that different from any other time of the year, unless of course a hurricane happens along. Rains most afternoons offer a cool respite. For the August 2013 trip we had a variety of caves to visit between Playa del Carmen and Muyil. These are described below as they range from north to south.

Dos Árboles area. Just south of Playa del Carmen the federal highway passes over Sistema Dos Árboles, a meandering maze over 7 kilometers long that appears to be a disconnected downstream segment of the Río Escondido and Pool Tunich systems. It is a mostly dry labyrinth of walking and crawling passage, with plenty of things left to map and some nearby caves waiting to be connected. On this trip we would try to connect to Cueva del Higo Caído (Fallen Fig) on the northwest and Sistema Kana Kiwi on the southeast. To bridge the Fallen Fig gap, Devra Heyer and I took a look at two new entrances, Maestro and Esclava. At the end of the day these both continued, and later Cori Schwartz and I were able to connect them together and to Fallen Fig, making that cave 1190 meters long. But the connection to Dos Árboles is yet to happen, though they are now only 40 meters apart.

The southernmost part of Dos Árboles, within the Yucatan Explorer ATV Park, still had leads heading to the east toward Kana Kiwi. Andrea Futrell, Guin McDaid, Ben Schwartz, Cori Schwartz, and Zach Schwartz spent three days mapping watery maze in this area, which they named Burnsville in the Riviera Maya. Although they ran out of leads in that area, they got within 20 meters of connecting to Kana Kiwi, and they ran the length of Sistema Dos Árboles up to 7920 meters. Another cave in close proximity is Sistema Trono, located along a public bike path. Frank Binney, Devra Heyer, Janie Hopkins, Barbara Luke, Peter Sprouse, and Terri Sprouse pushed this cave to a new length of 1219 meters.

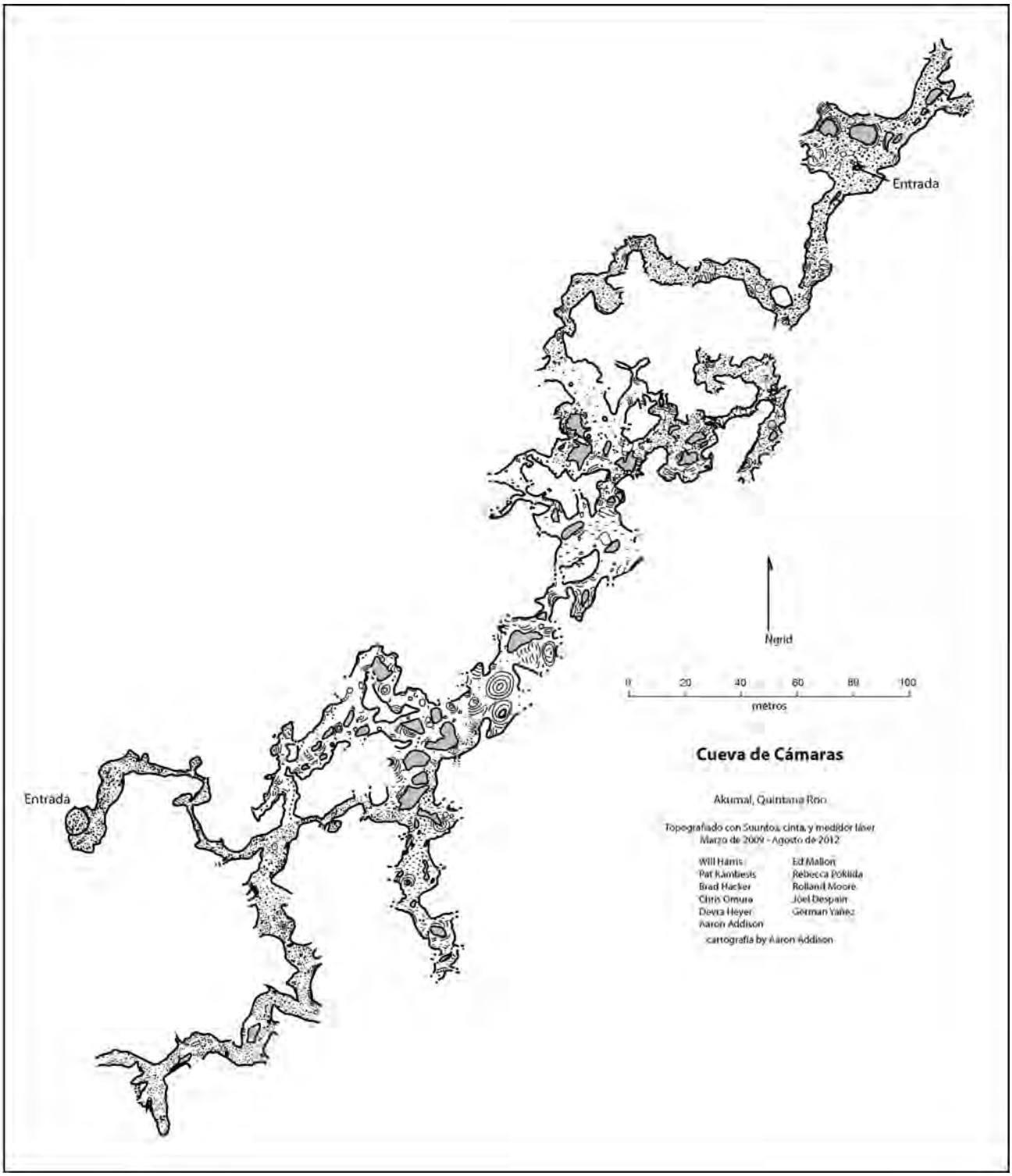
Paamul area. Between Playa del Carmen and Puerto Aventuras lies Paamul, "old pyramid" in Mayan. This has been the home of the NSS Paamul Grotto since 1999; lots of cave exploration is taking place there. Devra Heyer, Barbara Luke, and Kayleen McMonigal checked out various leads in Sistema Muévelo Rico, adding 86 meters to make it 1151 meters long, but did not find an expected extension to the southwest. Andrea Futrell and Pat Kambesis continued the survey of Cueva Tres Días, so named because it was initially thought that it would take three days to map. But Andrea and Pat left it going, and at 673 meters long it shows no signs of stopping.

The real action in Paamul on this trip was happening off to the north. Gil Harmon, founder of the Paamul Grotto, had years ago explored a number of large caves along what was now known as the Chain Road. A chain at the turn off the highway now blocked the way, with a resident guard watching it. But we knew the landowner next door, and he arranged for us to get in. So over the course of several weeks numerous trips were made out this old road, but they were made on foot, as it was a bit too rough for vehicles. But the hike was no more than 2 kilometers, and pleasant enough if it wasn't raining. Gil recalled several caves that he had visited, and we had waypoints for these, but before getting to them a large new cave was found. This became known as Aktun Zac, in honor of our youngest caver on the trip, and with 1204 meters surveyed it was the biggest project of the expedition. A bit farther out the road, another cave was mapped for 137 meters, but as the name Not Gil's Cave indicates, the good stuff is apparently still farther inland. Much remains to be done out the Chain Road, as in so many other places up and down the coast.

Xpuha area. The area south from Puerto Aventuras toward Akumal was known by the Maya as Xpuha. There are many famous underwater

Critters in a guano-rich area of Cech Chen. *Ben Schwartz*

petersprouse@yahoo.com


Entrada
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metros
Cueva de Cámaras
Akumal, Quintana Roo
Topografiado con Suuntos, cinta, y medidor láser
Marzo de 2009 - Agosto de 2012
Will Harris
Pat Kambesis
Brad Hacker
Chris Omuro
Devra Heyer
Aaron Addison
Ed Mallon
Rebecca Pohlida
Rolland Moore
Joel Despain
German Yañez
cartografía by Aaron Addison

Terri Sprouse in a pool in Cueva Alux. *Peter Sprouse*

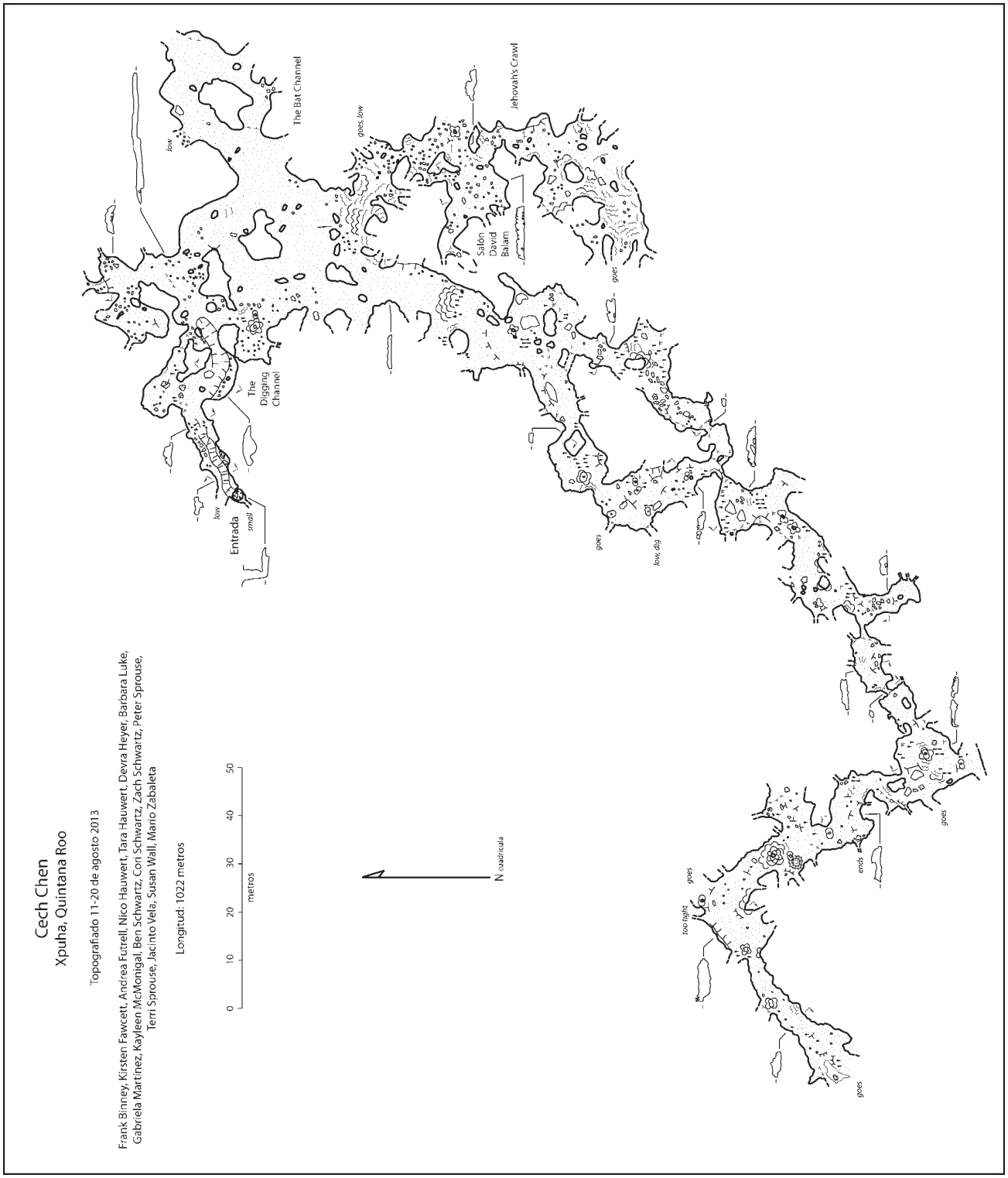
systems in this area, including Chac Mol (9,193 meters), Ponderosa (15,019 meters), and Tajma Ha (5,463 meters). On this trip we worked in two caves upstream of Sistema Taninah, where we had surveyed in conjunction with diver Alessandro Reato the year before. These two caves, Alux and Cheen, were shown to us by Germán Yañez of the Círculo Espeleológico del Mayab (CEM). We started in this area by meeting up again with Alessandro, who had been diving in the dry cave Nen Tun Ha, which was a short, private tourist cave with a fun water slide. Alex found that the underwater portion was much more extensive than the dry portion, and he had surfaced in an air-filled section with bats flying around. Naturally we were keen to find another entrance into this, so we arranged for him to dive to that spot and yell while Barbara Luke, Terri Sprouse, and I looked on the surface for an entrance. While we found some tiny openings, they were not promising, and we never heard Alex's calls. So we trekked farther out into the jungle to map Cueva Alux, which had been reported by Germán and also previously visited by Alan Formstone and Liliana Viola. When the three of us arrived at the entrance via a short jungle chop, we found a convenient wooden staircase leading down. This got us into a stream passage heading two ways. Upstream soon led to a sump. Downstream it led to a dry maze area and some low water passages and possible sumps.

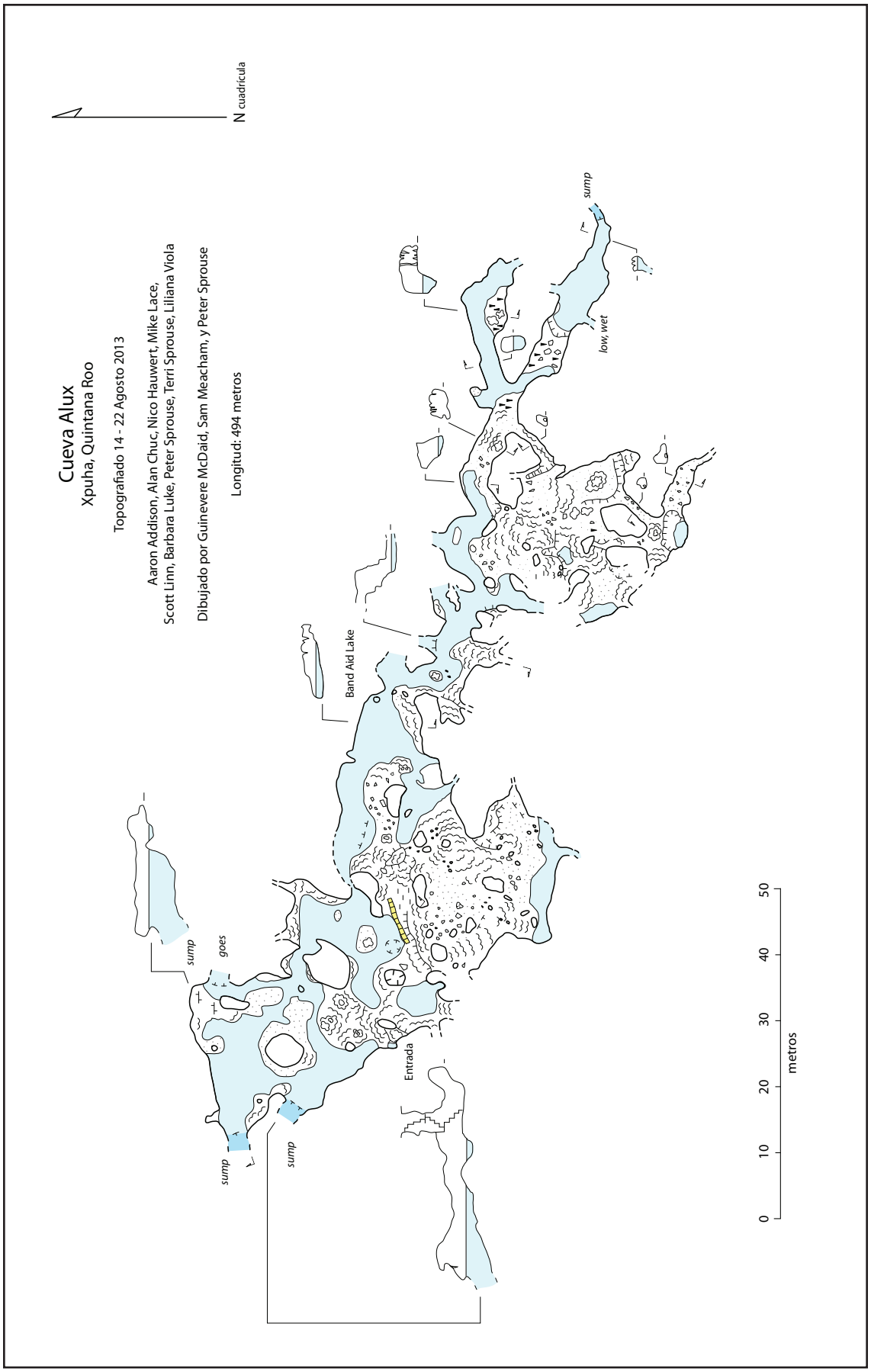
Meanwhile 600 meters to the northwest, Cueva Cheen was clearly an upstream extension of Alux. This was mapped in several trips by Kirsten Fawcett, Andrea Futrell, Devra Heyer, Barbara Luke, Guin McDaid, Roberto Rojo, Ben Schwartz, and Jacinto Vela. A short rappel lands beside the water, which like in Alux was a streamway flowing southeast toward the sea. Both upstream and downstream went for a ways to sumps, and 599 meters of passage was surveyed. Plans were made by the CEM cavers to dive the sumps.

One lead on our list to check out in the Xpuha area was on the property of a Canadian cave-diver friend. He told us that it led to a dry cave with perhaps a kilometer of passage. It was a 4-meter pit behind his house, located on an old beach ridge a bit higher than the surrounding terrain, which boded well for significant dry passage. We rigged a cable ladder to a tree and dropped into a stoopway where the floor had been trenched for 30 meters or so to allow easier passage. From there the cave was mostly hands-and-knees crawls, splitting into various routes that sucked in up to three teams at a time. Over the course of several trips, Frank Binney, Kirsten Fawcett, Andrea Futrell, Nico Hauwert, Tara Hauwert, Devra Heyer, Barbara Luke, Gabriela Martínez, Kayleen McMonigal, Ben Schwartz, Zach Schwartz, Cori Schwartz, Peter Sprouse, Terri Sprouse, Jacinto Vela, Susan Wall, and Mario Zabaleta all helped with the survey of this maze cave. It generally paralleled the coast underneath the beach ridge, and we concentrated on heading southwest, though it goes northeast as well. On the last push to the southwest, led by Ben Schwartz, they wiggled through some low areas beyond the signs of anyone having been there before. Soon they reached a guideline that was clearly set by someone coming up from another entrance ahead of them. There were even notes left by those explorers, including one signed by three people, and I recognized one of the names. When I contacted her she said that she had entered at Cenote Chikin Ha, part of 15-kilometer-long Sistema Ponderosa. So it seemed that a connection would soon be in the offing. For the time being we had mapped 1022 meters in what we were calling Cech Chen. *Chen* means well or pit in Mayan. *Cech* simply referred to the fact that our survey stations started with the CE and CH prefixes.

Zach Schwartz wading in Aktun Zac. *Ben Schwartz*

In the Akumal area, Aaron Addison led more trips into Cueva de Cámaras, which he has been mapping since 2009. This is another dry cave in a beach ridge, in fact the same beach ridge that Cech Chen is in, 11 kilometers to the south. The passage morphology is similar, so who knows, they may turn out to be the same cave. It was once, unusually, a single-entrance cave, but new pushes to the north brought the number of entrances up to four, and the length to 3123 meters. There is


Cech Chen
Xpuha, Quintana Roo
Topografiado 11-20 de agosto 2013
Frank Binney, Kirsten Fawcett, Andrea Futrell, Nico Hauwert, Tara Hauwert, Devra Heyer, Barbara Luke, Gabriela Martinez, Kayleen McMonigal, Ben Schwartz, Cori Schwartz, Zach Schwartz, Peter Sprouse, Terri Sprouse, Jacinto Vela, Susan Wall, Mario Zabaleta
Longitud: 1022 metros
0 10 20 30 40 50
metros
N cuadrícula
Entrada
small
low
The Digging Channel
The Bat Channel
low
goes, low
Salón David Balam
Jehovah's Crawl
goes
goes
low, dig
goes
too tight
goes
ends
goes
goes


Cueva Alux
Xpuha, Quintana Roo
Topografiado 14 - 22 Agosto 2013
Aaron Addison, Alan Chuc, Nico Hauwert, Mike Lace,
Scott Linn, Barbara Luke, Peter Sprouse, Terri Sprouse, Liliana Viola
Dibujado por Guinevere McDaid, Sam Meacham, y Peter Sprouse
Longitud: 494 metros
N cuadrícula
Band Aid Lake
Entrada
sump
goes
sump
sump
low, wet
sump
0
10
20
30
40
50
metros

Andrea Futrell inspects a cave-pearl pool in Cueva NGC (Not Gil Cave). *Ben Schwartz*

August 2013 Expedition Surveys

name	Aug. 2013 survey (m)	total length (m)
Aktun Zac	1204	
Cech Chen	1022	
Cueva de Cámaras	1012	3123
Cueva Cheen	599	
Sistema Dos Arboles	568	7920
Cenote King Kong	548	
Cueva Alux	494	
Cueva Tres Días	377	673
Cenote Chef	325	
Sistema del Higo Caído	295	1190
Sistema Trono	224	1219
Cueva Mariposa Apestosa	163	
Cueva NGC	137	
Cueva Xibalbá	102	
Sistema Muévelo Rico	86	1151
Cueva Fracasa	70	
Cenote Jaguar Cove	58	
Cenote Softcore	50	
Cueva Tres Entradas	36	
Cueva Huérfano Iowa	33	
Cenote Rescatado	20	
Cueva Jaguar	13	
Cueva Beeware	7	
Expedition total	*7443*	

still no end in sight to this cave, and with several extensive underwater caves nearby, the potential for connections is good.

Chemuyil area. Chemuyil is close to Tulum, and is close to the area of the world's longest underwater caves. Sistema Xunaan Ha (52 kilometers long) underlies the village of Chemuyil, and K'oox Baal (75 kilometers) and Sac Actun (319 kilometers, including dry connecting passage) are nearby. There are dry passages over these underwater systems, and we got a chance to map some of them on this trip. Local resident Jean Luc has a cave on his property just west of the village, and it turned out to be a cave previously reported to the Quintana Roo Speleological Survey as Cenote Chef. It had 325 meters of passage. Farther west, out the Chemuyil jungle road, our friends Mauro and Jason took us to a property where they have been exploring underwater Cenote Softcore, Cenote Jaguar Cove, and Cenote Rescatado. The first two of these had dry cave passages near the entrances that we mapped. They also showed us an impressive collapse entrance into a dry cave, where a troop of monkeys was hanging out in the trees. Cenote King Kong turned out to be 548 meters long. A couple of smaller caves close to Dos Ojos were also mapped, Cueva Xibalbá and Cueva Jaguar.

Muyil area. Mauro also took us to some dry caves south of Tulum, with hopes that these might prove the key to connecting some nearby underwater systems. Cueva Mariposa Apestosa (163 meters) and Cueva Huérfano Iowa (33 meters) were, unfortunately, disappointing in that regard.

All told, 7443 meters of cave passage was mapped on this trip, with plenty of things to follow up on in the future.

Agosto en la Selva

En agosto del 2013, espeleólogos exploraron y topografiaron cuevas secas a lo largo de la costa de Quintana Roo, desde cerca de Playa del Carmen hasta Tulum. La mayoría de las cuevas fueron cortas; sin embargo, se logró aumentar la longitud del Sistema Dos Arboles a casi 8 kilómetros, la cual se dirige hacia la costa desde los sistemas Río Encondido y Pool Tunich.

SÓTANO DE YERBANIZ

William R. Elliott

This report is a follow-up to last year's article on *Astyanax* cavefishes in this newsletter[1] and a preview of what will come in an AMCS bulletin on the *Astyanax* caves of Mexico. In 2015 I hope to publish that bulletin on about thirty cavefish sites in the Sierra de El Abra and Sierra de Guatemala, San Luis Potosí and Tamaulipas, and one cave in Guerrero that contains an interesting population of evolving cavefishes.

After forty-five years I am sharing my map of Sótano de Yerbaniz with cavers and biologists. What a long journey! But it was worth the effort to redraw the July 1969 survey by Don Broussard, Jim McIntire, and me. I originally drew the pencil draft and then inked the map on two large sheets in 1969–1970, but unfortunately it was never published. Fortunately, I archived my survey notes and the two map sheets with the Association for Mexican Cave Studies and the Texas Speleological Survey in Austin. I recently traced the maps from scans of the notes and old maps, but over a new line plot. Yerbaniz is the most complicated cave map I have ever drawn. It took six days to map and months to draw. The original data processing was with pencil, paper, slide rule, and drafting machine. This new, more accurate version used the Walls program and Adobe Illustrator 12.

The cave was discovered from pilot Richard Albert's airplane on 25 January 1969 by Robert Mitchell, Francis Rose, Richard Albert, and Tom Albert. It was an accidental discovery as they searched at dusk for the landing strip at nearby Ponciano Arriaga after scouting for cavefish caves. Little did they know they had found one of the most complex and biologically rich caves of Mexico.[2,3]

Tony Mollhagen and Francis Rose, of Mitchell's research team from Texas Tech University, descended the 63-meter entrance pit on 28 January 1969. The next day Mitchell, Rose, Richard, and his son Tom Albert entered the cave with more Goldline rope, explored parts of the first and second levels, and collected eyed, surface *Astyanax* in pools on the upper level. They used two Jumars in the Texas prusik system to ascend. On 31 January 1969 the cave was explored to Level 3 by Jerry Broadus, David Honea, Ann Lucas, Russell Harmon, Tony Mollhagen, and Joe Cepeda, who collected several cavefishes in Lake 1 on the lowest level, about 96 or 97 meters below the entrance. On 2 February 1969, a sizable collection of cavefishes was made from the same lake by Bob Mitchell and Bill Russell.

Sótano de Yerbaniz is in the Arroyo Yerbaniz, about 22 kilometers north of Ciudad Valles, San Luis Potosí. Also discovered from the air and downstream are Sótano de Matapalma, 1.4 kilometers away in a straight line, and Sótano de Japonés, 2 kilometers away. This trio form what I call the Yerbaniz Cluster, with older caves in succession from north to south. Yerbaniz is the youngest and probably the most hydrologically active of the three fish caves.

The Arroyo Yerbaniz drains the largest area of any of the arroyos captured by fish caves, about 16 square kilometers. Surface fishes inhabit the arroyo, but the arroyo does not support a permanently flowing stream. In its course the fish populations are maintained in pools, some of which may be unseen deep in the bed of the arroyo.

The name, *yerbaniz*, refers to an herb, like St. John's Wort, the flowers of which are used in religious ceremonies on the Día de Los Muertos, according to Juan Gloria, friend to cavers in Cd. Valles, but now deceased. It is also spelled *yerbanís* or *hierba anís*.

Yerbaniz has fifteen pits, including the entrance, connecting three levels, and three lakes on Level 3, which is in two parts. The aggregate horizontal length is 2,075 meters. This is a challenge to represent on one plane. I rendered the new map in three translucent colors to depict the overlapping levels, and I labeled the pits in three series. Pits from Level 1 to Level 2 are numbered as pit 1.1 through pit 1.7. Level 2 pits are pit 2.1 through 2.4. Pits on Level 3 are pit 3.1 through 3.3.

Yerbaniz has massive floods and food input, and there is a large *Astyanax* cavefish population in the scummy Lake 1. Eyed, surface *Astyanax* are sometimes found on Levels 1 and 2 in shallow pools, but they usually are starving and are often swept away by floods. They become food for the cavefishes. The cavefish are survivors, and they can put on massive fat deposits during good times to make it through the lean times.

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The entrance to Sótano de Yerbaniz, in a 1969 photo by Robert W. Mitchell.

The entrance of the cave is an elliptical slot about 10 meters long by 1 to 4 meters wide. It lies in the northern edge of the Arroyo Yerbaniz at an elevation of about 260 meters, according to Google Earth and the Las Palmas 1:50,000 topographic map, not 241.5 meters as given in Mitchell et al. in 1977;[2] survey benchmark elevations have been revised upward since then. The location in that paper is also erroneous. Although a relatively young opening, the entrance is of sufficient size to capture all of the water flowing down Arroyo Yerbaniz except at high flood stage. Water can move past the entrance at such times, as demonstrated in September 1969, when Bill Russell visited the cave entrance immediately after a very heavy rain. So much water was being carried in the arroyo that the entrance could not take all of it. Water about 1 meter deep was flowing by the entrance, where a large whirlpool took water down; at another point mist shot up about 12 meters where air was exhausted from the cave. The results of such violent flooding are seen within the cave, with cobble piles, large palm trunks wedged into corners, and log jams scattered in the floodwater mazes of Levels 1 and 2.

The cave is a joint-controlled, three-level, floodwater maze with one major flow path to Lake 1 and two overflow paths to Lakes 2 and 3. The entrance pit drops to Level 1, which has joint sets at about 25° and 330°, witnessed by bedrock pillars in wide rooms and in narrow passages. Level 1, consisting of several large rooms, small intersecting passages, and one long northeast-trending passage, lies at 54–56 meters beneath the entrance datum.

Level 2, at about –68 to –88 meters, has two large rooms (depending on your perspective), many small intersecting passages, one long northwest-trending passage to a part of Level 3 with Lake 3, and a shorter south-trending passage, the Blind Scorpion Passage. Joint sets are about 0°, 45°, and 75°, with pillars trending along those joints.

The rest of Level 3, consisting of the Lake 1 Room the size of a football field and two long overflow passageways, lies about 91–97 meters beneath the entrance. Joint sets are about 45°, 75° and 330°. The deepest points in the cave, the surfaces of three lakes in Level 3, lie 96–97 meters beneath the entrance, or at an elevation of 163 meters, not 146.5 as stated in Mitchell et al. These three lakes probably are at local base level, connected via submerged passages. The water is warm, about 29° C in July 1969.

I entered Yerbaniz fourteen times over three years. On 31 July 1969, the last day of the survey, I was fortunate to discover a delicate blind scorpion on Level 2, hence the Blind Scorpion Passage on the map. Or rather the tiny, translucent scorpion found me, on my right thigh. I had been brushing off little amphibious *Brackenridgia* isopods as we surveyed the tubular passage, crouching against the wet walls. I was about to brush another one off when I looked down and saw what was to become the holotype specimen of a new species to science. I swore out loud and jumped up and down three times, then I collected it. Dr. Mitchell later described it as *Typhlochactas elliotti*.[4] He found that it was similar to two other blind cave scorpions in Mexico that he had published. Return trips found only two more specimens. Years later it is still considered the world's most troglomorphic (cave-adapted) scorpion, and it is now by itself in the genus *Sotanochactas*.[5] This was an exciting find, especially since we did not know that blind scorpions could occur in the lowland tropics—the others were from montane areas. This helped form our idea that cave-animal evolution is possible, even common, in the tropics.

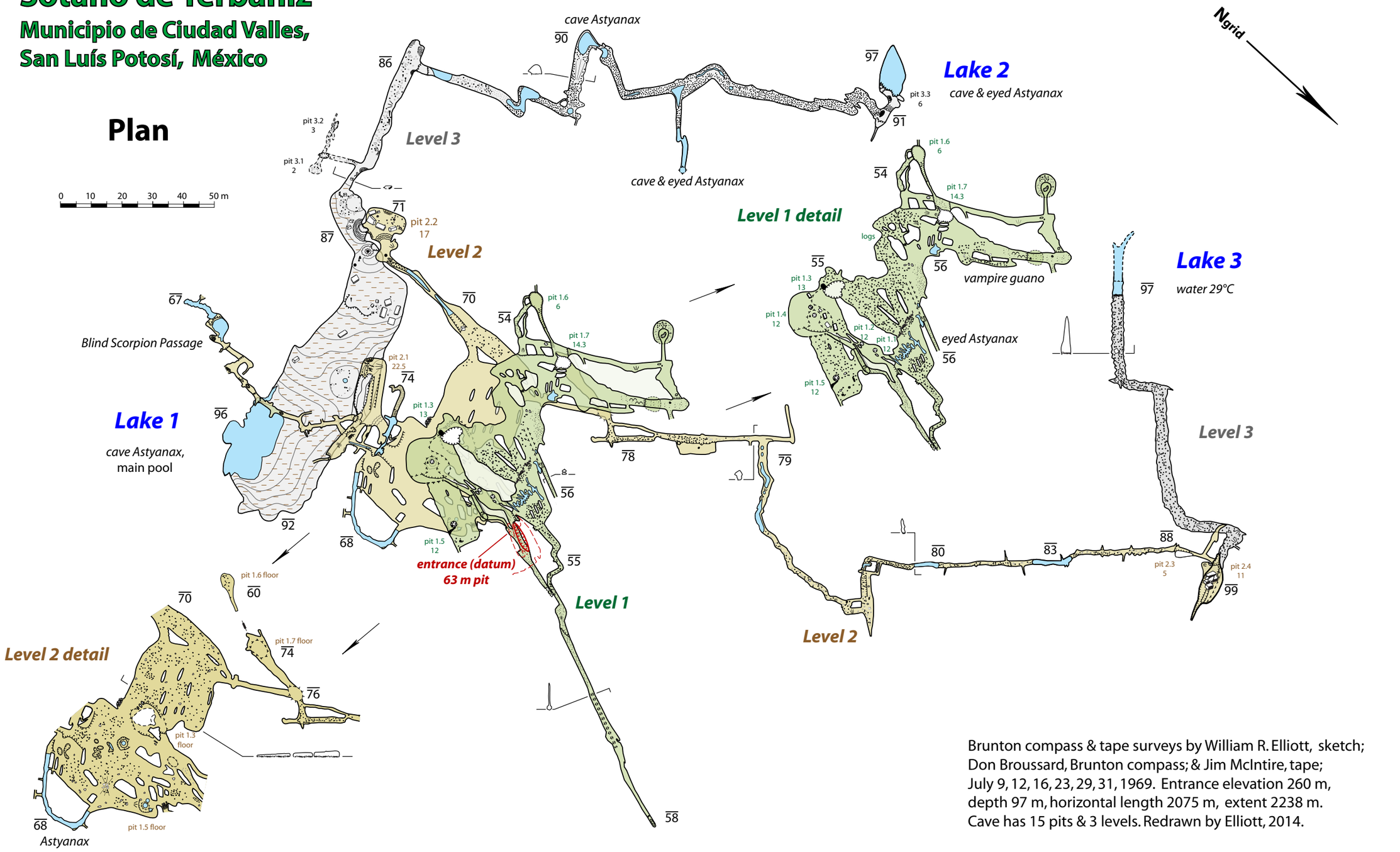
Some of us also found a new

Francis Rose climbing out of Yerbaniz. *Robert Mitchell*

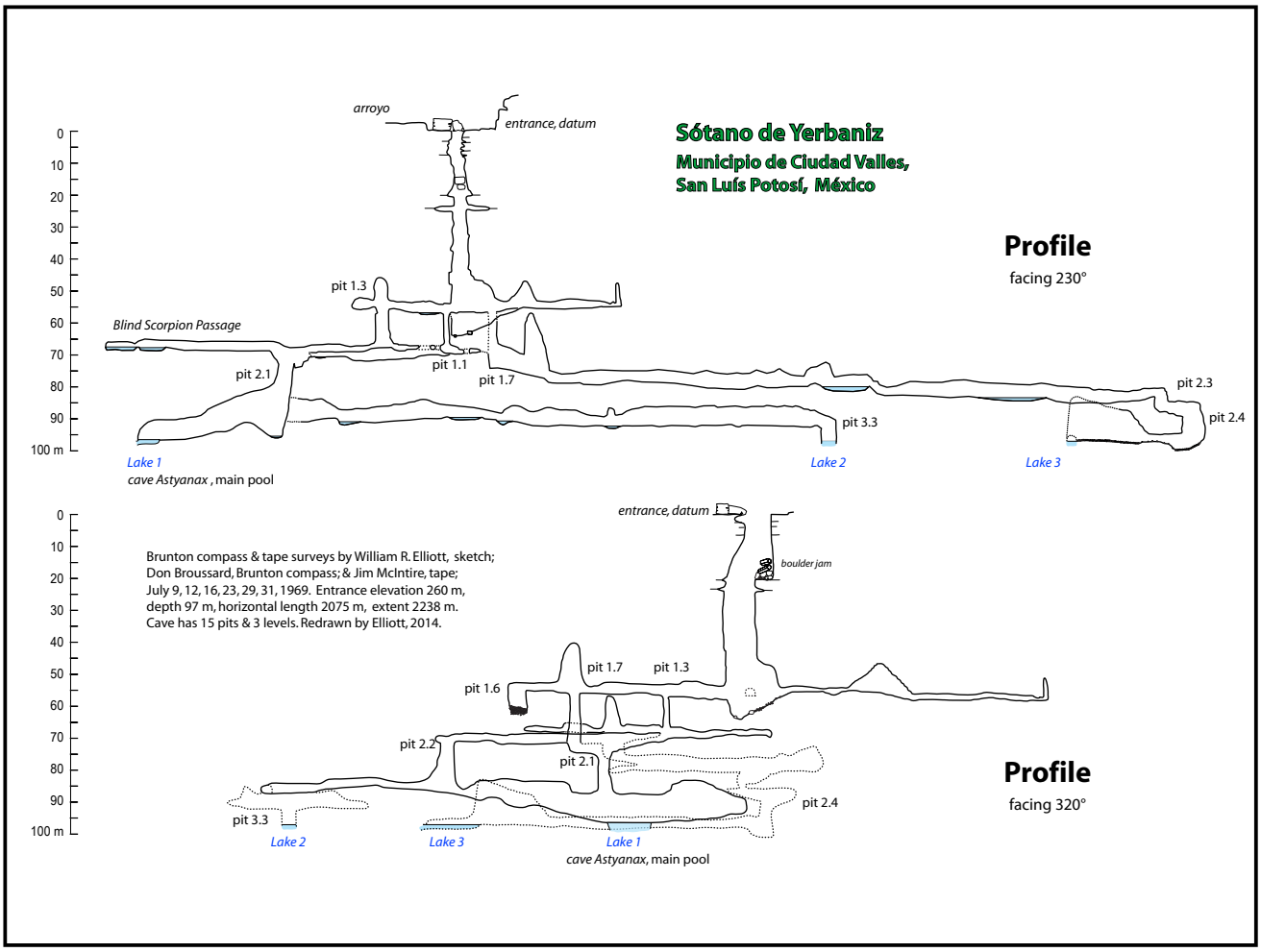
Sótano de Yerbaniz

Municipio de Ciudad Valles, San Luís Potosí, México

Plan



Brunton compass & tape surveys by William R. Elliott, sketch; Don Broussard, Brunton compass; & Jim McIntire, tape; July 9, 12, 16, 23, 29, 31, 1969. Entrance elevation 260 m, depth 97 m, horizontal length 2075 m, extent 2238 m. Cave has 15 pits & 3 levels. Redrawn by Elliott, 2014.



Francis Rose with flood debris in Sótano de Yerbaniz. *Robert W. Mitchell*

Sotanochactas elliotti (Mitchell, 1971), by Robert W. Mitchell, courtesy of Robert and Linda Mitchell.

genus and species of cave schizomid, *Agastoschizomus lucifer*. Schizomids are tiny arachnids, relatives of the whip-scorpions, but this one is relatively large. In 1970 Suzanne Wiley and I witnessed something strange on Level 2 while we were checking fish pools in the cave for her master's thesis. We found an *A. lucifer* sitting in a tiny rimstone pool on the wall. We thought it must have drowned, but when we gently poked the creature it walked up out of the pool onto the wall. Wow! They are not supposed to be amphibious, but maybe in that environment scorpions and schizomids have become so. We are not sure. On a return trip to the cave Suzanne's carefully documented fish pools had been totally blown out by a flood. That told us how tough it is for fish in upper-level pools, but she needed a thesis study, so she ended up doing one on *Rhadine* cave beetles in Texas.

In March 1971 Mel Brownfield and I made cavefish population estimates in Yerbaniz and Cueva del Pachón, which is near the northern El Abra pass. Using a two-census, mark-recapture method (Lincoln Index), I statistically estimated the Lake 1 population in Yerbaniz at roughly 8,700. Pachón also had a large population, about 9,800. Because of the limited number of marked fish recaptured, the uncertainties in these numbers are large, but all in all, I think that there could be astronomically large numbers of cavefishes in the El Abra region at base level, not in upper pools. The bottom of Sótano de Soyate also has a large population of cavefishes, not yet estimated. This is interesting to cavefish biologists because it could mean large amounts of genetic variation available for evolution in different isolated or semi-isolated populations.

We had a cave rescue at Yerbaniz in 1972 during a graduate arachnology class trip from Texas Tech, led by Mitchell. Some of us took John A. L. Cooke, British arachnologist, into the cave to photograph scorpions and schizomids. Mitchell always assumed that everyone could keep up with his maniacal pace, but Dr. Cooke had never been on rope, he was big, and he had a cold too. He tired out when we returned to Level 1, so we let him bivouac on a comfortable spot while we went to our hotel in Cd. Valles. The next morning we had our usual breakfast at the Café Condesa, and then we took John a *bistec milanesa* and a beer. I rappelled in with his breakfast, and I think he downed the beer before he touched the food. Then the class of about ten guys hoisted him out of the pit. All were happy, and we went on to the next maniacal thing.

1. William R. Elliott, 2013. Astyanax International Meeting 2013. *AMCS Activities Newsletter* 36, p. 66–69.
2. Robert W. Mitchell, William H. Russell, and William R. Elliott. 1977. *Mexican Eyeless Characin Fishes, Genus* Astyanax*: Environment, Distribution, and Evolution*. Special Publications of the Museum, Texas Tech University, no. 12, 89 p.
3. Richard Albert, 2006. The Great Sierra de El Abra Caving Expedition. *AMCS Activities Newsletter* 29, p. 132–143.
4. Robert Mitchell, 1971. *Typhlochactas elliotti*, a new eyeless cave scorpion from Mexico (Scorpionidae, Chactidae). *Annales de Spéléologie*, vol. 26, p. 135–148.
5. Oscar Francke, 1986. A new genus and a new species of troglobite scorpion from Mexico (Chactoidea, Superstitioninae, Typhlochactini), *in* James R. Reddell, ed., *Studies on the Cave and Endogean Fauna of North America*, Texas Memorial Museum Speleological Monographs 1, p. 5–9.

Sótano de Yerbaniz

El Sótano de Yerbaniz es una gruta importante en La Sierra de El Abra, con pescados ciegos *Astyanax*. El sótano fue descubierto por avión en 1969. El es un laberinto de inundación controlado por grietas, con tres niveles y 15 tiros. Hay un camino del flujo principal al Lago 1 y dos caminos del desbordamiento a Lagos 2 y 3. Profundidad total es de 97 metros y la longitud horizontal 2075 metros. Un alacrán ciego único y un schizomid fueron descubiertos en la cueva.

SISTEMA MURENA

Mauro Bordignon

Sistema Murena is a cave system in Akumal, along the Caribbean coast of Quintana Roo. It extends to the north underneath the Sirenis and Grand Palladium resort hotels, paralleling the coast for 4.5 kilometers so far. I started diving the Murena entrance almost by chance, since I live in the development owned by the Hotel Sirenis. There are lots of dirt roads where I like to go running, and one of these leads to the north side of the Yalku Lagoon, by a big spring that's impossible not to notice. The outflow changes with the tides and the seasons, but it is always present, a clear invitation to explore some cave. My first dive in Sistema Murena was in July 2012. I went in with a friend, Jason Renoux, and laid a few hundred feet of line in tight passage with major restrictions and a very promising flow. Right at the entrance a big green moray eel approached us in a "friendly" manner, inspiring the name. I had no idea of the unusual cave that would develop beyond.

The real exploration started a few months later, in October, when I did a series of dives with J. F. Huard from the Murena entrance in the lagoon, as well as from another cenote a bit north of it that we called Cenote Ballena. Connecting the two was easy, and the cave showed its full potential and its north-south general trend. North of Ballena, unlike the initial section with classic coastal-cave features like fractures and breakdown areas, we found bigger spaces. We entered a wide bedding plane with a very evident halocline close to the floor and rooms connected to one another through tight vertical passages, but with no tunnel continuing. Just after getting bigger, the cave seemed to choke into numerous little cracks. At that point I had to set aside the exploration for a while, but in March 2013 I was able to go back again with J. F. We started where we had left it, checking the tight cracks one by one. Finally I found the way through, a chimney going from the –8-meter level to a passage at 2 meters depth and then down again into a bigger tunnel. In eight days of diving we managed to find 4,500 meters of new cave. After that I continued the exploration alone, at first pushing south from Yalku.

I had heard from friends in Akumal about Greg Brown, a guy who had explored two caves just behind the Akumal beach front called Ak Kimin and Laguna Lagarto. Greg passed away a few years ago, and everybody who knew him had nothing but cool memories about the guy. Continuing the exploration that he had started seemed the best way to honor his memory. I checked with Jim Coke of the Quintana Roo Speleological Survey for more information about those caves. He and Johanna DeGroot were the first to dive Laguna Lagarto, around 1988, when they had explored the first part from the entrance south towards Akumal, but they never went back to explore the cave thoroughly. Greg had started exploring from a cave behind Hacienda Tortuga near Akumal beach in 2000, calling it Ak Kimin (dead turtle in Mayan) because of the sea-turtle skeletons that are common in that section. He explored using backmount steel 104s. His Ak Kimin project ran until late 2001. The larger passage went north, where he found a connection to the southern part of Yalku Lagoon, and finally the northwestern entrance in Yalku, probably the one I named Murena, and the

Steve Martin swims at the halocline, where fresh water overlies saltwater, producing a dramatic visual effect at the surprisingly sharp boundary. Here the halocline is at a depth of 7 meters. *Mauro Bordignon*

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Mauro Bordignon at a sidemount restriction. *Steve Martin*

Mauro Bordignon inspects the skeleton of a large sea turtle. *Steve Martin*

other one I have been using in the lagoon. This was the northernmost point of his exploration.

Greg also explored south from the Ak Kimin Cenote for some distance, but he had to stop when the cave became too small for his backmount configuration. He then started exploring from the Backdoor Cenote behind what is now the Centro Ecológico Akumal dormitory. From the Backdoor Cenote he explored north through fracture passage for over 900 meters until the passage again became too small for his gear configuration. Greg turned south from the Backdoor Cenote to arrive at the Laguna Lagartos opening, where he eventually found the original guideline laid by Jim and Johanna. In later years Greg did some photography in the cave and started drawing a map of the two caves that he ultimately did not finish. I connected into Ak Kimin on May 1, 2013, but the old line was in very bad shape. Due to its proximity of the sea, corals and sponges grew all over it, and, while it wasn't broken, it was about to be. This may be the reason why I hadn't seen any line at the Murena entrance; it probably broke and got buried in the sand during a hurricane.

I started laying new line and resurveying. The cave was amazing. Only 90 meters from the southern Yalku Lagoon entrance I found a fracture that descends straight down to –42 meters, and another fracture close to Cenote Ak Kimin goes down to –68 meters. It took quite a few long dives to get it all done, all from my first entrance in Yalku. On October 28 I managed to connect into Greg's Laguna Lagarto line through a sidemount restriction. Once I accomplished this I went back north. On the previous exploration I had stopped right at a collapse under the Sirenis Hotel. This time I managed to bypass the collapse by a deeper saltwater passage that led me to a wide part of the cave and eventually to a cenote right by the hotel theater. From there I found a vertical slot with various major restrictions, and while swimming sideways I wondered how long the fracture could go on like that. Finally, 250 meters farther north it opened up into another complex area, with a tunnel going north. Tight passages led down into the saltwater layer to the left, and collapse areas extended up to numerous air pockets to the right. Following one of the leads to the right of the line, toward the coast, I found Cenote 82, a proper opening, with more than 50 meters of open water surface. I am currently waiting for permission to cut a trail to this cenote, since diving from here will save around seventy minutes of combined scootering and swimming, and most importantly will bypass the vertical slot, which involves a complicated maneuver pushing tanks in front.

As of April 15, 2014, Sistema Murena had a total length of 14,205 meters (44,604 feet), most of it consisting of passages parallel to the coastline, a unique cave morphology for Quintana Roo. The distance from the northern to the southern point is around 4.5 kilometers.

Sistema Murena

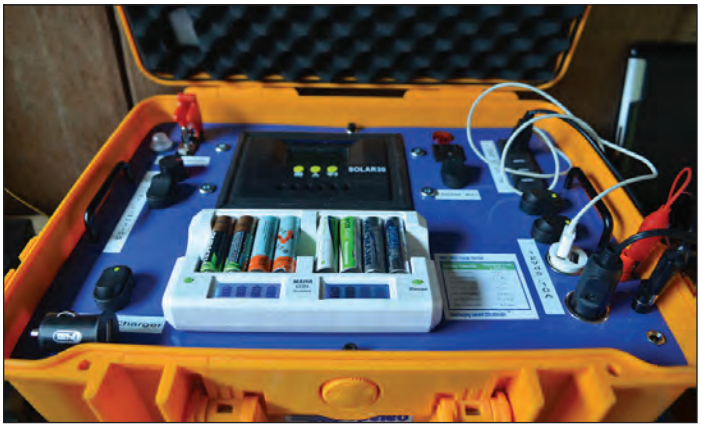
Sistema Murena es una cueva inundada inusual en Quintana Roo. Tiene una longitud de unos 4,5 kilómetros que corren paralelos a la costa, y sin pasajes que se dirijan hacia el interior de ésta. Se extiende al norte desde Akumal y corre por debajo de los hoteles resort Grand Sirenis y Grand Paladium. Se han explorado 14,205 metros.

PHOTOGRAPHY BY GUSTAVO VELA TURCOTT

Mexpé 2014 expedition of the Société Québécoise de Spéléologie

turmalinero@yahoo.com

Clockwise from upper left:
Scenery in the Sierra Negra, Puebla
Ramses Miranda in Cueva Chupa Pierna, Puebla
Roberto Rojo at the pool in Cueva Chupa Pierna
Charging station in camp
Dragonfly
Roberto Rojo traversing in Cueve Chupapolla
Roberto Rojo and Angeles Verde in a new 40-meter pit in Cueva Chupa Pierna



POOL TUNICH AREA, NOVEMBER 2013

Chris Lloyd

Once again the Paamul Grotto of Quintana Roo in Mexico hosted an expedition, this one in November 2013 to explore the caves around the Pool Tunich area, just north of Paamul. Some twenty-one people flew in from across Canada, the USA, and Mexico to join twelve local cavers to continue the project that is in its fourth year now. This trip would again be based out of a camp at Cleoxxo's Bar, located right over the mid-section of Pool Tunich, a multi-entrance cave that was 35.18 kilometers long before this trip. The focus of the expedition was to connect nearby caves into the Pool Tunich system and locate and map additional caves in the area. For the first time, this trip would include cave divers to help on the underwater sections. The expedition participants were Aida Ferreira, Alan Formstone, Andrea Corlett, Andy Belski, Chris (Batgirl) Omura, Chad Pedigo, Chris Lloyd, Cyndie Walck, David Moore, Ed Sitch, Elsi Lara, Emiliano Monroy, Fofo González, Geraldine Salignac, German Yañez, Gil Harmon, Heather Túcek, Jared Habiak, Jennifer Hopper, Kris Peña, Liliana Viola, Lydia Hernández, Mario Zabaleta, Matt Turner, Michel Vázquez, Peter Sprouse, Roberto (Chibebo) Rojo, Rodrigo (Roko) Ville, Shane Fryer, Terri Sprouse, Thomas Sitch, Tommy (Tommy-Gun) Livingstone, and Will Quast.

Saturday the twenty-third saw four teams out exploring, with Peter and Andy taking groups into the south end of Pool Tunich by the Sac Xuux entrance and to the nearby Sistema Río Escondido. Hopes of a quick connection between the two systems did not work out, despite pushing all available leads. Andy and Chad spotted one possible sump on the Río Escondido side. At the far north end of the system, Chris and Cyndie took their teams in the Coati Entrance of Cueva de los Ángeles Llorandos (Cave of the Weeping Angels) to survey the dry passage that diver Alan Formstone had located on a dive earlier in the year. Alan had come down from farther north, popped up into dry cave, traversed that, and continued on underwater to eventually surface in the north end of Pool Tunich. So the objective here was to survey the dry stuff and connect to the wet stuff, thus add all of Weeping Angels into the Pool Tunich system. Since Alan had found the cave from the inside, there was no existing trail to get to the entrance, so the group cut a trail with machetes, aiming for the known GPS coordinates. This went well, aside from Cyndie finding out what burning caterpillars are after brushing one on a tree. The chemical burn was still noticeable a few days later. The entrance was a comfortable 7 meters wide by 2 meters high and opened into a large chamber sloping down to water. Chris and Elsi completed 236 meters of survey starting from the entrance, while Cyndie and Shane added another 213 meters starting in the north end, then jumping over into the middle of the cave. They ended up leaving a small gap between the surveys in the north, not seeing any dive line to connect to. With water levels high this year due to continued rains, the dive line was presumed to be under water. A chat with Alan that night gave them some idea of where to look more closely on the next trip.

More cavers had arrived by Sunday the twenty-fourth, and seven teams were out collecting survey data. Weeping Angels took three teams, with Chris going to finish off the gap between the previous surveys and look for the dive line, to no avail. It was only later, while taking some photos, that Elsi spotted the plastic tag on the line just under water almost where they started the survey. So that was promptly surveyed to make that part of the connection. Meanwhile Cyndie and Shane were filling in the large dry passage to the south and Andrea and Tommy-Gun were completing

Thomas Sitch in Winik Sateem. *Chris Lloyd*

cjlloyd@prodigy.net.mx
Canadian Caver 79, February 2014, pages 16–27.

Cyndie Walck sketching in the Angeles Llorandos section of Pool Tunich. *Chris Lloyd*

the wet part. Again the dive line proved elusive, but perseverance paid off in the end, and the southern connection was made as well, adding in the whole of the Weeping Angels to the Pool Tunich system. Another attempted connection of Sistema Río Escondido, this one to Naj Woolis, a cave downstream toward the coast, was not successful. Peter had Thomas and Ed Sitch with him, and though they had some success digging, they were still left with a 10-meter gap between the systems. Will with his team of Kris and Lydia did add some survey to Naj Woolis, which continues toward the coast.

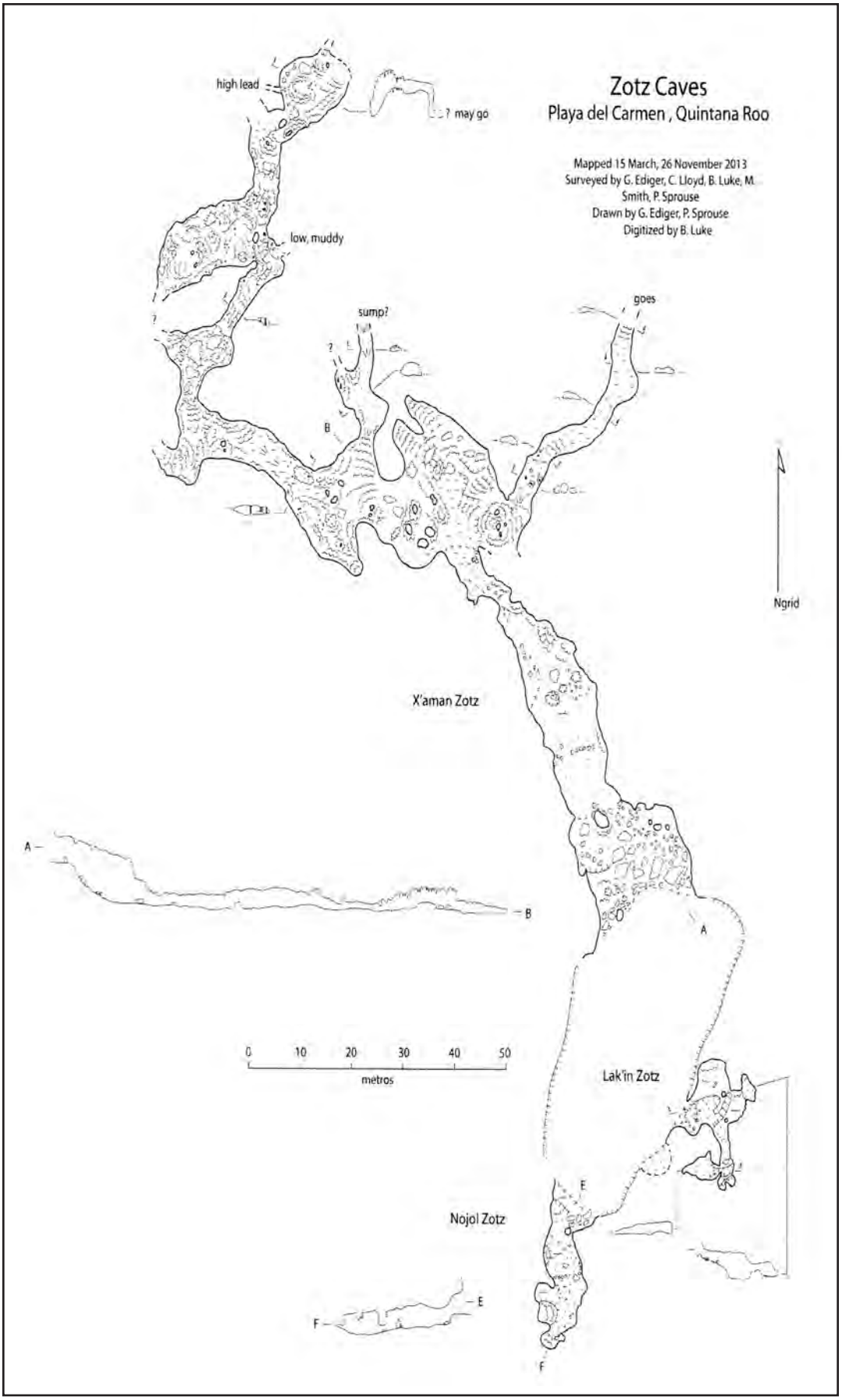
Some of the other newcomers decided to try their luck at finding new caves using some new topographical data we had. Better contour resolution seemed to be showing collapsed sinks and dolines, so they started out to check a promising-looking sink. Half a day of chopping a trail through the jungle took them to a closed sinkhole. It was right where it should be, but with no going passage. So after a return to camp and a few refreshments, they went back in to a series of promising collapses, hoping to find something heading off some side of a long, collapsed doline. By mid-afternoon they were about ready to call it a day when they stumbled upon an 8-meter-wide entrance that dropped under an arch and into what appeared to be a sizable cave. So Andy and Fofo each took a team in and quickly knocked off 94 and 93 meters of survey in what they would call Cueva del Arco del Triunfo (or later in Mayan, Chéel Náajal).

While all this "dry" (not counting all the sweating) caving was going on, the cave divers were busy looking for sumps to dive. They had some issues finding the two small vertical entrances not far from camp, but were helped out by Heather, who was heading into the main Pool Tunich entrance to locate the planned sump dive there. But with this year's higher water levels, the route just to get to the sump involved passing three short sumps. They just called them duck-unders, but if the water is up the roof and you need to swim underwater to get to the other side, that is a sump by most definitions. Not a big deal for the real divers, but Heather and Terri also cruised bravely through those and helped get David and Matt set up for a night dive, which they did after dinner. This particular sump had been dived before, but no information or map was available, so David and Matt followed the old dive line to see what they were up against and get set up for mapping. The day's total of surveying came in at just over 1000 meters, so the meters were adding up.

Elsi Lara in the Angeles Llorandos section of Pool Tunich. *Chris Lloyd*

Monday the twenty-fifth again saw seven teams out exploring, with Chéel Náajal producing the most joy. Andy, Andrea, and Chad got into a large, mazy area, or more accurately for caves in this area, a large room with large pillars, while Fofo, Jen, and Tommy-Gun filled in an area towards some water. Between them they surveyed 569 meters and still said there was more to do. Peter decided to try his luck at the north end of Sistema Pool Tunich and managed to add 170 meters to the Altar Entrance area of Weeping Angels. Nearby, Will took Kris and Aida into a 40-meter-wide entrance of what they called the Demon Beekeeper, or Kisin Máak Ka Mayajtik in Mayan. This looked particularly promising, maintaining a large width, and heading north.

Six people thought they might be able to duplicate the luck of the Arco del Triunfo group and continued cutting trail farther southwest along the same collapsed doline. Their day started out well with a 40-meter-wide entrance quickly found right where it should be, but it only went into a pool of water that Cyndie dutifully swam across, to no avail. Maybe with lower water levels a way might be found at the back, but the survey for this day in the cave called Melipona , after the stingless bees in the entrance was only 66 meters.


Zotz Caves
Playa del Carmen , Quintana Roo
Mapped 15 March, 26 November 2013
Surveyed by G. Ediger, C. Lloyd, B. Luke, M. Smith, P. Sprouse
Drawn by G. Ediger, P. Sprouse
Digitized by B. Luke
high lead
? may go
low, muddy
sump?
goes
B
Ngrid
X'aman Zotz
A
B
A
0 10 20 30 40 50
metros
Lak'in Zotz
E
Nojol Zotz
F
E
F

(No, they did not test out their lack of sting.) The rest of the day was a slog, slashing through dense jungle with machetes to GPS waypoints that did indeed have vertical rock walls with entrances, but nothing that went anywhere—the luck of the draw.

Tuesday saw three teams returning to Chéel Náajal, and over 500 meters of survey was collected. Fofo's team had the water section; Batgirl and Andrea had teams in mazy dry stuff. And still they left more to do. Will and Kris continued on in Kisin Máak, being challenged by the width of the large passage. They also popped into a pit entrance beside the trail called the Humidoor on the way back to confirm that it was indeed in need of mapping. It needed a cable ladder. Andy decided to return to the Hobbit House, which he had mapped back in March, to mop up some leads there with Tommy-Gun. They finished those and found a small blowing hole that needed some dis-obstruction to get through. Meanwhile Jared had gone out to the north on a cut trail through the next collapse with Mario and managed to locate a large entrance just at the end of the day.

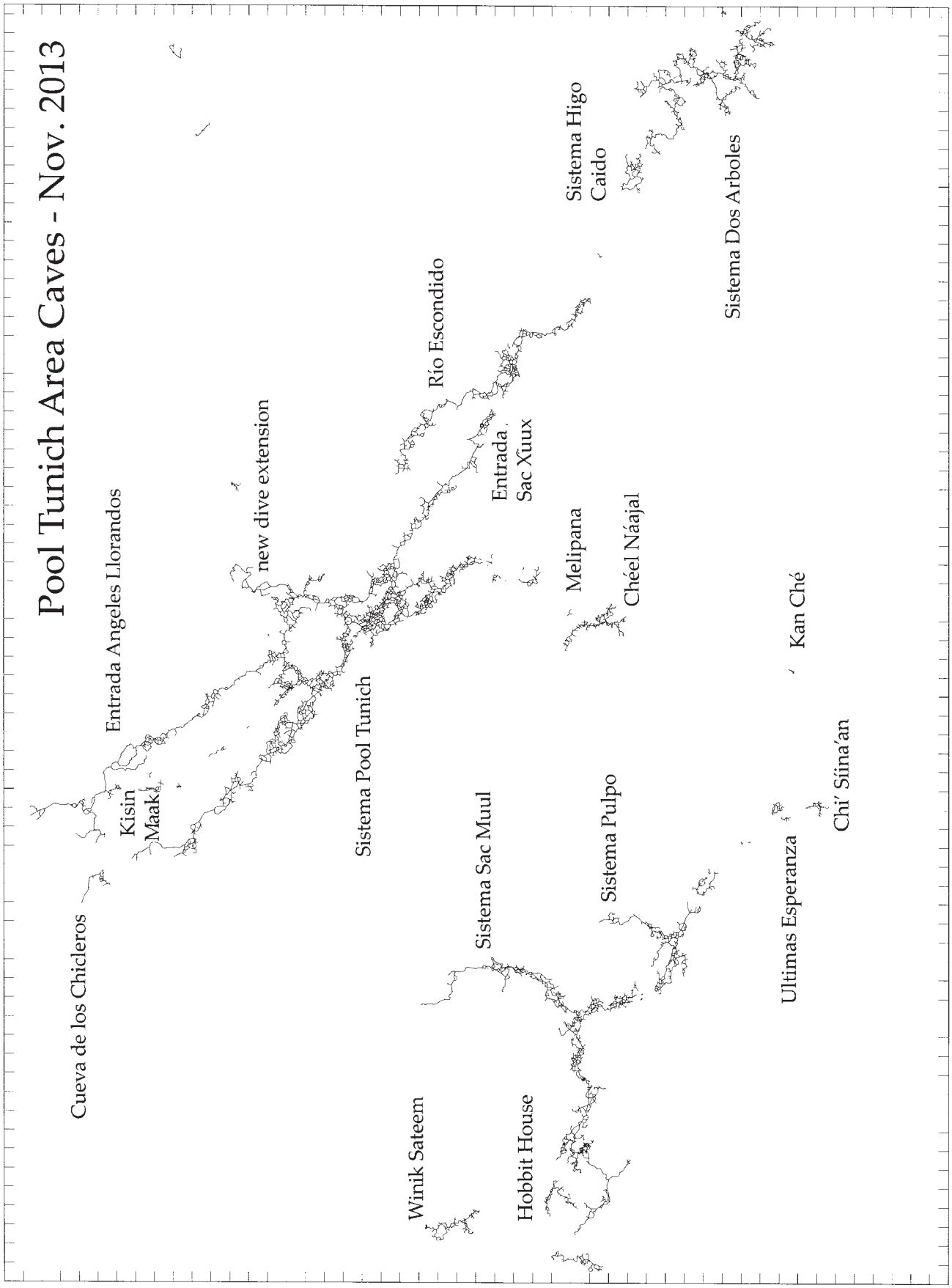
Farther out past that area, which is located to the northwest of Sac Mul, Peter took Chris out to follow up on some entrances that had been seen previously. The first cave to check, Cueva Caraveo, turned out to be some 10 by 15 meters across but completely overhung, dropping 5 to 9 meters down into big passage. When the existing wooden ladder was tested for stability, the top part of the post came off in Peter's hand and the mid part of the ladder broke in half, so it was deemed less than ideal for climbing. The backup plan was a return into Xaman Zotz, which had been started in March and left going in three directions. This one has a typical 30-meter-wide entrance that funnels down to a hands-and-knees crawl before opening up into sizable walking passage. The team headed north through walking passage punctuated with crawls, one of which needed some enlarging. Eventually the way on was a flat-out crawl, so it was left and they went to see what the other leads looked like. The northeastern one dropped out of the central chamber into a stoopway that continued on some ways as a hands-and-knees crawl. That was abandoned where a flat-out crawl through a pool was needed. The last way on was back up over the flowstone in the main chamber and reduced in size until the floor dropped out and a ladder would be needed to get down into nice large-looking passage. On the way out toward the entrance, holes in the ceiling were spotted; the line plot unfortunately confirmed that those were the same holes that had been seen from above. So that left two ways on to be pushed at a later date.

The divers David and Matt were able to start surveying in Pool Tunich and collected 366 meters, not finishing all the line they had laid, while German and Geraldine added another 76 meters of line off a sump farther northwest. This day proved to be the most productive of the trip, with 1509 meters surveyed.

On Wednesday the twenty-seventh we had the same three teams back into Chéel Náajal, and another 500-meters-plus of survey was collected with still no end in sight. Jared and Mario took Andy, German, and Aida to enjoy the new cave they had located late the day before, which they ended up calling Lord of the Rings, Winik Sateem in Mayan. The classic 30-meter-wide entrance passage continued north, maintaining its width until a smaller pit entrance was passed and things started getting lower, but a few ways continuing on were left for the next day. Chris went north with Will and Lydia to Kisin Máak and ended up finishing the cave, which started 30 meters wide and ended almost the same, with nice formations most of the way along. With time to do more, they climbed down into the Humidoor on a cable ladder and mapped a large, almost circular collapse chamber with no way on. Cyndie and Shane had hopes of glory on a jungle chop just to the south, but only came up with 20 meters in E'el Kaan and a likely exposure to a *chechen* poison-ivy-like tree. Peter, Terri, and Liliana were up in the north end in Chicleros and collected 152 meters of survey, while Alan staged tanks for a dive the next day in Weeping Angels. Various others went touristing at Chichén Itzá, but the divers David and Matt made up for that with a night dive in Pool Tunich, fixing more line.

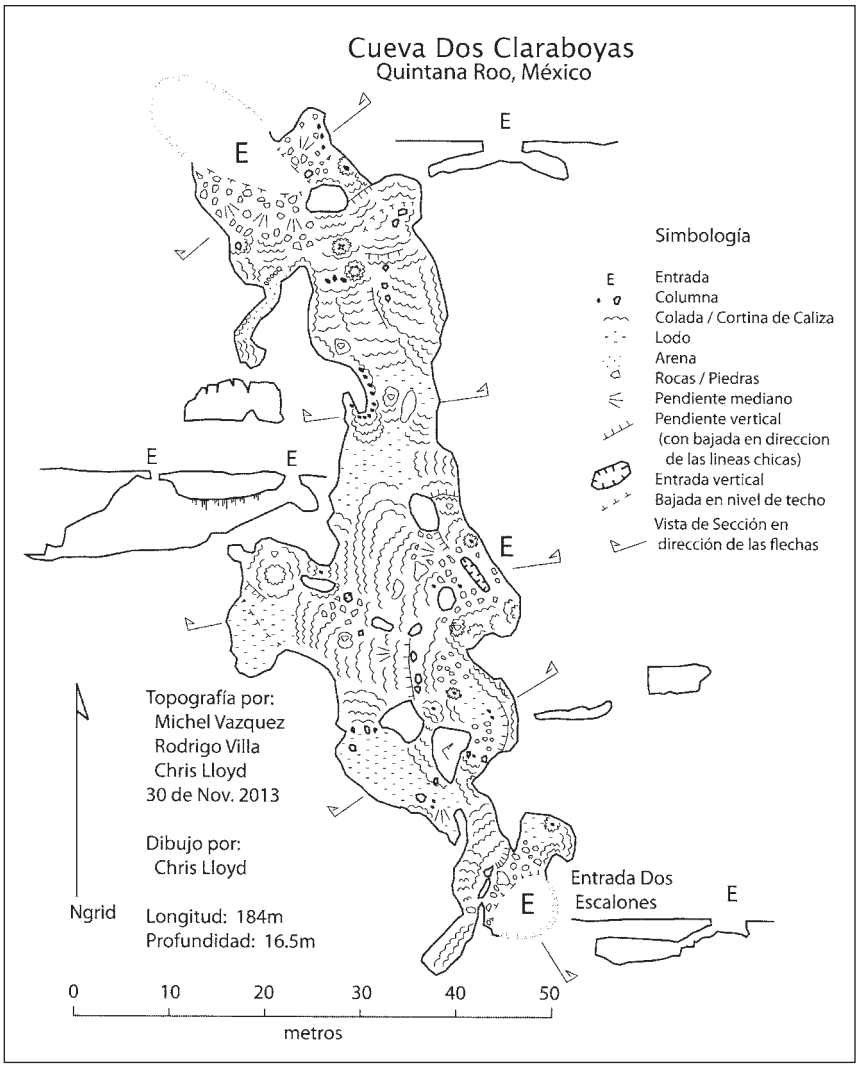
On Thursday two teams headed back into Winik Sateem, with Andrea and Jared taking the left-side low lead and Chris, Thomas, and Ed taking the center crawlway. The crawlway quickly opened up into walking passage that shortly led to a small skylight entrance that helped keep the air fresh though that section. Right below that entrance a small way continued north into a bigger chamber requiring a down-climb. There the left wall receded into blackness, and they noted a Maya stairway coming in from the right. As suspected, this led up to

Lydia Hernandez views roots in Kisin Maak Ka Mayajtik. *Chris Lloyd*


Pool Tunich Area Caves - Nov. 2013
Cueva de los Chicleros
Entrada Angeles Llorandos
Kisin
Maak
new dive extension
Río Escondido
Sistema Higo
Caido
Sistema Dos Arboles
Entrada,
Sac Xuux
Sistema Pool Tunich
Melipana
Chéel Náajal
Kan Ché
Sistema Sac Muul
Sistema Pulpo
Ultimas Esperanza
Chi' Síina'an
Winik Sateem
Hobbit House

yet another entrance, though the Maya must have used a ladder to climb the 4-meter pit. Following the old Maya route north into the cave, it was not long before the expected water source was found; it turned out to be a lovely lake, with a likely sump going under one wall. Here the passage widened out to fill the survey-book page and took the rest of the day to finish. There are still leads heading farther north.

Andy and Tommy-Gun headed back into Hobbit House with a hammer and succeeded in getting through the small, drafting lead and breaking out into borehole heading southwest. It was not long, though, before they started noticing what appeared to be freshly broken pieces of the wall on the floor, then lots of broken pieces that looked like they had fallen within the hour. Tommy-Gun, on lead tape, was the one to insist on halting the advance before they popped out into the operating quarry that couldn't have been more than 50 meters or so ahead. Batgirl and Terri went back to Chéel Náajal, figuring on finishing it off, but still left going passage. Peter and Chad added 62 meters of survey at the south end of Sistema Pool Tunich in the Sac Xuux section, while German and Geraldine dove sumps in both Sac Xuux and Sistema Río Escondido to try and connect them. But they found only a small room, though they did re-measure a dive line from 2010 to confirm the location of the Pool Tunich–Sac Xuux connection. David and Matt added 318 meters of survey on their dive line in Pool Tunich, while Alan added 47 meters of new dive line in Weeping Angels. Thursday was also American Thanksgiving Day, and Don Cleo put on a great spread of food to celebrate the event.



Grotesque stalagmites in Kisin Maak Ka Mayajtik. *Chris Lloyd*

On Friday the twenty-ninth three teams continued on in Winik Sateem, with Will, Thomas, and Ed filling in the left wall that had not been seen the day before and Andrea, Andy, and Geraldine, after they had finished some mop-up in Hobbit House, catching up from behind, then jumping out in front to carry on north. Fofo and Jen picked up some low stuff along the sides.

Two groups decided to look for new stuff on a jungle chop following the obvious line of collapsed sinks leading southwest from Sistema Pulpo. Chris and Tommy-Gun hiked through Sistema Pulpo to carry on to the south, picking up three small caves along the way, with the longest being 114 meters and located some 50 meters off the road, next to the planned pick-up point. Peter and Cyndie's teams had headed farther southwest from there and quickly found a big cave, Chi' Síina'an,which kept both teams busy most of the day collecting 430 meters of survey. They had a bit of time before the pick-up and added 76 meters more in Kan Ché, which they left still going.

Continuing to the north from Winik Sateem, Jared and Emiliano tried their luck looking for new entrances and found five, one of

November 2013 QR Expedition Survey Totals

name	Nov. 2013 survey (m)	total length (m)
Sistema Pool Tunich/Río Secreto[1]	3034	38212
Río Escondido	95	6116
Arco de Triunfo/Chéel Náajal	2127	
Lord of the Rings/Winik Sateem	1472	1472
Hobbit House	439	1012
Naj Woolis	357	721
Cueva de los Chicleros	152	682
Xaman Zotz	308	435
Chi' Síiaa'an	430	
Demon Beekeeper/Kisin Maak Ka Mayajtik	426	
Cueva Dos Claraboyas	184	
Cueva Ultima Esperanza	114	
Humidoor/Lúubul Uch Ben Baak	85	
Kan Ché	76	
Cueva Melipona	66	
Cueva de las Trampas Puerquitos	33	
Cueva Arco no. 2	28	
E'el Kaan	20	
Cueva Dos Columnas	15	
Expedition total	*9461*	

[1] Includes connected caves Leti Chen and Angeles Llorandos plus 1070 m new underwater survey.

Área de Pool Tunich, Noviembre 2013

Durante una de las varias visitas a la Riviera Maya en Quintana Roo, espeleólogos topografiaron más de 9 kilómetros de pasajes, incluyendo la Cueva de los Angeles Llorando, la cual fue conectada al sistema Pool Tunich. A diferencia de la mayoría los viajes organizados por Peter Sprouse y el Paamul Grotto, se logró además la topografía de cerca de 1 kilómetro de cueva inundada.

which had dive line heading into a sump, which nobody knew anything about. The divers continued with their survey in Pool Tunich and added 286 meters, starting to head east from known cave off into a blank area on the map.

Saturday was the last day of exploration and saw Andy and Andrea heading back into Winik Sateem and pushing that farther north, adding 153 meters of survey to make it 1472 meters long and still going. Fofo and Jen headed back into Chéel Náajal, mopping up 65 meters of survey and bringing that cave up to 2127 meters long. Will took Kris and Aida into the south end of Río Escondido and added 163 meters of survey, bringing that one up to 6116 meters. Peter and Cyndie took teams into Pool Tunich to check on corrections and side leads and added a total of 97 meters between them. Chris went out to the northeast of camp with Michel and Roko to a new area and surveyed 184 meters in Dos Claraboyas, finishing it off, but adding in some nice big passage in an area with no previously known caves. Following up that trend to the north and south should prove worthwhile.

With a short survey day over, various groups left camp for new adventures, leaving nine people behind for a last night in camp and a late afternoon photo session in the Auditorium area of Pool Tunich. In all, the group surveyed some 9461 meters in eight days, adding 3034 meters to the Pool Tunich system, bringing it up to 38,212 meters long. All another step closer to creating the longest cave in the world.

HISTORICAL REPRINT

THE HIGH PRIEST'S GRAVE

Edward H. Thompson

The excavations reported here were made in 1896 by Edward H. Thompson, the United States Consul in Progresso, Yucatán, and at the time the owner of Chichén Itzá. The report is the principal content of the book The High Priest's Grave, Chichen Itza, Yucatan, Mexico, *prepared by J. Eric Thompson, Field Museum of Natural History publication 412, 1938. The book contains illustrations from later sources that are not, except for the cave map made by J. C. Harrington in 1936, reproduced here. The comments embedded in the text are by J. Eric Thompson, who writes in his introduction, "The description of the excavations is contained in a letter to the late W. H. Holmes and in a report prepared in 1897 by E. H. Thompson for publication. It has been decided to publish these as they were written except for minimal grammatical corrections. Although the data they contain might have been more ample, the style is a refreshing contrast to that of the present-day archaeologist who in his reports seeks to establish his profession as a science by reducing all data to graphs and mathematical formulae. Edward H. Thompson belonged to the old school that was content to consider archaeology as history." The two Thompsons were not related.*

Hidden by the jungle growth that surrounds the great ruin group of Chichen Itza and about halfway between the Nunnery and the Tennis Court lies a mound about forty feet high. Its form is hidden by debris and vegetable growth. Only the closest search reveals the stones that here and there remain in place and indicate the original outline.

That it faced the east is evidenced by the fact that an imposing stairway, eleven feet wide, divided the eastern slope and led up to the crowning structure. Four great serpent heads, each over a yard high, guard the sides of this stairway, two at the base and two upon the terrace above. The wide-open jaws with bared fangs and protruded tongues were once painted in mixed colors, red predominating.

The stairway, ascending upward at an angle of 43°, had a length over all of forty-eight feet, the average lift and spread being exactly eleven inches.

The serpent heads at the base form the terminus of a series of stone sections that continue up the sides of the stairway and are evidently conventionalized serpent bodies but cannot compare in effect or artistic merit with the great serpent bodies that in massive undulations once guarded the angles of the great pyramid of the Castillo and made it the antique gem of the New World. [E. H. Thompson was mistaken in thinking that the angles of the Castillo represent serpents.]

The heads that guard the stairways upon the terrace above have their bodies conventionalized into handsomely formed square pillars, several sections of which are carved with the usual feathered ornamentation of this symbol. [These serpent columns supported the wooden lintels, now rotted away, of the doorway, and do not form part of the stairway.]

The upper terrace was, when perfect, about fifty feet long by forty-five wide. It is now covered with ruined stone work and debris to the depth of several feet, through which project various stone pillars both plain and carved.

On each side of the upper terrace, except that occupied by the great stairway previously described, are two curious stone posts. They are placed upright but are cut aslant at an angle of 82°. Each is backed by a second post straight cut and firmly placed. These slanting posts are separated by a space less than two feet wide. From their bases down the inclined plane runs a welt-like projection that might indicate the former existence of a stairway. Yet this would seem an unnecessary structure. It may be, however, that some religious rite or observance required these narrow stairways. [Actually there were stairways on all sides. The stones with slanting faces are corner jambs of the small exterior ambulatory doorways, the slanting area corresponding to the batter at the base of exterior walls of the Mexican period.]

Besides these paired slanting pillars there are single ones to the right and left of the serpents' heads upon this same upper terrace. The angle of the one on the right, which is still firmly in place, is 82°. The other one has fallen over owing to the breaking away of the walls of the pyramid, and I could not determine its angle, but from my estimate I believe it to have had the same as the other. A stone post, exactly a foot square and seven and a half feet high, is firmly fixed in place in the northeast portion of the platform and a similar one upon the southwest. I believe there were similar posts on the other two corners, but ruin has overtaken them, and the places they would have occupied are now yawning chasms over thirty feet deep.

Faint traces of carvings still exist upon one of these posts, apparently hieroglyphics, while the slanting pillars are perfectly plain.

Seventeen feet to the south [west] of the squared pillars of the serpent, and consequently several feet south [west] of the exact center of the upper terrace are four handsomely

squared pillars. Some [all] have traces of carvings, which, though nearly obliterated by time, show, by means of the magnifying glass, remains of red paint in the hollows—a striking evidence of the durability of some, at least, of the pigments of this ancient people.

Within the floor material between the pair of pillars on the north [east], securely sealed up by means of heavy, rectangular stone tablets, we found a well-like vault. First testing for mephitic gases, I caused myself to be lowered down. At a depth of twelve feet I stood upon a mass of worked stones whose angles and points showed that they had been thrown in without care or order. Looking around me and upward toward the sky, I found myself in most curious quarters. A deep shaft like a rectangular well extended from the surface above until buried beneath the debris upon which I stood, and how much farther could only be determined when the excavation was finished.

In order to give an intelligible description of this sepulchral shaft, I will anticipate my account in part, and state that it was found to be a little over thirty feet deep. The four sides were of cut stone well worked and laid in a most singular manner, each edge overlapping the one just above it. The projecting portions varied from an inch to nearly two inches, and thus afforded a very convenient foothold and materially aided us in our ingress and egress. The four corners were finished in a striking manner by means of vertical ribbons of stone placed diagonally with respect to the side.

At a depth of fourteen feet the rectangular shaft enlarges suddenly a foot or more, and then continues downward, not vertically as before, but gradually converging until at the bottom of the shaft the dimensions are reduced to four feet by five. The enlarged portion was constructed after the same manner as the vertical portion, but not finished so perfectly. The stones were not as well laid, nor the joints broken as often, and the general appearance was cruder.

As I have stated, this shaft was filled up to within twelve feet of the surface with stones and other material. Many of these stones were cut and finished, and had served as portions of structures at some period. They had not fallen by chance into this shaft. Neither had they become dislodged and fallen from above during the crash and vibration consequent upon the fall of some great structure above them.

The mouth of the shaft was perfectly sealed by stone slabs, rough, but effective. The sides of the shaft were perfect save in one spot midway from the top where one stone was missing.

By the use of windlass and pulleys the work of excavation was carried on slowly but carefully. Some of these stones embedded in the material weighed over fifty pounds, and a due regard for our lives made me proceed with caution. A man penned in a cavity thirty feet deep, only four feet by five in dimensions, may be pardoned for taking no unnecessary chances with suspended rocks.

The first few feet excavated consisted of large, worked stones embedded in mold, fine rootlets like twine, and insect casings, principally beetle wings. This continued until we began to think that the ancients had made the shaft and in a fit of insanity had filled it up again with worked stones, cobbles, and dirt. Nevertheless, I kept pegging away at the bottom of this pit, never removing a stone until I had examined it in position and assured myself of its purport.

At last, at a depth of sixteen feet I came upon a grave—two parallel lines of worked stones, separated by a space of two feet and extending across the shaft from east to west. The stones had been overturned and pressed into the earth by the superincumbent material, and the heavy slab covers had been dislodged and broken by the great stones evidently thrown down from above, but the grave was clear and unmistakable. With brush and trowel I at once went carefully to work. Lifting off the broken pieces of what was once the roughhewn stone tops I found the fragments of a skeleton beneath, together with two red vessels, one crushed into fragments and the other entire.

In the earth material around this grave were a large number of potsherds, principally of the small red vessels. Beneath this grave I came upon a second layer of large stones, about two feet thick, then a mixture of earth and mortar containing many potsherds of the class previously described, together with pieces of a very thick ware, like incense burners. Beneath this then appeared the outlines of a second grave. Around this I found red potsherds and the unmistakable fragments of a handsome terra-cotta mask that generally ornaments the front of the more important incense burners. This second grave, like the first, was almost obliterated in outline and, like it, contained a much broken skeleton and two small red vessels, cracked, but perfect in outline. Besides these there were two copper bells and several jade beads.

The finding of these copper bells filled me with the keenest pleasure, for they were the first I had ever encountered. In fact, the only one other recorded case of their being found in Yucatan was in 1887 when, during the construction of the Peto Railroad, the workmen in excavating a mound in the path of the railway found a jar containing over thirty copper bells, several of which the owner of the road, Don Rodolfo Canton, very kindly gave me. I have learned to regard all finds not made under my own eye with some doubt. However honest a workman may be, his judgment as to intrusive burials is not apt to be of much value. These two bells that I found were well shaped and nearly three times the size of those found on the Peto road.

Beneath the crumbling material and light-brown dirt that formed the floor of this grave came the usual layer of stone, then the dirt material that surrounded and covered the third grave. In this material I found the fragments of a curious green painted vessel, a green and blue painted clown-like head of terra cotta, a terra-cotta mask, and the usual red potsherds and fragments of an incense burner.

Within the grave were the fragments of apparently several skeletons much broken and mixed, one whole, and several broken vessels,

some very fine jade beads of a high polish, and several beads of a hard-grained red stone.

Then beneath the floor material were the great stones, the fine earth filled with potsherds, and a fourth grave. In this grave we found the usual potsherds and many pendants of jade.

In the southeast corner of the vault was a little heap of what appeared to be verdigris but proved to be twenty-two small copper bells, almost shapeless from the oxidation and incrustation. As I moved them some of the mold of centuries fell away, the little stone balls inside moved and gave forth a clear, musical tinkle. Several of these bells were cemented together by oxidization so firmly that I think the metal would give as soon as the adherent verdigris.

In the northwest corner a second dusty heap resolved itself into shining beads of clear rock crystal and polished jade. These finds look small and insignificant beside the golden treasures of Mycenae, yet, as coming from Yucatan and as the first scientific recorded finds of the kind from this region, they are in their way just as important to science as golden cups or jeweled tiaras.

The grave held three small red tripod vessels, one so absolutely triturated that no amount of care would make it useful as a specimen. Beside one of the vessels in the northern corner of the grave I found a round jade bead, several red beads, and a handsomely carved figure of jade. This amulet is the finest specimen of its class I have yet seen as coming from Yucatan.

At this point I was obliged to discontinue the work, for a long period of rains ensued which might have caused earth-slides and thus endangered our lives. I therefore braced up the well-like shaft, erected over it a protective cover of palm leaves, and left it until a more propitious time.

Once again at work, I found the same sequence of great stones, fine earth containing potsherds, one whole tripod vessel, and four crystal beads, three copper bells, several small jades, red stone and nephritic stone beads. Inside the grave was the usual skeleton in a bad state of preservation, a red tripod vessel, and several jade and red stone beads. Directly over the grave upon the stone capping that once covered it I found a curious resin-like mass lying upon and covered by thick layers of ash-like debris. A heavy stone completely covered it. It was thus hermetically sealed and preserved. I have an idea that it may be the incense used by the ancients. I tried a fragment with a lighted match and it gave forth a clean aromatic odor. I recollect once having tried a little globe of incense still left in an ancient incense burner. As the odor of the burning fragment was wafted toward me, it instantly brought to my mind this experience of several years before.

The sixth grave of the shaft was found in the usual sequence, and the surrounding earth yielded votive offerings of broken vessels, jade beads, some very handsome red stone beads, several copper bells, and three crystal beads. Inside the grave the skeleton was simply a mass of lime dust; the two vessels encountered were red tripod vessels, one of which was ornamented in a manner not before noted. The bottom was covered with incised or scratched lines evidently made with some toothed implement while the vessel was yet unbaked. Most of the potsherds found in this grave were of this incised pattern.

The seventh and last grave was so completely crushed out of all shape that an indiscriminate commingling of potsherds of the incised pattern previously mentioned, broken stones, and detritus were all that were visible. Patient work revealed three crushed copper bells, a broken crystal bead, several jade beads, a large jade bead calcined by fire, a terra-cotta vase much broken, but of rather uncommon form, ornamented with a curious pattern in black lines, charcoal, and a couple of small pieces of obsidian. Besides these finds were a second piece of the material that I have before described as incense and several fragments of stucco apparently from the walls of some structure, painted a clear blue color, made, as an artist told me, with some oil or oily substance. This pigment was almost as clear and fine as if fresh.

It is a noteworthy fact that up to the present time these graves have yielded none of the hitherto ordinary patterns of vessels and even among the potsherds intermixed in the debris around the graves the classes that hitherto have formed the largest portion of finds, viz. the plain and striated patterns, are almost entirely wanting. Red ware of all sizes and shapes, but principally fragments of small tripod vessels, constitutes the bulk of the potsherds encountered. At least 50 per cent of these vessels, when whole, were painted entirely, or in part, with a dark-slate color, inclining toward blue. The greater portion had a wide band of this pigment running around the inner rim of the vessel.

Neither was there found a single arrowhead. These facts surprised me as they are so different from the experiences during my past explorations.

Beneath the grave the trowel rang upon the cut stone of the floor at a distance of thirty feet from the surface of the mound above. As my brush carefully cleared off the dirt from the floor preparatory to sending it to the sieve above, I found myself in a rectangular space forty inches square. Nearly in the center of this space I noted a stone of a peculiar finished appearance. The inner edges of two of the surrounding stones were smoother than should have been the case naturally. Carefully working with my heavy hunting knife and trowel, I succeeded in lifting, without much effort, the stone that, while just as heavy to all appearances, had been skillfully cut to half the usual thickness, and was, therefore, easily moved by the initiated. Beneath me appeared a dark space half-filled with dirt. I projected the light of my lantern as far as possible, but the intercepting material prevented any intelligent observation and would do so until cleared out.

Little by little I excavated the material filling this pit. With much labor, in a most cramped and uncomfortable position, in an opening only thirty-two inches square, I excavated the material and passed it to a native

who placed it in a basket in which it was hauled up to the light of day, where the sieve and last investigation awaited it.

Although jade and crystal beads and copper bells appeared from time to time, the material in general was mixed with much ashes and burned stone, and for the first time among the ruins of Yucatan I found charred human bones. I also found one jade pendant completely changed by the action of heat. I extracted a great many stones and one portion of an image blackened and almost calcined by the action of heat.

As the work progressed and I got deeper and deeper into the pit, I found gradually appearing to view a narrow stairway just two feet wide—the width of the narrow opening above me. I continued working, sprawled out like a lizard for want of space, until I had cleared off and sent up the debris that covered the seven steps of the stairway and left me a space still cramped, but more bearable.

At a depth of six feet seven inches from the mouth of the secret entrance, the last step of the cut stone stairway appeared, and the passage seemed to have a gentle descent to the north [west]. Apparently, the stairway had originally contained nine steps, but as we were now beneath the actual level of the outside world, the passage, the rough vault above, and the steps were cut out of the solid rock, but the steps had become partially worn away by use, leaving a series of lumps in their place. As the descent to a distance of nine feet was gradual, their need was not greatly felt. On I burrowed, finding rich specimens constantly. Human bones were abundant. Potsherds existed, but not of incense burners nor sacred vessels. I noted here that the striated ware [sherds of unslipped storage jars?] found so often in my work at Labna and elsewhere, was again in evidence.

Still deeper and deeper I burrowed, completely out of sound of human life. At short intervals one of my natives would wriggle down from his position just above me, and taking the material accumulated, ashes and stones, work his way to the trapdoor, fill the basket, shout to the one above to haul up, then crawl down again and cover the secret entrance with a thick block of wood, lest the ascending basket should tumble a loose stone upon his skull. Then he would crouch back into his lair to await the shout from above that the basket was once more lowered and in readiness to be filled again.

I had already found a fine idol and a head of an idol or some important person, carved out of limestone, well shaped and still bearing traces of paint, a number of crystal beads, copper bells, and jade beads of remarkable fineness, when at a distance of nine feet from the last step the passage seemed to end in a solid wall having a large slab of worked stone resting at its base directly in line with the gently inclined passage. Working my way slowly along, I gradually removed the fine material around the stone and noted the presence of a strong draft of cold air at the same instant that I found amid the debris a very remarkable jade ornament or amulet in the shape of a fish. It was the largest and finest jade amulet that I had yet found in Yucatan, although not so finely carved and polished as the amulet previously described.

I stole a moment from my work to gloat over the find, and then went on with my digging. I gradually loosened the stone, and as I lifted it away, I found beneath an opening as black as night, from which poured a rush of air as chill as the breath of death. "It is the mouth of the underworld," stammered my two boys, as they cowered close to me. "If it is, we will soon have a chance to see what the underworld is like," I said, smiling at the wonderment and fear expressed on their countenances. In fact, I was nearly as excited as they, though in a different sense.

The inclined plane of the floor of the passage was such that a vigorous push would be all that was

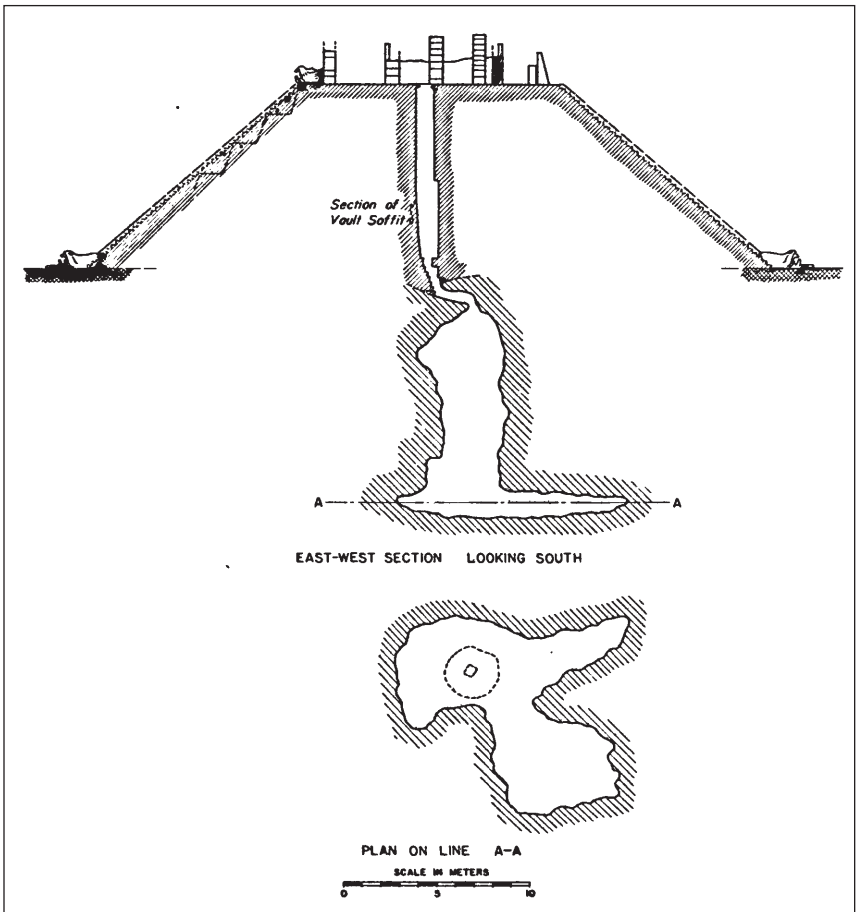


FIG. 2. Section through structure, showing shaft (drawn by J. C. Harrington).

needed, apparently, to send an inert body down the passage through the uncovered mouth of the pit—the sides of which seemed to have been smoothed by much use—into the inky depths below. I lit the small lantern of my kit and attaching it to my metal tapeline, leaned over the hole and swinging it clear of the side, commenced paying out the tape. Down it went, until I thought it would never reach bottom. Finally, at a depth of fifty-two feet it rested upon dry bottom, as I could easily see. This point settled, I then had a strong native take close hold of each of my legs and let myself down beyond the mouth until my head was beyond the wall of the mouth and into the pit itself. Thus, although head downward, I was, by gradually hauling up the lantern, able to study the formation of the pit for future use.

The next day was spent in arranging for the descent, and the following day I was let down by means of a rope and blocks into the pit. My previous experience in subterranean chambers had familiarized me with this class of work.

The clear flame of my lantern relieved me of any fear of mephitic air, and with my keen bowie knife between my teeth ready for instant use, and lighted lantern in one hand, I examined the walls of the pit as I went down.

The pit seemed to be in part the work of nature, but greatly changed and enlarged by the work of the ancient people. Projecting ridges of hard, white limestone that gave forth a metallic sound as of steel when hit with the back of my knife, were separated by layers of soft white earth called sahkab [sascab] by the Maya. Once in a while I noted a layer of white earth, like flour in color and texture. This is called Kub [cuut] in Maya. It is quite rare and is eagerly sought by the native pottery makers to mix with the earth called kat [cab] in the manufacture of the finer pottery.

The average diameter of the pit was eighteen feet until within fifteen feet of the bottom, where it widened and ended in a small chamber twenty-five feet wide having seven small passages or ramifications extending in different directions.

I touched bottom upon a heap of earth near the center of the chamber and directly under the orifice where the candlelights of my anxious boys gleamed like stars above me. I sent up a reassuring call that all was well and commenced my investigations. My brush had hardly raised dust when I found that my expectations were to be realized. A bead of jade over five inches in circumference, beautifully formed and so polished that it gleamed under the light of my lantern, was right at my feet, and close beside was a beautiful jade amulet. A little to one side were fragments of a vase, the like of which has never been dreamed of as belonging to this people. Not large, but made of a translucent mineral very much resembling alabaster, its artistic finish and general appearance make it easily the finest gem of the class ever found in Yucatan. It is unique of its kind.

I very soon saw that to make a systematic study of this place was the work of days of hard labor, and gave the signal for my now impatient boys to come down and share the interesting work. Down they came like monkeys, their black eyes shining at the prospect, for they had, by their long service with me in this kind of work, become as interested in specimens as if they were archaeologists of the first rank.

Platting off the bottom of the pit, we went to work by the light of many candles. There being little or no draft at the bottom of the pit, the candles burned quietly, needing no protection. Thus we worked for days from early morning until sundown. Buried beneath ninety feet of earth and rocky crust we knew neither daylight nor evening darkness, only candlelight. We ate our lunch in the intervals of the work, seated in crannies of the pit, and the brown dust that covered all things had so permeated us all, that no one at a casual glance could distinguish the white explorer from his brown-skinned workmen. Down to the very rock floor of the pit we went, the steel tapping rod entering into the floor two feet and still ringing true to prove the fact.

The mound of debris was eight feet deep from top to floor, but around the outer edge of the chamber the deposit was only three feet deep. Throughout all this material were found human bones in fragments, some being half-charred and commingled with half-calcined stone.

The specimen-bearing layer of material seemed to be about nine inches thick, although human bones were found throughout. Beneath this was a mass of mingled sahkab nodules, general detritus, fragments of human bones, pieces of the same stucco painted blue found in the upper pit or shaft, and large stones, some rough and some worked, but few beads or interesting specimens.

Among the stones a little to one side of the heap, I was much pleased to find the trunk of the idol, the head of which I had found in the narrow passage above. This idol will well repay special study as it has lain all these centuries untouched by time since unknown hands hurled it down from its honored place as a revered memento or sacred image. Its comparatively smooth surface still bears paint in many places.

Close by the actual floor of the cave I found several hammerstones and two small smooth stones of the general size and shape of grapeshot. And near the outer line of the central mound, buried seven inches in the debris, I found a curious flint crescent much resembling the golden ornaments of the same shape from the early tombs of Ireland. Space will not permit me to enumerate all the archaeological treasures found, but among the most interesting were some curiously wrought beads and pendants of jade, red stone, mother-of-pearl, and tiger's teeth.

It is worthy to remark that I found only two specimens of arrowheads, one of obsidian and one of flint, and I think these were votive offerings and not used as actual weapons.

Besides the beautiful alabaster vase before described were found many interesting vessels in fragments.

The position of some of the jade specimens found, notably those of the large globular bead and the amulet accompanying it, close by the fragments of the beautiful alabaster

vase, and the fact that I found large numbers of exceedingly small jade beads, unquestionably too fine to serve any other purpose than that of embroidered ornament, lead me to believe that some object, an armlet or embroidered loin cloth, was placed within the precious vase, and as it was thrown after the departed one into the black pit, the vase, fractured into many pieces, and the object, torn and wrenched apart, lay as it fell until the cords that bound it rotted into the black dust that I found beneath them, and each part covered with the gradually increasing dust of ages, like the diamond, with luster undimmed, awaited, unchanged, the gradual piling up of centuries.

Close examination of the two large jade ornaments just mentioned will show that some of the holes in each are still filled with portions of slender bone rods. These, when whole, probably served to stiffen and keep in place the heavier pieces of jade in the complicated designs of breastplate, armlet, or loin cloth of some great personage. I believe that the elaborate ornaments upon the persons of the warriors and priests, carved upon the pillars amid these ruins, were of this class.

The question naturally arises in our minds: are not these finds of crystal beads, fine cut and clear; copper bells, well-made and handsomely formed; curious beads of jade hitherto practically unknown to archaeologists as coming from Yucatan, evidence of later or intrusive burials?

It is an archaeologist's duty, always, to guard against false data, and in cases where finds of an unusual character are concerned, to look first for evidence of intrusive burials. I did not neglect this important point. Of course, if I had found the original floor of the temple or other structure that once crowned the mound, unbroken over the actual opening of the shaft, it would have been ample proof that the burial places were those of the builders of the structure. This class of proof I have often obtained in other groups and even in this same group of Chichen Itza. But in this case I cannot claim it because the original floor has entirely disappeared, and I am bound to state that the stones that formed the graves were for the most part worked stones that had at one time formed a part of a structure. A portion of the stone filling between the graves was structure stones, and a portion of the fine dirt around some of the graves was composed of mortar or the crumbled stucco from a structure, and amid this debris I found many minute fragments of a fine blue frescoing that could only have come from the destroyed wall surface of some structure.

Among this filled-in debris I found two inscribed stone blocks. One was in the filling just above the fourth grave and the other in the mound at the bottom of the pit itself.

These facts, together with the finding of the broken and mutilated stone figure or idol—portions in different places within the line of the work—at first thought seem to point to the fact that the graves were those of a people buried within the ruins of a conquered city whose ruined structures served as monuments above them; whose dethroned and mutilated sacred images were thrown in as trophies and votive offerings, together with the valued objects of peace and friendship, upon the graves of the deceased victors. This, I state, might be the logical deduction and in many regions would be conclusive proof of intrusive burial. But upon the Peninsula of Yucatan special conditions exist that require special reasoning. The fact is, I think, well established that Chichen Itza has within its life history been subjected to the chances of war many times and with varying results. But these wars have been internecine in their character, so far as we can learn, until the very last when the bearded white men of Castille lived and stood their siege within its stone chambers. Consequently, with the one exception just mentioned, and granting the fact of the conquerors burying their dead amid the ruined structures, it does not, in this case, constitute an intrusive burial within the anthropological sense of the term, both being members of the same race and possibly even relatives by blood.

In the foregoing I have granted the factor of war and warlike destruction, but I need not have granted it. In the little we know of the customs and life habits of this ancient period, it is certain that at intervals of time and especially after the death of great personages they made changes in their structures, remade wall surfaces, obliterated old mural paintings with a coating of hard finish, and made entirely new floors in the chambers beneath whose floors were the last buried remains. Consequently, it is well within the bounds of reason that the structure crowning this mound served as a religious shrine or adoratorio (Ku) of some important personage, and at his death or the death of the last of his line it was razed above his burial vault as the last mark of reverence to his memory.

Of course, these are to a certain extent mere conjectures and not to be confounded with facts actually proved, yet they are ideas founded upon a thorough study of these facts as they exist in situ and are, therefore, entitled to an expression, at least.

Tumba del Sumo Sacerdote

Esta reimpresión histórica describe la excavación arqueológica en el corazón de una pirámide de Chichén Itzá, Yucatán en el año de 1896. La excavación tuvo como resultado el hallazgo de una cueva natural ubicada debajo de las estructuras.

K'OOX BAAL, THE FOURTH-LONGEST UNDERWATER CAVE SYSTEM IN THE WORLD

Zdeněk Motyčka

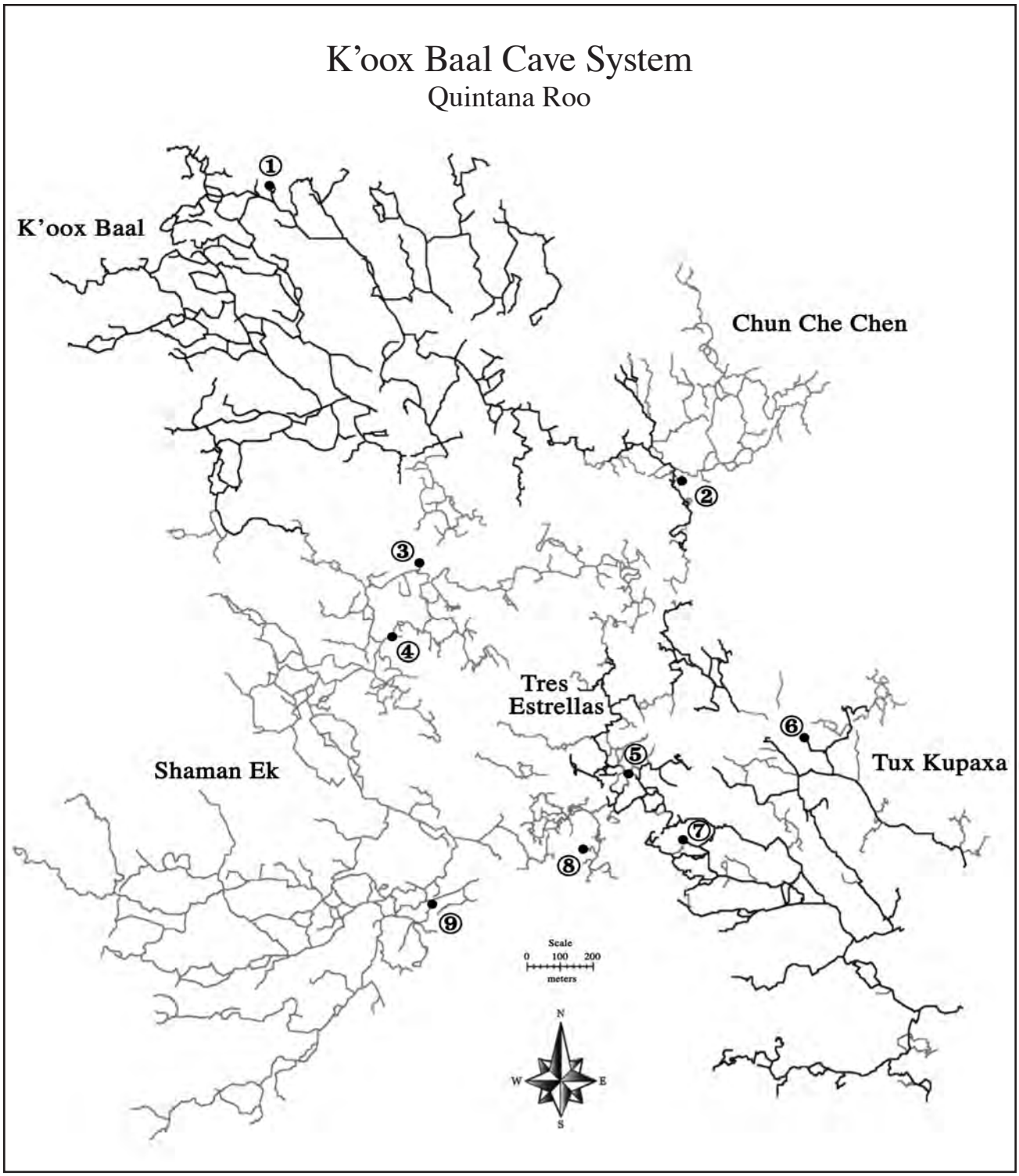
In February 2006 members of the Czech Speleological Society started their exploration of K'oox Baal, a 3.5-kilometer-long underwater cave system in the Chemuyil area in the Riviera Maya, Quintana Roo, part of the eastern coast of the Yucatan Peninsula, Mexico. By the end of 2008, their expeditions had discovered, explored, and surveyed 17 kilometers of new passages. [See AMCS Activities Newsletter *33, pages 91–93]*

The main goal of the Czech expedition in 2009 was detailed exploration and remapping of the Tux Kupaxa Cave System, which is located near the southern end of K'oox Baal. Tux Kupaxa was discovered in 1998 by Gunnar Wagner and Robbie Schmittner from the Cenote Nai Tucha entrance, but unfortunately neither a map nor even a length survive from their exploration. Another cenote located nearby, Sac Xiquin, was soon connected to Tux Kupaxa and fully mapped. In the space of one month, 12,828 meters of known tunnel was surveyed and 2,017 meters of new passage was discovered. Tux Kupaxa, with a length of 15,138 meters, became the eighth-longest underwater cave system in the Yucatan.

In 2010 two more expeditions took place, the first from January 26 to February 16 and the second from November 16 to November 30. The first expedition, thanks to a forest fire that the previous year had cleared a large part of the jungle, discovered ten new cenotes in the area located south of the well-known K'oox Baal cave. Our attention was at first directed to an easily accessible cenote, located approximately 200 meters from the road, that begins as an expansive dry cave where we have found the remains of charred palm leaves from previous visitors. Due to their similarity to banana leaves we named the cave Ha'ak Kak (Banana Candle). Two teams are gradually discovering 2 kilometers of tunnels there and are diving in another of the new cenotes, Muk Wakal. A third group first tried their luck in a large, beautiful cenote, but when they failed to find a continuation of the entrance pool, they carried their equipment to a more distant, smaller cenote located directly next to the path. They named it Kot Be (Under the Path), and here they gradually discovered 1.5 kilometers of passages. During the following week we were able to connect both of those caves to K'oox Baal. In the meantime, together with our colleague and friend Robbie Schmittner, a respected explorer of the world's now second-longest cave system Sac Actun, we discovered an additional 1.5 kilometers in the most distant of all the new cenotes, Sac Xib (White Man), and this too we were able to connect with K'oox Baal. The largest of the ten new cenotes contained a big lake but did not lead to any cave, so we turned our attention to a remote but beautiful complex of three cenotes with several lakes and long stretches of dry land. Thanks to the number of jaguars' paw prints found in the dust, we decided to call the complex Balam Ts'al (Jaguar's Paw). There even the the first dives brought discoveries of unexpectedly large halls with beautiful dripstone scenery and a connection to Cenote Kot Be, and thus Balam Ts'al also became part of K'oox Baal. We spent the entire final week of the expedition gradually discovering and surveying additional kilometers of corridors and giant domes. It was not unusual for the passage width to extend to 20 meters or more and the height to reach up to 8 meters. In Balam Ts'al we discovered the total of 3.6 kilometers, bringing the total length of the K'oox Baal system to 28.6 kilometers.

The second expedition, in the fall, was a mini-expedition of two members, and their main goal was to find a connection between the K'oox Baal system and the Cenote Tux Kupaxa located nearby. The pair began with a detailed survey of the parts that had been discovered during the spring between Cenote Kot Be and Cenote Muk Wakal, and they were able to penetrate through a set of low crawl spaces to the east, into a larger continuation. Over the course of thirteen dives, lasting approximately three hours

Text reprinted from the *16th International Congress of Speleology Proceedings*, volume 2, pages 130–133.



The 75 kilometers of the K'oox Baal system as of the end of 2012. The black lines show the parts of the cave surveyed at the end of 2008; the gray lines are the parts surveyed by Czech divers in 2009–2012. Major parts of the system that were connected to form the overall system are labeled, and some of the significant cenotes mentioned in the text are marked: 1, K'oox Baal; 2, Chun Che Chen; 3, Kot Be; 4, Balam Ts'al; 5, Tres Estrellas; 6, Sac Xiquin; 7, Nai Tucha; 8, Tan Ich; 9, Shaman Ek. Line plot from *Czech Speleological Society 2009–2012*; annotations added by Bill Mixon.

each, they discovered and mapped 2.3 kilometers, bringing the total length of K'oox Baal to more than 30 kilometers. Although the newly discovered passages were heading towards the Tux Kupaxa cave system, a connection between the cave systems was not found.

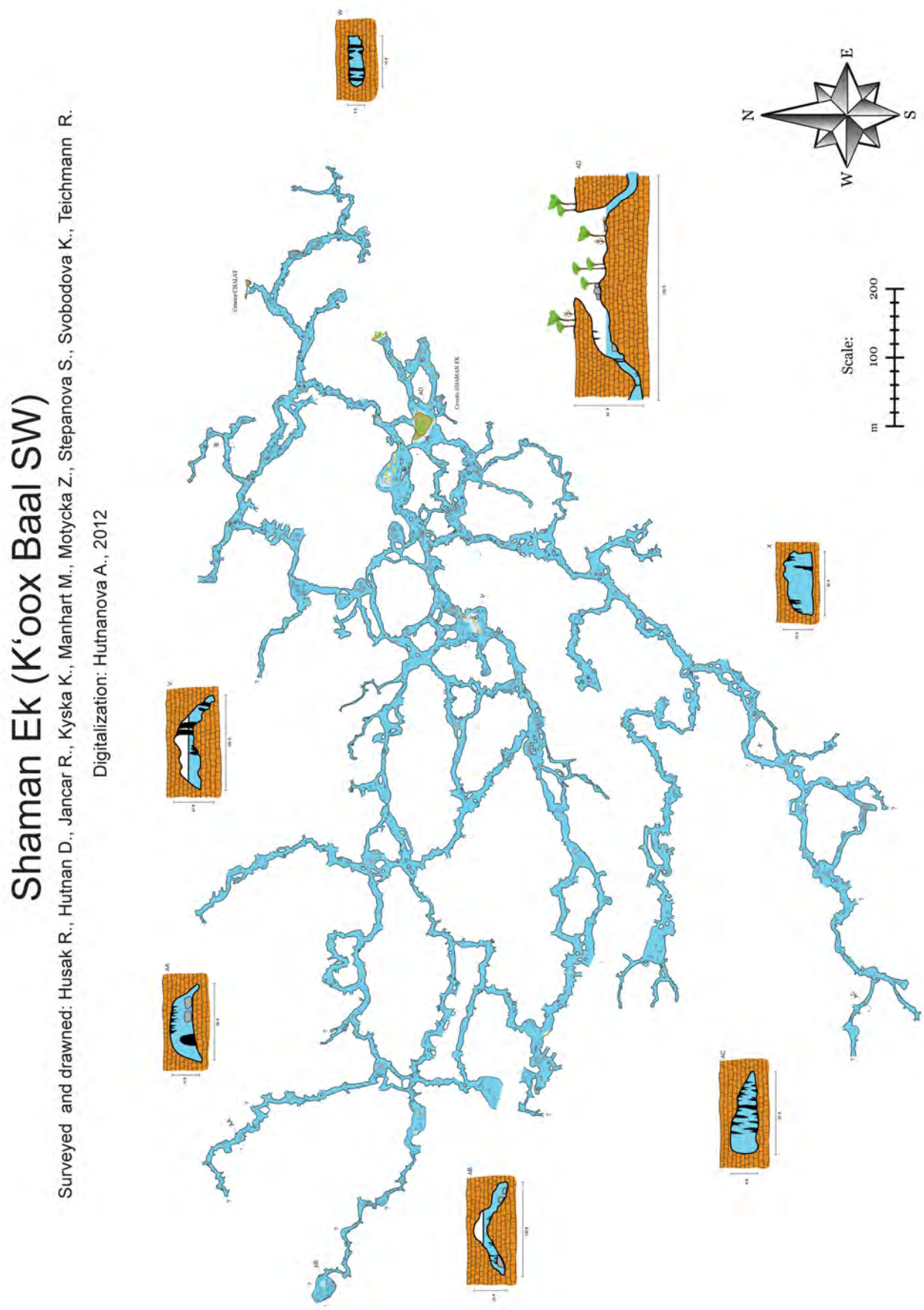
In 2011 two expeditions took place, the first from February 1 to February 23 and the second from November 28 to December 10. These brought extensive discoveries and a coveted connection of two neighboring cave systems.

In February, the first team turned their attention to the parts that had been discovered in the fall of 2010 with the obvious objective of finding the connection between K'oox Baal and Tux Kupaxa, because according to the map they were within 20 meters of each other. They tried their luck alternately from both sides, finding over 1 kilometer of new passages, but in the maze of narrow channels and crawlways a connection could not be found. The second team started their dives in Cenote Kot Be, where in the northwest direction were many previously undiscovered branches, and gradually they explored hundreds of meters of new passage. The third pair headed to cenote Balam Ts'al, where nearly 4 kilometers of large tunnels had been found in 2010 and where many questions were unanswered and leads beckoned. During the first three dives they found more than 500 meters to the west. But the character of the passage became breakdown domes, and unfortunately routes over or around could not always be found. This is characteristic of virtually all tunnels to the west in the overall K'oox Baal system, which suggests the possibility of an extensive fracture zone that forms a northwest to southeast boundary line along large parts of the cave. For that reason further exploration in this direction has little value.

In the course of the second week the first team continued with extreme dives on the edge of human abilities in order to pursue the connection between K'oox Baal and Tux Kupaxa. Alternately they dived from Cenote Muk Wakal in K'oox Baal and Cenote Tres Estrellas in Tux Kupaxa and pushed through many new routes, unfortunately without success. The second team completed the survey of the northwestern passages from Cenote Kot Be and moved to join the third team at Cenote Balam Ts'al. Together they explored and mapped all unexplored branches from the main route. In total they added an additional 2 kilometers to the length of the cave, mainly wide, low passage, with, in places, rich dripstone decoration, which is the general nature of caves in the area.

During the last week of the expedition, the first team gave up on finding the link and focused all their efforts on the southernmost part of the K'oox Baal cave system, where we had left off a year before on the doorstep of unknown tunnels and rooms. Considerable distance from the entrance now required the use of underwater scooters and additional tanks. From the last point reached in 2010, consistently massive tunnels continue for another 500 meters to where we were forced to stop the exploration for lack of time. The same distance was also reached in a significant left branch, where we also did not reach an end. The most interesting thing about these newly discovered passages is their general direction, southwest to south-southwest, which is very unusual. An additional half-kilometer of passages was discovered in various branches and parallel corridors. Several dives were also devoted to the exploration of a significant tunnel that extended out toward the well-known corridors of Tux Kupaxa, where nearly 300 meters of passages were discovered. The exploration ended in a narrow but high meandering passage that eventually went into a crack. Due to the complicated access we did not continue pushing this; it later turned out this passage was significant for further exploration. During the three-week expedition we discovered and mapped 7 kilometers, and the length of K'oox Baal reached 36,634 meters.

Kamila Svobodová in the Cenote K'oox Baal section. *Radoslav Husák, with lighting assistance by Daniel Hutňan and Martin Hutňan*


Shaman Ek (K'oox Baal SW)
Surveyed and drawned: Husak R., Hutnan D., Jancar R., Kyska K., Manhart M., Motycka Z., Stepanova S., Svobodova K., Teichmann R.
Digitalization: Hutnanova A., 2012
N
E
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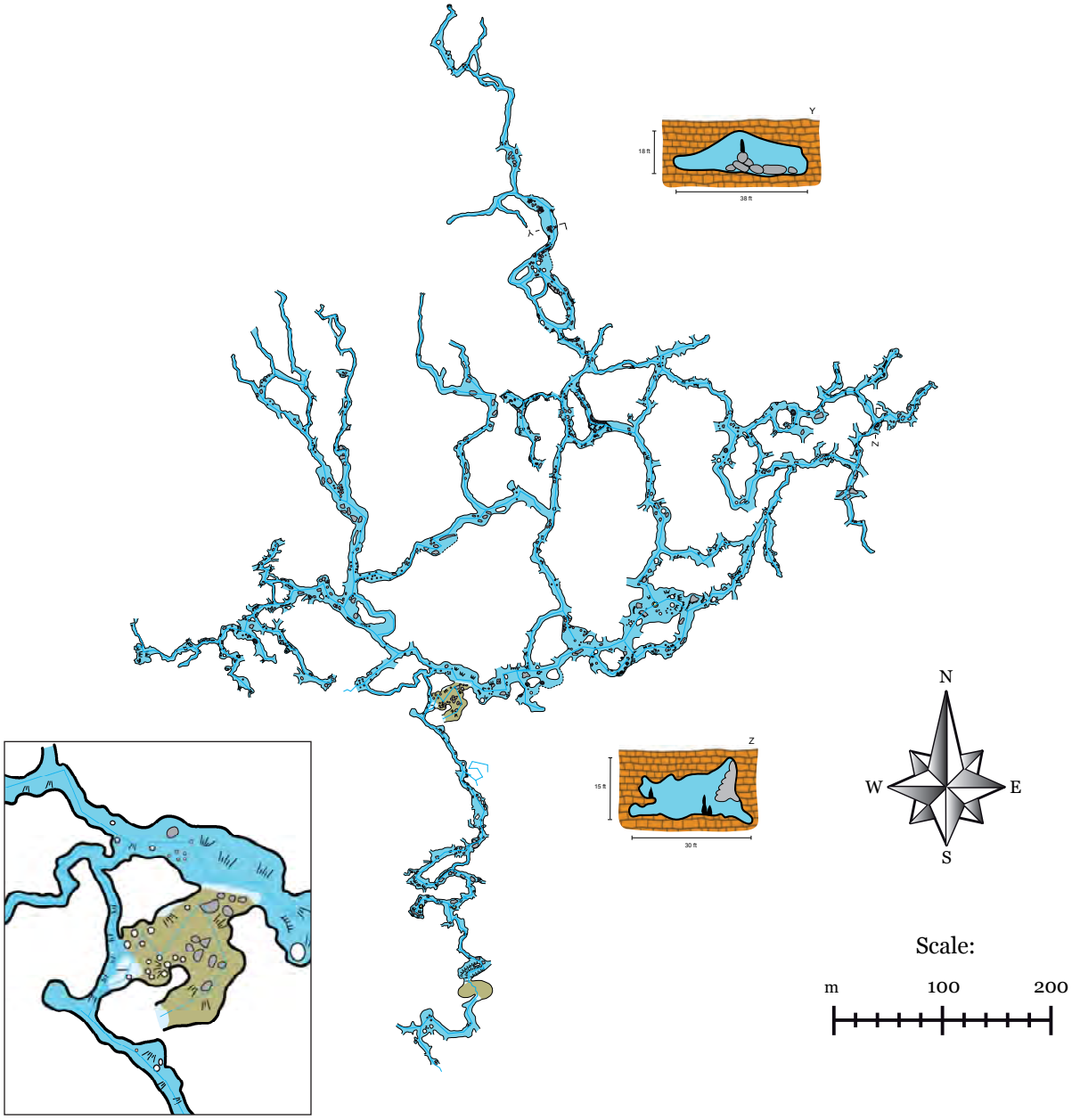
Scale:
m
100
200

Chun Che Chen (K'oox Baal NE)

Surveyed and drawn: Husak R., Hutnan D., Hutnan M., Jancar R., Kyska K., Motycka Z., Phillips B., Schmittner R., Sirotek J., Svobodova K.

Digitalization: Hutnanova A., 2012



The colored maps are from the *Bulletin of the Slovak Speleological Society,* 2013, pages 86 and 87. The enlarged inset on this page shows the amount of detail in the full map of the 75-kilometer cave. A map of the Tres Estrellas part of the cave appears on page 18 of *AMCS Activities Newsletter* 36.

Jan Žilina in the Cenote K'oox Baal section. *Radoslav Husák, with lighting assistance by Daniel Hutňan*

The second expedition of 2011 also tried to find the connection between the K'oox Baal and Tux Kupaxa systems. From three new cenotes, Tan Ich (Glasses), Numya (Passion), and Sac Ktu Cha divers gradually discovered and mapped 1,460 meters, in some places large and beautifully decorated corridors, but again mostly small, narrow tunnels and crawlways through which they sought the connection for twelve days. On December 9, 19,850-meter-long Tux Kupaxa and 36,741-meter-long K'oox Baal were connected into one cave system, creating the fourth longest underwater cave system in the world, with the total length of 56,591 meters. [See sidebar.]

As had become traditional, there were two expeditions in 2012, the first from February 8 to March 3 and the second from November 24 to December 9.

East of the K'oox Baal system was a 1300-meter-long cave entered at cenote Chun Che Chen. Like Tux Kupaxa, Chun Che Chen was first discovered by Gunnar Wagner and Robbie Schmittner in 1998. Due to the lack of maps of the cave, we decided to survey it all again and draw a map of the area. Another incentive was that part of it was located less than 100 meters from the end of K'oox Baal. During the survey we found extensive routes in several different parts of the cave. Three large tunnels in a newly discovered section led north, and in it we gradually discovered 5 kilometers of new, very rugged, and diverse cave. Great halls alternate with narrow restrictions, austere rock tunnels with chambers richly adorned with decorations. After a week with several dives of extreme difficulty we finally managed to connect Chen Chun Che to K'oox Baal, thanks to which the

PERSISTENCE

Again we have little room for maneuver. Miroslav and I part ways at a vertical fissure that has given us no end of trouble, 50 meters crawling on one's side, then removing the right-hand tank and worming one's way through sediment under overhanging rock. For my first breakthrough I have to grub about for twenty minutes. Now it's not too bad. Farther on the cave opens up into a hall. Yesterday when I was here I thought I had it beaten, but soon we were stuck again in a labyrinth of squeezes. We separate. Miroslav goes right to explore a tight corridor beyond the rock. I squeeze myself under the overhang and to the left. For over an hour the two of us try to make progress. We make a little, but in the end we swim—or rather crawl—back the way we came. Miroslav announces that he came across my line from yesterday. It seems hopeless. At the hotel we enter our data in the computer and study the plot. Something's not quite right. My line of yesterday was at a depth of 10 meters. Miroslav found it at 6 meters, and besides the lines are supposed to run in parallel, not towards each other, as the plot shows. Have we taken a wrong measurement at some point?

That night I have second thoughts. Which line did Miroslav come across? We might have made a wrong measurement on the other side. It is almost 2.5 kilometers from the entrance to the K'oox Baal cave. For the mapping of such a long stretch, 40 meters is not a bad deviation. I'm afraid to speak it aloud. There's just a chance that Miroslav came across the end of the line from the K'oox Baal cenote. . . . I want to go back there. I have to see that place for myself. Perhaps unjustified, this gnawing sense of hope must be dispelled.

After the dive we had taken all our things away from the cenote, in the belief that it would lead us nowhere. The next day we take equipment for one diver, lacking the strength to lug complete kit for two 500 meters—the chance is so small. I enter Cenote Sac Ktu Cha. I climb a rock, crawl through a fissure, and find myself in a garden of dripstone. I remove one tank and weave my way along the line to where Miroslav had found the end of the strange line. One look is enough to convince me that I'm at the place where last year Radek Husák and I abandoned our efforts in the K'oox Baal system. Hurrah! It wasn't my line from the day before that Miroslav had found, but the object of our search. We have the fourth-longest underwater cave system in the world. I emerge from the cenote with my fingers raised in a victory salute. We've done it at last!—Daniel Hutňan

(from *A Quest for the Secrets of Xibalba*, by Zdeněk Motyčka, Daniel Hutňan, and Radoslav Husák: ZM Production, Brno, 2013, p. 103)

length of K'oox Baal exceeded 60 kilometers.

The remaining time of the expedition was devoted to continuing work in the southern and southwestern parts of the system that had first been explored in 2010, where there were still large passages remaining to be discovered even after the work in 2011. The only complication was the great distance from the entrance, requiring the movement of many bottles and limiting the time for surveying. In spite of that, during five dives we discovered an additional 2 kilometers of new huge tunnels, and the length of K'oox Baal reached 64,600 meters.

At the end of the February expedition we organized several trips into the jungle, hoping to find new entrances that would give easier access to the southernmost region. After a few days we found a great cenote with several lakes, and during the first dive in one of them we connected easily to K'oox Baal. We decided to call this cenote Shaman Ek, according to the sign on the corner of the property.

The second expedition began its surveys in the cenote Shaman Ek, closest to the southwestern part of the cave. This cenote is accessible only by a very badly maintained road that is more than 3 kilometers long, which greatly hindered the transport of diving equipment. Initially, it was possible to continue the exploration through large tunnels, leading to kilometers of discoveries. Unfortunately the main tunnels abruptly ended, and we had to continue by systematically surveying all branches. The hope of easy continuation to the south was quickly reduced to the prospect of slow crawls through narrow passages. Leads to the north were the same. The only direction in which the way was open was west, at a distance of 1.5 kilometers from cenote Shaman Ek.

In the end, during the two weeks we were able to discover another 9 kilometers and two new cenotes. The total length of all the underwater parts of the cave is 73,600 meters. Together with some dry parts, the total length of the K'oox Baal system is 75,140 meters.

K´oox Baal is the longest completely mapped and drawn-up underwater cave system in the world. The three longer underwater cave systems have survey lines, but are only partially mapped in detail. Between 2009 and 2012 the Czech Speleological Society organized seven expeditions to the K´oox Baal system, and the following people participated: Miroslav Dvořáček, Petr Chmel, Martin Honeš, Radek Husák, Daniel Hutňan, Martin Hutňan, Radek Jančar, Michal Megela, Zdeněk Motyčka, Jan Sirotek, Kamila Svobodová, and Karol Kyška. Special thanks to the Quintana Roo Speleological Survey, Bil Philips, and Jim Coke for their support and to Robbie Schmittner, Nadia Berni, and David Sieff for their friendship and help.

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K'oox Baal, El Cuarto Sistema de Cuevas Inundadas más largo del Mundo

Desde 2009 hasta 2012, la Sociedad Espeleológica Checa organizó siete expediciones al sistema de cuevas K'oox Baal, en Quintana Roo. Varias cuevas sumergidas fueron conectados por los buzos. La conexión más importante se hizo en diciembre del 2011, cuando la cueva Tux Kupaxa de 19,850 metros se conectó al sistema K'oox Baal de 36,741 metros. Detalles de esta conexion se describen en el anexo de Daniel Hutňan. A finales de 2012, la longitud total del sistema sumergido era 73,600 metros. Si se le añade la longitud de algunas partes secas, el total es de 75,140 metros. Además de ser la cuarta cueva inundada más larga del mundo, es además la más larga de la que se haya hecho un mapa detallado.

XIBALBA AND IMIX

Gosia Allison-Kosior

Stan and I flew to Cancún, Quintana Roo, on December 23, 2013, and were transported by Peter Sprouse and Barbara Luke to our accommodations in Puerto Aventuras. Peter and Barbara had already been caving for four days with various cavers, including Alan Chuc, Caleb Draper, Alan Formstone, Roberto Ghisolphi, Gil Harmon, Daria Malin, and Pete Zabrok. They had been busy inland from Paamul, where they had found a new cave in the jungle that they named Macheterrorista. This was found by chopping a trail to a sinkhole seen on imagery, and the name came from the realization that he who holds the machete calls the shots. This cave consisted of crawling and walking passage and kept going. Alan and Gil had recently chopped a much longer trail deep into the jungle and found many new caves, and they took the group to the biggest one. They called this Pata de Jaguar (Jaguar Paw), and it sounded like it would be a very large cave. Before we arrived, several mapping trips into it had found it to be very mazy, with lots of entrances in its two sections.

The day after we arrived Peter and Barbara picked up Stan and me from our apartment in Puerto Aventuras, and we met up with Sergio Sánchez and Sandy Urbina at the Zero Gravity Dive Shop. Liliana Viola joined us for the drive out to Sergio's caves, Xibalba and Imix. From the end of the road we walked for about fifteen minutes to reach Rancho Dos Amores.

Here we split in two teams. Peter with Sergio and Liliana entered Xibalba; Stan, Barbara, Sandy, I, and Doggy, a dog on the *rancho*, started surveying in Imix. Imix is an amazing cave, with Maya walls, beautiful cave pools, and fantastic cave formations. We observed a rich cave fauna, including more than two species of fruit bats, many amblypygids, a gecko, a black scorpion, and cave spiders. It was very comfortable to travel through and a little complicated to sketch in the largest rooms. This day the teams surveyed 295 meters in Xibalba and 201 meters in Imix.

The next day Peter, Barbara, Stan, and I checked some cave survey and exploration possibilities in the Puerto Maya area. Stan entered Cueva Basura next to a body shop. It had a lot of trash in the entrance area and good-size passages, with water and many bats. Barbara and Peter followed a local guy to a nice-size cave entrance in the jungle that looked good but had bees. It turned out that these had all been mapped by French cavers.

After the reconnaissance, we drove to the Cueva Macheterrorista area near Paamul. Peter and Barbara looked for new caves near Sistema Muevelo Rico and found two new short ones, Cueva Neveria, 54 meters, and Cueva Regalito, 95 meters. Stan and I surveyed in a cave across the road named Cueva Atractiva, right next to Macheterrorista. It was nice and dry, with small passages, many entrances, Maya rock walls, a rich fauna, including frogs, black scorpions, amblypygids, and of course bats, and many sea shells. We surveyed 126 meters in this cave. It was a short survey day because we had been invited to Paamul by Pat and Gil for Christmas dinner.

The day after Christmas Stan and I returned happily to Cueva Atractiva. We enjoyed easy surveying and sketching, again meeting our friends the frog and scorpion, and finding a shed snake skin in a small crawl that is still going.

On the twenty-seventh we had a team of seven traveling to Sistema Pata de Jaguar: Barbara, Ali, Cameron, Gil, Skyler Templin, Stan, and me. We enjoyed a beautiful and easy walk through the forest and formed two survey teams. Barbara, Ali, and Cameron followed the edge of the cave, where there are many entrances with gorgeous tree roots and Maya walls. Stan, Skyler, and I surveyed nearby. We connected with Barbara's team's survey three times, getting nice survey loops. It was Skyler's first cave survey, and he was good at reading instruments and setting points, but lost interest quickly. Gil was a free spirit, looking for good leads and communicating with both teams about the progress.

After lunch it started to rain, and soon the cave ceiling started to leak. What an awesome experience! We were in a dry and very comfortable cave and we could hear water everywhere. The water entered the cave mostly in the areas where there were tree roots. We all enjoyed listening to the rain outside and inside the cave, watching it flow down the roots and on the floor, true rain-forest magic. This day we surveyed 293 meters in Pata de Jaguar. We walked back to our vehicles in heavy, warm rain. We

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Stan Allison facing the sump in Cueva Imix. *Gosia Allison-Kosior*

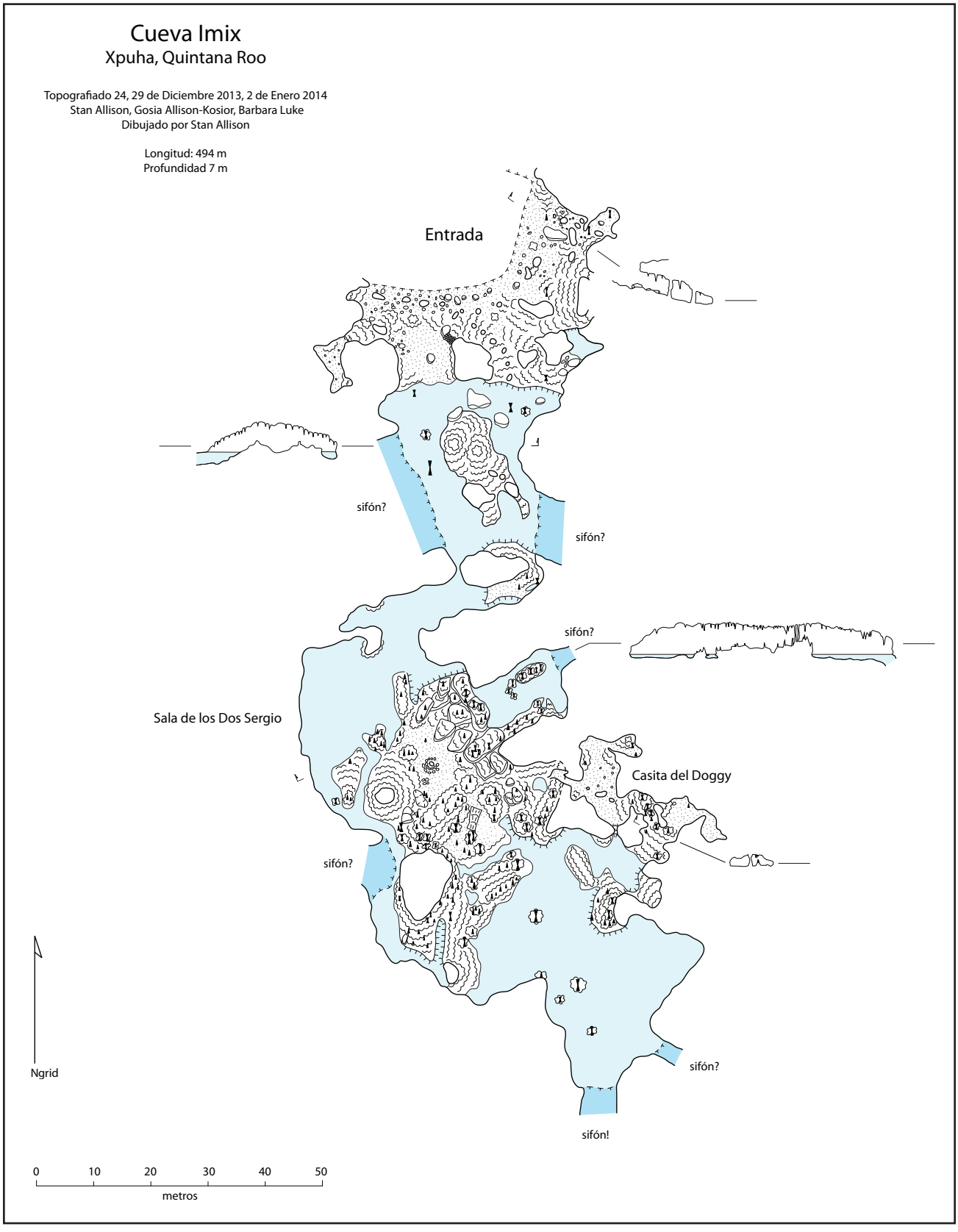
had a hard time following the forest path at times.

Stan and I took a day off to snorkel with sea turtles in Akumal, then met up with Barbara, Sergio, and Sandy on the twenty-ninth at the Zero Gravity Dive Shop. They took us in their truck to the Rancho Dos Amores, where we met Doggy again. We spent one more enchanting day inside Cueva Imix, swimming in crystalline cave pools with little catfish, surveying passages and a cave room filled with gorgeous cave formations, and watching fruit bats flying around us. Sergio spent the whole time underground with us; he was interested in cave surveying and helped with taking photos. Barbara helped collect biological specimens for Peter's research.

On the two last days of 2014 Stan and I traveled to Chichén Itzá to spoil ourselves with the tourist life. But Peter didn't relax and got busy in Cueva Boca de Jaguar. He and his team surveyed 285 meters on the last day of the year.

After our very long and fun New Year's Eve celebration with our neighbors in Puerto Aventuras, Peter picked Stan and me up from our apartment. Together we traveled to Cech Chen, a cave belonging to a Canadian diver in Xpuha. This was a dry crawlway maze that had been mapped to 1022 meters the previous August, with lots of leads left. The last team to push the cave in August went through some tight crawls, and when it opened up they found some guideline and markers set by people coming from another entrance. There was actually a note with the name of a friend of Peter's on it. This confirmed that they had indeed come in from another cave. We met with the owner, then headed into the cave for a long crawl. We reached the far end of the survey and jumped into Sexy Fish Lake to cool off. Then we surveyed ahead, confident that we would find a way out without having to go back through the long, hot crawls. The adventure brought us to a big and deep cave

Barbara Luke in the Salón de los Dos Sergios in Cueva Imix. *Gosia Allison-Kosior*


Cueva Imix
Xpuha, Quintana Roo
Topografiado 24, 29 de Diciembre 2013, 2 de Enero 2014
Stan Allison, Gosia Allison-Kosior, Barbara Luke
Dibujado por Stan Allison
Longitud: 494 m
Profundidad 7 m
Entrada
sifón?
sifón?
sifón?
Sala de los Dos Sergio
Casita del Doggy
sifón?
sifón?
sifón!
Ngrid
0
10
20
30
40
50
metros

Xibalba

Xpuha, Quintana Roo

Topografiado 24 de diciembre 2013, 2 de enero 2104
Chad Pedigo, Peter Sprouse, Terri Sprouse, Liliana Viola
Dibujado por Peter Sprouse

Longitud: 513 m
Profundidad: 7 m

Barbara Luke wading in a pool in Imix. Undisturbed pools in the area often have a near-solid coating of calcite ice. *Gosia Allison-Kosior*

December 2013 QR Expedition Survey Totals

name	Dec. 2013 survey (m)	total length (m)
Sistema Pata de Jaguar	1468	
Sistema Boca de Jaguar	978	
Xibalbá	513	
Imix	494	
Sistema Cheen	414	1013
(includes 186 m of underwater survey)		
Cueva Atractiva	337	
Cech Chen	297	1319
Cueva Macheterrorista	114	
Cueva Regalito	95	
Cueva Nevería	54	
Expedition total	*4764*	

pool. Peter swam for about 60 meters to the opposite side and saw several leads. He believes it will connect to a cenote surveyed by Aaron Addison in 2008. We observed many large fruit bats in the area of the cave pool, and we followed a dry passage with a recently trenched floor. After a few hundred meters we were stopped by a modern stone and mortar wall. Our hopes for an easy way out were waning until Peter and Stan found a low crawlway continuing on. This went through a tight squeeze to emerge at an entrance with a lake. "I can see kayaks and a boat dock," Stan called out. We swam to the far shore and discovered that we had emerged at Cenote Sask Leen Ha in the Ecopark Kantun Chi. This made our day. We had surveyed 297 meters and effectively connected Cech Chen to 15-kilometer-long Sistema Ponderosa.

For our last day of caving Peter, Terri, Chad, Stan, and I met once again with Sergio Sánchez at Zero Gravity. Sergio had his son Sergio with him this time. All of us traveled up the jungle road as usual to Rancho Dos Amores. We split into two teams; Peter, Terri, and Chad went to Xibalba; Stan and I and *los dos Sergios* to Imix. I took a photo of Sergio and his son in a side room of the cave, then both Sergios left. Stan and I surveyed in the Salón de los Dos Sergios to the downstream sump, which we hope leads to Xibalba. Then we explored and surveyed a small, crawly, and perhaps virgin lead just to the side and above the pool in the room. We called the area the Casita del Doggy. Stan and I got to watch an amblypygid eating a bat wing near the pool. We had mapped an additional 106 meters in Imix, while the others had done 118 meters in Xibalba. It still goes downstream. They also got a visit from local diver Harry Gust, who plans to check the sumps.

This was the last day in the Riviera Maya for Stan and me. We ended it snorkeling in the Caribbean and having a great fishy dinner with Peter, Terri, and Harry at our favorite restaurant in Puerto Maya.

After we left, Peter and Terri stayed for a few more days of caving. They met up with cavers from the local group Círculo Espeleológico del Mayab to map a new cave in Xpuha called Cheen Dos. This was just south of Cueva Cheen, which had been surveyed in August. Melissa Galván, Aida Ferreira, and Mario Zabaleta worked on the dry cave survey with them, while Michel Vázquez and German Yañez pushed sumps in both caves to try and connect them. Due to some confusion about whose dive lines were whose, it wasn't until the next day while entering data that they realized the connection had been made. Sistema Cheen was now 1013 meters long.

Xibalba y Imix

En otro viaje a Quintana Roo, espeleólogos americanos, integrantes del Paamul Grotto y del Círculo Espeleológico del Mayab, se organizaron en la exploración hacia el interior de la zona de Paamul en busqueda de cuevas secas, aprovechando los nuevos senderos realizados recientemente dentro de la selva.